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80micro

A WAYNE GREEN PUBLICATION

the magazine for TRS-80*

Micros in Business

- Your Color Computer and the IRS
- QuickCalc— an alternative to VisiCalc
- Getting the most from an IRA

A Primer on Color Computer Graphics

A Basic Compiler in Basic

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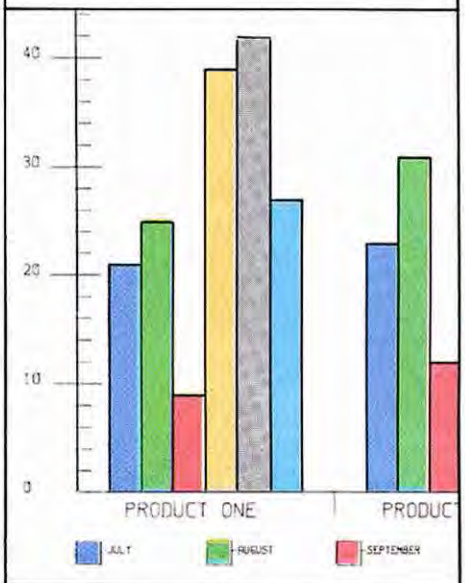

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80 formats its program listings to run 64-characters wide, the way they look on your video screen. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

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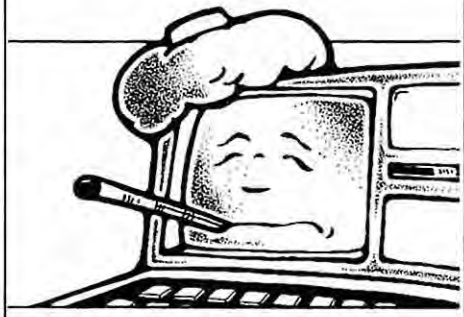

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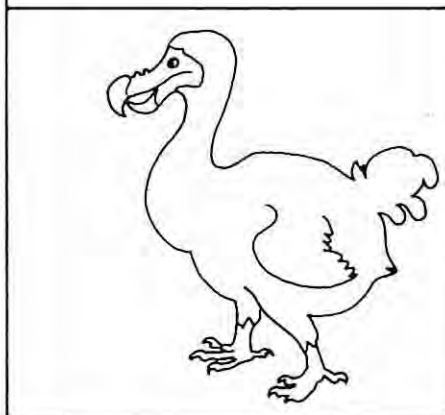

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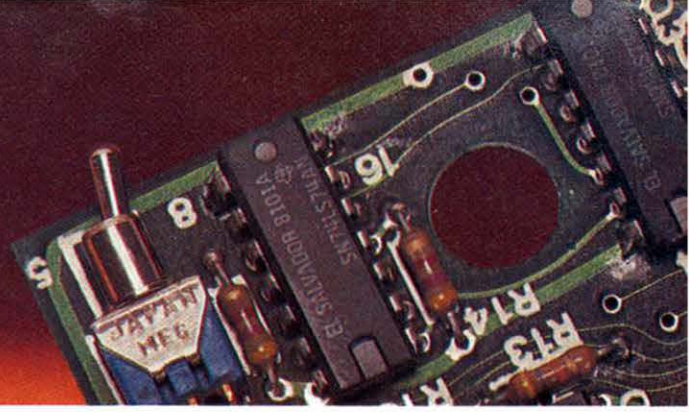

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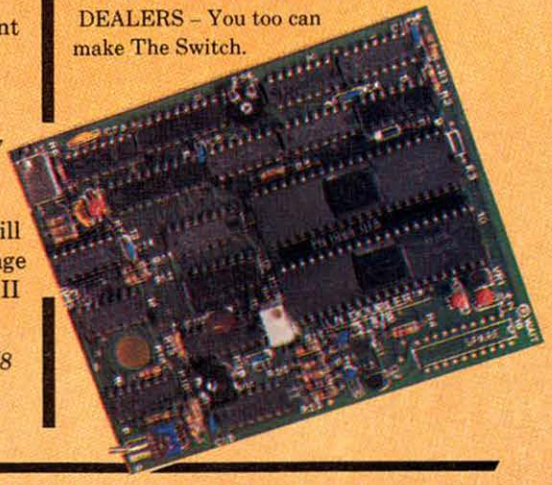

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REMARKS

by Wayne Green

Disney vs. VCRs

The court decision to uphold the Disney Studio request that the sale of video cassette recorders be stopped since they are usable to copy copyright movies has resulted in a rash of proposed laws in Congress.

Senator Kennedy and some other liberal senators have proposed a law that would put a tax on the sale of recorders *and* tape... and that would include audio recorders and tape too! Well, if they are going to do that I would suggest that they are derelict in their efforts to protect industry if they do not include both floppy and hard disks.

The aim is to have the government collect this royalty in the form of a tax on recorders and tape and then distribute this to the royalty holding firms. For perhaps the first time in history I find myself applauding Senator Kennedy.

Instant Software is paying a royalty of 20 percent to the authors of programs published and distributed by that firm. Recent estimates of the market show that at least 90 percent of the copies of Instant Software programs are illegally copied. I would assume that the government will take this into consideration and put a royalty tax on each audio cassette, which will reimburse Instant Software for the lost royalties on all copies of the program made ...which would run to about $24 per cassette.

But that's nothing compared to the losses on disk copies of Instant Software programs. Let's say that each disk has 20 programs, each with an average retail price of $25. At wholesale then we are looking at $300 worth of programs, or royalties of $60. I can't see where we should be entitled to any less than this for each disk sold. Okay, okay, not *all* disks are used for program storage... some are used for data storage. I'll split the difference with you...$30 royalty per disk. No problem. I certainly don't want to be difficult to get along with.

Where do I get in line for my payments?

Exaggeration?

A recent deluge of letters and phone calls from concerned computerists would seem to indicate that my estimates of program theft are conservative.

Massive theft of programs must cease

For instance, I got a call a couple of days ago from a computer camper who wanted to know if he was in any trouble. He'd been at camp two days and already filled over 100 disks with programs, all at no charge... and all copyrighted. Many, he explained, were from Instant Software. He wondered how we could make money with this sort of thing going on. We don't.

An Instant Software dealer recently told me that a well known chain of computer stores was buying one copy of Instant Software programs and then making copies for all their area stores... which were, in turn, passed along to customers as an added incentive to buy a computer. He estimated that the loss of sales to him was on the order of 5,000 of each program.

In talking with other software firms I find that their experience is the same as that of Instant Software. Newly released programs sell for a few weeks and then sales peter out. The only rational explanation of that is massive theft.

A letter from a computer club member in Texas claimed that the only real reason for the local user club was the free swapping of copyright programs. He said that he had already gotten over $100,000 worth of programs from club members and that often he was able to fill up dozens of disks with new programs...often programs just barely announced on the market. He said he had copies of just about everything Microsoft and VisiCorp has out, plus plenty of programs running into the hundreds of dollars each...and even a couple retailing over a thousand.

A chap on Long Island is selling just about any program on the market for 50% of retail.

A teacher on Long Island is bootlegging VIC-20 software, according to a ham friend of mine. In Chicago a software pirate has a quarter million dollar program inventory he is copying for peanuts. A user club member in San Diego says that he got over $5,000 worth of software at the first meeting he attended. A chap in Manchester, NH brags that he has copies of over 7,000 copyrighted programs and will swap any of them with anyone interested.

Are there any user clubs where massive program theft is not taking place? To judge from the phone calls and letters I get, not many. After adding up the estimated losses of Instant Software and figuring from that what the rest of the industry must be losing, the number comes to well over $2 billion.

Yes, I recognize that many computerists are copying far more programs than they can ever use and that calculating the value of unused programs is like Vietnam body counts. But if we make a realistic estimate of the actual sales losses due to software theft, whether it be from one friend to another, via an unscrupulous dealer, a club swap, or summer camp copying, the theft of programs that are probably being used still is most significant.

The theft of Instant Software programs alone...of programs which are actually used...must come to well over $20 million in the last year. If we

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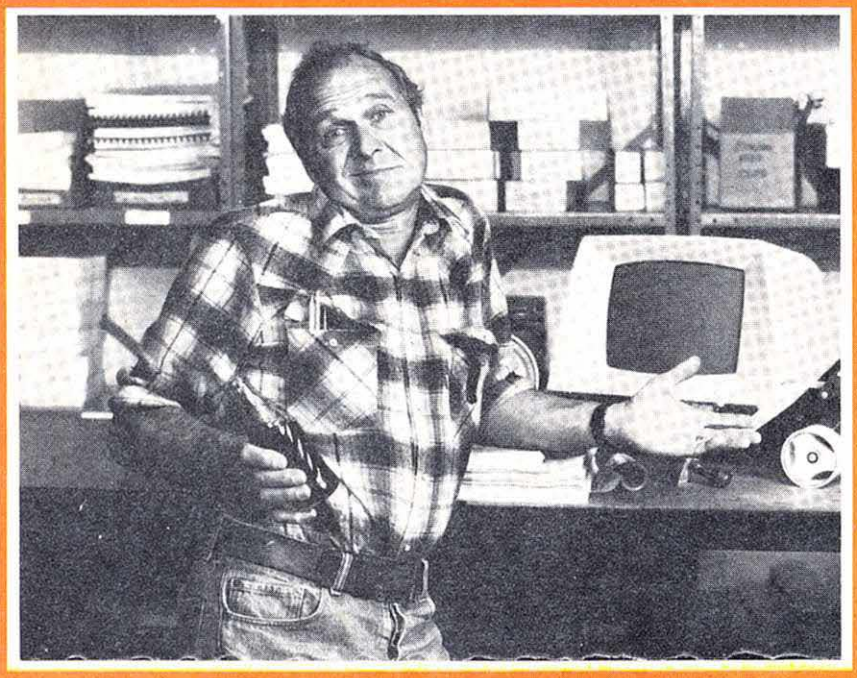

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figure that Instant Software had only 2 percent of the total software market we are looking at $1 billion in theft.

This is the theft of massive royalties for the programmers involved. This explains why it is getting more and more difficult to get programmers to write the needed programs for microcomputers. That's at least a half million dollar loss for every computer store and about $150 million loss in programmer royalties.

It may be time to consider doing something about this.

Service Debacles

I hate to keep harping on this subject, but there is such a desperate need for service for TRS-80 computers that I have to keep bringing it up. It's my understanding that the service aspect of the Radio Shack Computer Centers is a separate entity from the centers and thus not under their management. This explains, perhaps, why these centers have so little control over the servicing.

Typical of what I'm hearing was from a firm that bought the hard disk drive and wanted it mated to its Model II. The computer center checked with their resident service people and gave a guaranteed delivery date for the update on the Model II. When the time came for the promised delivery, the system had not even been touched. The customer, who had made further plans around the delivery date, was furious and took the system home and made the modifications himself in a couple of hours. That's fine if you are expert enough to do this; otherwise, you are helpless at the hands of the Tandy service people, who seem to have little responsibility to the stores that work with them—or to the customers.

Considering all of the service work that has to be done, this is a golden opportunity. The disks, in particular, seem to break down with agonizing regularity. And each time they break down, a business can be stopped for days to many weeks. Businesses just can't live with that. There is a serious need for independent service firms that can fix these computers within hours of when they break. Unless Radio Shack makes some major changes in their approach to this, they are providing a fantastic opportunity for some enterprising people to just plain take over this lucrative business. ■

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Dealers: Contact Ginnie Boudrieau, Bulk Sales Manager, *80 Micro*, Pine St., Peterborough, NH 03458. (800) 343-0728.

Power. Psychologists analyze it, sociologists observe it, historians record its progress. The word means many things but its most positive definition is the ability to do, the capacity to act, and the capability of performing or producing. It's nothing more than an entrepreneur's motto.

The businessman must be able to gather, access, and interpret data, make well-thought-out decisions quickly, and act on the moment. Microcomputers, with the correct software, compile, file, graph, plot, calculate, and store data. They can simplify difficult tasks and alleviate repetitive ones.

In a business, money is time and time is money. Micros save time, and free time for the more creative side of running a business. If used correctly and to their best potential, micros are suited for the business setting and are powerful tools.

To the Future

In the near future, micros will further increase the small businessman's power to organize, evaluate, and efficiently use business data.

When perfected, 16-bit microtechnology, featuring multi-user operating systems, will let the user create a comprehensive data file that can be accessed simultaneously by more than one terminal. The information stored could be totally or partially accessed by different programs depending on the application. Currently, most software store their data files on disk or cassette, usually not accessible to other software. One of the exceptions is VisiCalc's DIF format, which allows other DIF-compatible software to access its data base—for example, Visigraph, marketed by Micro Software Systems of Fullerton, CA.

As the differences among micros, minis, and mainframes decrease, the business uses that were once out of the average business's reach will soon be available. So will the storage devices.

It would be difficult to ignore the faster access time and increased storage that hard disks provide. Thirty companies began manufacturing hard disks in the last six months in the United States. Prices will drop dramatically, making them more affordable and service more accessible.

If you have been noticing new printer advertisements, it will not surprise you that quality machines are available at reasonable prices. Low-cost letter-quality dot-matrix printers are not far off.

Portability will also be a factor. Just recently released is a conversion that turns the Model III into a portable computer with a nine-inch CRT and two disk drives. The Model 3000, by Adcock and Johnson of Fort Worth, TX, features options prime for business use: a 10 megabyte hard disk and modem.

Increased memory storage and access time, better software, more sophisticated hardware, letter-quality dot matrix printers—small business will benefit from them all.

In this Issue

This issue contains articles that you can use now in your business. QuickCalc is a VisiCalc look alike for the Models I and III for sales projections and other calculations. Written by Kurt Leafstand, QuickCalc features an 8 by 14 matrix and is designed for numeric values. If you are contemplating an IRA account, Robert Montgomery's article will help you visualize your long range financial status. For Color Computer users, Peter Stark's Income Tax Estimator will help you calculate a rough estimate of your tax liability.

Additional feature material includes information on computing learning and production curves, invoicing, keeping track of vehicle expenses, and a unique application in computer-aided manufacture (CAM) monitoring with the Model III written by staff writer Kerry Leichtman. Also, Bill Barden's Color Computer Primer and the Basic Compiler by Dimitri Bertsekas will interest many.

If you don't have sound business practices these programs won't make you successful. Software must have meaningful data to have effective results. If you have a good business head, though, this issue will be a welcome addition to your tool box. ■

—J.F.

WAYNE GREEN INC.
PETERBOROUGH, NEW HAMPSHIRE 03458 USA

To: 80 Micro readers
From: Eric Maloney

Re: Our Anniversary Issue

Dear Reader,

I want to tell you about our Third-Anniversary Issue. Because when it comes out next month, it's going to be more than just another magazine. It's going to be an event.

When you see this special 500-page monster, you will turn into a raving maniac. You will laugh, scream, jump up and down on your kitchen table, punch a hole in your wall, throw your furniture into the nearest lake. You will then slip into a berserk computing frenzy.

You think I'm being hyperbolic. You want to know what makes this special issue so special. Well, part of it's a secret. But I can give you some of the highlights.

For starters, we've got Bill Barden writing an introduction to Assembly language. Nobody knows the subject better than Bill. If you've always wanted to get into Assembly language, now's the time. Bill even covers the CC.

Tom Quindry had an idea: Why not combine some of the better utilities we've published into a mini-operating system? We gave him the go-ahead, and NODOS 80 is the result.

If you're a CC fan, you'll get an assortment of games, utilities, and programming techniques, plus a unique (and secret) graphics program that'll knock your socks off.

And if you own a Model II, you'll want to read Charles Perelman's crackerjack disk indexing program.

What else is on tap? A 6502-to-Z80 program converter, a spooler for the I/III, a guide to printers and how they work, an intro to encryption--the list is virtually endless. We've lined up over 75 all-new programs and features.

And then there's the big surprise. You probably wouldn't believe me if I told you what it is. I'm not even sure that I believe it. What'll they think of next?

You can order this special issue with the card facing p. 163. (It's not part of your regular subscription, so be sure you mail in the card.) And be ready to crank up the old TRS-80--you're going to be burning a lot of midnight oil this winter.

Yours,

Eric Maloney
Managing Editor
80 Micro

73 MAGAZINE
KILOBAUD MICROCOMPUTING
80 MICROCOMPUTING
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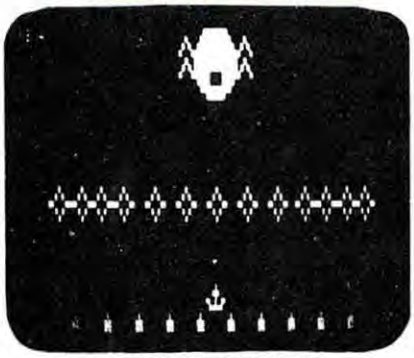
WHY IS THE ALPHA JOYSTICK SUCH A SUCCESS ?

Because of games like these.

THE LATEST BLAST FROM BIG FIVE...

NEW! **DEFENSE COMMAND**



Actual unretouched photos

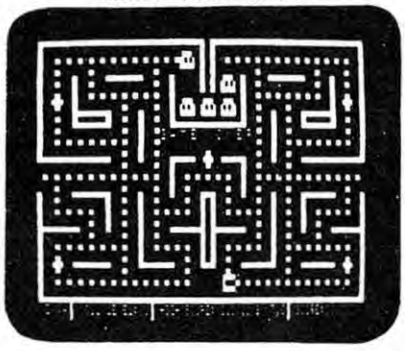
DEFENSE COMMAND

NEW!

Big Five has done it again! Now the most popular arcade game of all time has a fascinating new twist. The Invaders are back! You are alone, valiantly defending the all important nuclear fuel cannister stockpile from a convoy of thieving aliens who repeatedly break off and attack in precision formations. An alien passes your guard, swiftly snatching up a cannister and flying straight off. Quick! you have one last chance to blast him out of the sky. Great action and sound!

BEST SELLER

SCARFMAN



SCARFMAN

BEST SELLER

THE LATEST ARCADE CRAZE now runs on your TRS-80.

It's eat or be eaten. You control Scarfman around the maze, gobbing up everything in your path. You attempt to eat it all before the monsters devour you. Difficulty increases as game progresses. Excellent high speed machine language action game. From The Cornsoft Group. With sound.

CAUTION: Played with the Alpha Joystick, Scarfman may become addictive.

SUPER NOVA®

Asteroids float ominously around the screen. You must destroy the asteroids before they destroy you! (Big asteroids break into little ones.) Your ship will respond to thrust, rotate, hyperspace and fire. Watch out for that saucer with the laser! As reviewed in May 1981 Byte Magazine.

LUNAR LANDER

As a vast panorama moonscape scrolls by, select one of many landing sights. The more perilous the spot, the more points scored —if you can land safely. You control LEM main engines and side thrusters. Absolutely the best use of TRS-80 graphics we have ever seen! From Adventure International. With sound.

ATTACK FORCE®

As your ship appears on the bottom of the maze, eight alien ships appear on the top, all traveling directly at you! You move toward them and fire missiles. But the more aliens you destroy, the faster the remaining ones become. If you get too good you must endure the "Flagship".... With sound effects!

COSMIC FIGHTER®

Your ship comes out of hyperspace under a convoy of aliens. You destroy every one. But another set appears. These seem more intelligent. You eliminate them, too. Your fuel supply is diminishing. You must destroy two more sets before you can dock. The space station is now on your scanner.... With sound!

METEOR MISSION II®

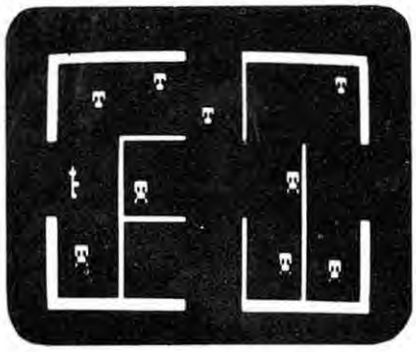
As you look down on your view, astronauts cry out for rescue. You must maneuver through the asteroids & meteors. (Can you get back to the space station?) Fire lasers to destroy the asteroids, but watch out, there could be an alien FLAGSHIP lurking. Includes sound effects!

TALKING ROBOT ATTACK

INCREDIBLE! This amazing game actually **TALKS** without a speech synthesizer, through the cassette AUX plug.

You are armed with just a hand held laser. In a remote section of the space station you encounter armed robots, some march towards you, some wait around corners. Watch out, the walls are electrified. Zap as many robots as you dare before escaping into a new section where more robots await you. The struggle continues. With Joystick action and **VOICE OUTPUT**, this game will amaze you.

VOICE OUTPUT!



GAME PRICES

16K Level 2, Mod 1 + Mod 3 Cassette: $15.95
32K Level 2, Mod 1 + Mod 3 Diskette: $19.95
All games on this page are "Alpha Joystick Compatible." They may be played with or without joystick (using arrow keys).

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Joystick + 1 game : Deduct $ 6.00
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The Alpha Joystick gives you real arcade action. Game producers know that it makes great games better. That's why each month more games from more producers are "Alpha Joystick Compatible."

There has never been a better time to get your Alpha Joystick. With so many excellent action games to choose from it's time to step up to joystick power.

You will find the Alpha Joystick simple to use. Just plug it in. No modification, wiring or batteries are required, and it's fully compatible with any other TRS-80 accessories. The instructions are clear and complete, we even show you how easy it is to experiment in BASIC (A = INP(0) reads stick) and to convert BASIC programs for joystick control.

MODEL I - Plugs into any Level II keyboard (40 pin card edge in the back) or expansion interface (left side, next to printer port). Our latest design has a "mode" switch for compatibility with the many different producers of joystick compatible games.

MODEL III — Works with any Model III BASIC system. It plugs into the 50 pin I/O bus (largest edge connector underneath, centered toward the rear). It will work with "Joystick Compatible" Model III games from any producer.

> "If you purchase Alpha's Joystick you get the exquisite pleasure of enjoying (action games) to the limit of arcade-style realism."
>
> – 80 Microcomputing
> 80 Reviews, Jan '82

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INPUT

Marketing Software

I've recently begun developing software packages which I consider marketable. I have not previously written any commercial software and don't know how to sell what I write.

I consider your magazine a reliable and excellent source of information for TRS-80 users. Can you supply some information on how to get TRS-80 software marketed successfully?

John J. Szucs
495 W. 12th St.
Chicago Heights, IL 60411

We've been thinking about all our readers with software to sell, John. Our January 1983 issue will feature topics which should interest you—marketing, copyrighting, and tax breaks are just a sample of what you can expect.—L.R.

Just One

Upon rereading my recent article "Extended Color Basic" (*80 Micro*, June/July 1982), I noticed that I neglected to mention an important point. The instruction DEFFN is not the same as that in TRSDOS. DEFFNX(A,B) is illegal. Only one argument can be used, for example, DEFFNX(A). This seriously limits the instruction's utility.

Franklyn D. Miller
8871 Falmouth Drive
Cincinnati, OH 45231

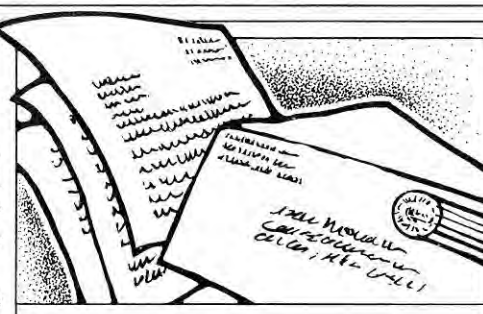
Neatlist—Take Two

Well, I guess it's true—no matter how hard we try, something still goes wrong.

In reference to my letter on Neatlist ("Neatlist for Disk," 80 Input, June 1982), there is a small error in Program Listing 2 (page 16). In retyping from my listing, the variables I3 or I4 were incorrectly shown as 13 or 14 three times in statement 65505. It should read:
. . . LN! = PEEK(I3) + 256*PEEK(I4)
. . . and . . . I = I4. . .

These are small errors but when typing or proofreading any computer text I-1 and 0-O transpositions are the first thing to look out for.

80 Micro is not completely to blame and there are a few things that potential



writers to *80 Micro* can learn from this:

- When submitting even the smallest of programs (or modifications) to *80 Micro*, give them a break and send a tape or a disk. If you want it back include a self-addressed label and postage. I can just imagine the huge number of listings they have to look at.
- When naming variables (especially for a fix as complex as this), don't get so locked in on a clever naming convention like I3 (for I + 3), that you overlook the poor guy trying to read that tiny listing.
- Avoid the use of I, 1, O and 0 in variable names.
- Don't over-compress to save space (unless you really have to). Remember that readability is more important than anything. You want the reader to be able to type from your listing.

James H. Gates
4316 Bannister Road
Fair Oaks, CA 95628

We couldn't have said it better. We also suggest that authors get our writer's guidelines before submitting. A properly prepared manuscript has a much greater chance of being accepted.—Eds.

Help the Consumer

On several occasions I've ordered software from ads in *80 Micro*. I can't use much of the software I receive because the vendor distributes it on protected disks.

I have two 80-track disk drives. Most software is recorded on 35 or 40-track format. If the software is not on a protected disk, I can easily copy it onto an 80-track disk, and store the original disk in a safe place.

However, I can't copy protected software, and protected 35 or 40-track disks will not work in my 80-track drives. I'm forced to return the protected software to the vendor, and wait forever for a refund of my money.

The software vendor has his own interests at heart when he uses the protected software. The magazine, which is dependent on advertising revenues, has the vendor's interests at heart. Who's looking out for the subscriber/consumer?

It would be too much to expect *80 Micro* (and others) to approach vendors and ask them to do away with protected software. But is it too much to ask that *80 Micro* consider a policy to identify such software in the advertising it prints?

Jeff Briner
Route 1, Box 260
Hickory, NC 28601

Jeff, if you possess a non-standard hardware or software configuration, the responsibility for determining if a specific software product will run on your system is up to you, not the manufacturer. If you have any doubts as to whether a program will load on your system, call the manufacturer before *you place your order. If he really wants to make a sale, he'll make sure you get a copy you can use.*

Terry Kepner aids a reader with a problem almost identical to yours in this month's Feedback Loop. We suggest you look it up.—Eds.

Historical Misinformation

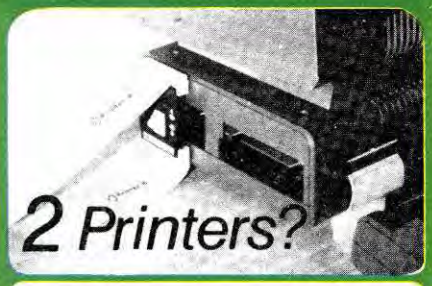
Although I don't have a TRS-80 computer and I'm not a novice, the program Mr. Chidsey provided in his article "For the Novice—Part I" (*80 Micro*, June/July 1982, page 148) seems to be a sophisticated and useful one which most novices should be able to implement.

However, I write to protest the incredible amount of misinformation given under the form of a historical aside. Deforest patented the triode, not the diode. ENIAC was a decimal calculator, not a binary computer. Bits used to be represented by flip-flop circuits, not single tubes or transistors. Using the term printed circuit to describe a chip is misleading at best. And anyone who can describe a chip as a cockroach has not lived in Gainesville.

Because ENIAC was our first stab at a computer (but not designed as a com-

NOW MODEL I AND MODEL III!

Now Model III users can take advantage of the ALPHA I/O system too. Our new MOD III/I BUS CONVERTER allows most port based Model I accessories (such as our ANALOG-80, INTERFACER 2 and INTERFACER-80) to connect to the Model III bus. MOD III/I BUS CONVERTER, complete with all connectors, only $39.95.



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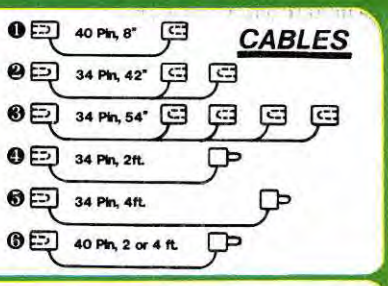

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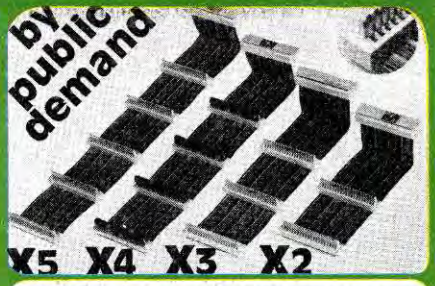

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Custom configurations are also available, call us.

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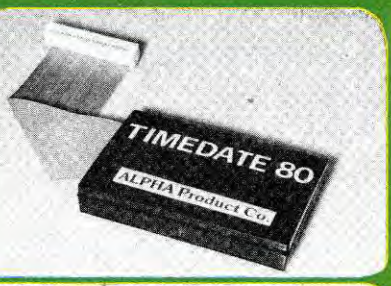
8 DIGITAL MULTIMETERS PLUGGED INTO YOUR TRS-80!!! Measure Temperature, Voltage, Current, Light, Pressure, etc. Very easy to use: for example, let's read input channel #4: 10 OUT 0,4 'Selects input #4 and also starts the conversion 20 A = INP(0) 'Puts the result in variable "A". Voila! Specifications: Input range: 0-5V to 0-500V. Each channel can be set to a different scale.

Resolution: 20mV (on 5V range). Accuracy: 8 bits (.5%). Port Address: jumper selectable. Plugs into keyboard bus or E/I (screen printer port). Assembled and tested. 90 day warranty. Complete with power supply, connector, manual . . . $139.



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GREEN SCREEN WARNING

IBM and all the "biggies" are using green screen monitors. Its advantages are now widely advertised. We feel that every TRS-80 user should enjoy the benefits it provides. But **WARNING:** all Green Screens are not created equal. Here is what we found:

- •Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a fuzzy display.
- •Some are simply a piece of thin plastic film taped onto a cardboard frame. The color is satisfactory but the wobbly film gives it a poor appearance.
- •One "optical filter" is in fact plain acrylic sheeting.
- •False claim: A few pretend to "reduce glare". In fact, their flat and shiny surfaces (both film and Lucite type) ADD their own reflections to the screen.
- •A few laughs: One ad claims to "reduce screen contrast". Sorry gentleman but it's just the opposite. One of the Green Screen's major benefits is to increase the contrast between the text and the background.
- •Drawbacks: Most are using adhesive strips to fasten their screen to the monitor. This method makes it awkward to remove for necessary periodical cleaning. All (except ours) are flat. Light pens will not work reliably because of the big gap between the screen and the tube.

Many companies have been manufacturing video filters for years. We are not the first (some think they are), but we have done our homework and we think we manufacture the best Green Screen. Here is why:

- •It fits right onto the picture tube like a skin because it is the only **CURVED** screen **MOLDED** exactly to the picture tube curvature. It is Cut precisely to cover the exposed area of the picture tube. The fit is such that the static electricity is sufficient to keep it in place! We also include some invisible reusable tape for a more secure fastening.
- •The filter material that we use is just right, not too dark nor too light. The result is a really eye pleasing display.

We are so sure that you will never take your Green screen off that we offer an unconditional money-back guaranty: try our Green Screen for 14 days. If for any reason you are not delighted with it, return it for a prompt refund.

A last word: We think that companies, like ours, who are selling mainly by mail should:•list their street address•have a phone number (for questions and orders)•accept CODs, not every one likes to send checks to a PO box•offer the convenience of charging their purchase to major credit cards. How come we are the only green screen people doing it?

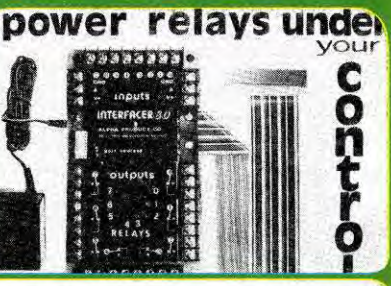
Order your **ALPHA GREEN SCREEN** today. . .$12.50

DISK DRIVE EXTENDER CABLE, FREE YOUR MINI-DRIVES.

End the daisy-chain mess once and for all. Fits all mini-drives: Percom, Aerocomp, Shugart, Micropolis, MTI, Vista, Pertec, Siemens, BASF. East to install: just remove the drive cover, plug in the EXTENDER CABLE and replace the cover.

Now you can change and move your drives without disassembly. Keep the cover on and the dust out. High reliability gold plated contacts, computer grade 34 conductor cable. Tested and guaranteed.

Get one for each drive . . . ONLY $8.95



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- •8 convenient LEDs constantly display the relay states.
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10 ' 3-D DOT GRAPHICS BY BOB BOOTHE.  FROM 80 MICROCOMPUTING,
12 ' APRIL 1981 ISSUE, PAGE 122.  MODIFIED FOR USE WITH
14 ' C. ITOH 8510 AND NEC 8023A PRINTERS.  DIP SWITCH SHOULD
16 ' BE SET FOR UNIDIRECTIONAL PRINT.
18 '
20 '    MODIFIED LINES ARE: 30,50,60,270,290,300, AND 310
22 '
30 LPRINTCHR$(27);"Q";CHR$(27);"T16"  'CHAR SIZE & LINE SPACING
40 CLS
50 DEFINT H,L,M,I,Q,X,Y,F,A: LP=14312   'LINE PRINTER ADDRESS
60 DIM A(8,576)      'USES ALL 8 PINS AVAILABLE FOR GRAPHICS
70 A1=0
80 FOR X1=1 TO 484
90 A1=A1+1
100 H=-2000: L=2000
110 N1=.09: N2=.0001
120 FOR Y=1 TO 320
130 X=(X1-Y)*2
140 IF X<1 THEN 270
150 IF X>320 THEN 260
160 D1=SQR((X-240)[2+(Y-80)[2)*N1+N2
170 D2=SQR((Y-240)[2+(X-80)[2)*N1+N2
180 M=X+180-SIN(D1)/D1*320-SIN(D2)/D2*220
190 IF M>H THEN 220
200 IF M<L THEN 240
210 GOTO 260
220 H=M
230 IF M>L THEN 250
240 L=M
250 A(A1,M)=1
260 NEXT Y
270 IF A1=8 THEN 290
280 NEXT X1
290 LPRINT CHR$(27);"S0576";: FOR Q=1 TO 576
300 IF PEEK(LP)<>63 THEN 300 ELSE POKE LP,(A(1,Q)+A(2,Q)*2+A(3,Q
)*4+A(4,Q)*8+A(5,Q)*16+A(6,Q)*32+A(7,Q)*64+A(8,Q)*128)
310 FOR A1=1 TO 8: A(A1,Q)=0: NEXT A1
320 NEXT Q
330 LPRINT
340 A1=0: GOTO 280
```

Program Listing 1

puter; it was originally hard-wired for each problem, a process which usually took a week or two) its pre-Neumann architecture should be of interest. Most importantly, the accumulators (20) each held 10 digits and each digit was held in a ring counter composed of 10 flip-flops, each flip-flop being basically a 6SN7 dual triode vacuum tube. This idea was apparently due to John Atanasoff and one of the reasons that the Mauchley patents were disallowed in the famous lawsuit in the early seventies.

The article is good and useful; I'm sorry though that an editor didn't catch the historical misinformation.

David Block
P.O. Box 12473
Gainesville, FL 32604

80 Micro Is Here To Stay

I hope you aren't planning to keep the new title, *80 Micro*, for long. It sounds like an incomplete sentence. *80 Microcomputing* sounds much better and was one reason why I subscribed to it rather than another magazine. So here's a big YEEECK for the guys in the old think tank at, ugh!, *80 Micro*.

James Tripiano
P.O. Box 175
Veno Beach, FL 32960

Sorry, James. 80 Micro, *like rock and roll, is here to stay.—Eds.*

3D Dot Graphics

Following my review of the C. Itoh 8510 printer (*80 Micro*, May 1982) I've received a lot of correspondence from owners who want to produce Bob Boothe's three-dimensional drawing on their printers.

The modified version of Bob's program from his article "A Turn of the Screw" (*80 Micro*, April 1981) is shown in Program Listing 1. It takes a long time to run, so I recommend that users plan to let it run overnight. The key modification is in line 300. It now POKEs an 8-bit value to the printer, making use of all eight graphics pins available on the 8510 and the NEC 8023A. Line 290 is a control code sequence that prepares the printer for the 576 graphic bytes which make up each print line.

Several readers have also requested my machine-language program to reproduce the TRS-80 Model I screen graphics on the 8510. I'm making it available for $13 to anyone who sends me a blank disk. For $17 I will supply the disk.

Mike Keller
13423 Desert Hills NE
Albuquerque, NM 87111

RAM Test for Disk

I've received a number of inquiries from Model III users attempting to run the Model III RAM test program ("Expand It—Burn It In," *80 Micro*, June/July 1982, page 344) under Disk Basic. Here are a few suggestions for those who'd like to modify the program for disk use.

I wrote the program under Model III ROM Basic for a cassette-based TRS-80. With the excellent RAM test programs available for disk systems, I didn't feel it necessary to provide changes for using the program under Disk Basic. Disk Basic reserves a significant portion of RAM for extended features and DOS overlays. ROM Basic makes no such demands and permits access to many more RAM addresses.

You must change the PEEK and POKE values in lines 260, 415, 425, 700, 800 and 900 for DOS compatibility. Addresses 16561 and 16562 contain the LSB and MSB values for memory reservation. For my 48K Model III under TRSDOS 1.3 Disk Basic, the values on power-up for 16561 and 16562 are 249 and 255 respectively. If you have a system with a smaller RAM configuration you should check your system addresses for the correct values. To avoid RAM addresses used for Disk Basic and TRSDOS, change all occurrences of PEEK or POKE 20000 to 22075 and 20005 to 22080. These are values for TRSDOS 1.3. If you're using another DOS, you'll have to do some exploration. Also, since disk operating systems unconditionally reserve RAM space for

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their own use when you turn on the computer, the RAM available to the user is smaller. Therefore, change line 418 to reflect accurate MEM values.

A very informative article on employing the memory reservation technique I used in the RAM test program can be found on page 50 of the October 1981 issue of *80 Micro*.

Colin Alexander
28 Gladys
San Francisco, CA 94110

Crabby Old Wayne

I suggest you fire crabby old Wayne Green as a writer. Pay him his regular fees but don't publish his tripe. He hates Tandy with a passion, and must sit up nights dreaming new ways to submarine them. We *80 Micro* readers should not be subjected to his monthly hate messages to Tandy. Further, his writings are subjective, not objective. They represent irresponsible journalism at its worst.

Fred E. Guth
831 South Bemiston
Clayton, MO 63105

Of course Wayne's column is subjective. That's what it's for, to give opinions, create controversy, and stimulate discussion. We suggest that your reaction is far more vituperative than any of Wayne's observations.—Eds.

Marketing Genius

I disagree with Wayne Green's assessment of the Model 16 ("80 Remarks," June/July 1982, page 6). I don't believe Radio Shack is deliberately attempting to orphan the Model II. I believe the Model 16 is a stroke of marketing genius.

Far from putting the Model II out of business the Model 16 gives it a new lease on life. Buy a Model II now to use all the available software and when your business needs more power (and Model 16 software becomes available) upgrade your Model II to a Model 16. The advertising clearly states that the Model II can be upgraded to Model 16 specs. Although the maximum memory is only 256K, this is still quite a bit more than the 64K that the Model II ordinarily addresses.

Yes, Radio Shack has been and will be slow in bringing out Model 16 software, but this is nothing new. It gives all those private software houses a chance to make money—they generally do a better job anyway.

Andrew Shorter
2578 Sylvan Road
Cuyahoga Falls, OH 44221

Too Many Little Letters

Among the many goodies in the February issue, John R. Olsen, Jr.'s utility for converting upper to lowercase in Basic Print statements ("Lots of Little Letters to Litter Your Listings") was one of the most welcome. However, users may find it almost too effective since nearly every alphabetic character to the right of an open quote mark is changed, including the initial letter of every first sentence, and the "Y" in string comparisons such as, IF A$= "Y" THEN... To reduce the editing you must do after running the program, you need to add only one line and make minor changes in three others (Program Listing 2). With these modifications, John Olsen's program will leave the first character to the right of an open quote mark completely untouched.

Michael M. Finefrock
The College of Charleston
Charleston, SC 29401

Tab Extender

The TRS-80 doesn't allow you to print past TAB(63). Why? The value you specify for Tab is ANDed with 3F hex in ROM. This truncates any value to a max of 63. The ROM was cut like this so Print and LPRINT could both use the same Tab routine. There are numerous ways around this limitation.

You can LPRINT past position 63 in an orderly fashion. Forget using Tab and create your own tab function using the Disk Basic statement DEF FN. The code shown in Program Listing 3 does the trick. As line 100 shows, you use this FNT function just like Tab. It works for any value through maximum line length of your printer—80, 132, or whatever (up to 255).

Phil Lawson
P.O. Box 766
Richardson, TX 75080

*See also "Tab Extender" (*80 Micro, *February 1982, page 248).—Eds.*

A Patch for Scrip Patch

One of the many gems published in *80 Micro* was "Scrip Patch" by Daniel Allred (March 1981). This has become a valuable tool for getting out of and back into Scripsit without losing or having to reload data.

I recently started converting all my disks from TRSDOS to NEWDOS80 V2 and was dismayed to find Scrip Patch didn't work. Part of the problem is the Basic program in line 30. Change the address 66DFH to 26335 decimal.

The other part of the problem is caused by the reboot of NEWDOS when exiting Scripsit. Using Tasmon

```
465 IFI=JGOTO520
480 FOR Z=I+1 TO J
490 IF J>I THEN A=ASC(MID$(L$,Z,1))
500 IF J>1 AND (A>64)*(A<91) THEN MID$(L$,Z)=CHR$(A+32)
```

Program Listing 2

```
  5 CLEAR 500
 10 DEFSTR T:DEF FNT(X)=STRING$(X-PEEK(16539), " ")
                          .
                          .
                          .
100 LPRINT FNT(30)"POS-30"FNT(75)"PAGE 2"
```

Program Listing 3

Circle 83 on Reader Service card.→

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from The Alternate Source, I found the reboot command (C3 00 00) at 6594H. I changed these three bytes to read C3 2D 40 (JP 402D). Now Scripsit goes directly into NEWDOS without rebooting.

Bill Geib
8185 State Road
North Royalton, OH 44133

Clean Bill of Health

This letter is to retract my previous letter to you ("Z80 Microprocessor Bugs," 80 Input, September 1982) related to a problem with the Z80 microprocessor.

Further research indicates that the problem is caused by DDT using stack at the point specified by the entry and exit values specified by the user (see Fig. 1). I set the stack pointer (SP) to 444AH and then ran the program listed in the figure. The stack area is displayed at the bottom line.

Point 1 is where the SP was set prior to running the program. It shows that DDT uses the stack upon entry to DDT (with the G command), and again upon exit from the user program as at point 2. No use of the stack area has occurred in the user program, since the SP was set to 4445H prior to the LHLD instruction, contrary to my earlier suppositions.

Thus the Z80 still has a clean bill of health!

Gavin Brickell
P.O. Box 38155
Howick
Auckland, New Zealand

Sorry, Gavin, that the timing was such that we printed your first letter before receiving your second one. As we mentioned in our reply to your first letter, monitors like DDT and T-Bug must use the stack as a repository for information about the program being altered in order to give the monitor control over the target while the monitor executes its own functions. Remember, it's not the monitor that pushes the program counter or other register information onto the stack; it is the Z80 itself responding to a Call instruction.—80 Micro *Tech Staff*

```
-X
COZOMOEOIO A=00 B=0000 D=0000 H=5555 S=444A P=500A NOP
                                          (1)
-D4440,444F
4440 88 88 88 88 88 88 88 88 88 88 88 88 88 88 88 88 ...
-L5000,500A
  5000 NOP
  5001 LXI SP,4445
  5004 LHLD 5000
  5007 LXI SP,444E
  500A NOP
  500B
-G5000,500A
*500A
-X
                                          (2)
COZOMOEOIO A=00 B=0000 D=0000 H=3100 S=444E P=500A NOP
-D4440,444F
4440 88 88 88 88 88 88 88 88 00 50 88 88 02 00 88 88 .........P...
                              (1)         (2)
```

Figure 1

BIPED and State Government

I read with interest and dismay the recent article on BIPED by Kerry Leichtman (*80 Micro*, April 1982). Mr. Leichtman's statement that "BIPED receives no government financial assistance" and that "every aspect...is funded with corporate dollars" is erroneous.

The Connecticut State Department of Education, Division of Vocational Rehabilitation (DVR) has played a significant role in the assessment, preparation, placement, and continual guidance of their BIPED students. Due to confidentiality no names can be specifically mentioned. However, thousands of dollars in conjunction with coordination efforts of counselors have been extended to our BIPED clients so that they could participate in this program. DVR counselors were the first to contact clients from the Stamford community and advise them about the formation of BIPED and to keep them encouraged during a 15-month waiting period prior to matriculation.

Evaluation costs for our agency to have a client psychologically and physically assessed for this program as required by the BIPED admissions procedures exceed $500 in most cases. Ad-

Error Trap

The correct price for Procopy as featured in the New Products column (*80 Micro*, August 1982, p. 393) is $50.

Copy-Tape ($9.95) from Modtec, 4144 N. Via Villas, Tucson, AZ 85719, was omitted from the Buyer's Guide to Utilities (*80 Micro*, April 1982).

Our Readers' Choice Awards listings in August (p. 378) included several errors. Micro Proof and Hexspell were listed under I/III—Word Processing instead of under I/III—Spelling Checkers. VisiCalc should be number 16 under I/III—Business.

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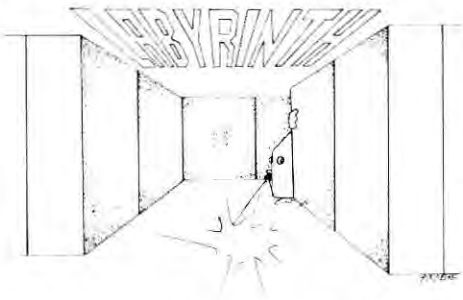

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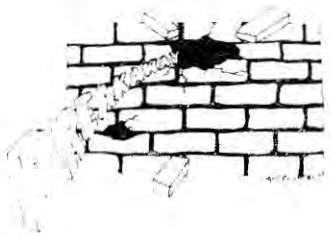

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ditional costs for needed equipment, such as wheelchairs or transportation travel expenses, are subsidized by DVR. Two clients are now being evaluated to drive and will require van modification equipment in excess of $20,000 each. Without such equipment these BIPED clients will be unable to establish independence in driving to and from their working sites allowing for a tax return on these potential taxpayers. Also, DVR pays for medical and vocational supplies needed by clients through the duration of their program not covered by similar benefits.

I believe in giving credit where credit is due. Mr. Leichtman's article ignored the large contribution made by many people in our state government at all levels. Severely handicapped individuals do not just enter training programs unaided. It sometimes takes years of professional rehabilitation efforts to prepare our disabled clientele for successful completion of a program. Virginia's Woodrow Wilson Computer Programming Course, the New Haven Easter Seal's Computer Training Program and other similar ones throughout the United States have been so established through the joint efforts of the State Departments of Vocational Rehabilitation. I'm not sure if there would even be a BIPED if not for the government assistance extended through DVR.

Kieren M. Hambley, M.S.
Senior Counselor
Connecticut State Department of Education
Division of Vocational Rehabilitation
26 Palmer Hill Road
Stamford, CT 06902

BIPED Support

I also believe in giving credit where credit is due. And, according to your letter, some ought to be thrown your way. But while we're tossing praise and criticism about, I'm afraid we'll have to pass some of the latter BIPED's way. Had anyone mentioned Connecticut's Department of Vocational Rehabilitation to me, either as an aid or a hindrance to BIPED's conception and continuation, I would have been happy to include it in the article. I went into great detail explaining who is in BIPED, who is responsible for BIPED's existence, and what the program means to its participants. We at 80 Micro *thought BIPED's approach and aims deserved special attention, and so devoted twice the space we normally give to a non-TRS-80 subject.*

Some of the students mentioned counselors as being responsible for them knowing about the program, others told me the state helps them convert vans so they can drive, and I was told of New York State's refusal to cooperate in the program. But no one told me that their counselors did more than tell them about BIPED, and no one told me that converting a van to a handicapped vehicle is something the state does not do for its other handicapped citizens.

I am sorry your generous support was omitted from the article and am glad you took the time to set the record straight.—Kerry Leichtman

Unbiased Reviews?

I have a question about some of Paul Wiener's "Notes from Beneath the Keyboard" columns. For how many products that he has reviewed has he been on a beta type test team? In the column where he discussed Super Utility Plus I noticed that he was on Kim Watt's team. How can he give an unbiased opinion of a product he helped to develop? How much faith can I put in his column?

I am on several pre-release-give-him-a-copy-to-try lists. I think it's unfair to the readers and the manufacturers to write about these products. I will never review a product that I tested.

By the way, his article on MULTIDOS expressed my sentiments exactly. It could become a contender especially for those who develop Basic programs.

Jerry Latham
Midwest City, OK

Paul Wiener Replies

Thanks for your letter, Jerry. You brought up some interesting points.

First, to answer your immediate question, Super Utility Plus is the only product for which I have been an officially designated beta test site. However, I have been what amounts to the same thing with other products. For instance, I have passed several suggestions about MULTIDOS to Vernon Hester. He was generous enough to mention my name in his documentation supplement.

For two years I was a software editor. Even now in my "retirement," I tend to pass constructive criticism on what I consider worthwhile software to the programmers. In the process I often develop a working or friendly relationship with the authors. I have many software friends whom I've never met in person.

Since I normally review only software I am enthusiastic about, it is likely I will have already developed some kind of rapport with its author as described above. Also, I like to contact authors of material I'm reviewing to make sure I'm not about to make myself look stupid due to ignorance or misunderstanding.

I do my best to not let my relationship with software authors affect my objectivity. I have never reviewed software by any author or publisher with whom I had any business transactions (i.e., my getting money or other compensation from them). Only after my review of Super Utility Plus appeared in 80 Micro, *did Powersoft ask me to do a book for them. It came as quite a surprise. I have never received any compensation for any review I've written, except for the (sometimes) free review copy of the program, and the magazine's payment for the piece.*

I have always shied away from doing reviews in which an honorarium is involved. For instance, a company that sells a popular version of Forth won't give away review copies of Forth. But they indicate that they'll send other software goodies to anyone who has purchased and written a good review of their Forth. They say they need to know the reviewer has a commitment to Forth, because a reviewer without Forth savvy was likely to do an unsatisfactory review.

I bought their Forth, but haven't given much thought to reviewing it, even though I'd like a free review copy of, say, their Forth-based word processor. If I ever do do a review under those circumstances, it will only be after conducting a reader's forum to see how they'd feel about it.

I hope the fact that my report on MULTIDOS echoed your own impressions helps to maintain my credibility in your eyes.—Paul Wiener

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Philly Phiasco—Take 2

The article titled "The Philly Phiasco" (*80 Micro*, May 1982) has to be one of the most destructive, uninformed, and childish dissertations I have ever seen in a computer publication.

I think the problem is that the author came to the Small Computers in the Arts Symposium expecting to hear and see high caliber art being done and instead heard and saw the tools with which art may be done. The symposium was after all sponsored by IEEE, not ASCAP. For the most part he was meeting the creative engineers and programmers who develop these tools, not the creative artists who will be using them in the future.

He also seemed to miss entirely that the symposium addressed techniques suitable for small computers and unfranchised individuals, not university mainframes and corporate fellows. I would be hard pressed to find any application of small computers today that wasn't done 10 or 15 years ago on an IBM 360 in some research lab somewhere. Innovation in microland is doing those things on hardware that can be bought with a month's wages, not millions in tax write-offs! If you want to see something truly new, go to the International Computer Music conference in Italy this fall.

I must also protest the innuendo-loaded description of my own contribution to the symposium. Yes, I gave four sessions: Fundamentals of Software Synthesis, Advanced Software Synthesis, NOTRAN Delayed Playback Synthesis Workshop, and a question/answer discussion session. Much of what I said in the first two of these can be found somewhere in my book and the natural discussion topics in the last session centered on statements and philosophies found in the same book. If Mr. Gunn thinks this is bad, then he must believe there is no need for teachers in this world.

He also got the coding date for the Bach piece wrong—it was coded in 1970 for a large synthesis program that ran on a 30-bit word campus computer with ½-inch digital tape. The significance is that the same program now runs on an 8-bit micro with floppy disks used for the digital audio playback.

I thought the concert was very well balanced. It simultaneously showed a wide variety of musical styles and a wide variety of synthesis techniques performed on synthesis hardware ranging in cost from perhaps $50 to several thousand. I scanned my program and was unable to find anyone who played 10 tunes. Frank Covitz and Cliff Ashcraft performed the shortest selections but these probably had the greatest timbral variety of any of the performances. In the second annual concert (this was the fourth), New England Digital, Crumar, Fairlight, and other professional groups were invited. The result was an evening of very good (but not revolutionary) music yet a comparative feeling of detachment as nobody in attendance could picture themselves ever using the $30K and up hardware involved.

It is probably good to have an occasional skeptical expression about this or any other computer application. However, we don't need uninformed mockery devoid of any constructive substance. Now that I have ridiculed Mr. Gunn about as much as he ridiculed the symposium, further discussion should be restricted to intelligent, constructive exchanges.

Hal Chamberlin
Route 1, Box 365
Wake Forest, NC 27587

Hal Chamberlin is the author of the book Musical Applications of Microcomputing, *reviewed on p. 22 of the September 1981 issue.—Eds.*

David Gunn Replies

According to the catalogue published for the Symposium, the "real purpose. . . (was) to bring out the applications which rely on computers, those that involve the computer directly in the creative task and involve the artist with the media in a new way." Sorry, Mr. Chamberlin, no new artistic directions or applications were present at the tutorials which I attended (including three of yours). And I stand by my review of the utter futility I witnessed at the concert, regardless of your idea of what constitutes breaking new musical ground.

David Gunn
106 Midway
Riverton, NJ 08077

Wordsmith Update

Hugh Ruppersburg's review of our Wordsmith word-processing program (*80 Micro*, June/July 1982, page 63) was an excellent one. He indicated that his roots were in writing and bookkeeping, so he may have had different expectations than our Basic word-processing program could meet.

Wordsmith is indeed slower and has little to offer when compared to expensive, more sophisticated word-processing programs. Wordsmith is in a different category and cannot be fairly compared with them. Because machine-language programs run about 300 times faster than Basic programs, Wordsmith presents marginal utility to the person who types rapidly.

We promote Wordsmith as a trainer for word processing as well as a programmer's tool. As a Basic program, Wordsmith is not suited to the business environment.

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Wordsmith's instructions are clearly written and accurate. They are easy to master because there are only 12 commands to learn (14 for disk version). Once the commands are learned, you are prompted by the menu for the feature you desire. You don't have to constantly refer to the manual.

Given the constraints of Basic, the hobbyist will find Wordsmith easy to use. It provides an environment to make text retention and revision easier. I consider it to be the best Basic word-processing program you can buy. The reviewer indicated that Wordsmith was intended for slower typists and most computerists fall into this category. Wordsmith was not intended to compete with the more expensive word-processing packages now available. There are already several excellent ones being sold.

As a trainer, Wordsmith provides the skeletal features most others have. With it you can rapidly acquire the insight for how word processing works. Because Wordsmith is written in Basic users can modify the program to better meet their needs. This is especially true of our Print command which was written for the MX-80 printer. If you don't have an MX-80 printer, just replace our print routine with one that uses Basic code to drive your printer. This lets you customize your Wordsmith for your non-MX-80 printer.

It is unfortunate that the reviewer, a user, was called upon to evaluate a product intended for the hobbyist market of doers.

Thomas Wnorowski
ABS Suppliers
3352 Chelsea Circle
Ann Arbor, MI 48104

Hugh Ruppersburg Replies

Mr. Wnorowski's opinion of Wordsmith generally reflects my own. As his letter states, and as my review stated, Wordsmith is suitable for the hobbyist (but not the professional), simple to use, and accompanied by clearly written instructions. The slow typing speed of this Basic word-processing program would not pose a problem for slow typists.

In evaluating Wordsmith, I set out to determine whether it really made writing easier, and whether its promise of making such writing projects as term papers and books easier was valid. My answer to these questions, as expressed in my review, was that though there is much to be said in favor of Wordsmith, the disadvantages of slow typing and cumbersome editing did not justify these claims.

As for Mr. Wnorowski's contention that Wordsmith is intended as a trainer for word processing, I wonder whether word processing is really such a complicated procedure that it requires a trainer to begin with.

I stand by my review, which I believe is a fair and accurate assessment of the program in question. Contrary to what Mr. Wnorowski implies in his final paragraph, my status as a user eminently qualifies me to judge his program. Word processing is for writers, and writing is no less a process of doing than any other activity, including computer programming, that I can think of.

Hugh M. Ruppersburg
186 Clyde Road
Athens, GA 30605

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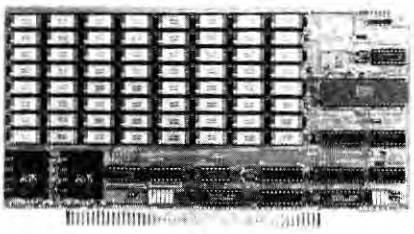
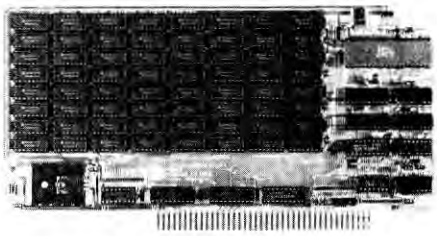


S-100



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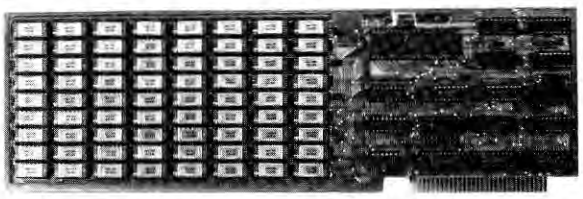

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✓ 372

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DEBUg

Straight Shooter Fix

Following are corrections for two of my recent programs which appeared in *80 Micro*.

In my article "The Straight Shooter" (*80 Micro*, January 1982), there is an error in line 30 of the program listing. It should be 30 DEFINT A-Z.

In my article "The Sargon Saver—Part II" (*80 Micro*, December 1981), the following comments apply:

Since publication of my article giving modifications to Sargon II, distributed by Hayden Book Company Inc., they have come out with a Model I/III version of Sargon II. The loader for that program has a one byte difference from the original version. In order to make MODIIB work with the Model I/III version (Model I only), change the following lines:

```
1580  LD  (4499H),A
1600  LD  (449AH),HL
```

Though it is not really necessary for the original version, a better address than that published for these lines would be:

```
1580  LD  (449AH),A
1600  LD  (449BH),A
```

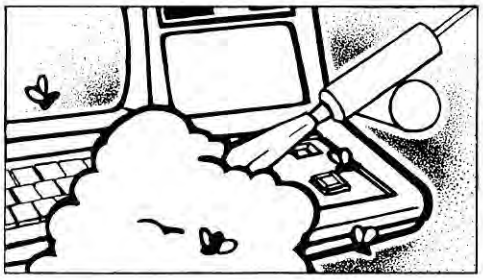
This enables you to hit reset on your Model I and gain control of the computer rather than go back to Sargon.

The magazine version of MODIIB still will not work on the Model III with either version of Sargon II distributed by Hayden. I am still offering a version of MODIIB for $4.50 which will work with either of Hayden's distributions of Sargon II and for either the Model I or Model III. Also I am still offering the disk conversion program for $4.50 which allows you to load the program with modifications to disk. Send an SASE for prices and details.

Thomas L. Quindry
6237 Windward Drive
Burke, VA 22015

Space Chase Fixes

There are two minor bugs in my "Space Chase" program (*80 Micro*, May 1982). Line 1280 fails to award the expected bonus after a safe landing because the variable "HS" is wrongly



used in the phrase BONUS OF"HS" SOLS PAID. Change this HS to HB. I forgot to list the HS variable in Table 1. It represents the number of humans saved during the trip.

The other bug is that a plasma bomb found during one trip (the BB flag is set to 1) also appears on the next flight as

*The Key Box for the Cube-80 program (*80 Micro, *August 1982, pages 106-110) states that it requires 16K RAM. The correct figure is 32K for Disk and Cassette Basic. Also, lines 1670-2150 were missing from the listing. They appear below.—Eds.*

```
1670 IF (B(2)=BB(8)ORB(8)=BB(18)ORB(18)=BB(2))AND(B(2)<>BB(2)AND
B(8)<>BB(8)ANDB(18)<>BB(18)) THEN GOSUB1880 :RETURN
1680 IF (B(8)=BB(2)ORB(18)=BB(8)ORB(2)=BB(18))AND(B(8)<>BB(8)AND
B(2)<>BB(2)ANDB(18)<>BB(18)) THEN GOSUB1890 :RETURN
1690 IF (B(4)=BB(10)ORB(10)=BB(8)ORB(8)=BB(4))AND(B(4)<>BB(4)AND
B(10)<>BB(10)ANDB(8)<>BB(8)) THEN GOSUB1940 :RETURN
1700 IF (B(10)=BB(4)ORB(8)=BB(10)ORB(4)=BB(8))AND(B(10)<>BB(10)A
NDB(4)<>BB(4)ANDB(8)<>BB(8)) THEN GOSUB1950 :RETURN
1710 IF (B(4)=BB(18)ORB(18)=BB(8)ORB(8)=BB(4))AND(B(4)<>BB(4)AND
B(18)<>BB(18)ANDB(8)<>BB(8)) THEN GOSUB1960 :RETURN
1720 IF (B(18)=BB(4)ORB(8)=BB(18)ORB(4)=BB(8))AND(B(4)<>BB(4)AND
B(18)<>BB(18)ANDB(8)<>BB(8)) THEN GOSUB1970 :RETURN
1730 IF (B(4)=BB(16)ORB(16)=BB(8)ORB(8)=BB(4))AND(B(4)<>BB(4)AND
B(16)<>BB(16)ANDB(8)<>BB(8)) THEN GOSUB2000 :RETURN
1740 IF (B(16)=BB(4)ORB(8)=BB(16)ORB(4)=BB(8))AND(B(16)<>BB(16)A
NDB(4)<>BB(4)ANDB(8)<>BB(8)) THEN GOSUB2010 :RETURN
1750 IF (B(2)=BB(8)ORB(8)=BB(6)ORB(6)=BB(2))AND(B(2)<>BB(2)ANDB(
8)<>BB(8)ANDB(6)<>BB(6)) THEN GOSUB2020 :RETURN
1760 IF (B(8)=BB(2)ORB(6)=BB(8)ORB(2)=BB(6))AND(B(8)<>BB(8)ANDB(
2)<>BB(2)ANDB(6)<>BB(6)) THEN GOSUB2030 :RETURN
1770 IF B(6)=BB(6)ANDB(8)=BB(8)ANDC(5)<>C(6)ANDC(5)<>C(8) THEN G
OSUB2040 :RETURN
1780 IF B(2)=BB(2)ANDB(8)=BB(8)ANDC(5)<>C(2)ANDC(5)<>C(8) THEN G
OSUB2050 :RETURN
1790 K$="22":GOSUB2100 :NEXT:RETURN
1800 K$="11111717111117171111171722111117171111171711111717":GOS
UB2100 :RETURN
1810 K$="1111171711111171711111717":GOSUB2100 :RETURN
1820 K$="1005051005050101":GOSUB2100 :RETURN
1830 K$="1010050501050501":GOSUB2100 :RETURN
1840 K$="1410050510050501010511":GOSUB2100 :RETURN
1850 K$="1410100505010505010511":GOSUB2100 :RETURN
1860 K$="0214100505100505010510511":GOSUB2100 :RETURN
1870 K$="0214101005050105050105111":GOSUB2100 :RETURN
1880 K$="1114101005050105050105102":GOSUB2100 :RETURN
1890 K$="1114100505100505010510502":GOSUB2100 :RETURN
1900 K$="1200031005051005050101120903":GOSUB2100 :RETURN
1910 K$="1200121005051005050101030903":GOSUB2100 :RETURN
1920 K$="0302121005051005050101031112":GOSUB2100 :RETURN
1930 K$="0302031005051005050101121112":GOSUB2100 :RETURN
1940 K$="1003061005051005050101151201":GOSUB2100 :RETURN
1950 K$="1003061010050501050501151201":GOSUB2100 :RETURN
1960 K$="0202000015051010141401141401140600001111":GOSUB2100 :RE
TURN
1970 K$="0202090915051005051005050101140609091111":GOSUB2100 :RE
TURN
1980 K$="0212100505100505010103111":GOSUB2100 :RETURN
1990 K$="0203100505100505010112111":GOSUB2100 :RETURN
2000 K$="0905000006100505100505010115000001400":GOSUB2100 :RETURN
2010 K$="0905000006101005050105050115000001400":GOSUB2100 :RETURN
2020 K$="1111140200121211091717051111":GOSUB2100 :RETURN
2030 K$="1111141005051005050101050202":GOSUB2100 :RETURN
2040 K$="0813131717040812171317170404170 3":GOSUB2100 :RETURN
2050 K$="0611081313171704081217131717040417030215":GOSUB2100 :RE
TURN
2060 K$="0202081313171704081217131717040417031111":GOSUB2100 :RE
TURN
2070 K$="1713131717040812171317170404170317 17":GOSUB2100 :RETURN
2080 K$="1107110711071107":GOSUB2100 :60250:RETURN
2090 K$="0517131317170408121713171704041703171714":GOSUB2100 :RE
TURN
```

Program continues

well. To resolve this bug simply add BB = 0 in line 190.

Some people may find the game too difficult because of the distance to be covered on each flight. This can easily be changed in line 190: Initialize the variable G to a lesser value. I find that G = 50 + RND(50) works quite well.

The subroutine at line 2010 prints five blank lines to erase the text at the bottom of the screen. The same effect can be obtained more economically by PRINT@704,CHR$(31);:RETURN.

I've also modified the machine-language routine of the game. The modified program should work equally well on Models I and III, tape or disk, and in any memory size configuration.

Make the following changes to the published listing. Delete line 120, the old sound routine. Delete CLS from line 100. Delete CLEAR 400 from line 110. Add the two new lines shown in Program Listing 1.

Charles E. Gillen
1458 Greenmont Court
Reston, VA 22090

Program continued

```
2100 SD=1:FOR G=1 TO LEN(K$)-1 STEP2:Y=VAL(MID$(K$,G,2))
2110 IF Y>17ANDSD=1 THEN 2150
2120 IF SD=1 THEN GOSUB340  :PRINT@576,"CAREFULLY POSITION CUBE
AS SHOWN"
2130 IF SD=1ANDINKEY$="" THEN OUT255,RND(2):GOTO2130
2140 SD=0:PRINT@576,STRING$(40,32):PRINT@576,"TURN ";M$(Y);" (MO
VE";Y")":FOR D=1 TO 100*DD:NEXTD:GOSUB210  :GOSUB340  :NEXTG:K$=
"":RETURN
2150 GOSUB210  :NEXTG:K$="":RETURN
```

```
50 CLS:CLEAR400:ZZ$=STRING$(29,0):ZZ=VARPTR(ZZ$):Z1=PEEK(ZZ+1):Z
2=PEEK(ZZ+2):IFZ2>127THENZ2=Z2-256
60 Z3=Z2*256+Z1:FORZZ=Z3TOZ3+28:READZ4:POKEZZ,Z4:NEXT:IF201=PEEK
(16396)POKE16526,Z1:POKE16527,Z2ELSECMD"T":DEFUSR0=Z3:POKE14308,
0:DATA 205,127,10,62,1,14,0,237,91,61,64,69,47,230,3,179,211,255
,13,40,4,16,246,24,242,37,32,241,201
```

Program Listing 1

Program Listings 4 and 5 in the article "Four in One Plus Another" (80 Micro, August 1982, page 202) were printed incorrectly. Listing 4, "Pixprint" on page 207, should only include lines 100–540. Listing 5, "Tank-Gunner," has lines 0–540 on page 208. Lines 550–1180 were accidentally included on page 207 at the end of "Pixprint." Lines 1190–1640 are included at the top of page 208.—Eds.

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REVIEWS

edited by Janet Fiderio

The TRS-80 Means Business
Ted Lewis
Wiley and Son Publishers
603 3rd Ave.
New York, NY 10016
Softcover, 195 pp.

by Tim Daniel

Ted Lewis, author of *The TRS-80 Means Business*, outlines three goals for his book. According to the preface, readers will learn how suitable Radio Shack's Model II is for their particular business application, develop Basic programs, and select the necessary hardware and software for a complete system. However, once the business-minded reader progresses beyond the enticing cover and preface, he or she is in for a big surprise.

The first-time buyer of a small business computer system is reassured by only one thing: the fact that computers have helped businesses with similar needs. Real life or practical examples sell computers, not the system-analyst approach that dominates the early chapters of *The TRS-80 Means Business*. In one of the book's few detailed examples, an ice cream parlor with 11 employees buys a Model II and reduces its payroll chore to a two-hour-per-week job. Fine, I believe that. What I don't believe is the claim that this small business previously needed 60 hours per week of manual labor for payroll. Selling computers to the small, cash-conscious business requires believability, not fairy-tale examples like this one.

After addressing why you should buy a computer, the author tackles the job of programming. Never mind the fact that there are hundreds of programs already available; you'll be able to do it yourself. I don't know about you, but most business folks I've met could care less about direct access, hash functions or binary search trees. If you have a yearn to try programming, there are a number of examples waiting for you in *The TRS-80 Means Business*. Watch out, though; the water gets deep quickly and there are pitfalls like missing program listings. To save time and aggravation the programs are available on disk, something you don't find out until the end of the book.

Hardware selection hints consist of a thumbnail sketch of the Model II technical parameters and brief mention of printers. The most useful feature for the would-be computer buyer is a two-page list of questions concerning software purchases. By following the Radio Shack company line, the book fails to mention possibilities offered by CP/M or the growing collection of non-Tandy peripherals.

The TRS-80 Model II does mean business, but this book remains trapped in the generalities common to the old school of computing. ■

How to Make Money With Your Microcomputer
Carl Townsend and Merl Miller
Dilithium Press
Beaverton, OR
Softcover, 154 pp.
$12.95

by Silvia Burnes

How to Make Money With Your Microcomputer is an excellent starting point for cashing in on the money-making potential of your computer. Not merely a list of money-making ideas, *How to Make Money* is a guide to developing ideas into profitable businesses. Enough information is given for the reader to start seriously planning his business and, in some cases, to start making money immediately.

The breadth of opportunities appeal to a wide variety of computer enthusiasts with varying levels of expertise. By giving an inside look into the details of operating many different kinds of microcomputer businesses, the reader can select a feasible business that matches his skill and interests.

Most of the book deals with the business of selling microcomputer products or services. Individual chapters cover a specific type of business such as how to operate a service bureau or a computer-repair business, how to develop and sell software or hardware, how to sell systems as a consultant, and how to open a computer store.

For each business the authors state the minimum experience required and possible monetary rewards. Although most of the opportunities discussed require experience in either software, hardware, or some specialized knowledge in another field, a few require only a little computer knowledge.

For example, operating a service bureau that offers accounting or word-processing services requires minimal computer skills, while operating a repair business requires extensive knowledge of computer electronics and some experience working with small systems.

Several chapters are devoted strictly to business considerations: how to market your product or services, how to establish a business, and how to manage it. Appendices contain valuable information regarding grants and proposals, and show sample service and software license agreements. References where more in-depth material can be found are included.

If you enjoy sharing your knowledge, you can make money selling information. The first two chapters explain how to write articles and books on microcomputers and how to get them published. The names and addresses of 41 computer magazines and 11 book publishers as well as references of books to aid the article writer are listed in appendices. In addition, the book tells how to make money teaching others about computers and how to hold a computer show.

How to Make Money With Your Microcomputer is not exhaustive, but does serve as a good starting point for both the novice and the experienced microcomputerist. Its non-technical language and its coverage of diverse types of microcomputer businesses make it an excellent choice for public and users' group libraries.

It is particularly valuable for the experienced microcomputerist interested in starting his first business and for the professional looking to publish. The thorough coverage of article writing is justification enough for the price of the book. ■

Maxprint
Peggytronics
381 First Street—Suite 5147
Los Altos, CA 94022
$27.95

by E. M. Collins

It is one thing to have a versatile printer such as the Epson MX-80, but it is yet another to be able to harness that versatility and use the printer in the manner for which it was designed.

C. E. Krehbiel of Peggytronics has the solution to this situation with Maxprint. Designed for use with Models I and III, 32K or 48K with one disk, Maxprint is a printer-driver utility consisting of over 3K of Z80 Assembly language. It offers support of all MX-80 print styles, total control from text, partial control from menu, proportional justification, underlines, subscripts, superscripts, horizontal centering, and line spacing (1/72-inch increments).

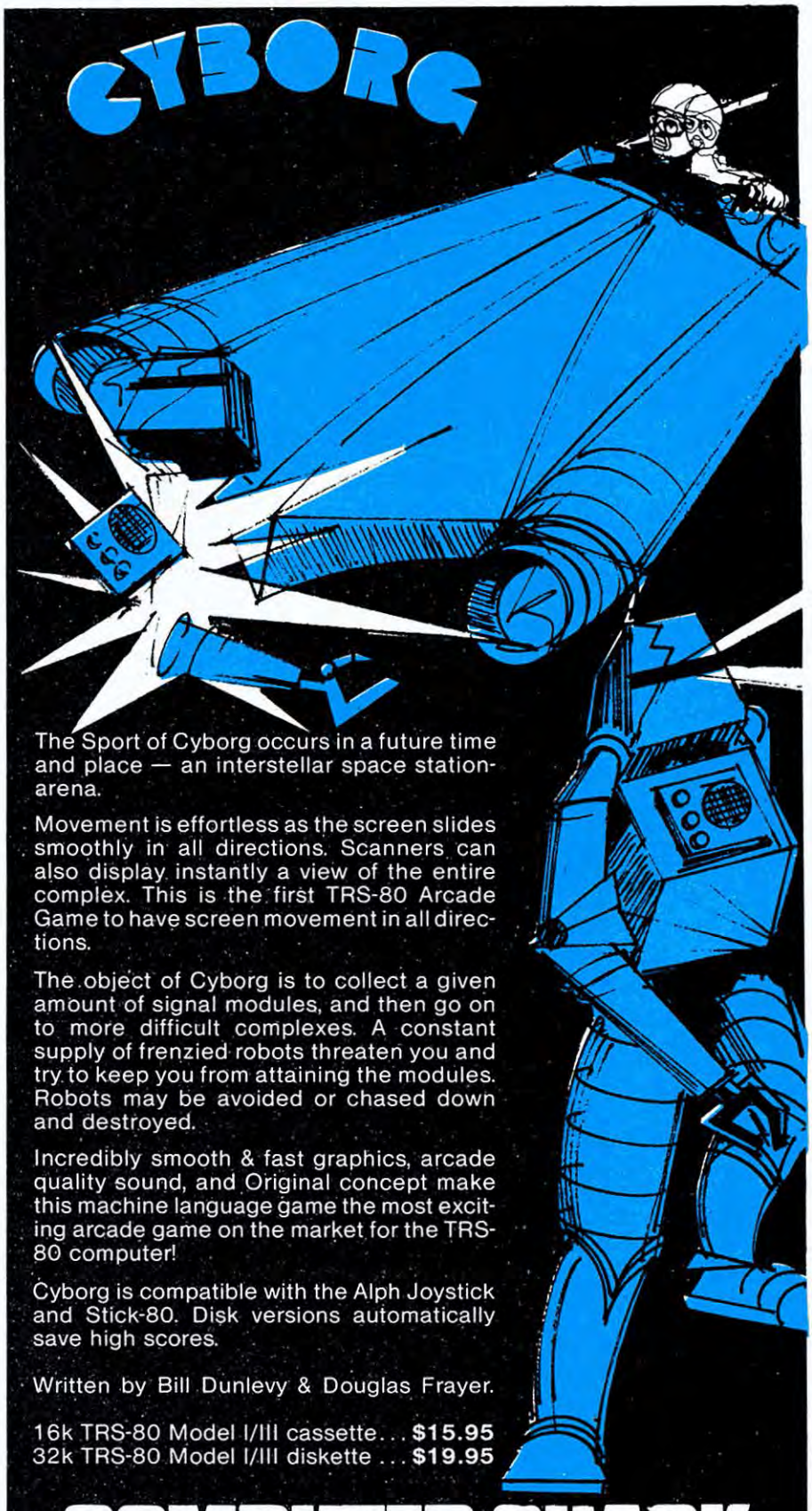
Besides being more than pleasantly content with my copy of Maxprint, I find a couple features of the package very impressive. First, it comes with a manual that contains approximately 40 pages of usable instruction material with most of the special print commands listed on the back cover.

Second, the source code for both the Scripsit conversion as well as Maxprint itself is printed in the instruction manual. As if that weren't enough, an editor/assembler provides easy access to the source code on the disk, providing you with all the flexibility needed for customizing your version.

Although Maxprint was created primarily for use with Scripsit, it can be used with other word-processing programs; you need only advise Peggytronics prior to purchase what your system is.

Once inserted into your system, Maxprint is a powerful, easy-to-use utility. My biggest problem came when trying to understand the process of combining it with my DOS. Armed with the instructions and a lot of trial and error, this was ultimately accomplished. In that regard, the manual could have been more helpful by providing a simpler step-by-step procedure.

Maxprint does provide a menu mode for setting up certain parameters such as margins, character size, and so on. I



The Sport of Cyborg occurs in a future time and place — an interstellar space station-arena.

Movement is effortless as the screen slides smoothly in all directions. Scanners can also display instantly a view of the entire complex. This is the first TRS-80 Arcade Game to have screen movement in all directions.

The object of Cyborg is to collect a given amount of signal modules, and then go on to more difficult complexes. A constant supply of frenzied robots threaten you and try to keep you from attaining the modules. Robots may be avoided or chased down and destroyed.

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Cyborg is compatible with the Alph Joystick and Stick-80. Disk versions automatically save high scores.

Written by Bill Dunlevy & Douglas Frayer.

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found the only time I used it exclusively was in a business or personal letter where not many of the special features of the MX-80 were needed. Other times, you will find it just as easy to use the flexibility of inserting the special commands in the body of the text.

The only thing that disappointed me involved the hardware. Certain cables (mine) make it necessary to break into one of the pins and add a SPST switch to allow Maxprint to call for its own line feeds. The switch is used so the printer can be switched back to the normal mode for use with standard printing chores outside the word-processor mode.

If you own an Epson MX-80, use it for word processing, and want to get everything out of the printer that it was designed for, look into Maxprint. ■

Lablmakr
ETS Center
Box 651 35026-A Turtle Trail
Willoughby, OH 44094
$19.50 disk, Model I or III

by Mark Sprague

Every once in a while I come across a software package that is actually enjoyable to evaluate. Lablmakr is one such program.

Lablmakr is designed to create custom labels and should not be confused with mail-list-type label programs that are used for mass mailings. This program is most useful for generating customized labels such as return addresses or disk labels, or for generating a mailing list if your list numbers just a few hundred. The package can be used with an Epson printer with or without graftrax.

The program has sixteen different label formats (for the standard 15/16 by 3 1/2-inch label) that run the gamut from the compressed (50 characters per line) to the jumbo mode (13 characters per line). Most of the labels utilize two or three modes so you can choose the combination that best suits your needs.

The documentation was easy to use. The instructions take you through a step-by-step procedure for setting up an auto-booting disk for the various DOSes the program works with (TRSDOS 2.3, NEWDOS 2.1, and NEWDOS80 1.0 and 2.0). It will also run under TRSDOS 2.3 for the Model III if you run the convert utility first. You will need a lowercase driver if your DOS does not already have one.

The program is menu driven with four user options. The first option allows you to sample the files that come with the program or the files that you have created with option number four. You can visually access each label at any point, and scroll backwards or forwards to view what is stored on disk.

The second option allows you to print, correct, or add a new label. While using this option you can also scroll through your files (as in option one). One handy function I liked was the program's ability to correct any label without having to retype the information from scratch. You can also correct information stored on disk and then resave it—nice when you want to make a minor change on an existing label.

Option three enables you to print the sample labels included on the program or your own personal creations. It is possible to print up to 99 copies of each label.

The fourth option is for adding new labels. This allows you to create or correct a label, save it to disk, print it, or abort operation. Though the program does not provide any graphic capabilities, I was able to create borders and underlining by using the percent, asterisk, and equal characters. Some of the labels were quite striking when borders were created using the double-size or jumbo modes.

The program does allow auto-centering of each line, but the instructions were somewhat vague. However, after figuring it out it was relatively simple to use. There is a fifth option of sorts that allows you to access a second or third data-file disk when the original is full.

A minor problem with the package appears when you first initialize a data disk. You must break the program and type GOTO 1300; this accesses a routine that allows you to name the disk for future reference. It's a good feature, but I feel it should be menu-driven. Also, the program does not have an insert, delete, and reorder function. If, for example, you have a disk filled with unwanted labels, the only way to replace them is by using the correction mode in option two. This makes it impossible to keep an up-to-date alphabetized mailing list. The ability to alphabetically reorder, insert, or delete labels would certainly be a plus, but in no way detracts from the package.

I found the program to be self-prompting, easy to use, adequately error trapped, and very versatile. Lablmakr is a good value for the money. ■

Qwerty
Med Systems Software
P.O. Box 2674
Chapel Hill, NC 27514
Model I or III
$74.95 disk

by D. Wilson Cooke

Can your word processing software make your printer do all the things it is capable of doing? Qwerty is a patch that expands Scripsit's word processing capabilities. It is the best word processing package I have used for typing technical documents and general-purpose manuscripts.

Qwerty is a machine-language program and comes in several versions for various printers. The supplier claims the program works with either TRSDOS or NEWDOS and possibly other DOSes. I reviewed the Qwerty for the Line Printer IV (Centronics 737). Figure 1 shows an example of the output that can be generated. Med Systems reports that versions are now, or will soon be available for the Daisy Wheel II, the Line Printer VIII, and the new NEC printer.

The Qwerty Patch

QWERTY was developed because its author, Walter L. Smith, wanted a word processor to type technical

papers on a Line Printer IV using a Model I. He devised a program to modify Scripsit to take advantage of most of the hardware capabilities of the printer. Qwerty is useless without a copy of Scripsit/LC (the version written for the lowercase-modified Model I computer). Qwerty uses it for both the Model I and Model III machines.

Commands and Features

Qwerty uses most Scripsit commands. Four additional special purpose keys are added to those of Scripsit with the odd names of UND, YEN, QUAD and MOD. UND (shift, up arrow) starts and stops underlining in the text. YEN (shift, break) and MOD (shift, down arrow) generate special characters not on the keyboard and to replace the tab function of Scripsit. QUAD (shift, enter) is a control key for several special functions. I made some small labels to stick on the keys similar to those supplied with Scripsit.

For the Line Printer IV, the default type font used by Qwerty is proportional spacing without right-justification. The default margin values of Scripsit are modified to give a pleasing page of double-spaced text. You can select any of the six type fonts or mix them all on the same line.

Right-justification is possible only with mono-spaced 10 characters per inch or 16.7 characters per inch (cpi). Some users, like myself, would like right-justification with proportional spacing, but Qwerty cannot provide it. You can ignore the margin settings and print a character, or start a line to the left of the usual margin, or past the right margin. This is handy for such things as numbering paragraphs or calling attention to a special item.

It is also possible to compose pages with a two or three-column format (similar to the way magazines are printed) using either a proportional or 16.7-cpi font. This is convenient to get a maximum of readable material on a single page. The index of the Qwerty manual uses this format.

Another handy format feature of Qwerty is the ability to check the format of the text without printing anything. The Print command in Scripsit first checks to see if a printer is ready, then formats the text and prints it. Qwerty formats the text, then checks to see if a printer is ready. All you have to do to check for format errors is to

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turn the printer off and issue a Print command. Any errors found are displayed and can be corrected prior to printing. Qwerty can also mark on the video monitor exactly where each page of a printed document ends. This reduces the number of trial printing to get the final version to look as desired.

Qwerty provides for the printing of superscripts and subscripts. Simple equations with exponents are easily done, and rather complicated fractions are possible with a little programming practice. The manual suggests that the writing of ratios be learned last, and I can see why after trying it. It is not hard, but does take a little practice. The manual claims that a PhD dissertation in statistics was accepted directly from the Line Printer IV using Qwerty, an indication of its powerful symbolic capabilities.

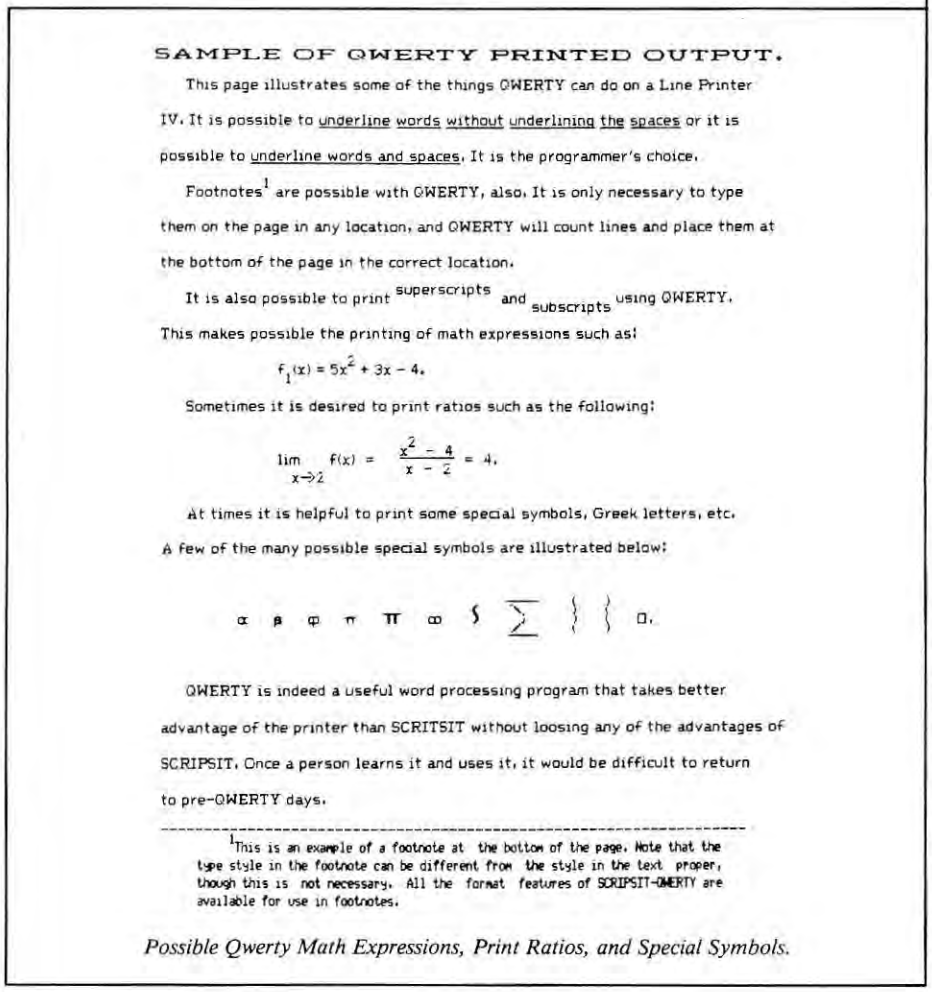
About 76 special characters can be generated from the keyboard. This includes the ASCII characters not on the keyboard, part of the Greek alphabet, and a variety of mathematic and scientific symbols. The special symbols are generated by overstriking standard characters, but only two keystrokes are necessary even when the printer has to print several overstrikes to get a symbol.

Scripsit has the capability of placing the same header or footer on each page of text, but it is not easy to place a single footnote of the kind used in research papers at the bottom of a page. The writer must count lines and place the footnote in exactly the correct location. If the page is edited, then the footnote location must be revised. Qwerty makes it possible to type the footnote anywhere on the page, the computer takes care of putting it where it belongs.

Footnotes of up to about 800 characters of text are possible using the 48K version of Qwerty and 400 characters using the 32K version. Qwerty accomplishes this by introducing a footnote block similar to the blocks in Scripsit. One footnote block is permitted per page, but several footnotes are permitted in the block. Format lines can be introduced into the footnote block for a different format than the regular text. Since it is easy to see where pages begin and end with Qwerty, footnote placement is not difficult.

The tab function of Scripsit doesn't work well with proportional characters. Some strange looking columns can result! Qwerty replaces the standard tab function with another function called Tables, which permits the printing of any character at any horizontal position on the paper including outside the specified margins. The writer specifies by a prefix control code where the particular character is to be printed. Med Systems Software supplied a sticker to place on the printer, so a glance at the printer is all that is necessary to determine a specific print location.

The program was supplied on a disk with versions for machines with 32K and 48K of RAM. It is shipped on a data disk without a DOS. Qwerty works fine with a single-drive system when copied onto a DOS disk, but a single-drive user will have to find a friend or a friendly Radio Shack dealer to make the copy.



SAMPLE OF QWERTY PRINTED OUTPUT.

This page illustrates some of the things QWERTY can do on a Line Printer IV. It is possible to underline words without underlining the spaces or it is possible to underline words and spaces. It is the programmer's choice.

Footnotes[1] are possible with QWERTY, also. It is only necessary to type them on the page in any location, and QWERTY will count lines and place them at the bottom of the page in the correct location.

It is also possible to print superscripts and subscripts using QWERTY. This makes possible the printing of math expressions such as:

$$f_1(x) = 5x^2 + 3x - 4.$$

Sometimes it is desired to print ratios such as the following:

$$\lim_{x \to 2} f(x) = \frac{x^2 - 4}{x - 2} = 4.$$

At times it is helpful to print some special symbols, Greek letters, etc. A few of the many possible special symbols are illustrated below:

$$\alpha \quad \beta \quad \phi \quad \pi \quad \Pi \quad \infty \quad \S \quad \sum \quad \{ \quad \} \quad \Box.$$

QWERTY is indeed a useful word processing program that takes better advantage of the printer than SCRITSIT without loosing any of the advantages of SCRIPSIT. Once a person learns it and uses it, it would be difficult to return to pre-QWERTY days.

---

[1] This is an example of a footnote at the bottom of the page. Note that the type style in the footnote can be different from the style in the text proper, though this is not necessary. All the format features of SCRIPSIT-QWERTY are available for use in footnotes.

Possible Qwerty Math Expressions, Print Ratios, and Special Symbols.

Performance

I checked the program for both Model I and Model III machines on a Line Printer IV, and each works equally well. I also checked it on the Line Printers VII and VIII even though it was not written for them. Some features worked, and some gave garbage output since the printer control codes are different. The Qwerty user must specify the printer when ordering.

The Manual

The 73-page manual supplied with Qwerty describes each feature in detail. It is well written and complete, but assumes the reader is familiar with Scripsit. Each function in Qwerty is discussed in a separate chapter of the manual. A two-page summary of all the commands provides a quick check on how a particular function is performed. A detailed index is also provided. While there were a few passages that were unclear at first reading, I had no real trouble with the manual. I suggest that a few examples of complex functions might be a welcome addi-

tion. The manual provides the memory addresses of a few points in the program and offers suggestions for changes in the machine code. Such things as cursor speed control and default format settings are easy to change.

Problems

I encountered a problem with TRSDOS incompatibility with the Model III. Qwerty was supplied for use with 1.1 or 1.2, but I wanted to use the newer DOS 1.3. I also wanted to use Qwerty to edit some old text files created by another program. A few things did not work quite right. A letter to Med Systems Software brought a quick reply and a replacement disk that cured my problem. I feel that the problem was with Scripsit and my old files rather than with Qwerty. Radio Shack has since brought out a TRSDOS 1.3 version of Scripsit for the Model III. This problem does not exist for Model I users.

"Like any useful skill Qwerty must be practiced to be appreciated."

The horizontal centering function from Scripsit doesn't work well with proportional spacing unless the writer supplies extra spaces to adjust for the variations in letter width. Switching to either of the mono-spaced type fonts sometimes gets the computer confused as to character counts. The result is uncentered text. I tried several different format statements to correct this, but did not succeed. I called Med Systems but was not able to get any help or suggestions for solving the problem.

Because Qwerty is a flexible and powerful word-processing program, it does take some practice to learn the commands. I recommend that potential users feel comfortable with Scripsit before attempting to learn Qwerty. Don't be discouraged if the first few times you try typing some complex charts or formulas the printouts look rather strange. Like any useful skill Qwerty must be practiced to be appreciated. ■

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Personal Finance
Tandy/Radio Shack
Fort Worth, TX
Color Computer
cat. #26-3101
$39.95, Program Pack

by Carlos Calle

The Personal Finance Program Pack for the Color Computer is one of the best answers to the perennial question, "Nice, but what else does it do?"

The Personal Finance Pack is just that—a program that helps you to keep track of 26 personal-budget categories.

The program loads instantly when you turn on the computer after inserting the ROM Pack in the slot. After typing Y in response to the new-user query, you are ready to personalize the program. The screen immediately displays a listing of 26 budget categories common to the average person. The list can be personalized and remains in effect every time you load your stored data from cassette tape to begin a new session. You can change categories at any time.

Your next step is to assign values to each one of the budget categories. To some categories, Auto for example, you might want to set up equal amounts for each month. For others where you don't pay a fixed amount every month, the amount can vary to reflect the months when premium payments are due.

Next, enter the names of your banks and the account numbers. The program accommodates up to three separate bank accounts and balances. You can select the first check number and the program remembers to start counting from there. If you cancel one check, merely type X.

Your expenses can be recorded as they occur or at a convenient regularly scheduled time. Roughly once a week you can comfortably sit at the computer, insert the Personal Finance cartridge, load your previously stored data from the cassette tape, and begin entering your recent purchases from your checkbook register or monthly bank statement.

I have developed a system to easily keep track of my cash or credit-card purchases. I keep an envelope in my desk where slips from credit-card purchases and the cash receipts can be placed. When the credit-card statements arrive, I identify each purchase listed by matching it with the store slip. After I write the check to the bank for the amount on the statement, I enter the information on the program. By pressing the @ key for the budget category, Credit Card automatically appears on the screen. After entering the amount, the program asks for the budget category and amount for each item on the credit-card statement.

Cash purchases can also be recorded in your budget. I quickly jot down the budget category on the cash receipts before putting them into the envelope. Periodically, when I enter new checks into the program, I retrieve the cash receipts and enter them. After pressing the $ key the word Cash appears. The budget category and amount can now be copied from your receipts.

The program has one-key commands to move up or down the screen to list the budget categories, to change from one menu to the next, replace check numbers, advance to the next check number, and to cancel checks and deposits. You can record automatic withdrawals, enter interest and finance charges in your checking account, balance each of your checkbooks, make corrections, and review all budget categories for a specific month and any budget category for the entire year. After each session, the data can be stored on cassette tape by selecting option 7 from the main menu. Every time new information is added, both the old and the new data are stored; you can store up to 1,918 checks on a Color Computer with 16K of memory. Three copies are automatically made on the same tape to reduce chances of loading errors.

This program is very easy to use and is well documented. Its one drawback, though, is major; you can't print your budget. You can save it on cassette, look at it on the screen whenever you want to, but you can't get a printed copy. Nevertheless, for $39.95 it is a good buy. The Personal Finance Pack may pay for itself many times over when you consider that setting up your budget will help you organize your priorities and understand your spending habits. ■

Newtalk
Star-Kits
P.O. Box 209
Mt. Kisco, NY 10549
$20

by Scott L. Norman

Newtalk is an ingenious addition to the toolkit of anyone doing machine-language or Assembly-language programming on a 6800 or 6809 system, including the Color Computer. Peter Stark's Newtalk is a memory-examination utility with audio readout. It is by no means a full-featured monitor, but a helpful assistant for such chores as comparing the actual contents of memory with a printed listing.

Newtalk is written in relocatable machine code, and the brief manual contains complete details for putting the program anywhere in memory. It goes much further, in fact, and includes a complete assembly listing—a commendable gesture at a time when some vendors are reluctant to supply data needed for making legitimate backups. Star-Kits also includes a completed registration coupon plus an SASE entitling you to automatic notification of any future updates and fixes. There are some differences between the versions intended for the Color Computer and for SS-50 bus systems, and these are spelled out in detail. Naturally, the SS-50 systems require appropriate interface boards to be installed (MP-L, MP-LA, and MP-C are mentioned), while the Color Computer's audio output capability is used. I tested the Color Computer disk version although cassettes are standard.

Newtalk requires just over 6,500 bytes; 6,000 are used for the digitized representations of the 16 hex digits. (These aren't included in the documentation.) The speech samples are not synthesized from scratch, but are derived from actual voice recordings by sampling and storing the zero-crossings of the audio waveforms. The resulting intelligibility is quite good, although a price is paid in terms of the amount of memory required. Newtalk can use this technique because of its limited vocabulary.

Loading and initiation follow standard practice for machine-language programs. The Color Computer ver-

sion generates a text request for the first address to be examined, while the SS-50 versions just prompt you with a colon. All addresses are interpreted as being in hex notation. As soon as the four digits of the first address are specified, Newtalk pronounces them, followed by the two bytes of data contained there. Now you are off and running. There are only three commands, and their keys are conveniently grouped together at the lower right corner of the keyboard:

- A comma causes the next address and its contents to be pronounced and printed on the screen.
- A period causes the address and contents of the next location to be printed, but only the data is pronounced.
- Finally, a slash causes the address and contents of the current location to be repeated.

There is no command for scanning back toward lower addresses. To back up, or to jump ahead for that matter, hit any key other than the three just mentioned. This puts you back in Basic, and another EXEC gets the prompt for a new starting address.

The male voice is quite intelligible, although some characters are rather buzzy; the fact that you know the limits of its vocabulary undoubtedly helps. The quality is considerably higher than that of Spectral Associates' Compuvoice synthesizer, for example, although not as good as that from the Votrax chip used in Type 'N Talk and some other hardware synthesizers. If you are experimentally inclined, the pitch of Newtalk's voice can be altered by changing the contents of a particular delay counter location.

Usefulness

Newtalk is something of a novelty and should not be thought of as replacing a real monitor in any programmer's toolkit. By itself, it doesn't even have a facility for altering the contents of a memory location.

I have found it useful, however, to help follow machine code entered from the keyboard. Newtalk has proven to be of real value in reading out code to me while I follow the listing. It is much faster and more pleasant than visually scanning from printed page to video screen. If you think this sounds like a convenient way to work, and if you can spare the 6,500 bytes, then pick up a copy. ■

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Powerdraw
Powersoft
11500 Stemmons Exp., Suite 125
Dallas, TX 75229
Model I or III
$39.95

by Mark E. Renne

Powerdraw is one of the new generation of screen graphics utilities for the TRS-80. The program allows creating graphic screens and either printing them or using them in your programs. It's easy to use and you can save your creations in any of six different formats on disk or tape.

The program is in machine language and uses either joystick or cursor controls. There are two different modes: text and graphics; all commands may be used during either mode. The graphics mode allows you to draw on the screen using the arrow keys. Erasing is possible and you can move the cursor without destroying any of the graphics. There are eight different directions supported, the K, L, O, and I keys are used for moving in a diagonal direction. Movement at an angle may be changed to allow a variety of angles and shapes. Powerdraw supports the 32 character mode.

There are several special functions in the graphics mode including mirror image top-bottom and right-left, reverse, flip sides, display grid, and move. Figure 1 is an example of a drawing created with Powerdraw. Figure 2 is the same drawing after using the mirror-image, right-left mode. The reverse mode was used to compose Fig. 3.

The display-grid mode presents a pattern on the screen that can be used for centering your artwork. The flip-sides mode shows all locations during 32-character operation.

Move is a very powerful command that can make animation seem effortless. By entering the move mode and pressing a direction key, you can change the location of the entire screen in any direction. Text is entered by simply typing at the locations desired and may be screen edited. Screens may be sent to the printer using any of the three screen-printer drivers within the program.

When you are finished designing a screen, save it into a buffer. Powerdraw provides 34 buffers to work with. Several buffers together make up a file and several files can be merged together to create long animation. Buffers may be merged with each other or exchanged easily. You might draw a design, save it to buffer one, move it to the left five spaces, save it to buffer two, move, save, and so on. By using the watch-buffer command, you can watch all the buffers played back to back. Creating motion with this system is very easy.

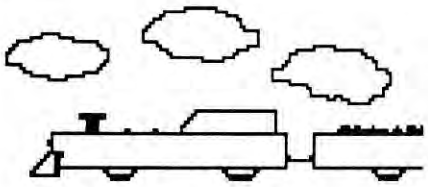

Figure 1

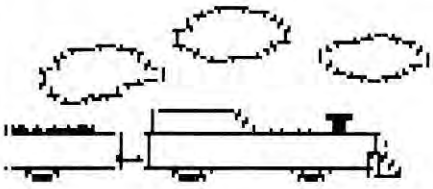

Figure 2

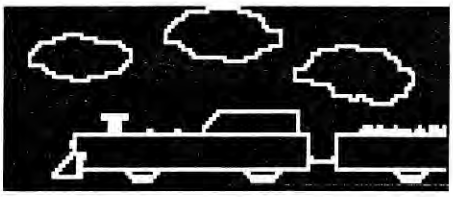

Figure 3

You can save files and several screen buffers only by using the Powersoft compressed format. They may then be seen from either Basic or TRSDOS by using the play utilities. Individual screens may be saved in either EDAS assembler code or EDTASM code for all of the machine-language folks. For Basic users the screen can be converted either to data statements or print statements. The screen may also be stored as a TRSDOS command.

The documentation is excellent and all commands are explained in great detail. Files may be transferred off the original disk as many times as you wish. There is a 23-buffer file included for demonstration and experimenting.

The program makes designing program covers very easy as well as creating cartoons to reward children using educational software. There are very few drawing assignments that could not be handled easily by this program.

The only thing missing from the program is a way to convert the screen into a string-pack format. If you try to edit the existing code and change PRINTS to A$=; the line will no longer execute. I'm sure this is a minor bug.

The overall performance of the program is great; I recommend it to anyone interested in a screen editor. ■

Color Scripsit
Tandy/Radio Shack
Fort Worth, TX
cat. #26-3105
$39.95

by Stephen G. Stone, III

At $40 a copy, Color Scripsit is a good value. As can be expected, however, of any $40 product in a market where $100 is considered cheap, some compromises have been made.

The program allows maximum use of your memory because of its ROM pack location. It is accompanied by a good 40-page manual thats biggest failing is its lack of caution regarding the program's limitations.

After you have inserted your ROM cartridge and turned on your machine, you are presented with a menu listing the six basic functions of Scripsit. The choices are: clear memory, edit text, save on tape, load from tape, print and change standards. Clear memory does just that, so be careful. Scripsit does give you a chance to change your mind before any damage is done.

The text editing mode is probably what you'll use the most. Text editing is accomplished by several facilities that make the job relatively painless. The arrow keys position the cursor within the text in memory. The left and right arrows move the cursor one position to the right or left. The up and down arrows move the cursor up or down one line.

Used in conjunction with the shift key, the arrow keys move the cursor to the start or end of the text (up and down arrows), to the next occurrence of a tab, or the start or end of a line (left and right arrow).

Text can be inserted and characters,

words, or blocks of text can be moved or deleted. Character strings can be located and changed. All these operations are easily accomplished.

There is one, however, that can lead to disaster if not executed carefully. When inserting text, pressing both the shift and the left arrow cause spaces to be inserted until the next tab location. This works well unless there is no tab between the point of insertion and the end of the line. If you press the shift and left arrow to insert spaces to the end of the line, the machine hangs up and the only way to recover is to hit the reset button. Unfortunately, when the reset button is hit, you lose the document in memory. To avoid this, use the enter key to space out to the end of a line.

Saving on Tape

Save on tape dumps the entire contents of your memory. After requesting this function, you get a new screen display that allows you to key in the name of the document you are saving and the name of the document on the tape which the one in memory should follow. If you don't key in a document name for the saved document to follow, the new document is saved starting at the current position on the tape. This is fine, just be careful that you are not writing over a good document. You can avoid this by specifying the name of the last document already on the tape.

Make very sure that you spell the name of the document on the tape correctly. If you should misspell the name, the processor goes merrily looking for a document that isn't there and continues to do so even after the end of the tape is reached. The only way I have found to regain control of the computer in this situation is to hit the reset button, losing all the text in memory.

Also important is to make sure when searching for the end of the last document on the tape, that you have only the play button engaged on the cassette deck. Do not place the deck in the record mode until Scripsit tells you to! If you use the record mode prematurely you risk the potential erasure of a document already on the tape.

Loading from Tape

The load from tape function displays a screen that asks you to key in the name of the document you wish to

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Z BASIC

To Celebrate Computer Shacks 1st anniversary, we have tested many hardware and software products and have slected these outstanding values to be given away in a drawing on December 15th. All gifts will be delivered by Christmas.

Our Grand Prize will be a Super Spooler by COMPULINK. The best 16k print buffer on the market. (List price $349.00) The next two lucky winners will receive copies of LazyWriter, the finest word processor for the TRS-80. (List price $175.00). We also have two copies of MULTIDOS, the Dos with the BEST BASIC (List price $79.95). Two Copies of SUPERUTILITY PLUS The original disk fixer upper (Retail $79) One copy of Z Basic the best compilier. Four copies of SuperDirectory the best Directory. Boxes of WABASH FLIPPY DISKS the first flippys made by a Major disk manufacture. Plus many games and other programs.

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load. If there is already something in memory, the new document is loaded in behind it, allowing you to edit both.

The print function allows you to direct the contents of memory to the printer or to print to tape. Printing to tape saves the text so it can be read by a Basic program. You can print less than the entire contents of memory when using the print function, by pressing the break key when you want printing to stop. By pressing both the break and 4 keys, you can print the line the cursor is on. Several contiguous lines can be printed by holding the keys down until you have printed the desired lines.

Standards

When you elect to change a page's format a screen listing the standards and their current values is shown. The seven standards are:

- Text width may range from 32 columns (screen width) to 132 columns (standard 14 7/8-inch paper width). The default is 32.
- The margin size allows you to specify the left margin size. The right margin will be the line width of your printer minus the total of the left margin size and text width. The default is zero.
- Hyphenation minimum allows you to specify the minimum number of letters a word segment can be after hyphenation. This value can be two or greater; three is the default.
- Lines per page allows you to select the number of printed lines per page. This value can range from 5–255. The default is 66. When using this parameter, you are determining the number of actually printed lines on the page. Blank lines in the text, such as those resulting from double or triple spacing, have to be taken into account. Thus, if you are printing double-spaced text on 11-inch paper, specify 33 lines per page.
- First page number allows you to specify the starting page number that is printed when using headings. This can range from 0–255. The default is one.
- Print spacing allows you to indicate the type of spacing (double, triple and so on) you want in the printed document. Acceptable values are 1–255. One is the default. Always make sure the value in lines per page is compatible with the value you have chosen for print spacing.
- All capitals allows you to specify whether you want your printed text to be all caps. An N enables upper and lowercase. A Y causes the text to be printed in all caps, regardless of how it is stored in memory. The default is N.

Color Scripsit operates quickly on documents not exceeding 5K or 6K. Documents larger than this cause a noticeable delay between the key stroke and the action on the screen. For personal or limited business use Color Scripsit is a good package. ■

Newtrieve
Unique Printing and Stationery Co., Inc.
11 Maiden Lane
New York, NY 10038
$49.95

by Bruce Powel Douglass

Newtrieve is advertised as "the programmer's program." It is an in-memory, recursive, sequential-search program of an array of 500 by 40 characters. It is meant to be used by programmers in data-base management systems for in-memory data structures. It performs very fast sequential searches of your data by key words. In fact, a 25,000-character array of data can be sequentially read in about one second.

The program disk contains a demonstration program called NT/DEM, a machine-language driver (which is the main part of the package), and two empty data bases of 500 entries of 40 characters each. A routine called ENHAN/BAS is provided and can be merged with NT/DEM to give additional commands.

The Manual

The manual is about 30 pages long, a large portion of which is devoted to listings of the two Basic programs. It does have a usable table of contents and is fairly complete in terms of providing enough information to operate the program. Some examples of using the program NT/DEM are given.

The program listing is complemented with a listing of the USR functions

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TRS-80* COMPUTING EDITION

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Percom's DOUBLER II™ tolerates wide variations in media, drives

GARLAND, TEXAS — May 22, 1981 — Harold Mauch, president of Percom Data Company, announced here today that an improved version of the Company's innovative DOUBLER™ adapter, a double-density plug-in module for TRS-80* Model I computers, is now available.

Reflecting design refinements based on both theoretical analyses and field testing, the DOUBLER II™, so named, permits even greater tolerance in variations among media and drives than the previous design.

Like the original DOUBLER, the DOUBLER II plugs into the drive controller IC socket of a TRS-80 Model I Expansion Interface and permits a user to run either single- or double-density diskettes on a Model I.

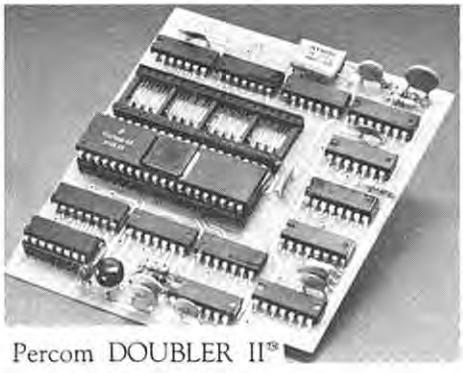
With a DOUBLER II installed, over four times more formatted data — as much as 364 Kbytes — can be stored on one side of a five-inch diskette than can be stored using a standard Tandy Model I drive system.

Moreover, a DOUBLER II equips a Model I with the hardware required to run Model III diskettes.

(*Ed. Note:* See "OS-80™: Bridging the TRS-80* software compatibility gap" elsewhere on this page.)

The critical clock-data separation circuitry of the DOUBLER II is a proprietary design *called a ROM-programmed digital phase-lock loop data separator.*

According to Mauch, this design is more tolerant of differences from diskette to diskette and drive to drive, and also provides *immunity to performance degradation caused by circuit component aging.*



Percom DOUBLER II™

Mauch said "A DOUBLER II will operate just as reliably two years after it is installed as it will two days after installation."

The digital phase-lock loop also *eliminates the need for trimmer adjustments typical of analog phase-lock loop circuits.*

"You plug in a Percom DOUBLER II and then forget it," he said.

The DOUBLER II also features a refined Write Precompensation circuit that more effectively minimizes the phenomena of bit- and peak-shifting, a reliability-impairing characteristic of magnetic data recording.

The DOUBLER II, which is fully software compatible with the previous DOUBLER, is supplied with DBLDOS™, a TRSDOS* compatible disk operating system.

The DOUBLER II sells for ~~$2[illegible]5~~ Now $169.95!, including the DBLDOS diskette.

The Percom DOUBLER II is available from authorized Percom retailers, or may be ordered direct from the factory. The factory toll-free order number is 1-800-527-1222.

Ed. note: Opening the TRS-80 Expansion Interface may void the Tandy limited 90-day warranty. ✓1

All that glitters is not gold

OS-80™ Bridging the TRS-80* software compatibility gap

Compatibility between TRS-80* Model I diskettes and the new Model III is about as genuine as a gold-plated lead Krugerrand.

True, Model I TRSDOS* diskettes can be *read* on a Model III. But first they must be converted and re-recorded for Model III operation.

And you *cannot write* to a Model I TRSDOS* diskette. Not with a Model III. You cannot add a file. Delete a file. Or in any way modify a Model I TRSDOS diskette with a Model III computer.

Furthermore, your converted TRSDOS diskettes cannot be converted *back* for Model I operation.

TRSDOS is a one-way street. And there's no retreating. A point to consider before switching the company's payroll to your new Model III.

Real software compatibility should allow the *direct, immediate* interchangeability of Model I and Model III diskettes. No read-only limitations, no conversion/re-recording steps and no chance to be left high and dry with Model III diskettes that can't be run on a Model I.

What's the answer? The answer is Percom's OS-80™ family of TRS-80 disk operating systems.

OS-80 programs allow *direct, immediate* interchangeability of Model I and Model III diskettes.

You can run Model I single-density diskettes on a Model III; install Percom's plug-in DOUBLER™ adapter in your Model I, and you can run double-density Model III diskettes on a Model I.

There's no conversion, no re-recording.

Slip an OS-80 diskette out of your Model I and insert it directly in a Model III.

And vice-versa.

Just have the correct OS-80 disk operating system — OS-80, OS-80D or OS-80/III — in each computer.

Moreover, with OS-80 systems, you can add, delete, and update files. You can read *and write* diskettes regardless of the system of origin.

OS-80 is the original Percom TRS-80 DOS for BASIC programmers.

Even OS-80 utilities are written in BASIC.

OS-80 is the Percom system about which a user wrote, in Creative Computing magazine, "...the best $30.00 you will ever spend."†

Requiring only seven Kbytes of memory, OS-80 disk operating systems reside completely in RAM. There's no need to dedicate a drive exclusively for a system diskette.

And, unlike TRSDOS, you *can* work at the track sector level, defining and controlling data formats — in BASIC — to create simple or complex data structures that execute more quickly than TRSDOS files.

The Percom OS-80 DOS supports single-density operation of the Model I computer — price is $29.95; the OS-80D supports double-density operation of Model I computers equipped with a DOUBLER or DOUBLER II; and, OS-80/III — for the Model III of course — supports both single- and double-density operation. OS-80D and OS-80/III each sell for $49.95. ✓3

Circuit misapplication causes diskette read, format problems.
High resolution key to reliable data separation

GARLAND, TEXAS — The Percom SEPARATOR™ does very well for the Radio Shack TRS-80* Model I computer what the Tandy disk controller does poorly at best: *reliably* separates clock and data signals during disk-read operations.

Unreliable data-clock separation causes format verification failures and repeated read retries.

CRC ERROR–TRACK LOCKED OUT

The problem is most severe on high-number (high-density) inner file tracks.

As reported earlier, the clock-data separation problem was traced by Percom to misapplication of the internal separator of the 1771 drive controller IC used in the Model I.

The Percom Separator substitutes a *high-resolution* digital data separator circuit, one which operates at 16 megahertz, for the low-resolution one-megahertz circuit of the Tandy design.

Separator circuits that operate at lower frequencies — for example, two- or four-megahertz — were found by Percom to provide only marginally improved performance over the original Tandy circuit.

The Percom solution is a simple adapter that plugs into the drive controller of the Expansion Interface (EI).

Not a kit — some vendors supply an untested separator kit of resistors, ICs and other paraphernalia that may be installed by modifying the computer — the Percom SEPARATOR is a fully assembled, fully tested plug-in module.

Installation involves merely plugging the SEPARATOR into the Model I EI disk controller chip socket, and plugging the controller chip into a socket on the SEPARATOR.

The SEPARATOR, which sells for only $29.95, may be purchased from authorized Percom retailers or ordered directly from the factory. The factory toll-free order number is 1-800-527-1222.

Ed. note: Opening the TRS-80 Expansion Interface may void the Tandy limited 90-day warranty. ✓2

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™Trademark of Percom Data Company, Inc. *TRS-80 and TRSDOS are trademarks of Tandy Corporation which has no relationship to Percom Data Company. †Creative Computing Magazine, June, 1980, page 26.

✓See List of Advertisers on page 371

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To see for yourself how amazing the ESF system is, or for more detailed information, call us toll-free at **800-538-8559** (inside California **408-737-7111**) and take advantage of our 30-day money-back return policy. Copies of the 80-page manual are available for $4.95 (which you can credit towards an ESF), and while you're on the line ask about our equally amazing 64K RAM/ROM board for the Model I.

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used to call the various functions from the machine-language routine, as well as a cross reference of variables and line numbers. The manual also lists the various optional data bases available from Unique Stationery. However, more specific information on interfacing Newtrieve with preexisting data bases and output for other purposes, such as a sorted printout of the index, would have been welcome.

One point that deserves mention is that since this program is directed to programmers, it is interesting that only a single license is purchased. It appears, therefore, that Newtrieve is meant only for in-house applications, and not for programmers to develop marketable products.

The Program

Newtrieve is composed of two parts: an index and a Basic program that references the index via USR calls. The index must all reside in memory at once. Additional power is added with the ENHAN/BAS module, which can be merged with the main Basic program. The Basic program is easy to use and reasonably powerful. It is also well documented, so the in-house programmer can see how the various parts of Newtrieve work, and develop his own application programs.

The index provided with Newtrieve allows 500 records with entries up to 40 characters. As mentioned, other indexes of varying character length (but limited to 20,000 characters total) are available from Newtrieve. Contact Newtrieve for price information on these optional indexes.

When you run Newtrieve, you will be presented with a menu. The top line of the screen shows the current load module (e.g., index) in memory, and the limit on the number of characters. The second line shows how to change the entry of the index at record "-." For example, if you wish to change the entry at record 100, enter 100. The program will display the record entry and ask you if you wish to change it. To make it empty, you merely enter X, and it becomes "EMPTY....." Pressing the enter key leaves it as is, and entering a string of characters changes its entry to be the entered string.

By entering G, you may search the index for *all* occurrences of the search key. When you do this, an asterisk appears by the G. Entering S causes the program to stop at the first occurrence of the search key and query you to continue with the search, return to the menu, or change the entry of the record.

The E option is very powerful. It allows a simple Boolean logical Not in your search. For example, suppose you wish to find all occurrences that have Length 34 but not those with Width 40. The E option enables searching for Length 34 with an Exclude for Width 40. Only those records that meet both the criteria are displayed. Your search key has an automatic And in that you may specify more than one word in your search key and it will return only the records with all the search words in them, although they do not have to be in consecutive order. Thus, a search of "pants long" would find "pants that are very long" as well as finding "long pants are good."

"It appears, therefore, that Newtrieve is meant only for in-house applications..."

B allows you to browse through your index. It displays the index beginning at some user-specified record number and continues displaying until it reaches the end. You may stop the scrolling by pressing the S key. The R key returns you to the menu, F continues scrolling forward, and B scrolls backwards.

Entering a 0 ends the program, 1 divides the index into two parts (250 records in each), and entering a 2 allows you to load another index into memory.

You get also a merge module with Newtrieve that provides two additional commands. The first command is used if a search does not find an entry, and provides you with the opportunity to enter it into the data base. The second command allows you to include data into the search string to execute a more specific search.

Limitations include the lack of a sort for printout, and the lack of specific information on interfacing the indexes with preexisting data bases, for both input and output. A few sentences are provided, but are rather incomplete. It would also be very nice to have a program to generate the custom data bases along with Newtrieve, rather than be stuck with the 500 records, 40 characters long, or one of the optional ones that you can buy from Unique.

The searches are very fast and do allow simple Boolean logical operators (And and Not) to be used. The program is easy to use and well documented. I would not recommend it for a general-purpose data-base referencing system for non-programmers, but a programmer should be able to use Newtrieve to his advantage in designing a data-base referencing system. ■

Microcomputer Data-Base Management
E.G. Brooner
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Blacksburg Continuing Education Series
Softcover, 158 pp.
$12.95

by Suzanne L. Foster

Microcomputer Data-Base Management is an introduction, definition and explanation of microcomputer data-based systems written for all experience levels. As in his first book, *Basic Business Software*, Mr. Brooner writes in a practical, down-to-earth manner that conveys complicated ideas without intimidating the reader.

The first two chapters prepare the reader for the rest of the book, which describes and analyzes several commercial data-base software packages. These chapters are helpful to anyone needing to evaluate commercial software and an asset to those wishing to write their own data-base programs.

Chapter 1 is a review of data bases and their distinctive characteristics. The differences between small and large systems and their pros and cons are noted, followed by a partial list of software and terminology definitions. Management of small data bases and

types of file material are covered, as well as the composition of disk files (hard and flexible), file mapping, and variations in operating systems.

Chapter 2 introduces sorting techniques and the methods used to search files. The discussion of sequential, random access, and binary search methods is thorough and well written. An introduction and explanation of hashing, using some easily understood examples, is given. This leads into linking of fields in hash files and their use as field pointers. Merge, Shell and bubble sorts are introduced, compared and explained. The author briefly introduces updating and renaming files, plus using key files.

Chapter 3 covers sequential reading and searching of unsorted files, using sorts to put keys in order, merging files, and saving the order of unsorted files within key files. Programs and sample printouts of data reinforce topics under consideration, enhancing the presentation of this material.

An in-depth discussion of file manipulation (hashing) is informative in chapter 4. Flexibility gain or loss is covered thoroughly, as is the structure of random-access files, preplanning file organization around a key field, and speed of record retrieval.

This portion of the book concentrates on the double table method, followed by a demonstration of the principles used. Hash data files and linking of lists are described concisely as is mapping data files. Programs, flowcharts and the sample printouts greatly enhance the material. Information on program applications and limitations assist in the comprehension of this material.

Chapter 5 contains an in-depth discussion of three different commercial data bases; Whatsit, Profile and Selector. These programs are presented as examples not to be directly compared, since each was designed for a different market and purpose.

For the real-estate executive, chapter 6 looks at a sophisticated, custom appraisal program adapted for the Selector package. Search criteria, file structure and sorted listings are discussed, as well as printouts with different formats, command sets and keyfiles. A 10-point plan is offered to convert Selector to this program or any other similar application.

The remaining chapters contain information including a multiple-file software package (not a data-base system), two applications for Profile, and an overview of QSORT and sort utilities.

There are three appendices, including a glossary, an ASCII table chart, and a list of addresses for software vendors. This is followed by the index.

This is an excellent tutorial book packed with information on data-base systems and their software applications. It is helpful for everyone from beginning computer-science students and small business owners, to those who already own or use computers. It is a valuable reference since many of the chapters include self-help test questions and exercises. ■

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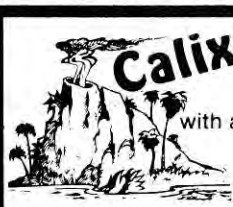

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Hayes Stack Smartmodem
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Automated Communications Exchange
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Deerfield Beach, FL 33441
$79 alone, $39 with purchase of Smartmodem

by Bruce Powel Douglass and Doris Christine Minnerath

What makes this modem think it's so smart? It's the Smartmodem's special Z8 processor, programmable in any language by ASCII character strings. The command buffer holds 40 characters that specify the modem's program. Eight DIP switches define the default parameters for the modem upon turning it on, but may be overridden by the modem's programming.

These capabilities open up some convenient options, of which Ace Computer Products of Florida took full advantage in their Automated Communication Exchange (ACE) software package.

The Smartmodem

The Smartmodem is an attractive 9.5 by 5.5-inch square by 1.5-inch high unit. Your phone or other Hayes Stack hardware, such as the Hayes Stack Cronograph, fit comfortably on top of the modem, merging compactness with attractiveness. The front of the Smartmodem sports seven LED indicators to show the state of the modem at any time. These include modem ready, send data, carrier detected, off hook, and others.

The Smartmodem has a two-year limited warranty (for you computer neophytes, that is virtually unprecedented in the computer industry). It is a direct-connect modem, which means that it is "cleaner" than other acoustical modems that require transmission through a microphone, and it is fully approved by the FCC.

The Smartmodem requires an RS-232C cable and interfacing software. It has an adjustable rate of 0–300 baud. The Ace software requires a 48K Model I or III with one disk drive.

The documentation for the Hayes Stack Smartmodem is a 70-page, wire-bound manual. It is well written and attractively reproduced on heavy 5 by 7.5-inch paper. Helpful diagrams, a detachable quick-reference card, and nine appendices all attest to the completeness of the manual. There is a good table of contents, although it lacks an index. The severity of this omission is mitigated by chapter 7, in which all of the commands and their parameters, default values, and ranges are listed and explained in alphabetical order.

Because of the excellent documentation, setting up the modem should be a breeze for even the greenest electronic communicator. To use it, you simply plug the modular phone cord into the back of the modem, connect the RS-232C cable to the modem, and you're in business.

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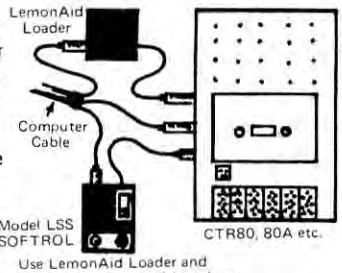

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The modem is always in one of two states; it is either in command state, in which case it can be programmed; or in on-line state, in which case the modem performs its classical function—transmission and receipt of data across phone lines.

For a simple example of modem operation, to tell the modem to dial a number, give the command AT D555-1212. The AT clears the command buffer and the D tells the modem to dial. The number that follows is the number dialed (at an amazing speed).

Several features contribute to the flexibility of the system. For example, the Hayes Stack Smartmodem incorporates auto-answer and auto-dial capabilities; no additional equipment is required for these tasks. With most modems, it is necessary to dial the number, and once you hear a carrier wave, to connect the phone line to the modem. This modem is so smart that in the event that it does not hear a carrier wave (indicating an on-line computer is responding) within a (programmable) length of time, it hangs up.

The modem cannot detect a busy signal, or a person talking over the phone line, but if a connection with another computer is not made within a certain length of time, the modem hangs up. The modem also has a redial option. If it receives a command A/, it automatically repeats the last command. If the last command is a dial command, the A/ causes the modem to redial the number and keep on redialing until an AT is received, informing the modem to give up by clearing the command buffer.

Either touch-tone, pulse dialing, or a combination may be used. A special group of Set commands allow control of dial-and-answer parameters. These parameters include dialing speed, number of rings before hanging up (0–255 rings), the number of rings before answering the phone when in auto-answer mode (0 means don't answer the phone), and others.

Programmability

Of course, the single feature that adds the most flexibility to the system is its programmability. With the right software you can program the modem to dial or answer, and send or receive ASCII files at some future time, even when you will *not* be there! One obvious application would be to program the modem to dial an information network and receive data during the low-telephone-rate evening hours, while you are sleeping.

If you are going to be present during the operation, the Smartmodem contains a two-inch speaker audio monitor (with adjustable volume) that allows you to listen to the progress of a call. This monitor cannot be used to speak to someone at the other end of the line, but in the event you would want to, you simply pick up the phone, and the Smartmodem will wait for a carry wave and then hang up (since it cannot hear voices). Or one command forces the Smartmodem to hang up immediately. Going the other direction, you can also initiate the call, and after you are finished speaking, transfer the call to the modem with the touch of a single key. In fact, the Smartmodem can go back and forth between on-line and command state within the same call session any number of times. This is convenient for entering ID numbers and other information required by bank services or information networks.

One sin of omission with the Smartmodem is the lack of ability to connect your phone to the modem in series. The Radio Shack modem, dumb as it may be, at least allows the phone line to connect to the modem and then from the modem to the phone itself. This allows you to pick up the phone in the event that a person, rather than a computer, answers the phone. This is possible with the Smartmodem by purchasing a signal splitter to divide a single phone line into two, connecting one to the modem and one to the phone. It would be nice to be able to avoid the additional cords.

The Hayes Stack Smartmodem is a great device, and I have had no problems with it. It is simple to program (much easier even than Basic), easy to use, and comes with good documentation. I highly recommend it for reliable and simple, yet sophisticated data communication.

Automated Communications Exchange

The Automated Communications Exchange (ACE) was designed exclusively for the Hayes Stack Smartmodem. ACE is a collection of interconnected programs designed to give you communication ease and power when used with the Smartmodem. The software requires a 48K Model I or III with at least one disk drive.

ACE allows some unprecedented clout for communication across the phone lines. It can look up a phone number, dial it, log on to the system, upload ASCII files, download ASCII files, log off, wait until another day and time and call another system, download a few files, and so on—all from a completely unattended TRS-80!

The system is easy to use, once you become familiar with it. The author, Mike Moore, thoughtfully included JCL (also known as DO) files, for those DOSes that support it, to allow the user to easily boot up ACE. Different files are provided for NEWDOS80 and DOSPLUS, since the protocol is slightly different for the two operating systems. To run the system, you first must set the DIP switches correctly on the Smartmodem. Once set, they do not have to be altered. These switches merely set the default parameters for the modem's operation, and ACE expects them to be set in a certain position.

Switch is a Basic program that loads the machine code driver GO/CMD and initializes the system for date and time. This is important for sending and receiving files. Once initialized, control passes to AHP, the automated host program. From here, the computer awaits the carrier signal of an incoming call or a keyboard command. You may transfer control to the ATP (automated terminal program) by pressing the space bar.

When you are in the host mode (AHP), you may call up your computer from a distant location. You will be asked for a log-on identification. If you fail to give an appropriate ID three times in a row, the program hangs up on you. After you log on, you may upload or download (save or receive) a call from the host computer. If you save the file, then AHP saves the file to disk using the name NOddhhmm, with dd = date, hh = hour, mm = minutes.

A list of outgoing calls from the host are kept in a disk file with the date, time, and file name to be sent. At the designated time, the AHP program transmits the ASCII file. What could be easier?

The ATP program puts you into the terminal mode. This allows you to talk to other computers as a terminal rather than a host; in this mode you may talk on the network systems and bulletin

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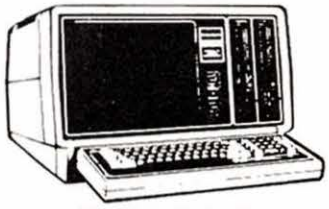

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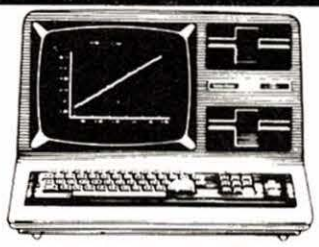

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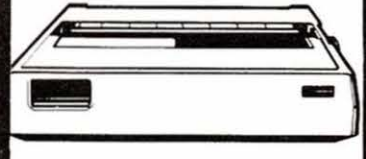

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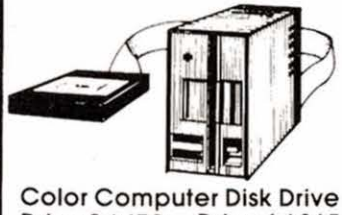

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"MAXI STAT Is The Most Versatile Statistical Analysis Program Available . . . On Any Micro."

Dr. Steven E. Mayer, PhD., Industrial Psychologist — Maxi User

Focus On: Maxi Stat

Who can use Maxi Stat?

Anyone who needs an analysis of statistical data. Maxi Stat has successfully replaced dedicated mainframe and time-sharing statistics programs for business, financial and marketing researchers, educational administrators, hospitals, medical schools and medical research facilities, agricultural testing, and social scientists.

What does it do?

If you're familiar with SPSS (Statistical Package for the Social Sciences) and what it can do on a mainframe, you have a good idea of what Maxi Stat will do for your TRS-80.

Maxi Stat offers many of the best features of SPSS (modified for microcomputers) as well as features you can't get in any other system, at any price. Maxi Stat is one of the most useful analysis packages available — anywhere.

Read on to discover what this remarkable new tool can do for you . . .

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- user-created codebook
- the ability to handle up to 255 variables
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  - frequency distribution
  - descriptive statistics
  - crosstabs & chi-square
  - correlation and linear regression
  - t-test
  - multiple linear regression
  - analysis of variance
  - multiple variable response

Summary

See for yourself what hundreds of other professionals have already discovered — Maxi Stat is THE solution to your analysis problems, and it's never further away than your TRS-80. Pull the plug on your time-sharing system and discover the power and convenience of Maxi Stat today!

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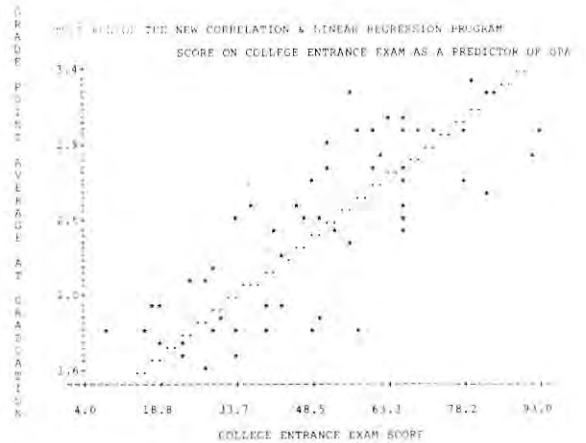

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By David Walonick

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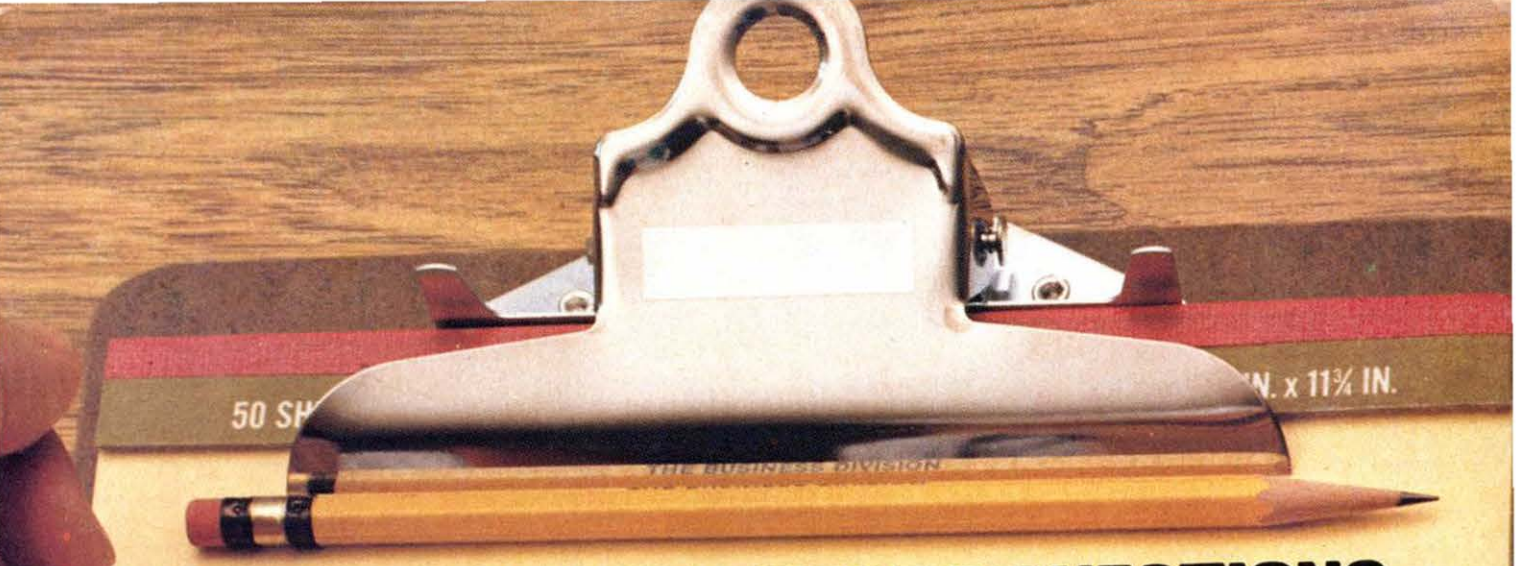

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2. Do you ever need to perform statistical analyses?	☐	☐
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4. Could you use a mail list program that will be easy to use, maintain an unlimited number of names, allow you great sorting flexibility, and even interact with a word processor?		
5. Do you own or have access to a TRS-80 microcomputer?		

If you answered "yes" to any of these questions, we can be of assistance to you. Our Maxi Series of applications programs are designed to give you maximum versatility with a minimum of hassle. These programs were created for business use, but you'll find yourself using them for personal applications as well.

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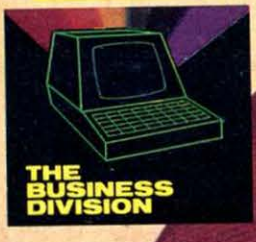

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boards. ACE is designed to allow single-command transfer of control from AHP to ATP, and when done, to revert control back to AHP (back to host mode). In ATP you may abort to AHP, dial a phone number, enter the live-keyboard mode, or transmit a file. In the live-keyboard mode, the characters you type are transmitted—this is the interactive mode normally used in communications networks.

The PFM program is used to edit the Call file. The Call file is used to indicate the time, date, phone number, transmission speed, prompt delay, and names of files to be transmitted. You may search by any of these fields for the appropriate record to edit, and this record will be displayed on the screen. You may then change any of the entries of the record. The Call file is the file used by AHP to find when and where files are supposed to be sent.

Documentation

The documentation for ACE is nicely printed and bound. It is somewhat lacking in its cross-referencing and is at times ambiguous. A new manual that remedies these problems is now being prepared. It does contain all the information needed and is reasonably well written.

Once you have played with the program and understand its operation, ACE is a joy to work with. It is simple to operate, and control flows smoothly among programs when necessary with a minimum of user interference. The programs function exactly as they are supposed to, and I have had no trouble with the package after taking the time to understand its operation.

The ACE software is excellent overall and takes full advantage of the Hayes Stack Smartmodem's unique characteristics. In fact, I am hard put to find anything that I would want a modem to do that this package will not do! The modem itself is simple to use, reliable, and has all the features I want in a modem except the serial connection of the phone to the modem.

The ACE software does everything I want a data-communications package to do—it sends, receives, auto-answers and auto-dials, it requires log-on identification, and it operates even when totally unattended. The Smartmodem and Automated Communications Exchange software together make an excellent communications system. ■

Newscript 7.0
Prosoft
Box 839
North Hollywood, CA 91603
$124.95

by Bruce Powel Douglass

Newscript is the best word-processing package I have seen. The well written manual references chapters divided into Edit commands and Script (formatting) commands. The manual includes chapters on installing Newscript for your computer and printer and how to create indices, titles, tables, and points (bullets).

Because of Newscript's power and flexibility, it will take a little while to get the hang of it but once you do you will find it to be a powerful word processor.

Newscript is written in Basic and machine language. Version 6.2 was fast, but you could sometimes tell when Basic was at work. This version has more of the program machine language. The editor is fast: no matter how fast you type, you won't lose keystrokes (except during disk I/O). The upper limit is 750 characters per second. Basic is used primarily for I/O and to install the front ends of Newscript.

Newscript is broken up into several programs. Control is automatically passed among them as needed freeing the user from the hassles of remembering which programs to run. Newscript is, for the most part, menu-driven and optionally integrates with Microproof's spelling checker, and the G.E.A.P. graphics editor. Control is easily passed to these programs. Newscript supports many printers, and provided your printer can handle it, supports double and single-width, italics, bold face, super and subscripts, underlining, and backspacing. Placing ASCII characters in your text will send the proper control characters to your printer. Further, various fonts are supported including 10, 12, 16 cpi (characters per inch) and proportional spacing for both dot-matrix and daisy-wheel printers.

Newscript is unsurpassed in printer control. The Itoh 8510 has a Greek character set. For my Statistical Package for Microcomputers (SPM), I needed to write an appendix of mathematical methods. It was simple to enter in the codes for the Greek characters and to super and subscript my mathematical expressions.

The editor is fine, but where Newscript shines is in how it formats the words on the printed page. Newscript easily creates tables, indices, tables of contents, form letters (with either keyboard entry allowed at format time, or selectively read data from disk files according to key words), change fonts, multiple top and bottom titles, center text, turn formatting on and off, and append and embed files together for long documents. No other TRS-80 word processor can match Newscript's ability to format text.

Newscript comes on a single disk for Model III users, and both sides of a floppy disk for Model I users. It is supplied on a TDOS system disk (an abbreviated version of DOSPLUS.) which is also quite good. Newscript can then use TBASIC, (a small Basic) leaving maximum space for your documents. The manual contains information of how to use TDOS, such as for backing up and formatting disks. Other DOSes are supported by Newscript, but TDOS does as well as any of them for Newscript's purposes, and it is certainly better than TRSDOS.

Newscript is for professional writing. It would be overkill for lesser needs.

Edit

Edit allows you to prepare and change documents. It does not format text. You embed the format commands for script within the text, but the editor will not format by itself.

The Edit screen is divided up into three areas. The top of the screen is the command line. On it you enter global or I/O commands. The left portion of the screen is called the LIMA (line manipulation area) and is used to enter line-oriented commands. The majority of the screen is taken up with the data area (columns 5 to 64 or more).

Think of the Edit commands as three categories. The character-oriented commands allow you to change a character by moving the cur-

sor to the offending letter and typing over it. You can insert or delete characters with the clear-key commands. Enter formatting commands by beginning the line with a period and the command, such as .pp to start a new paragraph.

The clear key functions as a control key in Newscript. Commands are activated by pressing it. You need only one hand to operate these commands since the clear key does not need to be held down while pressing the other command key. You can toggle the repeatability of the keys and send the current screen to the printer (no formatting takes place however), and you may enter any 8-bit code as an ASCII character.

With the LIMA commands you can label lines for block moves, copies, or deletes. You can also tell Edit to insert a number of lines or to replicate (make immediate copies) a line—useful in creating displays for the printed page. To enter LIMA, press the shift and left-arrow keys.

Global commands are entered on the command line ended with an enter. This is where you enter the global commands, such as (F)ind and (C)hange, as well as the I/O commands, such as (SA)ve and (GE)t.

There are a number of ways to find a string of characters. The simplest is to go to the command line by pressing shift, up arrow, followed by /string/ enter. The characters entered between the slash (/) delimiters will be searched for throughout the text in memory. You can repeat the command with a / enter on the command line, or a clear / from elsewhere on the screen. The Change options allow you to change one string to another. You can set the command to globally perform the change or confine it to the current line. To globally delete a string from the text, change it to a null string. The format of this command is C /string 1/string 2/.

Alter is an interesting command. It allows you to change one character to another in a manner similar to Change. You can change characters not included in the normal ASCII set by specifying the ASCII ordinal of the character. For example, AL /x/10/ will change x into an ASCII 10 character.

I/O

Pressing clear/S, saves the file with the current file name. You can save the file to another file name by entering SA file name. You can save the file to another disk by specifying the drive number. SA :3, for example, saves the file with its current name to drive 3. The Get function retrieves text from within a file and places it after the current (top of page) line. You may also specify a block of lines with the LIMA commands, and Put these lines into a separate file on disk. Other commands allow you to get a directory from any drive, repeat the last command, join lines, and assign limited macro definitions to global commands X and Y.

Newscript's editor is fast, easy, and powerful. It is similar to the IBM mainframe word-processor editors such as Waterloo Script, except that you have a repeating delete key and operation is much more interactive. After completing your document, save your changes and exit to a mini-menu from which you can Script the file or do a variety of other things. Control passes easily among the various parts on Newscript.

Script

Script formats the text and outputs it to the printer. When you enter Script you are asked for the name of the file to be Scripted. The file does not remain in memory—the various parts of Newscript are too large for that. The default name is the name of the last file operated on. After the file name is entered, you can enter any of a number of run-time Script options.

These options control the formatting of the text for this run only. The run-time options include the number of copies of the document to be made, single or double spacing, format to video only, enter a mini-edit format to edit a file while it is being formatted, specify the range of pages to be printed, indicate the number of the first page to be printed, print all lines in boldface, print only the table of contents, or do not generate a table of contents, and ignore any append commands within the text. I particularly like being able to specify a range of lines to be printed. Suppose that page 15 doesn't come out well. This option allows you to print only page 15. If you print long documents, this option is particularly nice.

Script recognizes the formatting commands because they all begin the line with a period (.) and have two letter codes. To center five lines of text, use .ce 5. To change to a font of 16 cpi, use the command .bf 16. The commands are many, but they are all fairly simple. The index and table of contents are built as the document is printed.

Controlling page parameters is easy. You can specify or change the left, right, top, or bottom margins, as well as turn formatting on or off and change the page length. You can specify several titles, top and bottom, and can even have different titles on the even-numbered pages as on the odd-numbered pages.

There are also commands for underlining and to permit keyboard entry of information into the document at format time. Superscripts and subscripts, as well as dark face, double width, italics, and backspacing are all done with escape sequences. An escape sequence is a pair of character pairs used to bracket a string of characters. For example, to print the string xxxx xxx in double width, type !(xxx xxx)! and the bracketed characters print in double width.

Form Letter

One of the most interesting and powerful attributes of Newscript is its ability to create form letters. You can create a data file and in it place a line of key symbols, a block of lines, followed by a number of variables.

When you use the Read .rd command, you can tell Script which key words to search for, and Newscript prints the documents for those entries with the keyword in its identifier list. You can then print out a number of lines in your text from the document, such as a name and address. In the body of your text, you can reference variables defined within the data-record entry, such as name or price information, and it is formatted as if it had been typed there! This is a very useful option.

I can use letter a for those folks that haven't paid for products. I merely specify the code word "unpaid" in my identifier list and it prints the letter for all those entries in the file. It prints out their names and addresses in standard form. Then in the body of the text, I reference their names (using variables), the product shipped, the date shipped, and the amount due. This is done for all entries in the data file, even though

the products, dates and prices may all be different for each entry in the data file.

Another thing Newscript does well is link different files together to create finished documents. If you want Script to format the text from another file and then return to the current position in the current file, just use an .im file name (imbed command). Another way to do that is to transfer control to a file never to return, with an .ap file name (append). The .im control word is used to insert text into a document at format time, while the .ap control word is used to link the end of one file to the start of another.

Between these two control constructs, Newscript makes it very easy to link files together into a finished document. A 100-page manual can be put comfortably into about 23 different files. The .st message command also allows you to stop the formatting and display a message, such as "go get disk #17,"; to continue formatting press the enter key. Thus, you may have any number of files linked together on any number of disks.

Other Programs

GENINDEX, another of Newscript's programs, allows you to create a list of words to be indexed. It actually takes a document and indexes all the words it is composed of. FITLINE breaks up large files into smaller files and links them together with .ap commands.

Newscript 7.0 is an excellent product. The documentation is great and sets new standards of excellence. The system itself is large, but needs to be to allow for the power packed by the Newscript package. Unless you are familiar with Wordstar or with mainframe word processors, it will take you a few days before you can put out any sizable documents, but the result will be well worth it.

Version 7 features even more machine language, and the speed is as fast as any program on the market. Newscript keeps a keyboard type-ahead buffer of 128 keys so that it never loses keystrokes, and can keep up with any printer I have seen attached to a micro. ■

Visigraph
Micro Software Systems
1815 Smokewood Ave.
Fullerton, CA 92631
$79 Model I
$89 Model III

by G. Michael Vose
***80 Micro* staff**

In a business, information is crucial to success, and gathering, organizing, and analyzing information is where computers make a significant contribution. With information, however, there is an intrinsic problem: What is the best way to look at it, to see quickly what it has to say? More and more businessmen will tell you the answer is graphs and charts.

Visigraph is a TRS-80 program intended primarily to produce graphs and charts from data generated by the popular VisiCalc program. Designed to work with the Epson MX-80 and MX-100 printers (Model III), or the Epsons plus the IDS Paper Tiger 440-G or 445-G printers (Model I), Visigraph offers high resolution, the ability to title and label graphs and charts, and a user-definable character set of plotting symbols.

Visigraph also permits the graphing of your own program's data, using VisiCalc's DIF (data interchange format) format.

Visigraph is distributed for the Model I on single-density, 35-track, NEWDOS-formatted disks. Model III disks are available for the TRSDOS 1.3 or the DOSPLUS 3.4 user. Both the Model I and Model III versions require 48K of memory.

The Whys and Wherefores

Once you've got all the Visigraph modules on your VisiCalc work disk, use this procedure to graph or plot a VisiCalc file. First, store your worksheet using the DIF format. Next, load a Visigraph graphform file, enter the graph features and the coordinates of the data to be plotted, and save the Graphform (now called a graphfile). Now load Visigraph, enter the name of the graphfile, and the graph is printed. If desired, you can even edit the graphfile to use different line and symbol shapes for plotting data.

"Visigraph is a TRS-80 program intended primarily to produce graphs and charts from data generated. . . by VisiCalc."

It all sounds quite simple, and it is, once you work with the program for a while. However, this is not a program for the novice computer user. Visigraph requires a working knowledge of the computer system and VisiCalc. Installation takes some time, and each graphform takes some time to set up. This program will *not* allow the plotting of VisiCalc files at the mere touch of a button.

But the program has many excellent features that make it a valuable tool for the VisiCalc user.

Advanced Features

There are two major features that make Visigraph so interesting—symbol definition and auto scaling.

The program uses 12 different symbols for making its graphs and charts. These symbols include simple periods, small squares (totally black or with a blank space in the middle), large squares, lines, a simulated circle, and others, including two Greek letters, epsilon and psi.

If you would prefer a symbol not offered, you can create your own (within limits) and save your symbols in a symbol table with a unique file name. You create these new symbols by filling in the individual blocks on a 7-by-7-block matrix printed on your screen. When you finish drawing a symbol, you add it to a symbol table and it will be available any time you want it. You can delete symbols from a table to make room for new ones. It is a nice program feature.

The auto-scaling function automatically calculates the most readable increment for any scale you attempt to plot. For example, if your horizontal scale starts at 1.34 and goes up to 56.7 with 7 increments showing, the program calculates those increments to be eight units each to give you the most easily read scale. (The mathematically correct value is 7.9044, which would

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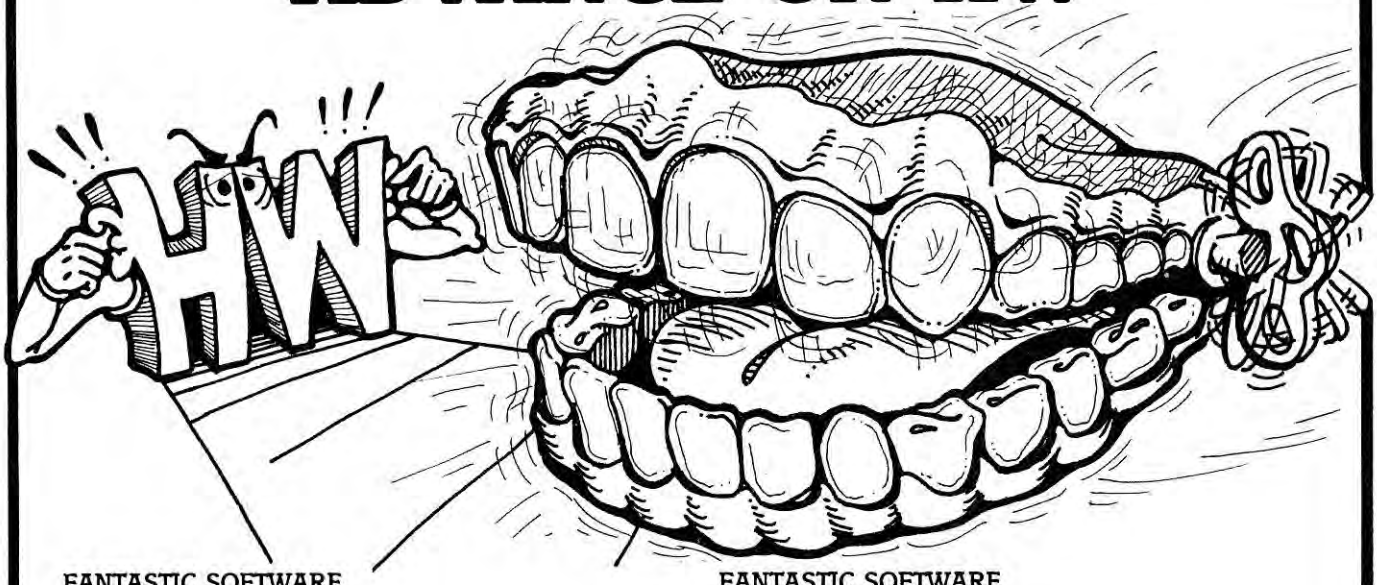

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produce a difficult-to-read graph.)

Most of Visigraph's features are similarly well planned and executed. The documentation, produced on an MX-80 and photocopied, is well written and complete. Micro Software Systems promises service after the sale and someone has always been there when I called. They have a patch to make the program compatible with Epson's MX-100 printer for users who bought a copy of Visigraph before June 1, 1982.

If Visigraph has a fault, it is simply that it works with only certain printers. I had to borrow an MX-80 to test the program because I have a Radio Shack Line Printer VIII. However, since it is written mostly in Basic, it is possible to make alterations that will allow the program to drive any printer that recognizes CHR$ codes. ■

Eds. Note: Visigraph is now available for the NEC 8023 and the Line Printer VIII printers for both the Models I and III.

Dynamic Report Generator
Dynamic Software
58-04 208 St.
Bayside, NY 11364
$14.95

by Bruce Powel Douglass

The Dynamic Report Generator (DRG) is an inexpensive program to generate columnar reports of data within specified parameters.

For your $14.95 you receive a program disk and manual. The disk has two programs—RUN/CMD, a runtime module for the compiled program, and DRG/CHN.

The manual is 4 by 5 inches and 44 pages long. The program is easy to use and the manual is composed primarily of a long example that uses all of the program's commands. The manual, although quite good for its limited scope, is rather poorly xeroxed.

The program is menu driven and allows little flexibility in the form of the data output. This makes manual writing easier. The flexibility is limited to varying the number of columns of data, their titles, data type (string, numeric or result), and the relationships among them.

To run the program, you enter the line RUN DRG from DOS, rather than Basic. DOS loads and executes the program RUN/CMD. RUN/CMD then checks the command line and finds that you want to run DRG/CHN. It then loads DRG/CHN and executes it. You are next presented with a command menu.

The first option, Create, allows you to create your data-base structure. The second allows you to add entries to it. The third allows you to change either data within the data base or the names or type of the data columns. The fourth allows you to delete records. The fifth sends the list of the data base to the printer. The X option allows you to exchange columns in your data base (to allow you to index your data by any entry). The last updates and sorts the data file and exits back to DOS.

In the Create mode, you may have up to 10 data columns, with a combined total of 132 characters. Each data column is a user-selected width and data type. The data types supported are string, numeric, and result. The string type may be any string of characters less than or equal to the length of the data column width.

"In the Create mode, you may have up to 10 data columns, with a combined total of 132 characters."

The numeric type is a decimal number. In the width for numerical type data, you must allow three places for a decimal point and two trailing digits even if you enter only integers. The most interesting data type is that of result. It is automatically numerical, but allows you to choose an arithmetic operator (+ − / *) and operands. You may use a constant operand and combine it with a data column to come up with a new data column, or you may use two data columns and combine them into a third.

You must remember to add two extra spaces to your columns or you may well run out of room when printing your data. If this occurs, the data is printed with as many digits as space allows, and a % at the left of the number.

When you create a data column, you are asked to specify its name, width, and type. If you exceed the number of columns specified in your response to "print width," the program tells you a mistake has been made. I found this routine a little clumsy to use, particularly if your typing is not too accurate. You may edit your column names and types later with the Edit option, but you may not change their width. Once the data is set into a specific format, it stays there!

When you have created your column structure, you may add data with the Add option. One nice thing is that it prompts you to input values for each of the columns except for the result columns (since these will be calculated by the program). It displays a graphics block out to the right of your cursor, to mark the limit of the width of that particular column. It does not prevent you from typing over it, but it won't accept a line that is too long.

Each record is stored on disk as you enter it. The Terminate option merges it with the previous cumulative data base, performs the sort by the first column, and then exits to DOS. It would be nicer if this could all be done while still in the program.

The first data column is the index column. You are required to use a unique index entry for each record. The data will be sorted by the index column with the Terminate option. You may use the Exchange option to exchange the index data column with any other string-type data column in your data base. This enables you to sort by any string (non-numeric) field. To have it sort by the new index, just use the Terminate option again.

The program lists your data sent to the printer as well. To do so, you are asked for the number of print lines per page, then if you would like to list today's entries, or all except today's. Press the appropriate number and you will be asked for the print title. This ti-

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tle, along with the page number, appears on each sheet of the output. Next, you are asked to ready the printer and away you go.

The program is not perfect, but quite good considering the cost. A few things that might be added include better error-trapping, a sort command independent of the Terminate option, and a way to browse through the data without sending it to the printer. The program bombs on several types of input errors, requiring you to reload the program. The manual doesn't even mention errors. It should tell you which entry number you are currently entering when you are adding data. The program is not case-blind. That is, it won't accept an a for an A. It does not support any printer options other than number of lines per page, a title, and page numbers.

Overall, the program is quite a good deal for the money. There is nothing of which I know that can compare for the low cost. If you need simple reports of the specific type that DRG can generate, you certainly would be hard put to find a better way to spend your $14.95. ■

Tandy Six-Pen Plotter
Radio Shack
Fort Worth, TX
$1995

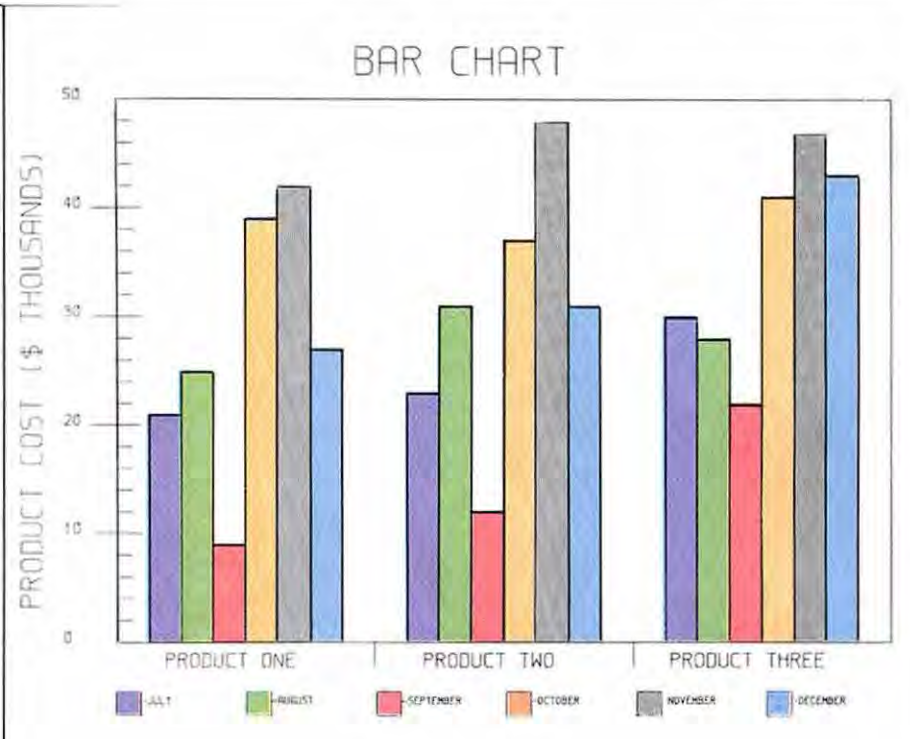
by Bruce Powel Douglass

A plotter is a device specifically designed to plot functions and data, rather than print text. A printer is designed to print text. Assuming adequate hardware capability, one may be forced into the role of the other, but usually with limited success. It is difficult to get the resolution necessary for data and function plots with a printer, and with many printers it's impossible. A plotter can simulate a printer by creating and drawing characters, usually with several angles of rotation, but it is not very efficient at text printing, even though it is very efficient at drawing lines and circles.

There are two types of plotters. Some plotters fit the paper on a drum and then roll the drum during the graph's creation. A flat-bed plotter holds the paper on a flat surface and plots by moving a pen over the paper. The Tandy six-pen plotter is a flat-bed plotter that handles up to 8.5 by 11 inches. It can plot graphs of up to 7 by 10 inches.

The resolution of a plotter refers to the fineness of its drawing capability. The Tandy plotter can plot 200 points per inch, which, although not extremely fine resolution, is adequate for most purposes. It plots at 2.8 inches per second. As with most plotters, the Tandy plotter requires special pens that may be purchased separately. With special felt-tipped pens, you can easily create overhead transparencies with the plotter, for those impressive professional presentations.

The Tandy plotter allows relative or absolute coordinate addressing, several line-type patterns for drawing, circle, and arc patterns; 93 ASCII characters with variable sizes; four rotational angles for plotting; and some special marker symbols for use in creating graphs.



Tandy Six-Pen Plotter

The plotter allows the use of up to six different pens, allowing for the easy creation of multicolored graphs. It features a touch control panel to allow manual or remote control of the plotter. In manual control mode, you may move the pen by pressing an arrow key on the control panel, raise or lower the pen, or reset the plotter. Since it requires an RS-232C interface, most computers can drive this plotter, including the Models I, II, and III as well as the Color Computer. I reviewed the plotter using a Model I.

The plotter is rather small (13.5 by 10.5 by 6 inches), yet attractive and it seems rugged. Its buffer can hold 768 bytes of instructions. The plotter has its own Z80 microprocessor and operating system. It has 1K of RAM and 6K of ROM for use in the generation of lines and characters. It accepts ASCII codes at 2,400 baud as instruction and data.

The Tandy six-pen plotter is easy to program. It lacks some of the flexibility of the HP 7225B plotter, but its use is simpler. Single characters comprise the plotter language (called DM/PL), and they allow a great deal of control over the plotter. Some of these commands are plotter select or deselect, plotter reset or test, pen up or pen down, new pen, home position, set plot origin, set line type, position pen (absolute or relative), plot characters or special markers, and plot arcs or circles.

A plotter allows drawing of a line

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Over the past year, a number of powerful competitors have introduced new microcomputers. Most people will instantly recognize the names of Xerox, IBM, Hewlett-Packard, Digital Equipment and Zenith. The Japanese companies, Sony, NEC, Sanyo, Toshiba and Sharp, are equally well-known. Together, these companies have committed over a billion dollars to compete effectively in the micro market. TRS-80 owners should be aware that every one of these companies has chosen CP/M for their standard operating system. Over the next few years, these companies will sell millions of CP/M computers. Considering these facts, it is clear that CP/M is the operating system of the future.

Apple and Commodore Offer CP/M.

In a recent press conference, the Apple Computer Company stated, "The largest installed base CP/M system in the world today is the Apple II with the Z80 card from Microsoft." In a recent full page ad in the Wall Street Journal, Apple announced CP/M for the Apple III. Commodore, refusing to be left behind, has recently announced their "Emulator" series of computers that support CP/M. There are even rumors that the new Tandy 16 will support a version of CP/M.

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CP/M has always been the standard for business and professional use. This market has always demanded high quality and high performance. The high prices for CP/M programs reflect the additional effort required to develop top-quality software products. To help our customers afford CP/M software, Omikron has formed Cougar, our official users group. Through Cougar, Omikron can purchase software products in large volume. This allows us to offer our customers some of the best CP/M software in the industry at greatly reduced prices.

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between points by dropping the pen onto the paper and moving the pen to the end point of the line. The Tandy plotter supports 10 types of lines, which make it useful for multiple-line graphs. The default is a solid line, but various types of dotted and dashed lines can be software selected. With a plotter, you can draw lines either with absolute or relative addressing. This means that you draw a line to x, y or you may draw a line up three and over 10 from the present position.

The New Pen command allows software selection of a different pen. The pen holder replaces the current pen into its place in the pen changer and grabs the next pen for use. It's nice to watch your plotter grab the various pens it needs, draw with them, and put them back. Now if we could just get it to put the caps back on the pens when it is through!

To print characters on your plot, the plotter must draw them. The Tandy plotter sports 93 ASCII characters in its character set, as well as four special marker symbols for use in graphs. Plotters allow you to specify virtually *any* size characters to be drawn, from too small to read up to big enough to fill the page. You can also rotate the characters and print them at a number of angles. The Tandy plotter is limited to four angles (0, 90, 180, and 270 degrees). This makes for easy labeling of graph axes. That is impossible to duplicate with a normal printer!

Many plotters cannot directly plot arcs and circles. Usually, this must be done by the plotting program, but the Tandy plotter has commands for directly specifying arcs and angles to be drawn. To draw a circle use CCx,y where x and y specify the center of the circle. The current pen position is on the circle circumference, and is used as the starting point for drawing the circle. To draw an arc, you use the command CA x,y d where d is the number of degrees of the arc to be plotted. One obvious use of these commands is the production of pie charts.

"Tandy-Graph is a software package that allows you to draw simple line, bar, and pie charts."

Tandy-Graph

Tandy-Graph is a software package that allows you to draw simple line, bar, and pie charts. The disk containing Tandy-Graph contains a curious problem. The sample files provided for examples cannot be read directly by the main program Tandy. They have an extension not supported by the program. It was trivial for me to change the program so that it could read the sample files, but a newcomer to computers would be stymied. The Tandy program works simply and easily for the creation of good looking graphs and plots.

The manual is a thin 50 pages, but it contains enough information to operate your plotter even if you don't know much about computers. Tandy generally has good manuals, and this one is not bad. It lacks an index, which it could use, but the organization of the manual makes it relatively easy to find what you need to know without too much thumbing through. The manual is printed and written understandably. It presumes a certain familiarity with computers that a novice might not have, but anyone who has played with a TRS-80 for a few weeks will be able to follow the manual quite easily.

The software provided works well and is menu driven for ease of use. It is not the most powerful software package imaginable, but it is serviceable and creates some very attractive graphs and does so with a minimum of pain. The plotter itself is simple enough to control, eliminating a great deal of the creative programming that normally accompanies the writing of software packages for specific purposes. The best commands available on the Tandy plotter are the rotational character drawing command, 10 line types for plotting, and the circle and arc plotting commands. The package is good and very useful. It is also competitively priced. If you need a multi-pen plotter that is simple to program and comes with software that will handle most of your graphical needs, then consider the Tandy six-pen plotter. ■

MDX-3 Interface PC Board
Micro-Design
Manchaca, TX 78652
Model III
$74.95

by Mel Patrick

At present there are many companies who offer whole or partial kits to upgrade your Model III for floppy disks. These kits usually include one disk drive, an additional 32K of RAM to give you a full 48K, a floppy-disk controller interface, and a power supply for the floppy disk. Micro-Design's MDX-3 interface board not only has these standard items incorporated, but an RS-232 and a modem as well.

The MDX-3 is a bare printed-circuit board that you populate with the required components. When fully constructed, the board's options include the RS-232, floppy-disk controller, and a 300-baud answer or originate modem. A 43-page manual guides you through all stages of construction, assembly, and installation.

The MDX-3 fits inside the Model III's case in the same place that is normally occupied by the RS-232 and Radio Shack's floppy-disk controller card. All mounting hardware for the installation is included with the board. The MDX-3's external disk-drive connector and RS-232 connector exit through the same slots in the bottom of the case as does Radio Shack's.

Assembly

Construction of the board begins by accumulating the parts required for the sections desired. The modem requires the RS-232 for operation and cannot be constructed as a stand-alone section. However, the floppy-disk controller or RS-232 can. The manual includes a total or separate parts lists for those needing only one of the options. Also included in the manual is the name and address of four companies who can supply some or all of the necessary parts. Computex in Webster, TX, is not mentioned but they do supply a complete set of pre-packaged parts.

Considering the complexity of the

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the Color Computer Word Processor

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The Color Computer is an incredibly powerful and versatile computer, but for text editing it has some major drawbacks. The small 32 character by 16 line screen format shows you too little of the text and, combined with its lack of lower case letters, bears little resemblance to the way text really looks on the page. Reverse video in place of lower case just adds confusion.

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You can copy, move or delete any size block of text, search repeatedly for any pattern of characters, then instantly delete it or replace it with another. Telewriter gives you a tab key, tells you how much space you have left in memory, and warns you when the buffer is full.

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— The RAINBOW, Jan. 1982

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You can print all or any part of the text buffer, abort the printing at any point, and there is a "Typewriter" feature which allows you to type straight to your printer. Because Telewriter lets you output numeric control codes directly (either from the menu or during printing), it works with any printer (LPVII, LPVIII, MX-80, Okidata, NEC 8023, C. Itoh 8510, Centronics, GE Terminet, Smith Corona TP-1, etc.). There's even a special driver for the Epson MX-80 that lets you simply select any of its 12 fonts and do underlining with a single underline character.

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The disk version can be simply customized to the precise number of drives in your system. From the disk menu, you can list any directory (including free space) to the screen or to the printer, rename or delete files, set the default drive and return to BASIC.

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. . . one of the best programs for the Color Computer I have seen . . .

— Color Computer News, Jan. 1982

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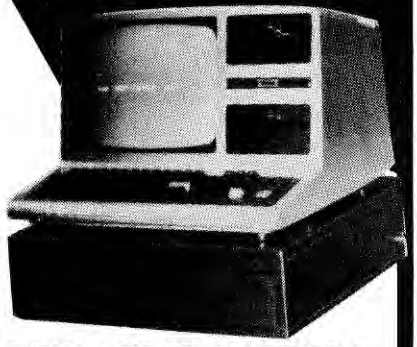

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circuitry, construction is quite easy. The PC board is silk-screened for parts placement and is not crowded. A page in the manual is an exact duplicate of the silk-screened board with all the component designations on it. This is extremely helpful in cases where drilling the board has removed the part number.

Micro-Design recommends that IC sockets be used because of the ease of repair or troubleshooting, should the need arise. After all the sockets are installed, resistors and capacitors are added.

"The cost of constructing the interface and buying the disk drives yourself is very low."

According to the manual the next step involves installing the crystals X1 and X2. On the board that I have (marked Rev C) there is no X1 or X2, but rather a Y1 and Y2. I found that Y1 is X1 and Y2 is X2.

Finally, the diodes and the polygore cables are installed. These cables are nothing more than ribbon cables with pins that fit the connectors on MDX-3 and the main board. They don't lend themselves to a great deal of flexing, so try to avoid it if possible.

Testing

Before the MDX-3 is actually installed in the Model III, the options must be checked out. Once mounted in its location in the Model III there is no way to get at it (it's behind the main CPU board). The manual is very useful as a guide in this section.

At this point none of the ICs should be installed. The manual clearly describes how to open the case and connect the MDX-3 to the computer's power supply and to the main CPU board. Also strongly recommended at this point is the installation of the additional 32K of RAM.

Once the MDX-3 is connected, voltage tests are conducted and verified. If all of the voltages are correct, install the ICs and proceed to test each section.

Troubleshooting

Should any section not check out, there are two avenues open. One is to remove the board and send it to one of Micro-Design's repair centers (located throughout the U.S. and Canada). The other is to refer to the manual and try to fix it yourself. I had a disk problem. Sometimes the disk worked normally and other times it wouldn't boot. The manual states that a Z80A CPU could replace the standard Z80 CPU if the main board (Radio Shack's) was marked REV F. It was, I did, and it worked—perfectly.

Installing Disks

The MDX-3 assumes that the owner already has installed the disk drives and their required power supplies. I obtained two standard 40-track, double-density drives with cases and power supplies. In order to mount them the same as the standard Radio Shack drives, I ordered a right and left disk-mounting bracket and an RF shield from Radio Shack.

I recommend the RF shield; it attaches to the left disk-mounting bracket. If it isn't used, the high-voltage lead to the videopicture tube, which is very close to the disk drives, may interfere with the drive operation.

You may also order bare disk drives (no case or power supply). In that case order the Radio Shack disk power supply, #AXX6005. It is capable of powering two internal drives.

Summary

If you can solder neatly and follow instructions carefully, there would be little or no problem in constructing and installing the MDX-3 interface board. Should you encounter any problems, Micro-Design seems more than willing to help. They have technicians available for this purpose after business hours and also have service centers should the problem be unresolved.

The cost of constructing the interface and buying the disk drives yourself is very low. Combine this with the fact that the interface also contains an RS-232 and a modem and you have an extremely low-cost system. It is this, plus the support of Micro-Design, that makes the MDX-3 a worthwhile investment. ■

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The Custom TRS-80 & Other Mysteries
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by Fred Blechman

If you have a TRS-80 Model I and you want to know what makes it work (or *not* work), and what you can do to make it do things it normally can't do, then this book will fascinate you. This work represents just a part of the vast storehouse of knowledge gathered by Dennis Bathory Kitsz.

A regular columnist for several microcomputing magazines, Dennis has combined his software and hardware expertise with his ability to write in readable (and sometimes humorous) form.

This book is almost a TRS-80 Model I encyclopedia, and contains many photos, schematics, tables and Assembly-language listings. Subjects include converting binary to decimal, reading the pins, color codes, power supplies, creating Basic tokens, and many more.

The overall coverage is very broad. There will be very few who pick up this book and don't find within its pages something new and interesting. However, much of the book may be well beyond their present abilities or interests; it is not for the beginner.

Although Dennis gets down to some basic information in the Introduction, like schematic symbols and resistor color codes, chapter 1 launches right into opening up the TRS-80 main computer unit. He then describes the Basic Level II ROM power-up routines starting at address 0000—useful if you are interested in Assembly language.

Chapter 2 gets into simple logic devices, machine language (with a detailed memory map showing significant hexadecimal addresses), and a long chart showing the commands available in Level I, Level II and DOS-like Level III.

Dennis discusses CPU hardware, program RAM control, video RAM, the keyboard, ROM control, output controls, wire-wrapping techniques, and peripherals (specifying the addresses, output ports, and other interfaces used by about 40 popular non-Radio Shack TRS-80 add-ons).

The chapter on software modifications covers the Editor/Assembler, and features 12 Assembly-language listings covering information as diversified as keyboard debounce and auto-repeat to dynamic memory tests and voice I/O using the cassette port.

Chapter 4 covers several hardware additions, some relatively simple (16K keyboard memory, and an RF modulator jack) and some more complex adding a hexadecimal keypad and reversing the video).

Chapters 5, 6 and 7 contain information on the Radio Shack Expansion Interface (with its problems and cures), the two "other 80s"—the PMC-80 and the LNW-80—high-resolution graphics, interpreters, a power-up monitor, the CLOAD problem, interfacing with external devices, D/A and A/D conversion, music, and sound effects.

The book concludes with topics such as a parallel printer interface, real-time clock/calendars, different disk operating systems, high-speed cassette loading devices, and 15 categories of 111 common crashes and their cures.

Appendixes I, II and III give recommended (and not recommended) parts suppliers, an extensive bibliography of books, manuals, guides and periodicals, and six pages of ASCII codes and conversion tables. Appendixes IV, V, VI and VII provide a six-page Assembly-language utility program that does everything but the windows, 30 pages of pinouts, technical specifications and data, an eight-page glossary, and parts lists and PC board layouts for the various projects in the book.

I reviewed the first printing of the first edition, February 1982, and some "problems" were evident, mainly in the captioning of the figures and text references like "see Fig. (?)" or "Table (?)"—obviously meant to be identified before printing. For example, Figs. 2-11 through 2-39 appear to be missing, but aren't—there's just a big gap in the numbers. Also, one would expect to find a big fold-out schematic of the entire Model I, but it's not included. Reference is made, however, to the *Radio Shack Microcomputer Technical Reference Handbook* (catalog # 26-2104), which does contain the Model I schematic.

No mention is made of the applicability of this book to the TRS-80 Model III. I suspect most of the hardware

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would not apply, but many of the programs could be used for the same purposes in the Model III.

This book is destined to become one of the reference classics among TRS-80 Model I owners. ■

The Custom TRS-80 and Other Mysteries
Dennis Bathory Kitsz
IJG Inc.
1260 W. Foothill Blvd.
Upland, CA 91786
Softcover, 335 pp.
$29.95

by Charles Edwards

Dennis Kitsz's long-awaited book, *The Custom TRS-80*, has finally arrived on the bookshelves. Many people, myself included, have awaited its appearance with bated breath.

This book has had a long and painful transition from Mr. Kitsz's fertile mind to your local bookstore. Publication was delayed several times and IJG even published an apology to those who had purchased it in advance. Unfortunately, the final product reflects this sorry history.

The book is riddled with editorial/typesetting errors. Diagrams are mislabeled or unlabeled, there are sudden and unexplained changes of topic, and an entire appendix is even missing.

In Chapter 6, after being promised information about how to replace the Basic ROM chips, Mr. Kitsz says, "Before turning to the details, you may be asking, 'How can control be wrested from the Z-80?'." He answers this question and then merrily proceeds to a different subject, leaving us completely in the dark about ROM replacement.

Also in Chapter 6, there is an article that should be interesting to many people: a high-resolution graphics board. There are two full pages of schematics for this project and several pages of assembly and troubleshooting advice. Unfortunately the parts list was omitted.

I wish these examples were atypical, but this occurs over and over again throughout the book. The prime culprit seems to be the hardware mods. There is simply no coordination between the text and the associated diagrams. This might have been ameliorated by Appendix VII which (according to the table of contents) contains a list of parts and PC board layouts for the projects. However, this entire appendix seems to have been misplaced somewhere in the typesetting room.

These problems seem mainly confined to the major hardware projects, but errors can creep up even in the smallest of projects. A modification to reenable the reset button for a system with an expansion interface has only one electronic component: a resistor. However, the text says to use a 10K ohm resistor and the diagram says to use 1K ohm. After making this change (with a 1K ohm resistor) I discovered that as a side-effect, the real-time clock is disabled. This would seem significant enough to warrant mention in the book.

The parts of the book dealing with software seem to have fared better. I have not tried all of the programs presented, but those I checked worked correctly. Mr. Kitsz presents a keyboard driver with debounce/repeat/beep functions, a method of creating self-executing Basic programs, and methods to save a NEWed program and reset memory size.

There are other programs scattered throughout the book, but the best by far is the custom interpreter. It patches Level II to provide the following functions: debounce/repeat/beep, lowercase driver, dynamic resetting of memory size, restoring NEWed programs, hex/ASCII/graphics monitor, single stepper, save a block of memory as a System tape, and save a running Basic program as a System tape.

But the most valuable part of the book is Chapter 11. This chapter provides 112 pieces of advice on how to avoid/repair common problems with the Model I. This chapter alone is almost worth the cost of the book.

Notice I used almost. Given its other problems, I find it hard to recommend that anyone spend $29.95 for this tome. Perhaps Mr. Kitsz and his editors should get together, reedit the hardware sections, and release a corrected version. Now that would be a book worth waiting for. ■

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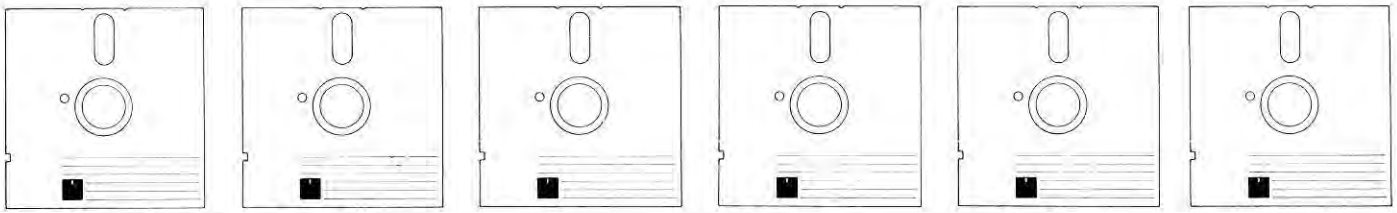

REVIEW DIGEST

edited by Janet Fiderio

Silicon Valley, Michael Rogers, Simon and Schuster, NY, $15.50.

"If you can accept their success and brilliance, and bear with the dialogue that sometimes sounds like a cross between soap-opera cliche and Sippl's *Microcomputer Dictionary*, you may enjoy your trip through *Silicon Valley*. . . . The plot is fast-paced, and the scenes involving the Turing Test are intriguing, notwithstanding the What's My Line nature of the panel. . ." *Infoworld,* July 26, p.31.

Ghost Gobbler, Color Computer, Spectral Associates, 141 Harvard Ave., Tacoma, WA 98466.

"The game is a good imitation of Pac-Man. It, like other TRS-80 Color Computer games, suffers from the horrible imprecision of the Color Computer joystick. Nevertheless, if you enjoy Pac-Man, you will enjoy Ghost Gobbler too." *Creative Computing,* August, p. 42.

System Saver, Models I & III, Acorn Software Products Inc., 634 North Carolina Ave., Washington, DC 20003.

"FLEXL provides you with a quick and easy method of duplicating System tapes and is extremely easy to use in converting Model III System tapes to the higher baud rate. . . . If you have ever had a System program that loaded below 5200 hex and tried to load it to disk, you will appreciate TDISK." *Infoworld*, July 26, p.

Science Observed, Jeremy Bernstein, Basic Books Inc., NY, 376 pp., $16.95.

"A quick scan reveals many magic names—Minsky, Einstein, Dyson, Whitehead, and Papert to name a few—and one can almost imagine a signpost reading 'Here there be giants' pointing to the depths of the volume. . . . The section on Artificial Intelligence gives much good background on the field. The essays on time and on fusion are interesting and informative. But. . .the book is unlikely to inspire anyone to go forth and learn more about the topics covered." *Creative Computing*, August, p. 251.

REMDISK-1, REMsort Inc., 571 E. 185th St., Euclid, OH 44119.

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Fun with Microcomputers and BASIC, Donald D. Spencer, Reston Publishing Co., 11480 Sunset Hills Road, Reston, VA 22090, 128 pp., $9.95.

"I am a person with a low pain threshold, when it comes to plowing through 'introductory guide.' . . . Don Spencer's book is different. It's fun, it really teaches, and it's an almost painless introduction to microcomputers and Basic programming." *Compute*, July, p. 187.

Android Design: Practical Approaches for Robot Building, Martin Bradley Weinstein, Hayden Book Co., 50 Essex St., Rochelle Park, NJ 07662, 248 pp., $11.95.

". . . *Android Design* is anything but fiction. It is full of facts and figures which readers must seriously consider if they are going to design androids, or beasties as the author prefers to call them. *Android Design* will interest computer users because it focuses on the problem/solution approach to developing guidelines and rules common to both androids and computers." *Personal Computing*, June, p. 130.

GRBASIC, Graphic Basic, Models I & III, Med Systems Software, Box 3558, Chapel Hill, NC 27514.

". . . this package. . . does add some of the graphic and sound commands of the Color Computer to a Model I or III. Usefulness will certainly be determined by how much you like to use graphics and sound in your programs. . . . Med Systems offers an add-on package for business-graphing purposes." *80 U.S.*, July, p. 116.

Incoprop, Models I & III, E-Z Software, Box 591, Novato, CA 94948.

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SOFT BITS

by Roger Fuller

Secrets of a Level I keyboard

The secrets of the Level II keyboard routine have been revealed in a number of books and magazine articles. I will discuss a Level I keyboard routine. This routine is not copyrighted and has been used by many stand-alone machine-language programs. It is for your edification and enjoyment. Since it resides in RAM, you can modify the code and experiment with it easily.

The keyboard on a TRS-80 is memory mapped into locations 3801H, 3802H, 3804H, 3808H, 3810H, 3820H, 3840H, and 3880H. Notice that although there are only eight locations, they are spread over 128 bytes of address space. Also note the power-of-two progression from 01H to 80H on the LSB (least significant byte) of the address. The key switches are arranged in a matrix or grid of rows and columns. See Fig. 1.

As you can see from the diagram, there is an order to the layout of the keys. This order is used by the keyboard routine to decode the key pressed. Whenever a key is pressed, the corresponding bit position to that matrix node is brought high. This means pressing the C key makes the contents of address 3801H contain a value of eight, which is the third power of two. Therefore, pressing a single key in the first row can produce values 1, 2, 4, 8, 16, 32, 64, and 128. Pressing all keys produces the sum of the above numbers or 255.

The shift keys are mapped to address 3880H. On the Model III the left key is bit 0 and the right key is bit 1. The Model I has both keys mapped to bit 0.

The routine below is taken mostly from the Level I ROM. On a Level I system, pressing a key always prints on the screen and stops execution of a program until it is released. There is no legitimate lowercase nor any two-key rollover. The routine decodes the keyboard matrix and very little else. The short length and simplicity of the code used to do the job are its strong points. The routine, once it is resident in memory, is accessed from Basic. Here is a short program to call the routine and display the value and character of the results:

```
10 DEFUSR 0=&H7F00
20 K=USR0(0) : IF K<>KK PRINT 0,
   K;CHR$(K) : KK=K
30 GOTO 20
```

The routine has a control section called KBSCAN. This section quickly tests all rows and all columns for any keys being pressed. If the result is a zero then the scan is exited. This method prevents the use of 3801H through 3880H for anything except the keyboard. If the result is not zero, an EXX quickly saves the BC, DE, and HL registers, and then FNDKEY is called to locate the key pressed.

Upon return the registers are restored, but the key, if any, is kept in A. This value is saved and a short test for all keys up is done. When all keys are released the load in line 180 returns a zero, the original value is restored, the value is transferred to HL and returned to Basic via 0A9AH.

In FNDKEY a debounce delay is executed first. The length of this delay is one reason why Level I keybounce is less of a problem. Line 280 makes DE a pointer to a table of base values for the decode routine. HL is used as a pointer to the keyboard row being tested. Just before FNDROW the A register is zeroed.

In FNDROW an OR (HL) gets the row image into the A register and per-

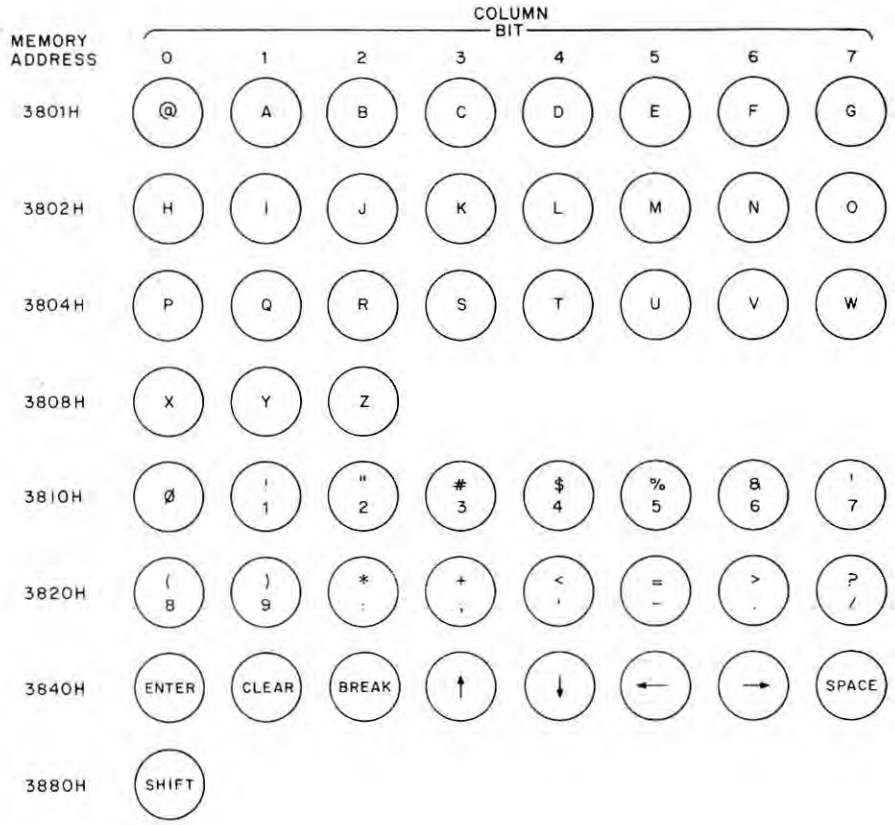

Figure 1

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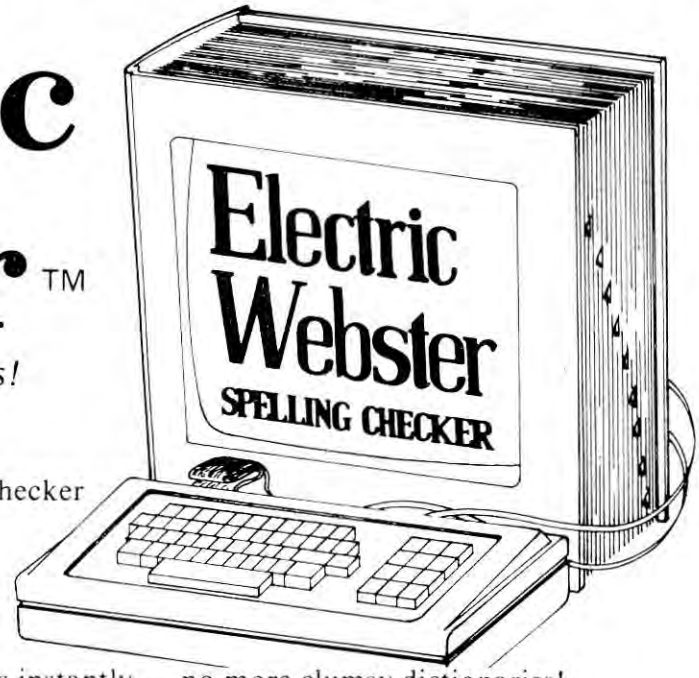

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forms a test on it, not bad for a single byte of code. If a key is found, control is passed to GOTROW. If no key is pressed on that row the KYTBL1 pointer is bumped and a SLA L moves the row address pointer, LSB, up a power of two. The SLA also tests for a bit-7 set condition. If bit 7 is set the JP P falls through, the registers are restored, the return address on the stack is cleared, and control loops back to KBSCAN. This allows the routine to recover from pressing a freak key such as might occur during keybounce.

At GOTROW the pointers are switched and the table value is loaded into B to serve as an ASCII base value. B is used as the image counter. An eight-bit search is done on that row to find the first key pressed. After the key is found B contains the unprocessed ASCII value. It is loaded into A for testing. A test is done for a letter value. If so a transfer to LTRKY takes place. At LTRKY a test for a shifted value is done. If the shift key is pressed as determined in line 720, the zero flag is reset. This causes the RET Z to fall through in line and strips the upper two bits off. Thus a shifted C produces a value of three. Would an ADD 20H instead of an AND 3FH give true lowercase?

However, if the key is not a letter key the value is tested for a <, =, >, or a ? in line 470. If the value is one of those four, control goes to LTEQGT for shift adjustment. If the shift key was not pressed then the key was a comma, a dash, a period, or a slash mark. The adjustment consists of removing bit 4 with an AND 2FH.

If the value was in rows 3810H or 3820H a test for the shift key must be made. This time a shift not pressed means leaving bit 4 alone.

If the key was not in any one of the above it must be in the last row. LSTROW moves the table pointer with the B register used to count into the KYTBL2 for the value of the last key. This is necessary since there is little order for the values of the last row's keys.

I hope you learn from tinkering with this routine. Try to improve it. For example, line 230 could be done with a LD H,A in line 205.

I would like to publish the most elegant and the shortest routine in a future column. Send any entries to me at 630 E. Springdale, Grand Prairie, TX 75051. Be sure to include a release to publish. First prize will be key cap for the winning entry. ■

```
7F00            00090           ORG     7F00H
7F00 3A7F38     00100 KBSCAN    LD      A,(387FH)
7F03 A7         00110           AND     A
7F04 C8         00120           RET     Z
7F05 D9         00130           EXX
7F06 CD197F     00140           CALL    FNDKEY
7F09 D9         00150           EXX
7F0A A7         00160           AND     A
7F0B F5         00170           PUSH    AF
7F0C 3A7F38     00180           LD      A,(387FH)
7F0F A7         00190           AND     A
7F10 20FA       00200           JR      NZ,$-4
7F12 F1         00210           POP     AF
7F13 6F         00220           LD      L,A
7F14 2600       00230           LD      H,0
7F16 C39A0A     00240           JP      0A9AH           ;RETURN KEY TO BASIC
                00250 ;*******************************

7F19 06FF       00260 FNDKEY    LD      B,255
7F1B 10FE       00270           DJNZ    $
7F1D 11707F     00280           LD      DE,KYTBL1
7F20 210138     00290           LD      HL,3801H
7F23 3E00       00300           LD      A,0
7F25 B6         00310 FNDROW    OR      (HL)
7F26 200A       00320           JR      NZ,GOTROW
7F28 1C         00330           INC     E
7F29 CB25       00340           SLA     L
7F2B F2257F     00350           JP      P,FNDROW
7F2E D9         00360           EXX
7F2F F1         00370           POP     AF
7F30 18CE       00380           JR      KBSCAN
7F32 EB         00390 GOTROW    EX      DE,HL
7F33 46         00400           LD      B,(HL)
7F34 04         00410 FNDCOL    INC     B
7F35 CB3F       00420           SRL     A
7F37 20FB       00430           JR      NZ,FNDCOL
7F39 78         00440           LD      A,B
7F3A FE40       00450           CP      40H
7F3C 3017       00460           JR      NC,LTRKY
7F3E FE3C       00470           CP      3CH
7F40 3021       00480           JR      NC,LTEQGT
7F42 FE30       00490           CP      30H
7F44 3016       00500           JR      NC,SHFTNM
7F46 21767F     00510           LD      HL,KYTBL2
7F49 23         00520 LSTROW    INC     HL

7F4A 05         00530           DEC     B
7F4B 20FC       00540           JR      NZ,LSTROW
7F4D 46         00550           LD      B,(HL)
7F4E CD697F     00560           CALL    SHFTED
7F51 C0         00570           RET     NZ
7F52 E63F       00580           AND     3FH
7F54 C9         00590           RET
7F55 CD697F     00600 LTRKY     CALL    SHFTED
7F58 C8         00610           RET     Z
7F59 E63F       00620           AND     3FH
7F5B C9         00630           RET
7F5C CD697F     00640 SHFTNM    CALL    SHFTED
7F5F C8         00650           RET     Z
7F60 E62F       00660 UNSHFT    AND     2FH
7F62 C9         00670           RET
7F63 CD697F     00680 LTEQGT    CALL    SHFTED

7F66 C0         00690           RET     NZ
7F67 18F7       00700           JR      UNSHFT
7F69 3A8038     00710 SHFTED    LD      A,(3880H)
7F6C A7         00720           AND     A
7F6D 78         00730           LD      A,B
7F6E C9         00740           RET
7F6F C9         00750           RET
7F70 3F         00760 KYTBL1    DEFB    3FH     ;@ABCDEFG
7F71 47         00770           DEFB    47H     ;HIJKLMNO
7F72 4F         00780           DEFB    4FH     ;PQRSTUVW
7F73 57         00790           DEFB    57H     ;XYZ
7F74 2F         00800           DEFB    2FH     ; !"#$%&'
                00810                           ;01234567
7F75 37         00820           DEFB    37H     ;()*+<=>?
                00830                           ;89:;,-./
7F76 00         00840 KYTBL2    DEFB    0
7F77 0D         00850           DEFB    13
7F78 1F         00860           DEFB    31
7F79 01         00870           DEFB    1
7F7A 5B         00880           DEFB    '['
7F7B 5C         00890           DEFB    '\'
7F7C 5D         00900           DEFB    ']'
7F7D 5E         00910           DEFB    '^'
7F7E 20         00920           DEFB    ' '
0000            00930           END
00000 TOTAL ERRORS
```

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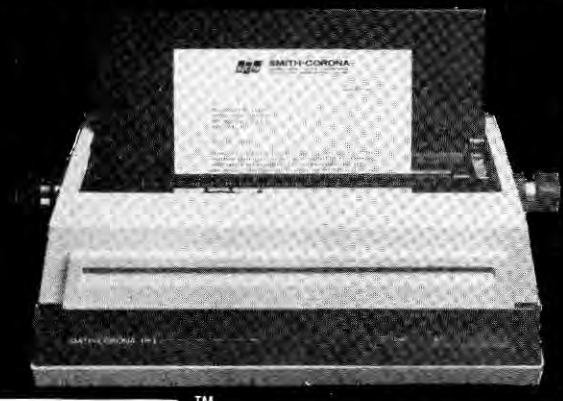

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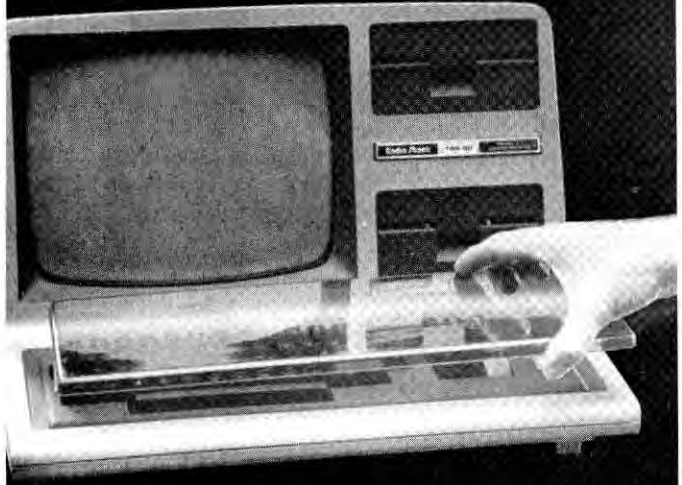

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KITCHEN TABLE, INC.

by David Busch

Bytespeak and CRT from KTI

It never ceases to amaze me how Kitchen Table Inc. produces a stream of innovative, unique, and sometimes useful products month after month. The key, I am told, is concentrate all resources into research and development, and allow frills—such as after-sale support, quality control, and packaging—to fall by the wayside.

This month, the world's leading fictitious supplier of non-existent computer products has introduced a Black Phosphor Screen video monitor and a new Basic dialect—Random Basic.

Unless you are very new to TRS-80-land, you are aware the quality of video monitors available to us has been something of a sore point. The monitor supplied with the TRS-80 Model I was just a black-and-white television that didn't receive VHF, UHF, or keyboard output very well. The resolution of the Model III monitor is noticeably better under some rare conditions. All models of the Sri Lankan-built TLS-8E computer are furnished with monitors removed from service in motel rooms. I don't even want to talk about the poor excuse for a video monitor built into the so-called "pocket" computers. On my own personal sample, I can barely read one line at a time.

Only the CRTs in the TRS-80 Model II, Model 16, and TLS-8E Model II are worthy of the name. We expect this oversight was unintended by either company.

However, those of us with an urge to upgrade now have a choice. Probably the most original CRT in the KTI line is its 9-inch Black Phosphor Screen monitor. This monitor provides instant reverse video by the simple expedient of having an all-white screen with a black phosphor coating. The CRT accepts either RF or composite video input, as well as RGB, PAL, SECAM, and AM/FM signals. While the BPS is built to accept those inputs, it's not equipped to do anything with them. Only the RF signals actually resulted in an image appearing on the CRT screen.

And what an image it was! Kitchen Table Inc. has outdone itself in pioneering the first 128-column CRT for TRS-80 and TLS-8E microcomputers. Instead of being limited to a narrow 64-character-wide display, the BPS monitor combines two normal video lines into one extra-wide 128-character format.

The black characters on white background closely resembled a traditional piece of paper, but we rarely use sheets 128 columns wide for text. In addition, the wide format is more difficult to read. With a 9-inch monitor, each character is almost microscopic in size, and a good hand-held magnifier is needed to scan the screen.

Our unit appeared to be ruggedly built. Its outer case—the standard riveted stainless steel used in most KTI products—bristled with impressive-looking, nonfunctional controls and hardware, including one socket for the optional remote-control garage door opener. I have to admit this is one monitor that is built like a tank. In operation, it sounds and smells like one, too.

We ran the unit through our usual battery of oscilloscope tests. These came out negative; the monitor definitely cannot be used as an oscilloscope. Our procedures also include a standard drop test onto a square of padded carpeting from a height of 30 feet. The BPS monitor survived repeated testing with no difficulty, despite the fact that we missed the carpet two times.

Those of you with other KTI products have discovered by now no legitimate electronics shop will touch them. No problem. If your KTI monitor requires servicing, the company has made the unit remarkably easy to repair—even for the untrained amateur. Included with the CRT is a thorough, four-page repair manual and partial schematics. If you are able to read Sri Lankan, repair should be a snap.

Many of us are leery about working on any television-type device because of the high voltages used. Kitchen Table Inc. provides an important safety feature. On the back of the case is a pair of contacts, accessible to the user without opening the monitor. In fact, these can sometimes be touched by accident. I'd urge a fair amount of caution around children and wanted pets.

When these contacts are shorted out, all capacitors in the monitor are drained instantly. We used a screwdriver to test this feature. After retrieving the melted handle of the screwdriver from across the room, we decided to unplug the CRT and try again. Unfortunately, by this time the BPS monitor had ceased functioning.

This was a perfect opportunity to test out KTI's troubleshooting suggestions. We opened the case of the monitor, and found a blown fuse in the middle of a two-pound mass of melted material we could not identify. However, replacing the fuse did not help. We had to wire in a backup power supply (already installed in the monitor by the factory) in order to restore the CRT to working order.

We were also able to fix a few other minor problems. The CRT arrived from the factory installed vertically causing the lines to run top-to-bottom, instead of from side to side. Kitchen Table Inc. reports this is a common procedure in the Orient. I have been told the monitor is also available reversed left-to-right when it will be used with a computer sporting a Hebrew character set.

Random Basic

The second important product introduced by KTI this month is Random Basic, an enhancement to Disk Basic that can be used to spice up game programs and take some of the predictability out of business software.

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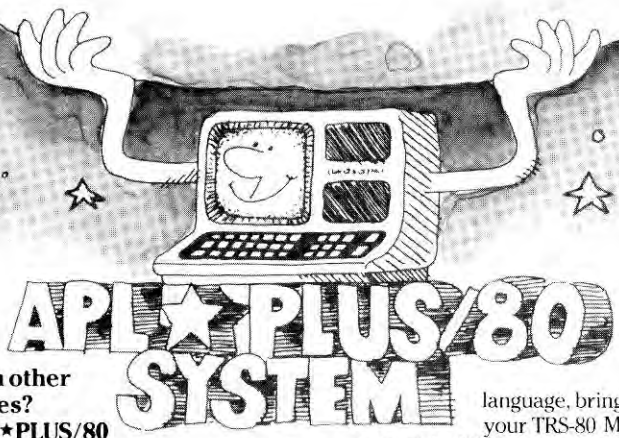

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```
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[2]   'I7,CP/$/F12.2' ⎕FMT ONCE,[1.5]COST+.×JOB∘.=ONCE
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Our Kitchen Table source explained Random Basic contains a number of powerful new statements injecting a desired degree of randomness into any program featuring them. These functions have previously been available only to users of KTI's BASBOL and NONSENSE languages. An explanation of the various commands follows:

- GOSUB RND—When RB's interpreter encounters this statement, program control is sent at random to any line numbered from 1 to 32767. If no such line exists, control passes to the next available line.
- RETURN RND—Opposite of GOSUB RND. On encountering this statement, program goes back to some other randomly chosen location in the program. Either of these two statements may have arguments:
- GOSUB RND 100,200,300,400 will cause the computer to branch to one of the listed lines at random.
- GOSUB RND A$ can send control to any line containing the variable A$.
- RETURN RNDOTHER will cause a return to a random line within some other program on your disk, which will be loaded and run without the knowledge or consent of the operator.

Caution: although GOSUB RND GOSUB RND is a valid statement, it will invariably lead to an endless loop. With TRS-80 computers, recovery is possible by hitting reset. Those with TLS-8Es may not be able to break out of the loop even by unplugging the computer. In extreme cases, it may be necessary to hit the keyboard with a hammer or other heavy object.

- READ RND—Assigns value of any data item to variable. If no data lines exist, computer will choose value from some other program statement, a random memory location, or make something up.
- DIM (RND)—Dimension array to any size. Excellent for use in data-base management programs where you have no idea how big the array needs to be, but still want to keep it from getting out of hand entirely.
- RND NEXT—Increment loop counter by a random amount. Can speed up program execution considerably by eliminating most iterations of a loop.
- POKE RND,RND—Put arbitrary value anywhere you please. This command may have amusing results, especially with the TLS-8E, where POKEs to ROM are not only permitted, but encouraged.
- IF...THEN RND—If expression is true, do something unexpected.
- OPEN RND—Open a buffer of computer's choice.
- CLS RND—Clear screen at random intervals.

We tested Random Basic extensively, and found it to produce many random errors. These can be avoided entirely by incorporating an ON ERROR GOTO RND statement as the first line of a program.

By the way, those of you who have been sending obscene EMAIL to my CompuServe account may continue to contact me through User I.D. number 70060,137.■

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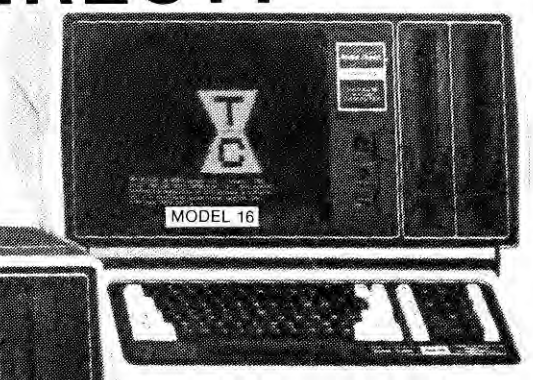

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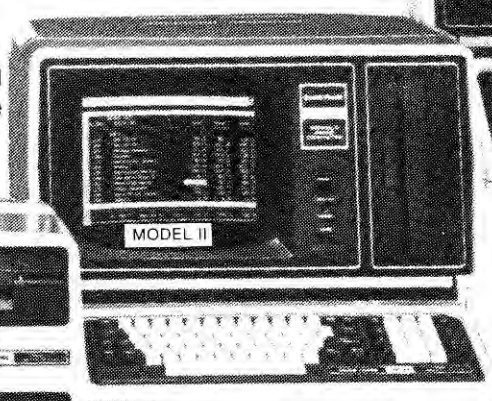

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COMMANDER 80

by Jake Commander

This month I'm here to tell you how lucky you are.

All of us microcomputer users already enjoy privileges above and beyond those of many others including mainframe computer users. It's not just that we're at the forefront of an exciting new technological era. It's not just that we enjoy the pleasures of personal computing from our own living rooms. It's the luxury (or right, if you will) of total computing freedom.

I'm not speaking of freedom as in freedom of speech—although that itself presents some fascinating arguments. It's tempting to imagine what it would be like owning a personal computer on the other side of the Iron Curtain.

No, the kind of freedom I'm thinking of is much simpler. It's the freedom to be able to enter what you want, when you want, and how you want.

It's a freedom that you probably take so much for granted, you don't even think about it. Well, let me tell you, it isn't like that for everybody, and especially the poor programmers on mainframe machines.

Micro users should enjoy their freedom

"It's considered beneath the dignity and a waste of resources for a programmer to type in his own program."

I realized this when I was looking through a book the other day and spotted a program coding form. Have you seen one? It consists of a sheet of paper laid out in squares with one square for each character of the program, and it can help present a tidy layout of the initial stages of hand-coding a program. That's not, however, why they exist; after all, a printout can be much tidier. These forms were needed because of the horribly constrained way a program had to be submitted on a mainframe. If this were the way it was still done on micros, there would be about 10 machines out there.

In the hierarchy of big computers, there exists a department called "data prep" (for data preparation). The data prep department traditionally consists of many women furiously typing away at keyboards and producing computer-readable output in the form of punched cards, paper tape, magnetic tape, or what have you. These poor underpaid women get many forms of data such as orders, statistics, and, naturally enough, computer programs. It's considered beneath the dignity and a waste of resources for a programmer to type in his or her own program, so the coding form is sent to the data prep department to be scheduled for typing.

If you're lucky, you receive a stack of punched cards the very next day. If you're lucky. This is when you schedule your program to be run on the computer. The shift-leader of the computer operations department places your job in the queue along with many other frustrated programmers' work. Your program is assigned a job number, which you have to remember if you ever want to see your creation again. No one expects his job to be run without being rejected by the computer for either a program logic error or a simple syntactical error in the program code. No "SN Error in line 10000" here; just a "Job Number XXYYZZ aborted due to blah blah." And a thick diagnostic printout. And your punched cards returned to you.

At this point you realize that the data prep people are thinking more about their love lives than they are about your precious program. They simply typed what they saw—or what they thought they saw. After all, what are they likely to know about the layout of your Fortran or Cobol code? Most of the errors in the initial stages are caused like this.

So you pull out the offending punched cards and return them to the data prep department for retyping. As likely as not, your job doesn't even get as far as debugging; with a large program, it could take three or four times before your card deck is 100 percent correct.

Finally, a week after submitting your masterpiece, you schedule it into the job queue. You're confident it'll run perfectly the first time. You give a sly call to the computer operator asking for your job to be given some urgency, seeing as how you tolerated the miserable luck so far.

One six-pack later, you check with the lady in charge of printouts and she promises to give you a call as soon as your job's ready. The operator, ever mindful of his promised six-pack, shuffles your job to the front and loads your cards into the card reader. Hitting the load button, he watches as your cards start flying into the electronic bowels of the reader. He continues to watch impassively as the card reader jams up and spews out your cards in an unrecognizable heap. The engineers are busy fixing the reader for a week. A quarter of your card deck is destroyed. You resubmit the quarter to the data prep department (being glad you didn't chew them out for their previous ineptitude). You still owe the operator a six-pack.

Give me a micro any day. ■

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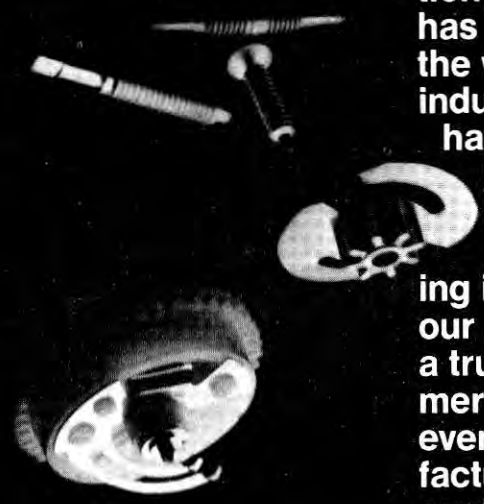

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The Color Computer lacks the graphics resolution of an Apple and the Cromemco Dazzler and the Digital Data Digicom hardware, but it possesses excellent Extended Basic commands for graphics operations, more than enough resolution for most display work, and it's cheap!

We will look at the Color Computer's graphics capabilities in this article. We'll investigate the Color Computer's architecture, the Extended Color Basic commands, and some advanced graphics techniques. I will resolve the graphics resolution question and show you why I feel it's not all that important to have a graphics resolution of 1024 elements horizontally by 1024 vertically.

Early in my career I worked for a company that did color display work. The company manufactured hardware that would display color graphics of up to 1024 by 1024 elements. Each element of those graphics could be programmed to one of eight colors.

As you know from late evening study of binary, we can use three bits to get values of 0–7. A 1024 by 1024 display with three bits specifying a color for each element requires 1024*1024*8, or 3,145,728 bits, or 393,216 bytes (384K)!

Assume no special graphics hardware and that the elements are held in RAM memory, which is another way of saying that the video display is memory mapped as it is in the Apple or Color Computer. Using Assembly language, we can store a byte of data into RAM in about 20 microseconds in typical microcomputers. That makes no allowance for number crunching—simply bringing in graphics data from a buffered disk file or from another memory location with some overhead for indexing and looping.

Twenty microseconds per element times 384K is about eight seconds simply to fill the screen with existing graphics data.

If we want to draw lines and surfaces to create three-dimensional objects, it takes computing time. For example, creating a three-dimensional color display without hidden lines, the ultimate type of display, in 1024 by 1024 by eight colors on that large-scale system I mentioned earlier took about six minutes of processing time for each second of picture! To get a 10-second animated display of One Tandy Center being ravaged by a Texas tornado would require about one hour of processing time on a large-scale computer.

It *is* true that with fewer colors and hidden lines showing and fewer graphics tricks you can produce excellent displays in much shorter time, but generally you would not want to process high-resolution graphics continually. A 1024 by 1024 element display contains 16 times the picture elements of a 256 by 256 element display, requiring 16 times the processing time.

Some applications require as much resolution as possible—displaying a digitized satellite weather picture, for example. Most graphics applications cannot afford the overhead of processing hundreds of thousands of elements. That's why I think the Color Computer is a good compromise for color graphics—moderately good resolution at relatively low cost.

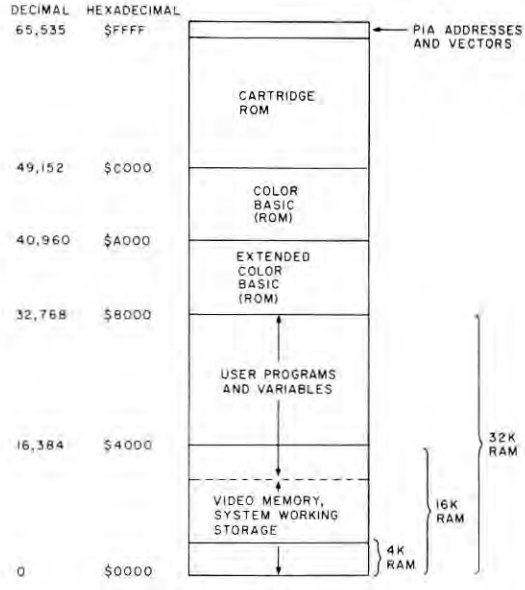

Fig. 1. 64K Color Computer Memory Layout

Mapping the Color Computer Memory

Figure 1 shows the layout of the system's 64K of memory. RAM occupies the first 32K, while ROM is in the upper 32K. Standard Color Basic is 8K bytes and is in the $A000 area ($ stands for hexadecimal in the Color Computer). The Extended Color Basic is an additional 8K of ROM in the $8000 area.

The upper 16K is dedicated to cartridge ROM and input/outpout (I/O) addresses. The I/O addresses are addresses of Color Computer PIA chips and hardware vectors. I will describe the PIAs later.

The 32K of RAM stores system variables, a text screen, from one to eight graphics screens, program variables, arrays, user programs, stack, string working storage, and an optional protected machine-language area, in that order, from bottom of memory to top (see Fig. 2).

The layout is reminiscent of the TRS-80 Model I/III memory layout—Microsoft did the Basic.

The areas we cover in this article are the text and graphics pages.

Text Screen

The area from $400 to $5FF (1024–1535 decimal) is dedicated to the text screen. The text screen corresponds to text video display memory and holds text as entered from the keyboard, text during Basic execution, and general system text.

The text screen holds 16 lines of 32 characters, for a grand total of 512 characters, or 512 bytes.

As in the Models I and III, you can intersperse some limited graphics with the text. Although this text screen is mapped at the $400 area, you can remap it dynamically by redefining the text screen area. To do this send a new address to one of the dedicated I/O addresses. I'll cover this later.

Graphics Pages

From one to eight graphics pages are above the text screen. The first page starts at $0600 and extends to $0BFF (1536 bytes), the next starts at $0C00, and so forth. You may allocate from one to eight graphics pages (but not zero), depending upon the graphics modes you use. Any remaining space is released to the common memory

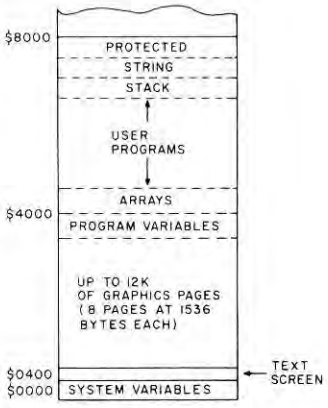

Fig. 2. RAM Contents

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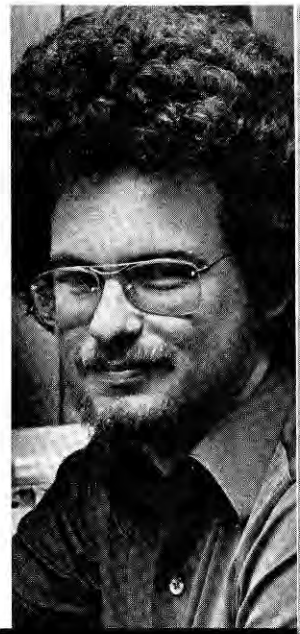

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pool and used for variable storage, arrays, and so on. A graphics display uses from one to four graphics pages depending upon the graphics mode.

The graphics pages are separate from the text pages. Under program control, you can switch from text page to graphics page (using the SCREEN command) and display either text data or graphics.

You can process a graphics page while displaying a text page and vice versa. You could display Basic text while loading up a graphics page with drawings of that tornado whipping through the 15th floor of One Tandy Center. Similarly, you could display a graphics picture on one page or set of pages while loading up another graphics page or set of pages with a second picture.

Each graphic page is 1536 bytes for an excellent reason—the lowest resolution graphics mode supported in Basic is 128 by 96 elements with two colors in each element. As two colors can be encoded in one bit, the number of bits required for this resolution is 128*96 or 12,288 bits or 1536 bytes.

The highest resolution graphics mode is 256 by 192 in two colors, requiring 256*192 = 49,152 bits or 6144 bytes or four graphics pages. You have to plan ahead in allocating graphics pages (by the PCLEAR command)—too many and you are wasting RAM, too few and you have too little memory for your high-resolution graphics displays.

Fifteen separate and distinct graphics modes are available on the Color Computer (see Fig. 3). Of these, Color Basic supports only three. Extended Color Basic supports only eight. The Motorola MC6847 Video Display Generator Chip (VDG), implements the text and graphics and thus determines the number of graphics modes.

If you are interested in getting down to the integrated circuit level, then buy a copy of the TRS-80 Color Computer Service Manual (RS 26-3001/3002) and the Motorola Data Library manual, which describes many of the Color Computer LSI chips.

Graphics Modes in Color Basic

Color Basic uses only the text screen in either the alphanumeric mode or the VDG Semigraphic 4 mode.

In the alphanumeric mode, each byte of the text screen RAM represents a single character position in the straightforward mapping of Fig. 4. Character coding is roughly ASCII. A single bit determines inverted or non-inverted display of text.

The Semigraphics 4 mode is similar to Model I/III graphics. It allows 64 by 32-element graphics.

In Semigraphics 4, each character position of the 512 character positions of the text screen represent four elements of graphics as shown in Fig. 5. The most significant bit of the character position byte is set to indicate graphics, the next three bits contain a color code 0–7, and the next four bits represent the on/off status of the four pixels.

Color Codes

In all the following discussion the color codes will be: green, yellow, blue, red, buff, cyan, magenta, orange. These codes are 0–7 in hardware (as in the graphics byte) or 1–8 in a Basic command. The Basic color code 0 represents black, or no color on the screen.

Typical Alphanumeric and Semigraphics 4 Displays

You can intermix Semigraphics 4 and alphanumeric modes on the text screen. You can display text data next to graphics data as shown in Fig. 6. If you wish, an entire block can represent graphics data.

The Semigraphics 4 mode is somewhat misleading. It's true that with a pixel being off (black) or on (color specified in byte) you can get a 64 by 32 element resolution in two colors. However, all four pixels of each character position must have the same color. This means if you intermix colors, you cannot have dissimilar colors adjacent to each other unless the new color starts at a character position boundary.

Color Basic allows a SET, RESET, and POINT. You may set, reset, or test each of 64 by 32 pixels with the above color limitation. A clear screen (CLS) is also provided; you may clear the screen to any color.

Extended Color Basic

Extended Color Basic supports five of the higher resolution graphics modes, as shown in Fig. 7. (Three lower true graphics modes remain unsupported, and the three Semigraphics Modes are still not supported.)

All of these graphics modes use the same mapping in graphics pages of RAM memory. If the mode is a two-color mode, the color code for each pixel is held in one bit, and a byte represents eight elements. If the mode is a four-color mode, the color code for each pixel is held in two bits, and a byte represents four pixels, as shown in Fig. 8.

Color Sets

Two sets of two or four colors can be selected by the SCREEN command, as shown in

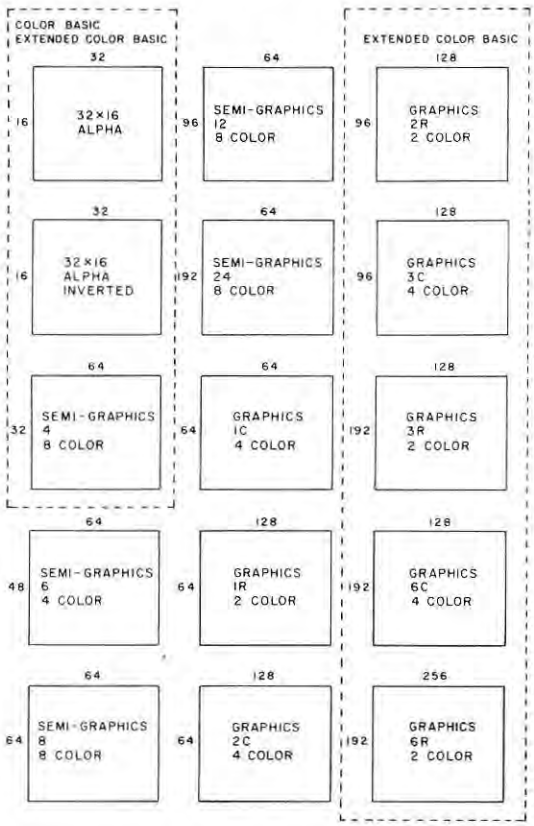


Fig. 3. Graphics Modes

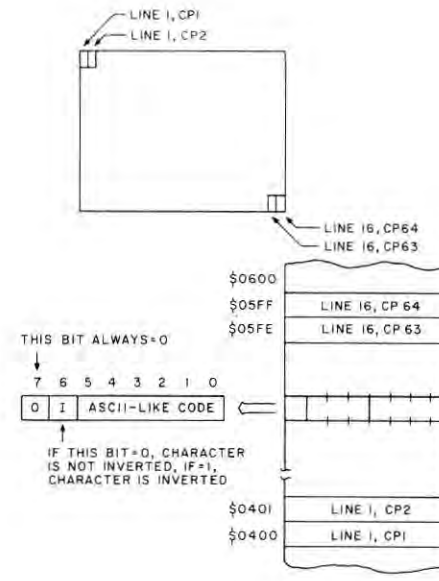


Figure 4

Table 1. Whereas the border in Color Basic was always black, in these graphics modes it is either green (color set 0) or buff (color set 1).

Pixel Addressing

All graphics commands in Extended Color Basic use the highest resolution mode to specify the x,y coordinates. In this mode (256 by 192), x may be 0–255 or y may be 0–191. These values define the smallest graphics element that may be displayed, one pixel, named after Herman Pixel, who did early work in PICture ELements. (Each character position is 8 pixels by 12 pixels.) Each element may be 1 by 1 pixel to 4 by 6 pixels, depending upon the mode (see Fig. 9). Don't worry about the fact that the resolution may be too coarse to pinpoint element 128,96, just use those values with impunity.

Extended Color Basic Graphics Commands

Table 2 shows all Extended Color Basic graphics commands. Some simply set a variable or execute some minor action; others are very powerful.

Static Commands

SCREEN selects the type of screen and color set. The type parameter is 0 for text

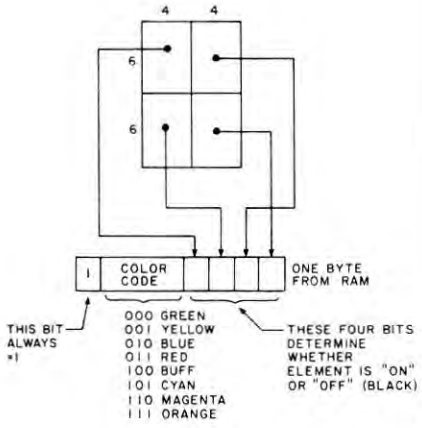


Figure 5

Two-color Colors

C	Color Set	Color	Border
0	0	Black	Green
1	0	Green	
0	1	Black	Buff
1	1	Buff	

Four-color Colors

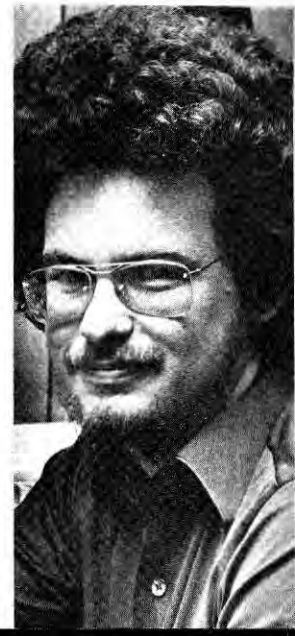
C	Color Set	Color	Border
0	0	Green	
1	0	Yellow	Green
2	0	Blue	
3	0	Red	
0	1	Buff	
1	1	Cyan	Buff
2	1	Magenta	
3	1	Orange	

Table 1

"I BOUGHT IT"

"My biggest loss of programming time using Snappware's EXTENDED BUILT IN FUNCTIONS is spent inserting my diskette."

SCOTT ADAMS - PRES. OF ADVENTURE INTL.



Snappware's EXTENDED BUILT IN FUNCTIONS is a collection of much needed additions to the TRSDOS* BASIC interpreter which greatly extends its convenience and utility. The following features become part of your BASIC language and provide the enhancements without requiring any additional memory. The most important component of EXTENDED BUILT IN FUNCTIONS is an in-memory sort routine, guaranteed to be the fastest general purpose in-memory sort on the market. Along with this you also receive other EXTENDED BUILT IN FUNCTIONS. Here is a sampling:

SRT—Sorts one or more arrays into a specified sequence
FMT—Arranges data into a string variable as with PRINT USING
PDAT/UDAT$—Permits user to do arithmetic on dates.
PK$/UPK$—Compresses strings to save disk space.
ETIM$—Shows the difference between two times.
CLEAR—Specifies the number of file blocks to be allocated when you specify high memory and string space.
DELETE—Allows you to dynamically remove portions of a BASIC program.

In addition to these, there are functions unique to Model II and to Model III. The exclusives to Model II are long error messages and PEEK/POKE. The exclusives to Model III are:

SWAP—Supports exchange of variables with a single statement.
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Command	Typical Form	Function	
SCREEN	SCREEN 1,1	Selects text/graphics, color set	
PCLEAR	PCLEAR 6	Reserves n graphics pages	Static
PMODE	PMODE 4,1	Selects mode and page number	Commands
PCOPY	PCOPY 2 TO 6	Copies one graphics page to another	
PCLS	PCLS 8	Clears graphics page	
COLOR	COLOR 2,3	Selects foreground, background color	
PSET	PSET (129,96,3)	Sets point	
PRESET	PRESET (129,96)	Resets point	
PPOINT	PPOINT (128,96)	Tests point	
LINE	LINE (23,23)-(100,100), PSET	Draws line, box, or filled-in box	Active
CIRCLE	CIRCLE (129,96), 40	Draws circle, ellipse, or arc	Commands
DRAW	DRAW A$	Draws line segments, scales, rotates	
PAINT	PAINT (120,100),3,4	Colors an area	
GET	GET (0,0)-(50,50),AA,G	Stores a portion of screen to array	
PUT	PUT (205,141)-(255,191),AA,PSET	Moves graphics data from array to portion of screen	

Table 2

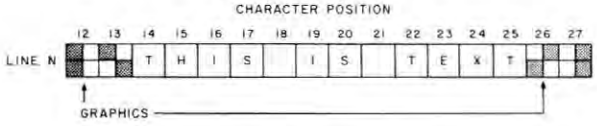

Figure 6

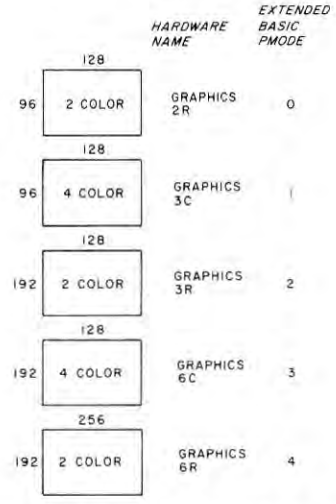

Fig. 7. High Resolution Graphics Modes

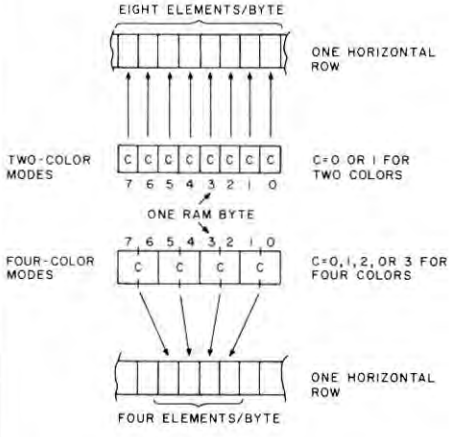

Figure 8

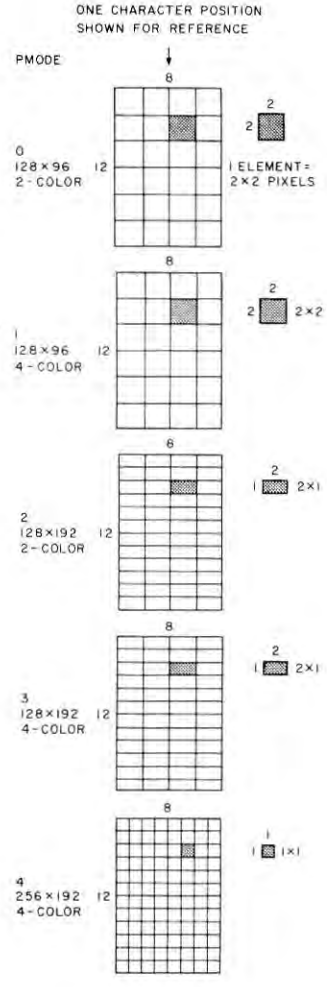

Figure 9

screen or 1 for graphics page. The color set code is either 0 or 1. SCREEN enables you to switch back and forth between the text screen at $400 and the "current" graphics page. Remember that the text and graphics screens are separate entities. The color set applies to the text screen as well; standard text display is black on green, but color set 0 selects red on orange.

PCLEAR reserves from one to eight graphics pages. If you never use PCLEAR, Extended Color Basic reserves four graphics pages automatically. Any remaining graphics pages are released to the common pool of RAM for variables, and so on. Note that no action is taken in clearing the pages. This simply sets an internal pointer to the location after the last graphics page; this will be the start of the Basic variable area.

PMODE selects a graphics mode of 0–4 and specifies the starting graphics page number of 1–8. You may use PMODE to change the graphics resolution. You normally use PMODE early in a program to select the resolution and starting graphics page. You can also use it at any time to select a new graphics page. You might have one display starting on graphics page 0 and a second starting on graphics page 4, for example.

PCOPY copies the data from one graphics page to another. This is a convenient way to duplicate a graphics page without having to do a series of PEEKs and POKEs. You may have to do more than one PCOPY to duplicate a given display, as certain modes require more than one page.

PCLS is the Extended Color Basic equivalent of the Color Basic CLS. It clears the current graphics screen (which may be more than one page) to a given color.

COLOR selects the foreground and background color. The background color is the primer for the canvas. The foreground color is on the paint brush. This is important as some commands cannot specify a color for the graphics action.

The normal sequence before starting any graphics would be something like

```
100 PMODE 4,1    'set mode, starting page
110 SCREEN 1,1   'select graphics, color set 1
120 PCLS 5       'clear screen with buff
```

PSET, PRESET and PPOINT

PSET, PRESET and PPOINT do not draw anything on the screen. The active commands in Table 2 initiate all graphics actions on the screen.

PSET, PRESET, and PPOINT are PMODE SETs, RESETs, and POINTs. They do essentially the same thing as the Color Basic commands—set, reset, or test a point. They do it with finer resolution, depending upon the mode.

PSET, PRESET, and PPOINT are useful in plotting points for graphs, but they are not really powerful graphics commands. Next month I will continue with a discussion of Extended Color Basic's very powerful LINE, CIRCLE, DRAW and PAINT graphics commands. ■

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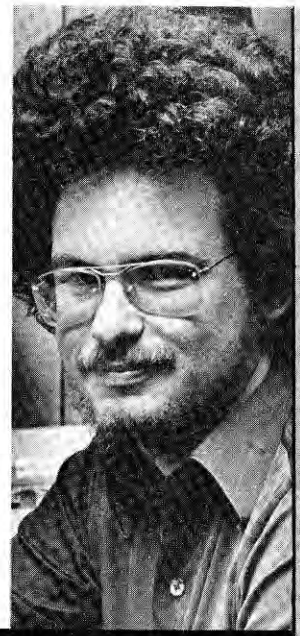

When working with direct files or creating a formatted screen, Autofile and Automap are indispensible aids.

Autofile is designed to automate for the BASIC programmer the task of moving data elements to and from a direct file. Previously, this was a time consuming chore because the FIELDed variables may not be directly referenced by user logic. The FIELD statement was eliminated, thereby relieving you of the guessing game as to where the FIELDed variable is. In addition, the LSET and the CVx functions are performed automatically. The software, when installed, becomes part of your BASIC interpreter providing the enhancements without additional memory.

Automap is designed to automate for the BASIC programmer the task of presenting information on the video display and accepting information from the keyboard operator. The software consists of two main components: the OFF-LINE COMPONENT used to describe to the system the screen formats and the ON-LINE COMPONENT from within your BASIC program to initialize a screen, send data to the video display and receive data from the keyboard operator. This facility when installed, becomes part of your BASIC interpreter.

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The Federal DP Expo, Washington, DC, is the biggest and flashiest of the capital's annual computer shows. A lot of money is at stake because the prime target of all the exhibitors is Uncle Sam. Despite, and in fact because of, Mr. Reagan's austerity program, the federal government remains a strong purchaser of computer mainframes, peripherals, software, and data processing (DP) support services. This year the phrase that characterizes Washington spending is "doing more with less."

Over 150 companies are exhibiting this year in the biggest DP Expo ever. The displays sprawl across 40,000 square feet of booth space interlaced with another 30,000 square feet of aisles. The major manufacturers listed on the GSA schedule, the master buying list that represents Uncle Sam's seal of approval, vie for the attention of the few key officials whose job is to buy systems and services to help the bureaucracy work efficiently.

Few of the feds attracted by the promise of free admission to the exhibit hall hold the power of the purse. The challenge for the slick sales force assembled for this three-day Expo is to distinguish the buyers from the browsers, the procurement people from the programmers, the executives from the lower echelon staff. No money changes hands. The purpose of the exhibits is to interest the federal government in products and services. Later, bids will be invited, proposals will be offered, purchase orders written, contracts drawn.

When the first Federal DP Expo was held eight years ago, microcomputers did not exist. The recent widespread use of microprocessors has reduced prices on computers and peripherals, and opened up whole new markets. Much of the equipment and software at the Expo is interesting because what's available for government today may soon be available for private microcomputer users at home, at school, and at work.

An Adventure Cave

As I enter the Expo's great hall with a stream of fellow sight-seers, the chatter and crowd noise falls away, absorbed by draperies, carpeting, and the white noise of thousands of blower fans cooling millions of dollars worth of computer gear. "Main Street" at the Federal DP Expo is a gridwork of intersecting aisles punctuated by flashing colored lights and revolving electric signs.

Hundreds of CRTs, printers, plotters, and more exotic equipment compete for attention. Keyboards, light pens, and digitizers await the explorer's touch to unleash the genies within. No wonder nobody is playing the video games in the hotel's arcade just outside; the Expo is the game! The exhibit hall is a real-time adventurer's cave. Each of us looks for his own set of treasures. And each of us has to use common sense and native wit to separate the valuable items from the worthless ones, and the wise men from the charlatans and phonies.

The adventure begins with a walk around the perimeter of the exhibit area. Unfamiliar names with vague mythological roots loom up from the heady swirl of color and light: Alanthus, Stratus, Hetra, Wylbur. Wylbur?

Animated Bore

Around the first corner, Wylbur twangs away on his guitar, singing a lively rendition of "Kansas City Star." This country-and-western singer is different: He is a humanoid robot that looks like one of the Nolan Bushnell robots now springing up in Pizza Time Theaters around the country. This high-tech restaurant chain, masterminded by the man who made Atari a household word, features an animated robot hippo at the piano bar, large-screen television so you don't have to talk to your dinner partner, and more ways to spend your money amid electronic razzle-dazzle than the corner video arcade.

Wylbur is one of the new generation of robots-for-play. He banters with passersby and gestures as he talks. His lifelike movements apparently can be controlled in real time. Behind the stool on which Wylbur casually strums and chats is a mirrored wall presumably hiding a well-trained operator. The effect is at once stunning and annoying. Why would anybody employ such sophisticated equipment for such a trivial application? Why would anyone design a robot from the ground up to be such a crashing bore? And what does Wylbur promote anyway?

I stand in line to play Wylbur's simulated slot machine and to learn more. The game's three servo-controlled slide projectors flash advertisements on adjacent rear-projection screens. If all three screens show the same ad when I push the button, I win a road atlas or a frisbee disk. (Losers get a ballpoint pen.) When my turn to play comes, I ask Wylbur's human assistant for product information. She seems surprised, and searches under the counter for literature.

The skimpy brochure she hands me de-

scribes Wylbur in vague terms. It is Litton Computer Services' combination word processor, remote job-entry system, interactive programming language, and data base management system with built-in business graphics—and no doubt enough bells and whistles left over to hum a few bars of "Kansas City Star" while simultaneously servicing 256 users and driving an outsized slot-machine simulator as well.

Why didn't Litton can the tin man's chatter and simply seat executives at a computer terminal? Why not show what Wylbur (the software, not the robot) can do? My strong impression is that Litton has blown its budget on the robot, and wound up with nothing left over for trained staff and a demonstration system. The robot draws crowds, but I think Litton has badly misjudged its audience. I wonder whether the singing Wylbur is a salesman or a distraction.

IBM: Conspicuously Absent

Thumbing through the exhibition catalog, I note that Radio Shack and Commodore are at the Expo, but Apple and IBM are not. IBM absent from the Federal DP Expo is nothing short of astonishing! Did conference planning fall through the cracks this year because of IBM's much touted reorganization? Or did they simply feel they could do without the government's business?

"We knew IBM wouldn't be here," crows Christopher Brown of Radio Shack. "We wanted our presence felt. Three out of every four of our machines are sold for business use." TRS-80s are not listed on the GSA schedule, but Brown says, "We have ways of getting around that." He refuses to elaborate.

I am reminded of Bell and Howell's brilliant ploy a few years back. They sold Uncle Sam a great many computers by registering their souped-up Apple IIs as "training devices" rather than as computers. That enabled crafty office managers to buy small office systems "for education purposes," circumventing their data-processing people entirely. The DP chiefs, who ordinarily must approve purchases of all computer equipment, ar often reluctant to acknowledge the existence of microcomputers for fear that decentralization will erode their information fiefdoms.

Commodore: "Our Computers Sell Themselves"

Commodore's spacious but unadorned booth sports no advertising—just computers sitting on a table. The $1,495 Commodore Business Machine shares equal billing with the $1,995 Super Pet and the $300 VIC-20 computer.

As I approach, VIC Avengers is cycling through its attract mode. Avengers is Commodore's Space Invaders lookalike, featuring a five-color display. Why is Commodore pushing the VIC and video games at a conference aimed at federal purchasers? "That's simple," says Rob Brown, a representative from Commodore's suburban Philadelphia headquarters. "We feel that all

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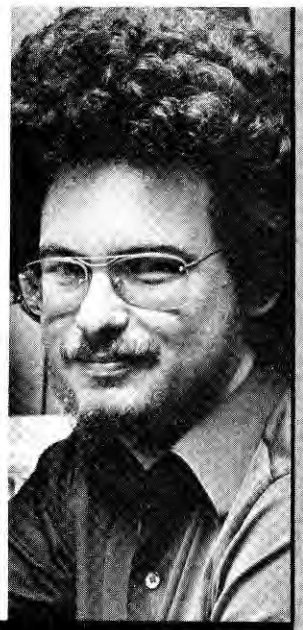

The Snappware College Educated Garbage Collector (SNAPP-VI) is an intelligent processing function which greatly improves performance of typical BASIC applications. And here's why.

Microsoft uses a 'variable length string' in the BASIC interpreter. Each time the string is assigned a new value, it is relocated in a string pool. Periodically the string pool must be reorganized and condensed into a single contiguous area. Performing this string space reclamation is time consuming and inefficient because this approach evaluates and collects each string individually. The time required is roughly proportional to the square of the number of active strings in the resident program. During reclamation the system seems to 'lock-up' and does not respond to the operator until the process is completed.

This time consuming approach requires a better solution. Snappware has developed a solution which takes advantage of the auxiliary memory available. SNAPP-VI requires only four bytes per active string as a work area. When free storage space is available, our system temporarily borrows, uses and returns the space to the free storage pool when completed. If storage is not available, our system will temporarily transfer out to disk enough of the BASIC program to make room for our work area and return the 'paged out' information to its correct location when completed.

Benchmarked times show, in some situations, SNAPP-VI performs one hundred times as fast as the Microsoft approach.

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these people have access to large computers. They understand them. I'm sure a lot of them are interested in home computers, too. So we bring our machines and let them sell themselves." And are they selling? "We're not taking orders here at the Expo," he continues. "But we have a few local dealers manning the booth, and we have a stack of leads this high!"

Big Printer, Little Printer

A chirping sound like submarine sonar is coming from the Hetra display. I investigate. A desk-sized line printer is stamping out a purple 2-by-4-foot dot-matrix version of the Mona Lisa. Hetra, according to an exhibit panel, is a printer "for use in tough environments such as tactical mobile vans for the U.S. Marine Corps, shipboard duty for the U.S. Navy, and telecommunications printers in the Defense Department communications network for the U.S. Army." It's nice to know we're sending culture over the wires to our boys in the service.

A computer hobbyist is talking to the Hetra representative. "Got anything for microcomputer users?" he asks. The salesman's face freezes into a mask, and he turns away. But a fellow hobbyist picks up the conversation, and the two debate the relative merits of the Hetra and the Epson. Do the Hetra people realize that American homes are a potentially vast market that will soon be ready for rugged, reliable printers "usable in a tough environment?" Five years from now, who will be raking in more dough, Hetra or Epson?

Delicious Daisy Wheels

Anderson-Jacobson's exhibit is more appealing, and its staff more approachable. A daisy-wheel printer terminal deftly draws the AJ logo with a flurry of microspaced periods. The logo finished, this 55-character-per-second, letter-quality printer grinds out a crisp X-Y coordinate graph. Each axis label features large text characters; the letters are individually plotted from shape tables. The result is striking proof that daisy-wheel printers can hold their own in the graphics department.

This AJ 833 terminal that thinks it's a pen plotter comes equipped with a full ASCII keyboard, and has several attractive options, including a floppy-disk system and a 2K print buffer for downloading documents or plotting instructions.

Intelligent printers that take the strain off your processor have been available for a few years now. The Anderson-Jacobson people have carried the concept a logical step forward by putting smarts into high-quality printers and selling them at reasonable prices.

While the AJ 833 at $4,000 (for a full computer terminal) is perhaps a bit steep for home computer users, the AJ 830 sitting next to it is not. This equally attractive machine, decked out in Apple beige, sells for $1,300 reconditioned. I'd prefer this 30 cps daisy wheel to one of the new Japanese 25 cps Vistas sans keyboard. It's usable as a remote terminal, and the Qume mechanism is likely to outlive us all.

Plotter Power From Japan

At a crowded junction on the exhibit floor Linda Lierman is showing off her line of Watanabe pen plotters to an enthusiastic audience. Watanabe Instruments Corporation epitomizes the Japanese threat to the American peripheral market. With smart, inexpensive plotters like these, it's easy to see why Japan is giving us trouble.

The WX 4671 for $1,400 is a handsome unit with an internal microprocessor that accepts simple ASCII commands for drawing characters (which can be enlarged and rotated), straight lines (solid or broken), and coordinate axes with tic marks. A six-pen option is available for $300 more. The nice thing about the color-pen option is that you can upgrade to it anytime without paying a premium for retrofitting.

One potential customer, a Navy man, asks Linda how much the six-pen plotter costs. She responds by asking what he *thinks* it costs. "$4,000?" he guesses. When she quotes him $1,700, his eyes light up like a kid's on Christmas morning. "The plotter's a little slow for these government types, who don't see much difference between a $1,700 and a $4,000 purchase," Linda confides. "But when I tell them the price, they think of a dozen uses for it at home." Watanabe has plotters in both medium and low price ranges. The $4,150 WX 4638 plotter resembles the $1,400 machine, but draws at almost eight times the speed.

A sophisticated device like a plotter without a variety of easy-to-use programs is only half a machine. Watanabe plotters are blessed with abundant software that is unusual in low-cost graphics systems. A screen-dump program enables the Watanabe to draw any color picture that an Apple II can generate. The plotter fetches various color pens as it tracks through the bit map, plotting each consecutive point on each raster line. The 40 minutes it takes to draw a complex multicolor picture are a fascinating introduction to robotics and the intelligent mechanical machines destined for home use in the next few years.

Other plotter programs include line and bar-graph generators with shading, labeling, and scaling; a pie-chart generator with exploded sector option, arc and circle drawing; a curve fitter; a United States mapping system; block lettering; three-dimensional plotting; and more—all available on a variety of popular microcomputers. Software for the Watanabe is available from West Coast Consultants.

If America wants to win back the peripherals market from the Japanese, let's see a low-cost plotter that can match the ingenuity and capability of the Watanabe series. Come on, guys, what's so difficult about building a durable flat-bed plotter with a microprocessor and a ROM chip or two?

Watanabe's plotters, slick as they are, represent a logical evolutionary development in graphic output devices. Pen plotters started out as expensive machines used primarily for mapping, graphing, and design work. They required much software support, which implied large, costly computer systems. Now that computers are cheaper, software more readily available, and plotters smarter and easier to control, the popularity of pen plotters is growing.

But challenging their supremacy in printout/color-output applications are revolutionary new technologies: computer-driven color Xerox machines, electronic screen image cameras, and now multicolor ink-jet printers.

Painting With Numbers

Two ink-jet printers are on display at this year's Expo. Both can reproduce a color picture from a CRT or operate under direct computer control. These dot-matrix machines spray a fine stream of colored fluid at the paper, one drop for each dot. They resemble conventional desktop printers, but with no ribbon and no print hammer or daisy wheel to make an impression on the page.

Intelligent Systems Corporation's Printacolor features three inks that can be combined for a total of eight basic colors (more by mixing colors on a dot-by-dot basis). It sells for $4,400 including an RS-232 interface. Not bad, considering the cost of a Spinwriter these days. Printacolor can dump a video raster image to paper in 75 seconds in bi-directional mode. Slightly better resolution is obtainable if the printhead sprays only while traveling from left to right, but the print time doubles.

Apparently the effort involved to accelerate and decelerate the moving printhead results in some minor image smearing near the margins in the high-speed bi-directional mode. That is no problem with many graphic images, but the crispness required for text does suffer somewhat. At under $5,000, Printacolor will probably find non-traditional applications among innovative computer users. No doubt someone will write software, for example, to generate customized Christmas cards, freeing us at last from the tyranny of Hallmark.

Another ink-jet printer, the ACT-1 Color Copier by Advanced Color Technology, is similar in appearance to the Printacolor, but retails for over twice as much. It's $9,000 with a Centronics-compatible parallel interface, or $9,750 with direct video input. The ACT-1 uses three inks to print any of seven basic colors (plus 64 two-color combinations, and 125 shades through pixel mixing). This printer can resolve up to 140 dots per inch horizontally, and 85 vertically. The colors are less muddy than you might expect, considering that most shades are created by slathering one or more ink layers over a base color.

The price of the ACT-1 seems steep compared with the Printacolor, but distributor Paul Myers doesn't believe the price will drop anytime soon. "Demand is running high," he says, "and it's a quality machine." The quality is evident in the print samples I inspect. Still, I can't help but notice the purple splotches on both his hands. "Just a little problem with an ink cartridge," Paul

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explains.

Saying It With Pictures

A less messy, more elegant approach to color printouts is available with electronic cameras that convert a video signal into a color film image. The Matrix, Image Resource, and Dunn processors with their interchangable camera mounts and computer interfaces have been around for several years now, but their prices are not dropping as quickly or as much as I had hoped.

A new and promising competitor may help change that: the Modgraph Smart Graphics camera system promoted by Henry Kunick. The Modgraph, like its predecessors, uses a high-resolution, black-and-white, flat-faced CRT in conjunction with color filters, special optics, and interchangeable film camera mounts to produce brilliant prints (Polaroid 4 by 5-inch, 8 by 10-inch, or SX-70), transparencies, 35 mm slides, or 16 mm films from the video output of a computer. But Henry's machine, unlike the Matrix camera across the exhibit hall, accepts composite video (a "dirty" but popular standard for video transmission) as well as the purer RGB format without expensive additional circuitry. That makes it compatible with cheap color graphic systems such as the Apple and Atari.

At $7,800, the Modgraph is anything but cheap. But when you consider the price of comparable systems, it's clear we're making progress toward an affordable screen camera for hobby and small-business use.

The Matrix screen camera, according to spokesman Bill Becker, is $8,000 for the basic mainframe, plus $1,200 for a 35 mm or Polaroid interface. (Add $6,500 for 16 mm format. Gulp!) The camera accepts RGB signals only; add-on composite video costs around $1,500 more.

Becker is eager to point out the money-making possibilities of the Matrix. "Sure, the system costs more than your home computer," he argues. "But if you owned one, you could print hardcopy—in color and in a variety of film formats—for any popular microcomputer. All you would need is a modem and software to interpret the screen image. Customers could send their images over the telephone for printing by the camera system. Buy the camera," he advises, "and advertise yourself as a graphics production service. You'll pay for the machine soon enough." As color graphics imagery grows in popularity, Bill's concept should attract growing numbers of potential customers. Are you entrepreneurs out there listening?

Graphics Software of the Future

With my mind on color graphics, I wander toward Megatek's nearby display. Ho, hum—more business graphics. Wait a minute—that pie chart is labeled, "Budget for a family of one." Is mighty Megatek featuring a VisiPlot lookalike to tempt Apple users? No, according to Dr. John Moreland, the pie-chart budget simply reflects the interests of the software demo's programmer.

John is operations director for Megatek's Template software, which can generate graphics using just about any computer with at least a 24-bit CPU and a Fortran compiler. Template can then output those graphics to a wide variety of printers, plotters, and vector and raster-scan terminals. It is primarily for computer-aided design, scientific and engineering applications, financial reporting, and geophysical modeling. Customers include ITT, Westinghouse, British Telecom, and NASA/Goddard—hardly your run-of-the-mill microcomputer users.

Yet John Moreland is cordial and willing to talk about the relationship of high-powered computer graphics to the growing hobbyist and home market. "We're promoting device-independent graphics software that adheres to the Siggraph Core [a proposed standard that would enable graphics programs to run on a variety of different computers and peripheral devices, each with additional software linking the general graphics commands to the specific hardware]. Megatek is a leader in the design of graphics hardware," says John. "But let's face it, the hardware will soon enough be on an inexpensive chip. The future is in the software that will drive it. Device independent software is the key to a continuing position in the marketplace.

"We believe in educating people," Moreland continues, "because as the hardware grows more affordable, people will want the software. If they don't learn now how it works and what it's all about, they won't be ready for the new products when those products are ready for them." A practical attitude, and a refreshing one as well.

Ultimate Graphics

No discussion of high-powered graphics software would be complete without mentioning California Computer Products Inc. (CalComp), a producer of complex software that fully supports their superb line of CRTs, digitizers, and plotters. CalComp is demonstrating color video terminals. On the screen is a detailed wire-frame model of the Space Shuttle, soaring around the display in real time. How does the system generate all those vectors so quickly? And next to the Shuttle, CalComp features another stunning animated graphic: a color X-ray of a clock, showing the face, hands, and associated gear train. The clock rotates slowly, as if on a turntable. Every so often the demonstrator punches in an instruction, and an enlargement of one of the gears in a 3-D wire-frame format appears. Neat. I wait until the clock face comes around again. The second hand is moving. The clock is actually running! And yes, the time is accurate—to the second! I stumble away hurriedly, more than ever convinced that computer designers, programmers, and black-magic practitioners are all close cousins.

Rich Man's Computer

A crowd huddles around the PERQ, a $33,000 engineering design terminal (or rich man's personal computer) designed by Pittsburgh's Three Rivers Computer Corporation. This magical machine resembles the Xerox Star, but apparently outshines the Star in its hardware capabilities. The high-resolution, black-and-white graphics display features multiple independent windows that can be moved around the screen, smooth text scrolling, elaborate user-definable cursors, and other goodies, all supported by the hardware and brought into play by simple calls to the operating system.

PERQ's strongest sales point, though, is its attract mode, a real crowd pleaser. Its programmer's flair for the artistic neatly balances a devilish sense of humor. Graphics literally dance across PERQ's screen in a show as exciting to the Expo's sophisticated computer users as Asteroid's teaser is to the arcade gamers. Fourteen Pascal programs load one another in sequence to produce the most electrifying and elaborate demo I have ever seen. Data flashes through windows, windows sail across the screen, moving graphic cursors (bouncing balls, pulsating objets d'art, and the inevitable Starship Enterprise) effortlessly pass around, across, and through each other without disturbing the alternate graphics planes above and below. And every so often another window opens to list more features of the perky PERQ.

It boasts a built-in digitizer pad (rather than Xerox's mouse) and speech synthesizer; apparently Three Rivers places a high priority on friendly input and output. The addressable 768-by-1024-point screen yields about 100 sharp dots per inch. The screen is sized and shaped like a sheet of 8½ by 11-inch paper. Multiple high-resolution character fonts and proportionally spaced letters give the screen image a typeset quality.

A multiprocessing operating system helps PERQ's user manage the powerful text editor, assembler/debugger, menu-driven utilities, and Pascal compiler—all standard equipment. PERQ can execute a million P-codes per second. The 16-bit CPU supports a 32-bit virtual address space, and its instruction set can accept additional software features as they are developed.

The built-in 12-megabyte Winchester hard disk can transfer data at seven million bits per second into the 512K RAM. A 24-megabyte hard disk, one-megabyte floppy, and additional 512K RAM are available as options. RS-232 and IEEE interfaces are standard, and oh yes, PERQ is Ethernet-compatible. Needless to say, this kind of hardware will never retail for $299.95. But it's reasonable to assume that some of PERQ's most attractive inherent capabilities, such as its high-quality display graphics, built-in voicebox, and powerful software will soon enough migrate down into affordable hobbyist systems. Meanwhile, we can dream.

Six-pound Powerhouse

RCA's impressive booth features the VP-3501 Videotex Data Terminal, a machine that shatters the image of RCA as a technological backwater. This one could be a best seller if videotext (an information-retrieval system that uses telephone or cable tv lines for transmission, and a standard tv set for

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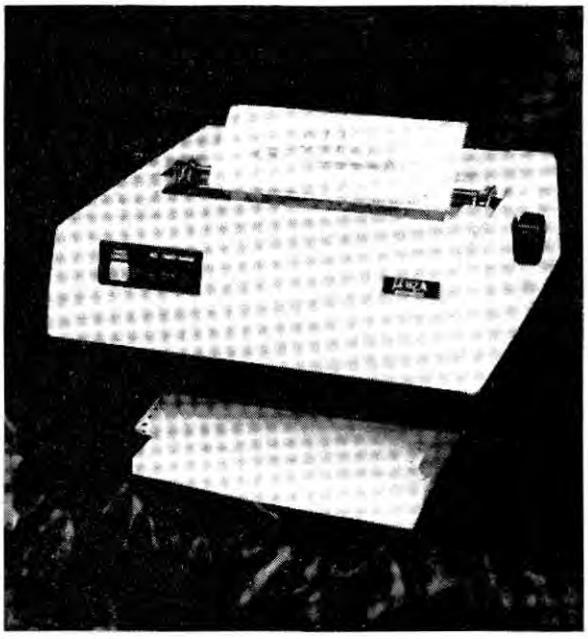

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display) captures America's imagination in the next few years.

The $399 unit is based on RCA's inexpensive terminal-in-a-keyboard. Its sealed-membrane keyboard is impervious to Cokes, cookie crumbs, and everything short of the business end of a hammer. The terminal hooks up to any color (or black-and-white) television through a built-in RF modulator that clamps onto the antenna leads. A direct-video output is provided for those folks with color monitors or video cassette recorders. The built-in modem plugs into a modular telephone jack; there's a printer port on board as well. A programmable sound generator provides a variety of tones and white-noise effects.

This six-pound marvel features remarkable graphics capabilities for such an inexpensive terminal. It can generate eight foreground and eight background colors with reverse video on a character-by-character basis. The character set is redefinable, and the cursor is fully addressable. That means the terminal can display foreign-language transmissions, complex pictures, and even limited animation. The screen format, too, is software-selectable. It can display either 24 lines of 40 characters (a de facto standard in videotext transmissions) or 12 lines of 20 characters for menus and headline emphasis.

As impressive as the basic terminal are its low-cost options. RCA's $69 cassette interface enables you to record conversations with a videotext system, and to review them later, when off line. Starting and stopping the cassette from the keyboard freezes the display, allowing you to read a screenful of data at your leisure. An expansion box provides space for additional memory, and a TTL-level output can hook up to a smart interface proposed for the near future. That would permit additional software to dial the phone automatically, store information, and perhaps process raw stock data from Dow Jones or automatically search through the *Washington Post* for news of special interest.

Right now the Videotex Data Terminal's performance is limited by the black-and-white, text-only service transmitted by information providers like The Source and CompuServe. But the terminal is clearly built with an eye toward the future. As graphics-oriented information services begin to attract the public's attention, the RCA VP-3501 will be ready for them.

It's Getting Late

I check the time and realize I've spent six hours exploring the vast Expo. I'm suffering from information overload. Time to go home and reflect on the good guys—and the bad—I've met in today's adventure game. ■

Bud Stolker writes, lectures and teaches about personal computers: their uses, their promise, and their importance in a changing society.

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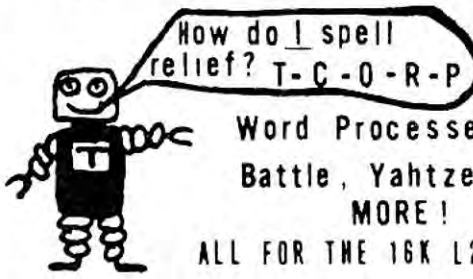

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What does baud mean?

Bit Smitten—Part III

Jay Chidsey
205 East Adams St.
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During the first year and a half of my cohabitation with a TRS-80, I was completely mystified by the term "baud rate." The Model I Level II has a baud rate (transfer speed of information from computer to tape or tape to computer) of 500. The Model III has a selectable rate, either 500 baud or 1,500 baud. The latter is three times as fast as the former, but what does baud mean?

The term baud comes from the words "bits of audio data." A bit is the smallest unit of computer information. A bit is either a one or a zero in machine language, the language your computer speaks. The term comes from the words binary digit. Bits can be grouped into sets of eight. It takes eight bits (one byte) to store the information needed by your computer to display one letter or number or blank space or symbol (like $ or # or &) or graphic block. If you make a chart with eight columns, you will find that there are 256 different possible combinations of one or zero in groups of eight. These eight-bit units, capable of 256 different combinations, form one byte. Half a byte, four bits, is called a nybble! There's a touch of dry wit in the field.

To human beings, who count by tens in a decimal system, 256 is just another unremarkable number, but to a computer, which counts by twos in a binary system, it is a notable number. This number is the result of multiplying $2\times2\times2\times2\times2\times2\times2\times2$, or of raising two to the eighth power. Two, and powers of two, pervade computer operation. There are 64 graphic blocks, Model I and III screens accept 64 characters per line, and maximum program line length is 256 characters (0-255). Even the 4K, 16K, 32K or 48K memory size is an approximation for the convenience of human decimal users; the actual size is 4 or 16 or 32 or 48 times 2 to the power of 10, or 1024.

Baud rate is related to the transfer rate from one component of your system to another (cassette, disk, modem, to or from your TRS-80). It has become common (though sloppy) practice in the field to equate baud with bits-per-second. This is not quite true. At 500 baud, you are transferring approximately 430 bits, or 54 bytes per second. Since the right asterisk at the upper right corner of your monitor screen flashes on and off once for every 64 bytes transferred, you get a blink rate of about once per second. The Model III, at 1,500 baud (164 bytes/sec), blinks about three times per second.

The correct definition of baud is: the reciprocal of the time duration of the shortest code element being transferred; a bit in this case. Reciprocals are two numbers which, when multiplied together, equal one. If the shortest duration of a code element is 20 milliseconds (0.02 seconds) the rate is 50 baud; if it is 2 milliseconds (0.002 seconds) the baud rate is 500.

A 500-baud transfer rate is very much at the low end of contemporary computer technology. Tandy's recently announced ARCNET system, connecting any number of Model II machines into a network, is said to transfer at 20 million baud. The biggest and newest mainframe computers conduct their internal business at the rate of 2 billion baud, and though I do not have a transfer rate for such a rig, it is substantially faster than ARCNET.

Screen Dump Routines

Few hobbyists acquire printers during the first year or two of computer ownership, but many business users do, often as an element of the original configuration. I have two useful screen to printer dumps for you. Both print everything that is on the screen, warts and all, including blank spaces, so they are relatively slow.

The first utility is a screen dump command built into the Model III. Press shift and

```
10 CLS
20 POKE 15360 + X, N
30 PRINT@X + 1, N
40 N = N + 1: X = X + 8
50 IF N=32 THEN N=192
60 IF N=256 GOTO 100
70 GOTO 20
100 PRINT: PRINT "THESE ARE ADDITIONAL MODEL III CHARACTERS."
110 PRINT "To view any Character in expanded form"
120 INPUT "enter its number here"; EF
130 CLS: PRINT CHR$(23): POKE 15360 + 476, EF
140 PRINT@478, EF
150 PRINT: PRINT: PRINT: PRINT "Press >ENTER< for"
160 INPUT "Character Chart"; YY
170 RUN
```

Program Listing 1. Model III characters

The Key Box

Cassette Basic
Model I or III
4K RAM
Printer required for screen dump

the down-arrow keys together, and then hit the asterisk key (since you are shifted, asterisk is active, rather than colon). The whole screen will print.

The second short utility works on the Model III.

```
10 POKE 16526,217
20 POKE 16527,1
30 X=USR(0):REM THAT'S A ZERO, NOT A CAPITAL O
```

I've written an interest calculation program which generates interest payment, principal payment, and balance due for each month. The month counter, M, accumulates to 12 and then resets for the next year. I use the above utility by putting the line IF M = 12 GOSUB 5000 in the calculation program. When the value of M is 12, and the year's payments are on the screen, the program goes to the subroutine

```
5000 POKE 16526,217: POKE 16527,1: X=USR(0): RETURN
```

So there's a useful one-liner.

Extra Model III Characters

Tandy packed 96 new goodies in the form of additional characters into the Model III. The manual refers to them only in passing, and with no description or illustration. These characters are easy to generate. Run over to your Model III and tap in Program Listing 1 and run it.

Just look at them—physics signs, railroad signs, happy face, sad face, spades, hearts, diamonds, clubs, male and female signs and figures, and even a rocket ship. Numbers 244, 245 and 246 are used together; they form a hand with pointing finger. Enter CHR$(23) to double-width any of them (happy face/sad face require it). To view any character expanded, just enter its number.

You can use any of these characters anywhere on the monitor screen in a program by adding the screen location to 15360 and specifying the character. Instead of PRINT@650, you use the POKE function. For example: POKE 15360 + 650,255 for the rocket ship. Character number 255 or any of the others will print at the location specified in the add-on to POKE 15360.

```
5 REM  'DRUNKARD'S WALK'
10 X = 60: Y = 23
20 CLS: SET(X,Y)
30 Z = RND(2)
40 X = X + (RND(2) - Z)
50 Y = Y + (RND(2) - Z)
60 IF X>127 OR X<0 GOTO 10
70 IF Y>47 OR Y<0 GOTO 10
80 SET(X,Y)
90 RANDOM
100 GOTO 30
```

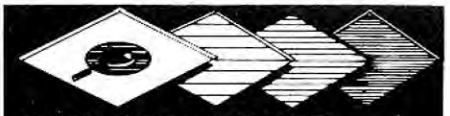
Program Listing 2. The Drunkard's Walk

The Drunkard's Walk

Colloidal particles in liquid never settle out to the bottom because they are so small that the random nudges of water molecules bump them in any random direction, and have a significantly greater effect upon their motion than does gravity. This is called Brownian Movement. More colorfully, it is called "The Drunkard's Walk," with the drunk starting from a lamp post and moving a short distance at random in any directon and then a short distance in any other (or the same) direction. Yet he remains in the vicinity of the lamp post.

I happened upon a computer approximation of The Drunkard's Walk which moves the lighted pixel trail in any of eight directions in each program cycle. When the trail reaches the screen's edge, it is cleared and begins again at the lamp post. It makes an amusing display to run on your screen just for fun. To slow the pixel's progress simply insert 75 FOR I = 1 TO 1000: NEXT. 35 RESET (X,Y) for "the Butterfly." See Program Listing 2. ■

Jay Chidsey uses his 48K Model III to track profit/loss in his business and writes prose and programs as a hobby.



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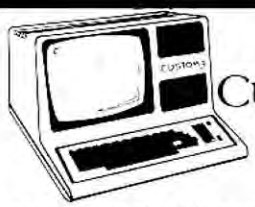

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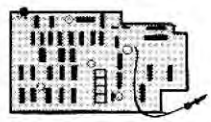

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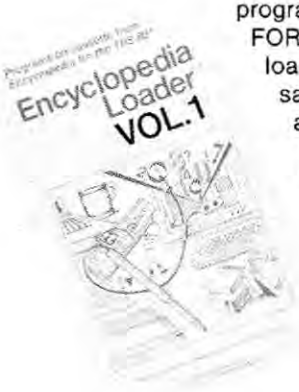

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What to expect when your 80 breaks down.

Radio Shack Repairs

Terry Kepner
Box 481
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Radio Shack has insisted that its customers buy upgrade equipment only from its stores or associate dealers. It has refused to work on equipment made by outside companies or repair computers that have been modified, even when the problem is obviously with the Radio Shack equipment. This has created a good deal of ill-will, and triggered a new cottage industry—repairing modified Radio Shack computers. Owners of modified computers tell horror stories about the difficulties they've had getting their machines worked on or repaired. For example, a friend of mine attached a "music generator" (it let him connect his computer directly to his stereo and play computer-generated music) to his computer. Because of a design flaw, the hot line of the stereo was connected directly to the ground line of the computer, and vice versa. The net result was the total destruction of his computer (except for his video monitor). In less than a second, over $2,000 worth of equipment was destroyed. Because non-Radio Shack equipment was attached to the TRS-80, and because the TRS-80 in question had non-Radio Shack memory, as well as an uppercase/lowercase modification, Radio Shack refused to touch the machine.

Another story concerns a computer magazine's Color Computer. They attached a hardware device via the cartridge port, and blew out the 6809 chip. Radio Shack again refused to look at it.

Radio Shack usually advertises a 90-day warranty, under which manufacturing defects will be repaired for free. Any repairs after the warranty period will be done for a basic labor rate, plus the cost of the parts required for the repair. To void the warranty, you must open up the case of the computer and install non-Radio Shack equipment or make modifications. Officially, the warranty is voided if the case has only been opened; fortunately, most technicians are more lenient.

Lately, Radio Shack has relaxed its hard-line stance. They've agreed to let their technicians work on computers that have non-Radio Shack alterations or additions, *when the non-Radio Shack modifications don't affect the problem being corrected.*

Thus, if you've added non-Radio Shack disk drives to your computer and you begin experiencing memory problems, Radio Shack will unplug your drives and test the computer. If the Radio Shack memory is bad, it will be replaced. If the memory that you added is bad, you'll be charged a minimum checkout charge, and the computer will be returned to you. (Optionally, you can have the Radio Shack technician remove the non-Radio Shack modifications and have him return the unit to their standard setup. You will, of course, be charged for this service.)

If, on the other hand, you begin having disk I/O problems, don't bother asking Radio Shack for help. You'll have to go to the company that sold you the drives.

This approach makes sense. After all, would you take a Radio Shack disk drive to Apple and expect them to repair it for you? Radio Shack technicians have repair manuals only for Tandy equipment, and their training is similarly restricted. And just because the equipment is compatible with the Radio Shack computer doesn't mean that its parts and design are identical with the Radio Shack equivalent equipment.

Another good analogy: Is it fair to expect Radio Shack to repair a non-Tandy printer just because you have it connected to your computer? Not only doesn't the Tandy technician have schematics, he probably doesn't have the necessary parts to repair the printer.

Radio Shack's new outlook has made the decision involving non-Tandy equipment a bit easier. Now at least you know that Radio Shack will take care of the basic equipment in your computer. All you have to take care of is the "foreign" equipment and modifications.

When your computer starts to misbehave, you must determine if the problem lies with the Radio Shack equipment or the "foreign" equipment. If the problem is with the non-Radio Shack equipment, you'll have to take your computer to an outside repair technician. If the Radio Shack equipment is at fault, you have a choice: you can take your computer to a Radio Shack computer repair center, or you can take it to an outside technician. The choice is up to you, but will probably be based on cost.

Radio Shack's policy is that any computer that's out of warranty, and that's brought in for repair work, is charged a basic service charge rate (see Table 1). If you bring in a peripheral (printer, modem, Vox Box, etc.) at the same time, the technician will charge you an extra $5 for each peripheral checked out with the CPU. If you bring in the peripheral separately, the ap-

Table 1

Service Charges

Any 26-xxxx product that is not listed below will be serviced at a rate of $15 per ½ hour. The service charges on the following pages do not apply to any equipment that has non-Radio Shack parts or modifications. Instead, the equipment will be repaired at the rate of $15 per ½ hour.

Checkout Charges

If any peripheral is checked out with a CPU, then the unit charge for the peripheral does not apply. Instead, a $5 charge (no charge if the peripheral is brought in at the request of the Service Center) for each peripheral will apply. For any 26-xxxx product not otherwise listed, the maximum check-out charge will be $30 for all CPUs and $15 for all other items. Any checkout charge billed within 45 days of a repair will be credited against the labor charge for that repair. The amount credited will not exceed the labor charge.

Upgrade Charges

All installation (service) charges for upgrade kits will be billed to the store on an ICRT to account #5791. All kits (if supplied by the service center) will be billed on an ICST to account #4001.

Table continues

propriate service charge (see Table 1) is made (e.g., the Vox Box repair service charge is normally $15).

If the equipment has any non-Radio Shack parts or modifications, the rates in Table 1 don't apply. Instead, the equipment is repaired at a cost of $15 per half hour.

These prices, of course, don't include the parts' cost.

Table 1 is a listing of the current service and checkout charges being used by Radio Shack. These prices are subject to change without notice, but if past experience is any indication, the prices should be good for about a year.

Any Radio Shack computer product (catalog # 26-xxxx) not listed in Table 1 will have a maximum checkout of $30 for all CPUs, and $15 for all other items. As a matter of policy, any checkout charge billed within 45 days of a repair will be credited against the labor charge for that repair. The amount credited won't exceed the labor charge.

The primary use of Table 1, for those with modified computers, is to determine how fairly you're being charged for repair work by independent technicians. After all, if Radio Shack thinks that aligning a disk drive should cost $25 (parts not included), an independent technician shouldn't charge too much more than that. (Usually, it'll be less.)

If your computer is unmodified, and contains only Radio Shack parts, Table 1 will give you a good idea of what to expect. ■

Table continued

Cat. No.	Description of Service	Service Charge	Checkout Charge
26-100X	Repair Model I CPU (maximum labor = $30, maximum parts = $25)	$15/½hr	$15
26-1006	Install DISD Modification	$50	(no discount)
26-106X	Repair Model III w/o drives (maximum labor = $30, maximum parts = $45)	$15/½hr	$15
26-106X	Install REV "B" ROM "C" (includes parts)	$20	N/A
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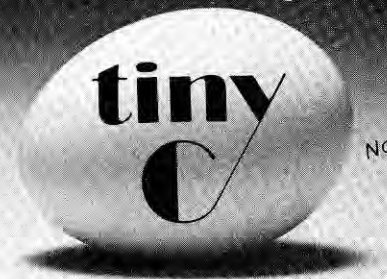

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Greet your neighborhood's goblins with a talking jack-o-lantern.

Trick or TRS-80?

Mike Keller
13423 Desert Hills NE
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Disneyland's Haunted Mansion inspired this Halloween special effect. Using the TRS-80, some Basic string packing, a sheet of glass, and some other accessories, I greeted my goblin visitors with an animated, talking jack-o-lantern.

Program Goals

The idea was to create an animated jack-o-lantern on the TRS-80 screen using inputs from the keyboard and a microphone. The arrow keys turn the face right or left, and the microphone, connected to an audio amplifier, moves the mouth. This image is then reflected using a sheet of glass to give the appearance of floating in space just inside my doorway. When the kids knocked on the door, they would be greeted by a smiling, disembodied apparition who would carry on a brief conversation with them.

Even if you have a "bah humbug" attitude towards Halloween, several features of the program are interesting in themselves. Combined, they produce a very effective illusion. These features are:

- Circle and oval-drawing routines to create the pumpkin.
- String packing for fast animation.
- Use of PEEK statements to monitor the keyboard.
- Use of the cassette port to monitor the microphone.

To implement the effect you need a small audio amplifier, the cable used to connect your TRS-80 to the cassette recorder, a microphone, a speaker, speaker wire, and a sheet of glass about 3 by 5 feet.

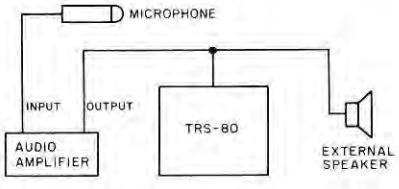

Fig. 1. Wired for Sound

Speaking to Your TRS-80

If your only previous means of communicating with your TRS-80 has been through the keyboard, you're in for a treat. When you

The Key Box

Model I or III
16K RAM
Disk Basic

Program Listing

```
10 'JAKOLANT      M. KELLER    ALBUQUERQUE, NM   (505) 294-4966
20 'ANIMATED JACK-O-LANTERN. USE RIGHT & LEFT ARROW KEYS TO
30 'TURN JACK'S HEAD, MICROPHONE INPUT TO ANIMATE MOUTH.
40 '
50 '====================== INITIALIZE ============================
60 CLS: CMD"T": CLEAR 50: DEFINT A,X,Y,Z
70 GOSUB 200    'DRAW PUMPKIN
80 CLEAR1000:DEFINTA-Z:P=255: KB=14400: F=335: M=388: A=1: L=32
90 GOSUB 470    'PACK STRINGS WITH JACK-O-LANTERN FACE
100 '================ START OF MAIN PROGRAM ====================
110 PRINT@F,F$;  'PUT FACE ON PUMPKIN
120 OUT P,0:IFINP(P)>127THENPRINT@F+M,M2$;:ELSEPRINT@F+M,M1$;
130 K=PEEK(KB):IFK=0THEN120
140 IFK=L THENF=F-A:ELSEF=F+A
150 GOTO110
160 '================ END OF MAIN PROGRAM !! ====================
170 '
180 '::::::::::::::: SUBROUTINE TO DRAW PUMPKIN ::::::::::::::::
190 '===================== DRAW OUTLINE ========================
200 R=32: CV=.0174533  'RADIUS=32, CV CONVERTS ANGLE TO RADIANS
210 FOR ANGLE=2 TO 74 STEP 2
220  RN=ANGLE * CV: X=COS(RN)*R*2: Y=SIN(RN)*24
230  SET (64-X,24-Y): SET(64-X,Y+24)
240 NEXT ANGLE
250 '=================== FILL-IN PUMPKIN =======================
260 FOR Y=1 TO 47
270  FOR X=0 TO 64: IF POINT(X,Y)=0 THEN NEXT X
280  FOR Z=X TO 127-X : SET(Z,Y): NEXT Z  'FILL A LINE
290 NEXT Y
300 '================== DRAW SEGMENT LINES =====================
310 ON ERROR GOTO 380: R=0: ADD=12
320 R=R+ADD: ADD=ADD-3
330  FOR ANGLE=2 TO 178 STEP 4
340   RN=ANGLE * CV: X=COS(RN)*R*2: Y=SIN(RN)*24
350   RESET (63-X,24-Y): RESET(63-X,Y+24)
360  NEXT ANGLE
370 IF R < 25 THEN 320 ELSE 400
380 RESUME NEXT  'SOPHISTICATED ERROR HANDLING
390 '======================= ADD STEM ==========================
400 PRINT@21,STRING$(8,176);STRING$(6,191);
410 PRINT CHR$(177);STRING$(7,176);
420 ON ERROR GOTO 0: RETURN          'PUMPKIN IS COMPLETE
430 '
440 '::::::::::::  SUBROUTINE TO PACK ALL STRINGS  ::::::::::::::
450 '========== PACK F$ WITH EYES, NOSE & CLOSED MOUTH =========
460 'NOTE: NEXT LINE MUST HAVE 217 ASTERISKS BEFORE RUNNING
470 F$="*****************************************************
*****************************************************
*****************************************************
```

Listing continues

Circle 547 on Reader Service card.→

are CLOADing a program, your machine listens to audio signals generated by an amplifier in the cassette recorder. You can also get your computer to listen to audio input from another source, like a microphone.

On the Models I and III the cassette is monitored through port 255. You may have already sent signals to this port to generate bells and whistles. Since it is a two-way device, it can be used to respond to sounds as well as send them. Here's how you can do it.

As a matter of good operating practice, the computer should be turned off for the next few steps. Connect the black plug that normally goes to the ear jack of your recorder to the external speaker jack of a small audio amplifier (such as Radio Shack's #277-1008). Connect a microphone to the amplifier's input jack. Your connections should look something like Fig. 1 (except for the addition of a speaker).

Start with the amplifier volume all the way down. Now turn your computer back on and run this short program:

```
10 CLS
20 OUT 255,0
30 IF INP(255)<127THENPRINT@0,"*"ELSEPRINT@0,""
40 GOTO 20
```

As the program runs, gradually turn up the volume while muttering something technical like "testing, testing. . ." into the microphone. When you reach a high enough volume setting, you will see an asterisk in the upper left of the screen (you have to

Listing continued

```
**********************************"
480 V=VARPTR(F$): START=PEEK(V+2)*256+PEEK(V+1)
490 FOR X=START TO START+216: READ CHAR: POKE X,CHAR: NEXT X
500 'JACK'S RIGHT EYE (ON LEFT OF SCREEN) BUILT FROM TOP DOWN
510 DATA 191,131,131,131,131,143,143,143,143,143,143,191
520 DATA 26,24,24,24,24,24,24,24,24,24,24
530 DATA 191,188,176,32,32,32,32,32,184,191
540 DATA 26,24,24,24,24,24,24,24,24
550 DATA 191,188,176,144,160,190,191
560 DATA 25,25,25,25,25,25,25,25,25,25
570 'JACK'S LEFT EYE IS BUILT FROM BOTTOM UP
580 DATA 191,189,144,160,176,188,191
590 DATA 27,24,24,24,24,24,24,24,24
600 DATA 191,180,32,32,32,32,32,176,188,191
610 DATA 27,24,24,24,24,24,24,24,24,24,24
620 DATA 191,143,143,143,143,143,143,131,131,131,131,191
630 'JACK'S NOSE (INCLUDES CURSOR POSITIONING TO MOUTH)
640 DATA 24,24,24,24,24,24,24,24,24,24,24,24,24,24,24,24,24
650 DATA 24,24,24,26,26,26,26
660 DATA 191,159,135,129,131,143,191
670 DATA 24,24,24,24,24,24,24,24,24,24,24,24,24,24,24,24,24,26,26
680 'JACK'S CLOSED MOUTH
690 DATA 191,188,176,179,131,131,143,143,143,191,143,143,143
700 DATA 191,143,143,143,143,135,131,131,179,176,188,191
710 DATA 26,24,24,24,24,24,24,24,24,24,24,24,24,24,24,24,24,24
720 DATA 24,24,24
730 DATA 191,188,191,188,188,188,191,188,188,188,188,191,188
740 DATA 188,191
750 '============== MAKE A COPY OF CLOSED MOUTH ===============
760 M1$=RIGHT$(F$,61)  'MOUTH IS LAST 61 CHARACTERS OF FACE
770 '================ PACK M2$ WITH OPEN MOUTH ================
780 'NOTE: NEXT LINE MUST HAVE 64 ASTERISKS BEFORE RUNNING
790 M2$="********************************************************
*********"
800 V=VARPTR(M2$): START=PEEK(V+2)*256+PEEK(V+1)
810 FOR X=START TO START+63: READ CHAR: POKE X,CHAR: NEXT X
820 DATA 191,188,176,179,131,131,131,131,131,131,131,131,131
830 DATA 131,131,131,131,131,131,131,131,179,176,188,191
840 DATA 26,24,24,24,24,24,24,24,24,24,24,24,24,24,24,24
850 DATA 24,24,24,24,24,24
860 DATA 191,180,128,176,128,128,128,176,128,128,128,128,176
870 DATA 128,128,184,191
880 RETURN                    'ALL STRINGS ARE PACKED
```


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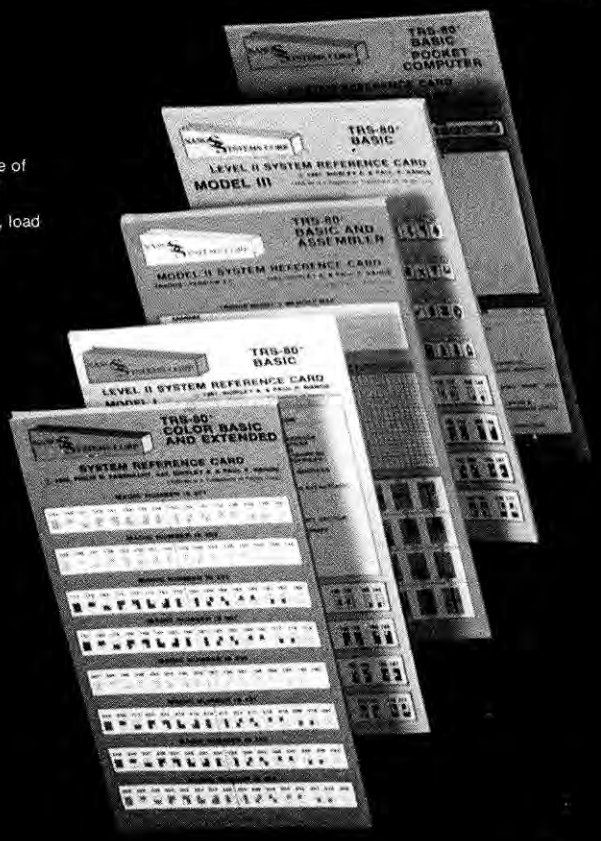

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Variable name	Value if constant	Description
A	1	Used to increment or decrement current screen position for face
ADD		Used for successive incrementing of radius while drawing segment arcs
ANGLE		Used while drawing pumpkin outline and segment arcs
CHAR		Current data character during string packing operations
CV	.0174533	Used to convert current angle to radians
F		Current print position for Jack's face (F$)
F$		Packed string defining Jack's face (with closed mouth)
K		Latest value found by PEEKing the arrow key address
KB	14400	Memory address where left and right arrow keys can be detected
L	32	Comparitor for possible detection of left arrow key
M	388	Screen displacement (from F) to determine current mouth position
M1$		Packed string defining closed mouth. Printed at F + M if no audio input
M2$		Packed string defining open mouth. Printed at F + M if audio input detected
P	255	Defines the cassette port
R		Current radius during drawing of pumpkin outline and segment arcs
RN		Current radians (ANGLE *CV)
START		Starting address of current string being packed
V		Variable pointer (VARPTR) of current string being packed
X		Generally used as X coordinate of screen pixel being SET or RESET
Y		Same as X, but for Y coordinate
Z		Used for starting and ending X coordinates during pumpkin-filling routine

Table. Variables for Jakolant

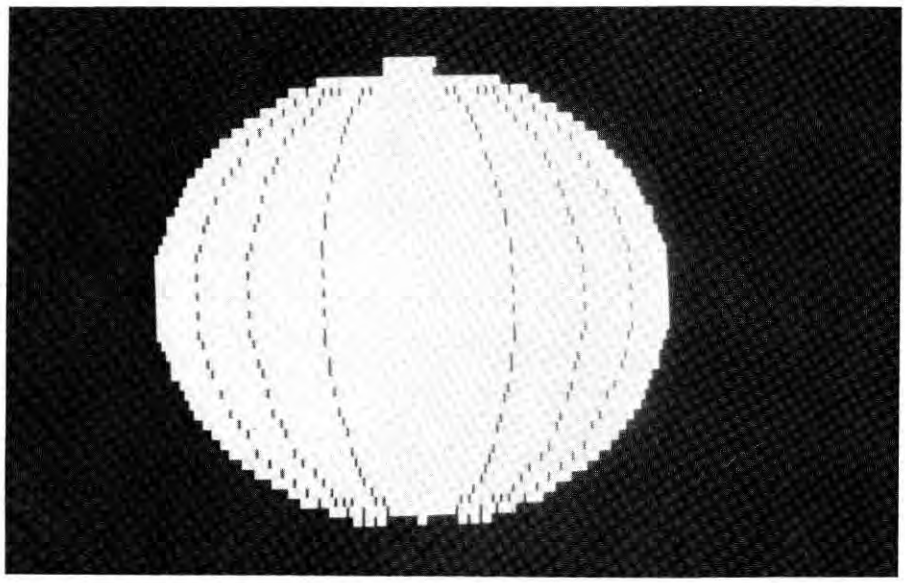

Photo 1. Segmented Pumpkin

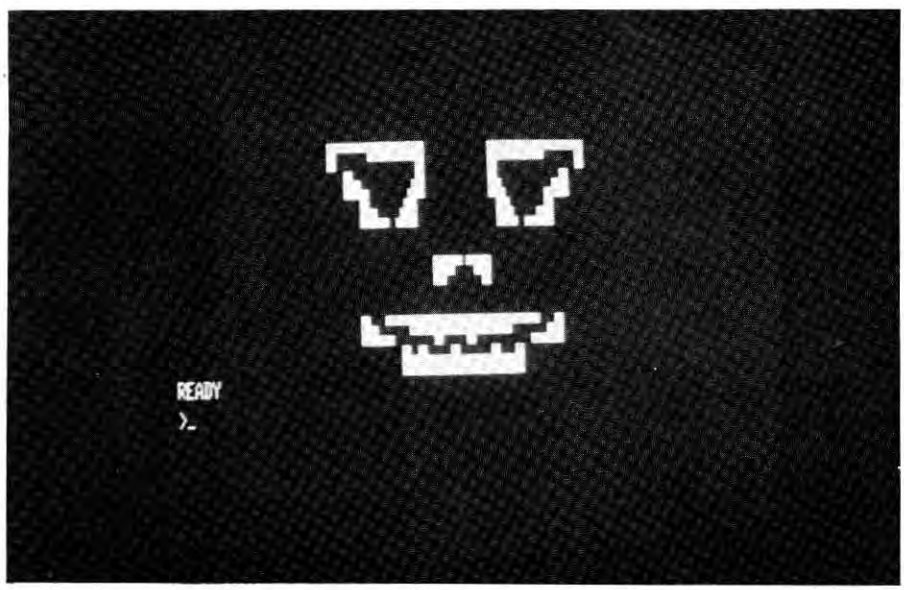

Photo 2. Jack's Face (F$) After Packing

keep talking while you adjust the volume). The asterisk will come and go as you speak. Voila! Your TRS-80 has ears.

Don't go any higher than necessary on the volume. Your computer is designed to work with fairly low power levels. This method will be used to open and close the jack-o-lantern's mouth. The amplifier's output can be tapped to drive a speaker as well as the computer.

The Program

The variables used in Jakolant (Program Listing 1) are listed in the Table. Jakolant can be functionally broken down into three parts. The pumpkin is drawn by the subroutine starting at line 200. Then several Basic strings are packed with graphics characters to define Jack's facial features (eyes, nose, and mouth). This is done by the subroutine beginning at line 470. The main part of the program (lines 110–150) is quite short. It scans the keyboard and cassette port and animates the face.

Following the program's flow requires a little skipping around. This was necessary because execution speed is important during the scanning routine. Jack's mouth must open the instant you speak into the microphone and close when you stop. At the same time, the program has to scan the left and right arrow keys for your commands to turn Jack's head. Since branching statements (such as those in lines 130 and 150) execute faster if they are located toward the beginning of a listing, the pumpkin-drawing and string-packing routines were placed after the main part of the program.

Some other things were done in the interest of speed. The CMD"T" in line 60 causes any interrupt-driven routines, such as the updating of the TRS-80's real-time clock, to be bypassed. This allows the processor to devote almost complete attention to the running of the Jakolant program. If you are using Level II rather than Disk Basic, this statement must be omitted. Also for speed, unnecessary spaces were left out of the main part of the program, except for the space in line 140 which is there for clarity. For the main part of the program, all variables are defined as integers, and even some values that remain constant during the program run are assigned to variables. This is (theoretically, at least) another time saver.

No special effort was made to speed up the pumpkin-drawing or string-packing routines, since these only have to be done once, before you bring Jack to life.

Graphic Curves

The TRS-80, even with its limited graphics resolution, is capable of drawing good circles and ovals, provided they are large. Jack's head uses the entire screen. When you run the program, a semi-circle is drawn on the left half of the screen by lines 200–240. It is not necessary to draw the entire outline of the pumpkin, since the right half can be defined as a mirror image of the left half.

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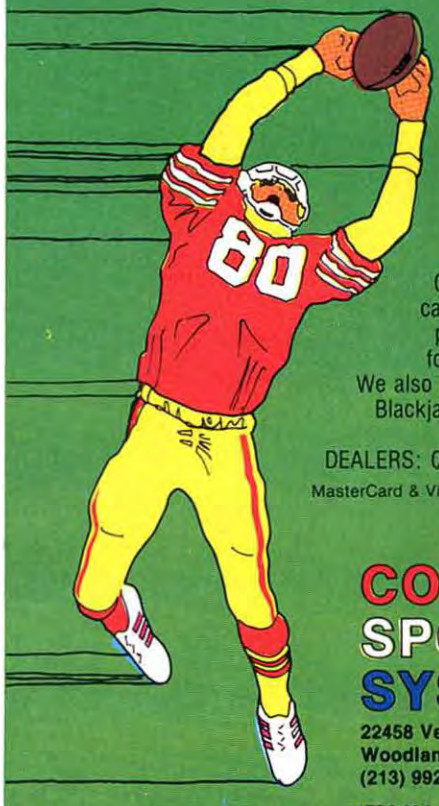

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Lines 260–290 use the existing outline to fill in the rest of the pumpkin. The variable X scans each screen line left to right. As soon as a lighted screen pixel is encountered, the remaining portion of the line is turned on up to a corresponding pixel on the right side of the screen. The resulting image is not a perfect circle, but then again, what pumpkin is?

The next task, done by lines 310–380, is to draw arcs to represent pumpkin segments. These arcs are parabolic, and are drawn using a variation of the earlier circle-drawing routine. In this case pixels are turned off to show black arcs on the white background.

Because of the size of the pumpkin and the need to avoid wiping out too much of its top and bottom, I designed the segment arcs to extend beyond the upper and lower screen limits. Of course, this will generate an error condition. The error is trapped by line 310 and routed to line 380, which ignores it and allows the program to attempt the next part of the arc. Three arcs are drawn for each hemisphere. The variable ADD spaces the arcs closer to each other as they extend closer to the outline of the pumpkin. The complete drawing of the pumpkin takes about one minute. When it is finished, the screen will look like Photo 1.

Packing for Speed

The only remaining task is to draw Jack's face on the pumpkin. This is done with a technique called string packing (see "Picture This," *80 Micro*, September 1981). String packing allows for fast updating of the display without the need for a separate machine-language routine. Since we want to be able to change the position of Jack's face on the pumpkin, as well as rapidly open and close his mouth, the technique is ideally suited to our needs. One caution about string packing—when you run the program, it actually modifies a portion of itself, specifically lines 470 and 790. There are lots of data values in this program and just as many opportunities for error when typing them in, so you would be wise to save it before running, just in case.

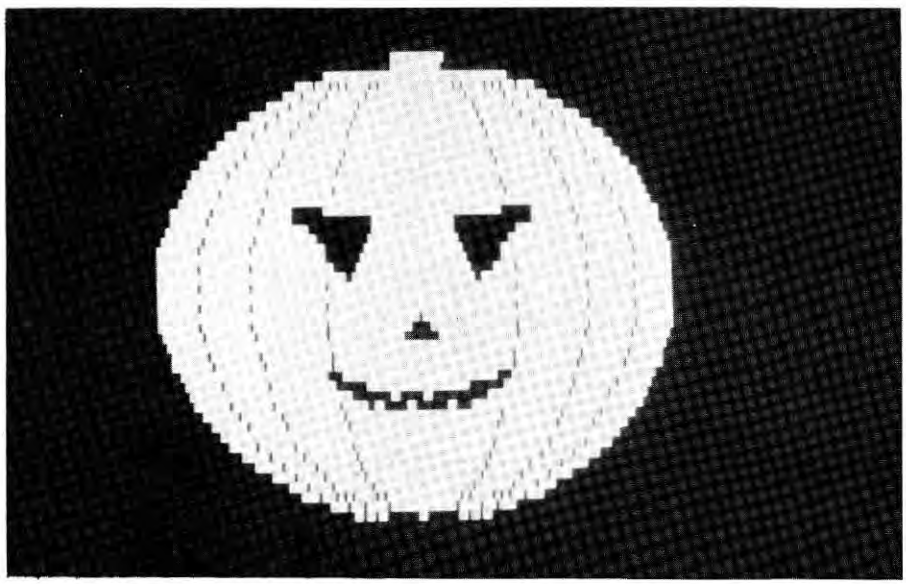

Photo 3. Complete Jack-o-Lantern

Photo 4. Jack Speaking

Short But Sweet

Now let's examine the heart of the program. Line 110 prints Jack's face (F$) at screen position F. (For a look at the packed F$ without the pumpkin, see Photo 2.) Initially, F equals 335 and the screen display looks like Photo 3. Line 120 sends a zero byte to the cassette port and checks for audio input from your amplifier. If a sound is detected, Jack's open mouth (M2$) is printed. If not, the closed mouth (M1$) is printed. We could reprint Jack's whole face since it includes a closed mouth, but M1$ is much shorter and can be printed faster. Photo 4 shows the screen display while the program is detecting voice input.

Line 130 takes a quick look at the keyboard row containing the arrow keys. If none are pressed it branches back to check the microphone's status again. If a key is pressed, line 140 checks to see if it was the left arrow. A left arrow causes F to be decremented by one. Any other arrow key is assumed to be a right arrow and increments F by one.

The program then branches back to line 110 to update the face position on the screen, producing the illusion that Jack has turned his head slightly. As long as an arrow key is held down, Jack's head continues to turn. Nothing will prevent the face from moving too far left or right and messing up the display. Such a check would be time consuming, and would slow the program's response to your voice input. Ideally, your final setup should allow you to monitor the display as well as the trick-or-treaters, so this should not be a problem.

Setting Things Up

Floor plans vary, but to give you an idea I will describe how we arranged things at my home (Fig. 2). A large sheet of glass can be extremely dangerous, so I put the glass behind a window adjoining my front porch. I mounted the speaker near the window to attract attention as the kids approached. This way I eliminated a possible safety hazard and was able to watch the tots from a secret location as they chatted with Jack.

Standing the sheet of glass at the right position and angle requires experimentation. I taped the edges to avoid cuts and used an open doorway in the hall as a support for the glass. I recommend the glass be at least ¼ inch thick. Laminated safety glass is best.

As illustrated in Fig. 2, Jack's image reflects off the glass and appears to float behind it. This distance can be controlled by varying the distance between the TRS-80 and the glass, and the lateral position of the image is controlled by adjusting the angle of the glass. Unwanted reflections can be subdued by hanging dark fabric. The illusion is effective only if the sheet of glass

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itself is not noticeable to the onlookers, but make sure everyone in your house knows *exactly* where it is.

If it is not feasible to use glass, position the video monitor so the image is viewed directly, rather than reflected. This will detract from the ghostly illusion, but should still be fun.

Outdoor lighting is an additional safety consideration. The porch needs to be dimmer than normal, but still bright enough for the kids to see where they are going (some Halloween masks make it hard to see). We kept the indoor lights low except when greeting the kids at the door. A carefully placed night-light inside enabled me to keep an eye on everything without disclosing my whereabouts to the children.

To make sure the trick-or-treaters could tell we were at home and ready for eerie visitors, two more touches were added. I taped a small light bulb to the inside of a hollow plastic skull and mounted it on the roof just over the doorway. We also bought a Walt Disney album of chilling sound effects (howling wolves, creaking doors), and played these through a separate speaker on the roof just loud enough to be heard from the street. By the time the kids reached the porch, they were filled with excitement.

Incidentally, I was concerned this atmosphere might be too scary for the little ones. I was mistaken. The smaller the kids, the more fun they had with the whole thing. The littlest goblins would walk right up and talk to Jack as if they talked to floating spectres every day.

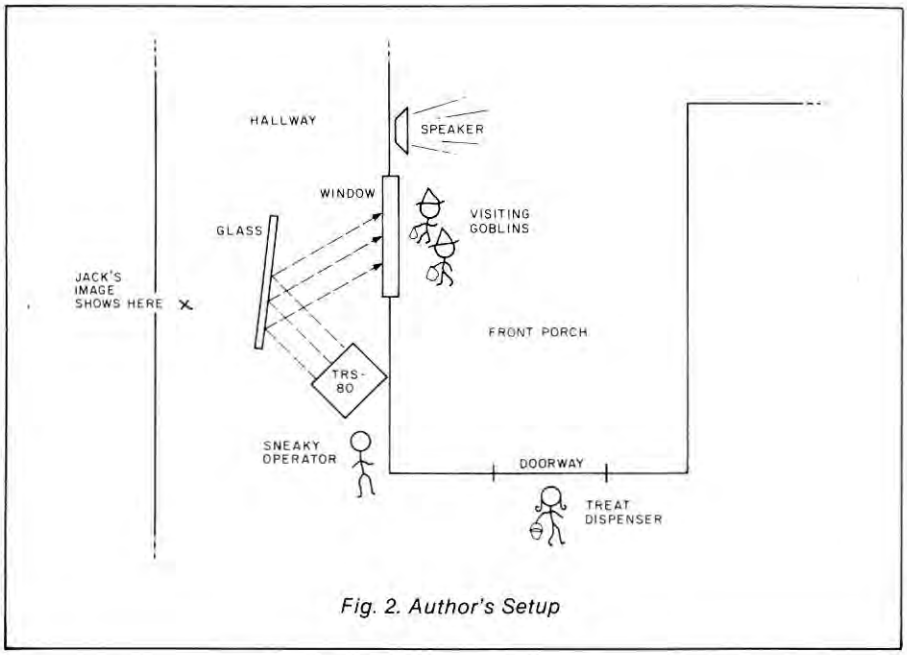

Fig. 2. Author's Setup

Try Some Imagination

To enhance the effect try positioning Jack's head just above the neck line of a stuffed suit of clothing. A few pieces of dry ice placed in a bowl of warm water creates an eerie fog. Remember, though, the idea is to entertain, not frighten them.

One little vampire, as he was leaving, waved to Jack and said, "Have a nice day." A few steps later, after reflecting on whether this was the right remark, he ran back to the window and corrected himself with "Have a spooky night!"■

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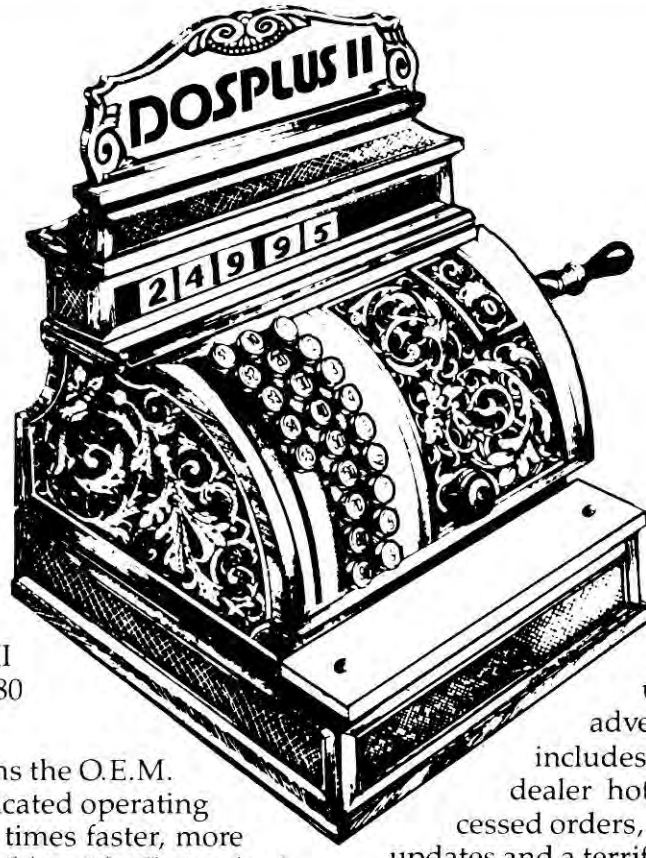

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MicroTerm retails for $79.95, but registered DOSPLUS owners can purchase it for only $59.95. $20.00 off the retail price! MicroTerm comes complete with the terminal program, the direct file transfer program, some standard translation tables, and documentation.

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LOAD 80

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QuickCalc

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QuickCalc gives you an 8 by 14 matrix. The rows are labeled 1-14, and the columns A-H. The flashing cursor is positioned in location A1. To move the cursor around the screen, use the arrow keys. To assign a value to a location, position the cursor over the location and type in the value. (Note: QuickCalc is only designed for numeric values, not alphanumeric.) To enter a special command, press the slash key.

Special Command Summary

- B—Sets the value of the current cursor location to zero.
- Q—Exits the QuickCalc program and returns to Basic.
- N—Restarts the QuickCalc program.
- P—Outputs the screen contents to a line printer. Printer must be ready when this command is issued.
- C—Compute. Performs a math function on two locations. QuickCalc responds with "Compute. Function (+, −, *, /) ?." Now type in the desired function and the "Enter coordinates:" prompt is displayed. When entering a location like A1, be sure to type A01. Now enter three locations, make two of them the numbers to be computed, and the third, the location to put the results. QuickCalc performs the function and returns with the flashing cursor.
- D—Delete. Allows you to delete a series of locations. QuickCalc responds with "Enter coordinates." You type in the starting and ending locations of the column or row

The Key Box

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(do CMD "T" for disk)
Printer optional

Program Listing, QuickCalc

```
0 '**********************
1 '**    QUICKCALC.    **
2 '**BY KURT LEAFSTRAND**
3 '**   MARCH, 1982    **
4 '**********************
5 'REQUIRES A TRS-80 MODEL I OR III 16,32,OR 48K CASSETTE OR
    DISK OPERATED COMPUTER SYSTEM AND AN OPTIONAL PRINTER
10 CLEAR1500:ONERRORGOTO60000:DIMM(8,15),Z(14),P(14):S$=STRING$(
2,188):X=131:C=1:R=1
15 CLS:PRINT@469,"QUICKCALC VERSION 2.0";:PRINT@535,"BY KURT LEA
FSTRAND";:PRINT@603,"MARCH,1982";
20 FORT=2TO15:PRINT@64*T,USING"##";T-1;:PRINTCHR$(191);:NEXT:PRI
NT@64,STRING$(2,128);CHR$(188);S$;" A ";S$;S$;" B ";S$;S$;" C ";
S$;S$;" D ";
25 PRINTS$;S$;" E ";S$;S$;" F ";S$;S$;" G ";S$;S$;" H ";S$;CHR$(
188);:FORT=2TO15:PRINT@64*T+59,CHR$(191);USING"##";T-1;:NEXT:FOR
T=1TO1000:NEXT:PRINT@469,STRING$(21,32);:PRINT@535,STRING$(18,32
);:PRINT@601,STRING$(14,32);
30 PRINT@0,STRING$(64,32);:M1=64+C:R$=STR$(R):R$=RIGHT$(R$,LEN(R
$)-1):IFB$<>""THENM(C,R)=VAL(B$):PRINT@0,CHR$(M1);R$;" = ";M(C,R
);ELSEPRINT@0,CHR$(M1);R$;" = ";M(C,R);
31 PRINT@X,CHR$(183);:PRINT@X+6,CHR$(187);:FORT=1TO60:A$=INKEY$:
IFA$<>""THEN35ELSENEXT:PRINT@X,CHR$(32);:PRINT@X+6,CHR$(32);:FOR
T=1TO60:A$=INKEY$:IFA$<>""THEN35ELSENEXT:GOTO31
35 IFA$=CHR$(91)THEN40ELSEIFA$=CHR$(10)THEN42ELSEIFA$=CHR$(8)THE
N44ELSEIFA$=CHR$(9)THEN46ELSE48
40 IFX<191THEN30ELSEPRINT@X,CHR$(32);:PRINT@X+6,CHR$(32);:X=X-64
:IFB$<>""THENM(C,R)=VAL(B$):B$="":R=R-1:GOTO30ELSEB$="":R=R-1:GO
TO30
42 IFX>960THEN30ELSEPRINT@X,CHR$(32);:PRINT@X+6,CHR$(32);:X=X+64
:IFB$<>""THENM(C,R)=VAL(B$):B$="":R=R+1:GOTO30ELSEB$="":R=R+1:GO
TO30
44 IFPEEK(15360+(X-1))=191THEN30ELSEPRINT@X,CHR$(32);:PRINT@X+6,
```

Listing continues

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to be deleted. (QuickCalc only deletes a single column or row, not a series of columns or rows.)

- S—Saves the screen contents on cassette or disk.
- L—Loads a previously saved screen from cassette or disk.
- H—Help. Provides help on a specified command.
- T—Total (Summation). Gives the total of the values in a series of locations. QuickCalc responds with "Total. Enter coordinates:." The first and second locations you enter should be the starting and ending points of the locations to be totaled, and the third should be the location to store the results. (QuickCalc only totals a single column or row at a time.)
- A—Average. Gives the values' average in a series of locations. QuickCalc responds with "Average. Enter coordinates:." As before, the first and second locations you enter should be the starting and ending points of the locations to be averaged, and the third should be the location to store the results. (QuickCalc only averages a single column or row at a time.)
- R—Replicate. Allows you to project a function over a series of locations. QuickCalc responds with "Replicate. Function (+,−,*,/,P) ?" P stands for percentage. Then you are asked "Value?" Enter the value that computes the source location. The final question QuickCalc asks is "Enter coordinates:." First enter the source location where the initial value will be taken from. The second and third values should be the starting and ending points of the computed values' display location. Then QuickCalc carries out the computations and returns with the flashing cursor.
- G—Graph. This command switches to the QuickPlot section of the program. You are prompted with "Graph a column or a row. (C/R) ?" After you have input your selection for column or row, the screen clears and QuickPlot plots the locations in bar-graph form. After the graph is displayed, press the space bar to continue or P to print the graph on a line printer. (The bar graph will only work on a Model III.)■

Kurt is an eighth-grade student whose hobbies are fishing and racquetball.

10-25	Initialize program
30-50	Main program loop
500-650	Compute function
1000-1130	Coordinate input routine
2000-2021	Special command routine
3000-3030	Print function
4000-4550	Replicate function
5000-5052	Save function
5500-5552	Load function
6000-6020	Total function
6100-6120	Delete function
6200-6220	Average function
8000-8200	Help function
9000-9003	Value input routine
10000-10510	QuickPlot
60000	Error-handling routine

Fig. 1. Summary of Program Lines

Listing continued

```
CHR$(32);:X=X-7:IFB$<>""THENM(C,R)=VAL(B$):B$="":C=C-1:GOTO30ELS
EB$="":C=C-1:GOTO30
46 IFPEEK(15360+(X+7))=191THEN30ELSEPRINT@X,CHR$(32);:PRINT@X+6,
CHR$(32);:X=X+7:IFB$<>""THENM(C,R)=VAL(B$):B$="":C=C+1:GOTO30ELS
EB$="":C=C+1:GOTO30
48 IFASC(A$)=13ORASC(A$)=31ORASC(A$)=10ORASC(A$)=91ORASC(A$)=9OR
ASC(A$)=8THEN30
49 IFA$="/"THEN2000
50 IFLEN(B$)=5THENPRINT@X+1,LEFT$(B$,5);:GOTO30ELSEB$=B$+A$:PRIN
T@X+(6-LEN(B$)),B$;:GOTO30
500 PRINT@X,CHR$(32);:PRINT@X+6,CHR$(32);:PRINT@0,"COMPUTE. Func
tion (+,-,*,/) ?";CHR$(95);
510 A$=INKEY$:IFA$=""THEN510ELSEIFA$="+"THEN520ELSEIFA$="-"THEN5
50ELSEIFA$="*"THEN600ELSEIFA$="/"THEN650ELSE510
520 GOSUB1000:M(D1,D2)=M(A1,A2)+M(B1,B2):B$=STR$(M(D1,D2)):B$=RI
GHT$(B$,LEN(B$)-1):B$=LEFT$(B$,5):D2=D2+1:X=(D2*64)+(7*D1):X=X-4
:PRINT@X+(6-LEN(B$)),B$;:PRINT@0,STRING$(64,32);:GOTO30
550 GOSUB1000:M(D1,D2)=M(A1,A2)-M(B1,B2):B$=STR$(M(D1,D2)):B$=RI
GHT$(B$,LEN(B$)-1):B$=LEFT$(B$,5):D2=D2+1:X=(D2*64)+(7*D1):X=X-4
:PRINT@X+(6-LEN(B$)),B$;:PRINT@0,STRING$(64,32);:GOTO30
600 GOSUB1000:M(D1,D2)=M(A1,A2)*M(B1,B2):B$=STR$(M(D1,D2)):B$=RI
GHT$(B$,LEN(B$)-1):B$=LEFT$(B$,5):D2=D2+1:X=(D2*64)+(7*D1):X=X-4
:PRINT@X+(6-LEN(B$)),B$;:PRINT@0,STRING$(64,32);:GOTO30
650 GOSUB1000:M(D1,D2)=M(A1,A2)/M(B1,B2):B$=STR$(M(D1,D2)):B$=RI
GHT$(B$,LEN(B$)-1):B$=LEFT$(B$,5):D2=D2+1:X=(D2*64)+(7*D1):X=X-4
:PRINT@X+(6-LEN(B$)),B$;:PRINT@0,STRING$(64,32);:GOTO30
1000 PRINT@0,STRING$(50,32);:IFT=1THENPRINT@0,"TOTAL. ENTER CO-O
RDINATES:";ELSEIFA=1THENPRINT@0,"AVERAGE. ENTER CO-ORDINATES:";E
LSEPRINT@0,"ENTER CO-ORDINATES:";
1010 GOSUB1100:A1=C:A2=R:PRINT"..";:GOSUB1100:B1=C:B2=R:PRINT"..
";:GOSUB1100:D1=C:D2=R:RETURN
1100 A$=INKEY$:IFA$=""THEN1100ELSEIFA$<"A"ORA$>"H"THEN1100ELSEPR
INTA$;:C=ASC(A$)-64
1120 Z$="":A$=INKEY$:IFA$=""THEN1120ELSEIFA$=CHR$(8)THENPRINTCHR
$(8);:GOTO1100ELSEIFA$<"0"ORA$>"9"THEN1120ELSEPRINTA$;:Z$=Z$+A$
1130 A$=INKEY$:IFA$=""THEN1130ELSEIFA$=CHR$(8)THENPRINTCHR$(8);:
GOTO1120ELSEIFA$<"0"ORA$>"9"THEN1130ELSEPRINTA$;:Z$=Z$+A$:R=VAL(
Z$):RETURN
2000 T=0:PRINT@X,CHR$(32);:PRINT@X+6,CHR$(32);:PRINT@0,"Special
command (B,Q,N,P,C,R,S,D,L,T,A,G,H) ?";CHR$(95);
2010 A$=INKEY$:IFA$=""THEN2010
2020 IFA$="B"THENPRINT@0,STRING$(64,32);:M(C,R)=0:B$="":PRINT@X+
1,"      ";:GOTO30ELSEIFA$="C"THENPRINT@0,STRING$(64,32);:GOTO500
ELSEIFA$="Q"THENCLS:ENDELSEIFA$="N"THENRUNELSEIFA$="P"THEN3000EL
SEIFA$="R"THEN4000ELSEIFA$="S"THEN5000ELSEIFA$="L"THEN5500
2021 IFA$="G"THEN10000ELSEIFA$="H"THEN8000ELSEIFA$="T"THEN6000EL
SEIFA$="D"THEN6100ELSEIFA$="A"THEN6200ELSEIFA$=CHR$(31)THENPRINT
@0,STRING$(64,32);:GOTO30ELSE2010
3000 IFPEEK(14312)<>63THENPRINT@0,"Printer is not ready.
                                  ";:FORT=1TO1000:NEXT:PRINT@0,STRING$
(64,32);:GOTO30
3010 POKE16427,62:I$=STRING$(2,"-"):LPRINT"  *";I$;" A ";I$;I$;"
 B ";I$;I$;" C ";I$;I$;" D ";I$;I$;" E ";I$;I$;" F ";I$;I$;" G "
;I$;I$;" H ";I$;:LPRINT"*"
3020 FORP=15488TO16383:IFPEEK(P)=191THENC$="*"ELSEC$=CHR$(PEEK(P
))
3030 LPRINTC$;:NEXT:LPRINTTAB(4)STRING$(62,"-"):PRINT@0,STRING$(
64,32);:GOTO30
4000 PRINT@0,STRING$(64,32);:PRINT@0,"REPLICATE. Function (+,-,*
,/,P) ?";CHR$(95);
4002 A$=INKEY$:IFA$=""THEN4002ELSEIFA$="+"THEN4100ELSEIFA$="-"TH
EN4200ELSEIFA$="*"THEN4300ELSEIFA$="P"THEN4400ELSEIFA$="/"THEN45
00ELSE4002
4100 PRINT@0,STRING$(64,32);:PRINT@0,"Value?";:GOSUB9000:V1=VAL(
B$):GOSUB1000
4120 IFB1=D1THEN4150
4130 V=M(A1,A2):FORT=B1TOD1:M(T,B2)=V+V1:B$=STR$(M(T,B2)):B$=RIG
HT$(B$,LEN(B$)-1):V=V+V1:X=((B2+1)*64)+(7*T):X=X-4:PRINT@X+(6-LE
N(B$)),B$;:NEXT:PRINT@0,STRING$(64,32);:GOTO30
4150 V=M(A1,A2):FORT=B2TOD2:M(B1,T)=V+V1:B$=STR$(M(B1,T)):B$=RIG
HT$(B$,LEN(B$)-1):V=V+V1:X=((T+1)*64)+(7*B1):X=X-4:PRINT@X+(6-LE
N(B$)),B$;:NEXT:PRINT@0,STRING$(64,32);:GOTO30
4200 PRINT@0,STRING$(64,32);:PRINT@0,"Value?";:GOSUB9000:V1=VAL(
B$):GOSUB1000
4220 IFB1=D1THEN4250
4230 V=M(A1,A2):FORT=B1TOD1:M(T,B2)=V-V1:B$=STR$(M(T,B2)):B$=RIG
HT$(B$,LEN(B$)-1):V=V-V1:X=((B2+1)*64)+(7*T):X=X-4:PRINT@X+(6-LE
N(B$)),B$;:NEXT:PRINT@0,STRING$(64,32);:GOTO30
4250 V=M(A1,A2):FORT=B2TOD2:M(B1,T)=V-V1:B$=STR$(M(B1,T)):B$=RIG
HT$(B$,LEN(B$)-1):V=V-V1:X=((T+1)*64)+(7*B1):X=X-4:PRINT@X+(6-LE
N(B$)),B$;:NEXT:PRINT@0,STRING$(64,32);:GOTO30
4300 PRINT@0,STRING$(64,32);:PRINT@0,"Value?";:GOSUB9000:V1=VAL(
B$):GOSUB1000
```

Listing continued

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Listing continued

```
4320 IFB1=D1THEN4350
4330 V=M(A1,A2):FORT=B1TOD1:M(T,B2)=V*V1:B$=STR$(M(T,B2)):B$=RIG
HT$(B$,LEN(B$)-1):V=V*V1:X=((B2+1)*64)+(7*T):X=X-4:PRINT@X+(6-LE
N(B$)),B$;:NEXT:PRINT@0,STRING$(64,32);:GOTO30
4350 V=M(A1,A2):FORT=B2TOD2:M(B1,T)=V*V1:B$=STR$(M(B1,T)):B$=RIG
HT$(B$,LEN(B$)-1):V=V*V1:X=((T+1)*64)+(7*B1):X=X-4:PRINT@X+(6-LE
N(B$)),B$;:NEXT:PRINT@0,STRING$(64,32);:GOTO30
4400 PRINT@0,STRING$(64,32);:PRINT@0,"Value?";:GOSUB9000:V1=VAL(
B$):GOSUB1000
4420 IFB1=D1THEN4450
4430 V=M(A1,A2):FORT=B1TOD1:M(T,B2)=(V*V1)+V:B$=STR$(M(T,B2)):B$
=RIGHT$(B$,LEN(B$)-1):V=(V*V1)+V:X=((B2+1)*64)+(7*T):X=X-4:B$=LE
FT$(B$,5):PRINT@X+(6-LEN(B$)),B$;:NEXT:PRINT@0,STRING$(64,32);:G
OTO30
4450 V=M(A1,A2):FORT=B2TOD2:M(B1,T)=(V*V1)+V:B$=STR$(M(B1,T)):B$
=RIGHT$(B$,LEN(B$)-1):V=(V*V1)+V:X=((T+1)*64)+(7*B1):X=X-4:B$=LE
FT$(B$,5):PRINT@X+(6-LEN(B$)),B$;:NEXT:PRINT@0,STRING$(64,32);:G
OTO30
4500 PRINT@0,STRING$(64,32);:PRINT@0,"Value?";:GOSUB9000:V1=VAL(
B$):GOSUB1000
4520 IFB1=D1THEN4550
4530 V=M(A1,A2):FORT=B1TOD1:M(T,B2)=V/V1:B$=STR$(M(T,B2)):B$=RIG
HT$(B$,LEN(B$)-1):V=V/V1:X=((B2+1)*64)+(7*T):X=X-4:B$=LEFT$(B$,5
):PRINT@X+(6-LEN(B$)),B$;:NEXT:PRINT@0,STRING$(64,32);:GOTO30
4550 V=M(A1,A2):FORT=B2TOD2:M(B1,T)=V/V1:B$=STR$(M(B1,T)):B$=RIG
HT$(B$,LEN(B$)-1):V=V/V1:X=((T+1)*64)+(7*B1):X=X-4:B$=LEFT$(B$,5
):PRINT@X+(6-LEN(B$)),B$;:NEXT:PRINT@0,STRING$(64,32);:GOTO30
5000 PRINT@0,STRING$(64,32);:PRINT@0,"SAVE. Save to <C>assette o
r <D>isk ?";
5010 A$=INKEY$:IFA$="C"THEN5020ELSEIFA$="D"THEN5050ELSE5010
5020 PRINT@0,"READY DATA TAPE,PRESS <ENTER> ?                ";
5022 A$=INKEY$:IFA$<>CHR$(13)THEN5022ELSEPRINT@0,"SAVING DATA
                    ";:FORA9=1TO8:FORA0=1TO14:PRINT#-1,M(A9,A0)
:NEXT:NEXT:PRINT@0,STRING$(64,32);:GOTO30
5050 PRINT@0,"INSERT DATA IN DRIVE #0,PRESS <ENTER> ?";
5052 A$=INKEY$:IFA$<>CHR$(13)THEN5052ELSEPRINT@0,"SAVING DATA
                                    ";:OPEN"O",1,"SPRDSHT/DAT":F
ORA9=1TO8:FORA0=1TO14:PRINT#1,M(A9,A0):NEXT:NEXT:CLOSE:PRINT@0,S
TRING$(64,32);:GOTO30
5500 PRINT@0,STRING$(64,32);:PRINT@0,"LOAD. LOAD FROM <C>ASSETTE
 OR <D>ISK ?";
5510 A$=INKEY$:IFA$="C"THEN5520ELSEIFA$="D"THEN5550ELSE5510
5520 PRINT@0,"READY DATA TAPE,PRESS <ENTEr> ?                ";

5522 A$=INKEY$:IFA$<>CHR$(13)THEN5522ELSEPRINT@0,"LOADING DATA
                    ";:FORA9=1TO8:FORA0=1TO14:INPUT#-1,M(A9
,A0):NEXT:NEXT:GOTO10250
5550 PRINT@0,"INSERT DATA DISK IN DRIVE #0,PRESS <ENTER> ?";
5552 A$=INKEY$:IFA$<>CHR$(13)THEN5552ELSEPRINT@0,"LOADING DATA
                                    ";:OPEN"I",1,"SPRDSHT/DA
T":FORA9=1TO8:FORA0=1TO14:INPUT#1,M(A9,A0):NEXT:NEXT:CLOSE:GOTO1
0250
6000 T=1:GOSUB1000:T=0:IFA1=B1THEN6020
6010 T=0:FORQ1=A1TOB1:T=T+M(Q1,A2):NEXT:D2=D2+1:M(C,R)=T:X=(D2*6
4)+(7*D1):X=X-4:B$=STR$(T):B$=RIGHT$(B$,LEN(B$)-1):B$=LEFT$(B$,5
):PRINT@X+(6-LEN(B$)),B$;:PRINT@0,STRING$(64,32);:GOTO30
6020 T=0:FORQ1=A2TOB2:T=T+M(A1,Q1):NEXT:D2=D2+1:M(C,R)=T:X=(D2*6
4)+(7*D1):X=X-4:B$=STR$(T):B$=RIGHT$(B$,LEN(B$)-1):B$=LEFT$(B$,5
):PRINT@X+(6-LEN(B$)),B$;:PRINT@0,STRING$(64,32);:GOTO30
6100 PRINT@0,STRING$(50,32);:PRINT@0,"DELETE. Enter Co-ordinates
:";:GOSUB1100:A1=C:A2=R:PRINT"..";:GOSUB1100:B1=C:B2=R:IFA1=B1TH
EN6120
6110 FORQ1=A1TOB1:M(Q1,A2)=0:X=((A2+1)*64)+(7*Q1):X=X-4:PRINT@X+
1,"      ";:NEXT:PRINT@0,STRING$(64,32);:GOTO30
6120 FORQ1=A2TOB2:M(A1,Q1)=0:X=((Q1+1)*64)+(7*A1):X=X-4:PRINT@X+
1,"      ";:NEXT:PRINT@0,STRING$(64,32);:GOTO30
6200 A=1:GOSUB1000:A=0:IFA1=B1THEN6220
6210 A=0:F1=0:FORQ1=A1TOB1:A=A+M(Q1,A2):F1=F1+1:NEXT:A=A/F1:M(D1
,D2)=A:B$=STR$(M(D1,D2)):B$=RIGHT$(B$,LEN(B$)-1):B$=LEFT$(B$,5):
X=((D2+1)*64)+(7*D1):X=X-4:PRINT@X+(6-LEN(B$)),B$;:GOTO30
6220 A=0:F1=0:FORQ1=A2TOB2:A=A+M(A1,Q1):F1=F1+1:NEXT:A=A/F1:M(D1
,D2)=A:B$=STR$(M(D1,D2)):B$=RIGHT$(B$,LEN(B$)-1):B$=LEFT$(B$,5):
X=((D2+1)*64)+(7*D1):X=X-4:PRINT@X+(6-LEN(B$)),B$;:GOTO30
8000 PRINT@0,"HELP ON WHICH OF THE FOLLOWING:B,Q,N,P,C,R,S,D,L,T
,A,G ?";
8010 A$=INKEY$:IFA$=""THEN8010ELSEIFA$="B"THEN8020ELSEIFA$="Q"TH
EN8030ELSEIFA$="N"THEN8040ELSEIFA$="P"THEN8050ELSEIFA$="C"THEN80
60ELSEIFA$="R"THEN8070ELSEIFA$="S"THEN8080ELSEIFA$="D"THEN8090EL
SEIFA$="L"THEN8100ELSEIFA$="T"THEN8110ELSEIFA$="A"THEN8120
8011 IFA$="G"THEN8130ELSE8010
8020 PRINT@0,"<B>LANK.CLEARS THE CONTENTS OF THE CURRENT CURSOR
POSITION.";:GOTO8200
8030 PRINT@0,"<Q>UIT.EXITS THE QUICKCALC PROGRAM AND RETURNS TO
```

Listing continues

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Listing continued

```
BASIC.";:GOTO8200
8040 PRINT@0,"<N>EW SCREEN. CLEARS THE SCREEN AND STARTS THE PRO
GRAM OVER.";:GOTO8200
8050 PRINT@0,"<P>RINTER OUTPUT. OUTPUT SCREEN TO PRINTER FOR HAR
DCOPY.";:GOTO8200
8060 PRINT@0,"<C>OMPUTE. PERFORMS A MATH FUNCTION WITH TWO CO-OR
DINATES.";:GOTO8200
8070 PRINT@0,"<R>EPLICATE.PERFORMS A MATH FUNCTION ON A SERIES O
F CO-ORDINATES.";:GOTO8200
8080 PRINT@0,"<S>AVE. SAVES THE SCREEN CONTENTS ON CASSETTE OR D
ISK.";:GOTO8200
8090 PRINT@0,"<D>ELETE. ALLOWS YOU TO DELETE A SERIES OF CO-ORDI
NATES.    ";:GOTO8200
8100 PRINT@0,"<L>OAD.LOADS A PREVIOUSLY SAVED SCREEN FROM CASSET
TE OR DISK.";:GOTO8200
8110 PRINT@0,"<T>OTAL (SUMATION). ADDS A SERIES OF CO-ORDINATES
TOGETHER.";:GOTO8200
8120 PRINT@0,"<A>VERAGE. FINDS THE AVERAGE OF A SERIES OF CO-ORD
INATES.";:GOTO8200
8130 PRINT@0,"<G>RAPH. DISPLAY A ROW OR COLUMN GRAPHICALLY ON TH
E SCREEN.";:GOTO8200
8200 A$=INKEY$:IFA$=""THEN8200ELSE30
9000 PRINTCHR$(14);
9001 A$=INKEY$:IFA$=""THEN9001ELSEIFA$=CHR$(13)THENPRINTCHR$(15)
;:RETURN
9002 IFA$=CHR$(8)THENPRINTCHR$(8);:B$=LEFT$(B$,LEN(B$)-1):GOTO90
01
9003 PRINTA$;:B$=B$+A$:GOTO9001
10000 CLS:FORT=1TO14:P(T)=0:Z(T)=0:NEXT:PRINT@0,"--QUICKPLOT VER
SION 1.7 WRITTEN BY KURT LEAFSTRAND,MAR.1982--";
10002 PRINT@128,"GRAPH A COLUMN OR A ROW (C/R) ?";
10004 A$=INKEY$:IFA$=""THEN10004ELSEIFA$="C"THENPRINTA$;:GOTO100
06ELSEIFA$="R"THENPRINTA$;:GOTO10008ELSE10004
10006 PRINT@256,"WHICH COLUMN TO YOU WANT TO GRAPH (A-H) ?";
10007 A$=INKEY$:IFA$=""THEN10007ELSEIFA$<"A"ORA$>"H"THEN10007ELS
ES=AS(A$)-64:FORQ=1TO14:P(Q)=M(S,Q):Z(Q)=M(S,Q):NEXT:GOTO10100
10008 PRINT@256,"WHICH ROW DO YOU WANT TO GRAPH (1-14) ?";
10010 A$=INKEY$:IFA$=""THEN10010ELSEIFA$<"0"ORA$>"1"THEN10010ELS
EZ5$=A$:PRINTA$;
10011 A$=INKEY$:IFA$=""THEN10011ELSEIFA$<"0"ORA$>"9"THEN10011ELS
EZ5$=Z5$+A$:PRINTA$;:S=VAL(Z5$):Z5$="":FORQ=1TO8:P(Q)=M(Q,S):Z(Q
)=M(Q,S):NEXT:GOTO10100
10100 CLS:FORX=9TO841STEP64:PRINT@X,CHR$(191);:NEXT:PRINT@905,ST
RING$(55,131);:IFP(9)=0THENPRINT@971,"A       B       C       D
  E       F       G       H";:NE=7ELSEPRINT@970,"01  02  03  04  05
  06  07  08  09  10  11  12  13  1";:POKE16383,52:NE=13
10110 F=0:FORN=1TONE:IFP(N)>P(N+1)THENGOSUB10130
10120 NEXT:IFF<>0THEN10110ELSE10200
10130 F=1:S1=P(N):P(N)=P(N+1):P(N+1)=S1:RETURN
10200 Q2=1:FORX=1TONE+1:PRINT@896-(64*Q2),USING"######.##";P(X);
:Q2=Q2+1:NEXT:X=843:IFNE=7THENINC=7ELSEINC=4
10210 L=1:Q3=1:FORW=1TONE+1
10211 IFZ(L)=P(Q3)THENZ2=Q3:L=L+1:Q3=1:GOTO10220ELSEIFQ3=NE+1THE
NL=L+1:Q3=1:GOTO10211ELSEQ3=Q3+1:GOTO10211
10220 P3=X-(64*Z2):P3=P3+64:FORP=XTOP3STEP-64:PRINT@P,CHR$(191);
:NEXTP:X=X+INC:NEXTW
10230 A$=INKEY$:IFA$=""THEN10230ELSEIFA$="P"THEN10500ELSEIFA$<>"
 "THEN10230ELSECLS:PRINT@27,"QUICKPLOT":PRINT:PRINTTAB(25)"<Q>UI
T PROGRAM":PRINTTAB(22)"<P>LOT ANOTHER GRAPH":PRINTTAB(20)"OR <R
>ETURN TO QUICKCALC":PRINT@474,"SELECTION?";CHR$(95);
10240 A$=INKEY$:IFA$="Q"THENCLS:ENDELSEIFA$="P"THEN10000ELSEIFA$
="R"THEN10250ELSE10240
10250 CLS:FORT=2TO15:PRINT@64*T,USING"##";T-1;:PRINTCHR$(191);:N
EXT:PRINT@64,STRING$(2,128);CHR$(188);S$;" A ";S$;S$;" B ";S$;S$
;" C ";S$;S$;" D ";S$;S$;" E ";S$;S$;" F ";S$;S$;" G ";S$;S$;" H
 ";S$;CHR$(188);:FORT=2TO15:PRINT@64*T+59,CHR$(191);USING"##";T-
1;:NEXT
10260 FORX=1TO8:FORY=1TO14:IFM(X,Y)=0THENNEXT:NEXT:B$=STR$(M(1,1
))ELSECP=((Y+1)*64)+(7*X):CP=CP-4:B$=STR$(M(X,Y)):B$=RIGHT$(B$,L
EN(B$)-1):B$=LEFT$(B$,5):PRINT@CP+(6-LEN(B$)),B$;:NEXT:NEXT:B$=S
TR$(M(1,1))
10270 X=131:C=1:R=1:GOTO30
10300 GOTO 10300
10500 POKE16427,62:LPRINTTAB(11)"------------Bar graph of data--
----------":FORX=15360TO16383:C=PEEK(X):IFC=191ANDPEEK(X-1)>47AN
DPEEK(X-1)<58THENLPRINT"*";:NEXTELSEIFC=131THENLPRINT"*";:NEXTEL
SEIFC=191THENLPRINT"#";:NEXTELSELPRINTCHR$(C);:NEXT
10510 POKE16427,255:GOTO10230
59999 GOTO 59999
60000 PRINT@0,STRING$(64,32);:FORT=1TO10:PRINT@0,"*** ENTRY ERRO
R ***";:FORQ=1TO50:NEXT:PRINT@0,"***                ***";:FORQ=1TO5
0:NEXT:NEXT:PRINT@0,STRING$(64,32);:C=1:R=1:X=131:B$=STR$(M(1,1)
):RESUME30
60060 GOTO 60060
```

Listing continues

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Byte Magazine (on The Eliminator): "The best thing to happen to the TRS-80 in a long time."

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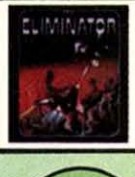

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A Basic Compiler in Basic

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The TRS-80 is not the world's fastest number cruncher. For example, inverting a 15 by 15 matrix takes three and a half minutes. A compiler that translates a Basic program into machine language will make it run much faster.

A compiler to translate ordinary Basic programs is probably the most valuable kind of compiler for the TRS-80. If you have one, you can write and debug your program using the convenient Basic interpreter and then compile the final program to gain a speed advantage. Since compilation is a long process in an inherently slow micro you would rather not compile each time you make a small program correction.

I became interested in a Basic compiler soon after I obtained my computer. I also became interested in exploring machine language and it occurred to me that I could write a simple compiler in Basic without excessive effort. The "Tinycomp" article by D. Bohlke (*80 Micro*, May 1980) gave a Basic program that could translate a few Basic statements into pure machine code.

I intended to add a limited vocabulary of floating point operations to the Tinycomp program. However, I gradually implemented a complete set of single precision operations, including trigonometric, logarithmic, and exponential functions as well as parenthesized expressions. Integer arithmetic, loops and conditional branching came next. Then I introduced a function that exchanges variable values with the interpreter. I finally added Set, Reset, Point, PEEK, POKE and string handling capabilities that allow you to enjoy the spectacular speed advantages of machine language graphics.

The compiler produces machine code that uses subroutines available in ROM. The excellent booklet by J. Blattner and B. Mumford, "Inside Level II" describes these routines and proved invaluable in writing the program. Using ROM routines limits the size of the machine code produced. On the other hand, the ROM routines are slow in part because they include error-checking and handling routines.

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The compiler will accelerate your programs by varying amounts depending on their nature. Programs involving primarily integer arithmetic and graphics can be accelerated by 50 to 100 times. Programs involving primarily single precision floating point operations are accelerated by a more modest amount (3 to 20 times is a ballpark figure). Even so, the gain is considerable and it may just keep you from getting into the trouble (and expense) of running your program at the nearest computer center.

I want to warn you that this is *not* a comprehensive professional compiler. There is only one such compiler currently on the market and it costs $195. Less comprehensive compilers cost close to $90. My compiler is written in Basic and is therefore slow (it generates roughly 500 bytes of machine code per minute during compilation). On the other hand, it produces machine code that runs at least as fast as that produced by the commercial compilers (and in some cases faster); it is adequate for many purposes and it is free. Furthermore, it provides you with the challenge of modifying and improving it to suit your purposes better.

What the Program Does

The compiler in Program Listing 1 (lines 501–7200) can translate into pure machine code an ordinary Basic program written and debugged using the interpreter. You can execute the machine code from Basic via a USR call an unlimited number of times during any single program run. Each time, you can pass (using machine or Basic code) an unlimited number of integer or single precision variables from the Basic portion of the program to the USR and vice versa. The compiler translates a fairly complete subset of floating point operations involving single precision variables and one and two-dimensional arrays, together with branching operations and For...Next loops. It also translates a limited subset of integer arithmetic, string handling, and graphics statements. You can use Basic to perform all operations not supported by the compiler and pass control to the machine code at the appropriate times via USR calls. You can save the machine code on disk and load it into RAM when needed. Alternatively you can translate it into data statements, and merge it into a single Basic program with any ordinary noncompiled Basic statements.

I wrote the program on a 48K Model I TRS-80 with NEWDOS80. It works without modification on any 32K or 48K Model I TRSDOS 2.3 system. It works also in a 32K or 48K Level II system provided you modify the DEFUSR0 statement in line 1300. You can also use it to compile small programs in a 16K cassette system provided you make some minor modifications described later. I tried the compiler on a friend's Model III and was pleasantly surprised to find that all my test programs compiled and ran without problems. While I cannot be sure about this, it appears that the compiler can be used on a Model III.

To use the program properly you must learn how machine code stores variables and the nature and syntax of Basic statements that can be correctly compiled.

Variables and Storage

The compiler accepts only three variable types and stores each variable in fixed memory locations. The storage method is identical in all cases to that used by the Basic interpreter.

There are 26 possible integer variables denoted A%–Z%. Each integer is stored in two successive bytes in the memory area VT to (VT + 2*26) where VT is MS minus 2*26 and MS is the end of the storage area set by the user. Thus A% is stored in locations VT and VT + 1, B% is stored in VT + 2 and VT + 3 and so on (see line 1015).

There are 286 possible simple single precision (SP) variables denoted by a single letter A–Z, or by a letter followed by a single decimal number. Thus the possible simple SP variables are A, A0–A9, B, B0–B9, . . . Z, Z0–Z9. Each variable is stored in four successive bytes in the memory area starting at memory location VF (see line 1015). Thus A is stored in VF through VF + 3, B is stored in VF + 4 through VF + 7 and so on. Then A0 is stored following Z, B0 following A0, A1

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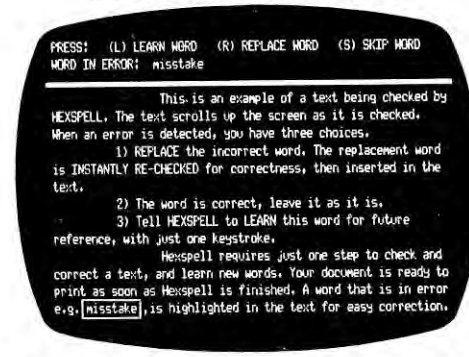

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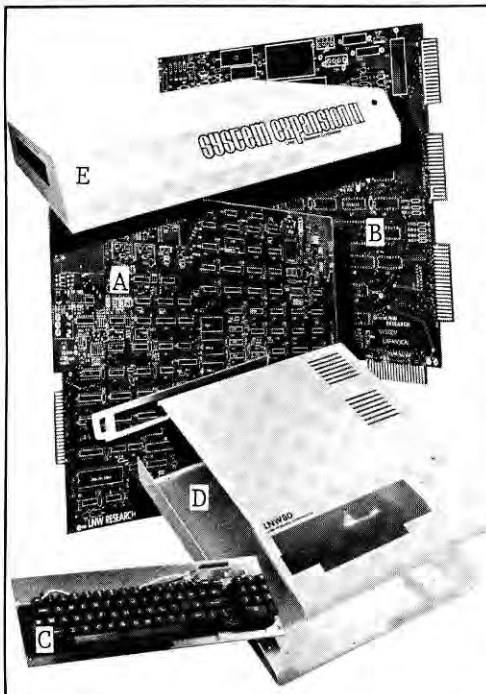

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following Z0 and so on. You can control the number of simple SP variables and economize in storage space by modifying the parameter IS in line 1010. This parameter specifies the number of available variables per letter in addition to the letter itself. If you set IS to zero, only the variables A-Z are allowed. If IS equals five, only the variables A, A0-A4, ...Z, Z0-Z4 are allowed.

One and two-dimensional arrays are denoted A(IV) or A(IV1,IV2) where IV, IV1, and IV2 stand for integer variables and A can be replaced by any letter. The number and the dimension of possible one-dimensional arrays are denoted NO and DO where NO< = 26 (see line 1010). For example, if you set NO = 26 and DO = 10, the arrays A(IV)-Z(IV) are available and the integer variable IV must take values from 0-9. If NO = 2, only the arrays A(IV) and B(IV) are used. One-dimensional arrays are stored consecutively starting at location VA (see line 1015). If DO = 20, the array A(IV) occupies the first 80 bytes starting at VA, the array B(IV) occupies the next 80 bytes, and so on. This makes it possible to safely use larger arrays than specified by dimension DO provided you do not use arrays stored in immediately higher locations. For example, you can use A(IV) as a 60-dimensional array even if DO = 20 as long as you do not use the arrays B(IV) and C(IV) and the parameter NO has a value greater than 2. You can use this device in the sorting program of Listing 1. Because only the array A(IV) is used, it is possible to sort arrays of dimension up to 520 with the parameters DO and NO at the values 20 and 26 specified in line 1010.

All two-dimensional arrays are assumed to be square. NT and DT denote their possible number and dimension where 0< = NT< = 26 (see line 1010). If NT = 2 and DT = 20, you can use only the arrays A(IV1,IV2) and B(IV1,IV2) in the portion of the program to be compiled and each integer variable IV1 and IV2 should be between 0 and 19. The compiler stores two-dimensional arrays in the same way as the interpreter, starting in memory location VD (see line 1015).

The compiler treats variables such as A, A(IV), A(IV1,IV2) as different; each index of an array must be an integer variable and not an integer constant. The compiler will accept A(I%), but A(2) will produce an error message.

There are at most 26 possible string variables denoted A$-Z$. SL denotes the length for each (including blanks) and is set by the user (see line 1010). NS denotes the number of strings allowed and again is set by the user (see line 1010). If NS = 2, you can use only the string variables A$ and B$; if NS = 26, you can use all 26 string variables A$-Z$. String storage begins in location VS (see line 1015).

The machine code uses a temporary storage area of length SL + 1 beginning in location VN (see line 1005). The machine code itself is stored from location MC to the top of the available memory. If you use only one USR in the composite Basic-machine code program, ordinarily you must set MC equal to MS.

If the preceding discussion seems confusing use the values of Listing 1 for variable and code storage. This allows you 2500 bytes of machine code; the integer variables A%-Z%; the simple SP variables A-Z, A0-A9, . . ., Z0-Z9; the one-dimensional arrays A(IV)-Z(IV); and the two-dimensional

Integer Variable (IV): One of the variables A%-Z%.

Single Precision Variable (SPV): A simple variable A-Z, A0-A9 . . . Z0-Z9 or a one or two-dimensional array element.

String Variable (SV): One of the variables A$-Z$.

Constant (C): Any integer or decimal number.

Possible Integer (PI): Any integer in the range minus 32767 to 32767.

One Byte Integer (OBI): Any integer in the range 0-255.

String (S): Any sequence of blanks or printable characters enclosed in quotation marks (the right quotation mark is optional if the string lies at the end of a line).

Integer Expression (IE): A sequence of the form X1sX2sX3s . . ., where X1, X2, X3, . . ., is a positive integer less than or equal to 32767 or an integer variable, and s is either plus or minus. The sequence may begin with a minus sign but not with a plus sign or a zero followed by a plus sign. Parentheses are not allowed (and not needed). The compiler evaluates integer expressions in the same way as the interpreter but if the result is outside the range minus 32767-32767 the machine code will not indicate an error.

Single Precision Expression (SPE): An arbitrarily parenthesized legal Basic expression involving constants, single precision or integer variables, the operators +, −, *, /, [, and the functions RND(0), SQR, ABS, LOG, EXP, COS, SIN, TAN, ATN. Here are some examples of SPE's:

a) −(1 + SQR(1.2*A% + SIN(A(I%,J%)*2.5)))
b) LOG(EXP(B0 + C)/2.3 + 1)*B%
c) (−1.2 + 3.4)
d) (I%)

Note: There is a major difference in the way the compiler and the interpreter evaluate SPE's. The interpreter evaluates each parenthesized expression by first carrying out the [operations from left to right, then the * and / operations from left to right and then the + and − operations from left to right. The compiler, however, orders *all* operations from left to right within a parenthesized expression regardless of their nature. For example, the compiler codes (1 + A*B[2) as if it were (((1 + A)*B)[2). This coding method is a nuisance. I have used it to simplify the program and speed the compilation process. Be careful that the compiler will code each program statement as you intend. You may have to reorder the operations in the expression or appropriately parenthesize so the interpreted code and the compiled code produce the same results. For example, rewrite the ordinary Basic expression A + (B + 2*C)*(D + E) as (2*C + B)*(D + E) + A or parenthesize it as A + ((B + (2*C))*(D + E)). Parentheses do not slow down the machine code produced; use them freely when in doubt.

Table 1. Definitions and Abbreviations

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arrays A(IV1,IV2), B(IV1,IV2) where IV, IV1, IV2 can take values from 0 to 19. It also allows you the string variables A$–Z$ which must have a length from 0–40. If you have 48K or 32K of RAM, set the value of MR in lines 1010 and 1300 to zero or one respectively. The machine code uses 10163 bytes of memory with this allocation. When com-

Let: There are several types of LET (assignment) statements; in each case the LET keyword is optional.

1) X = Y (Integer LET)
X: IV
Y: IE or INT(SPE) or PEEK(PI) or PEEK(IV) or POINT(Z1,Z2) where Z1,Z2: IVs or OBIs
2) X = Y (Single Precision LET)
X: SPV
Y: SPE
3) X = Y (String LET)
X: SV
Y: S or CHR$(Z1)[+ CHR$(Z2)[+ CHR$(Z3)[+ ... where Z1, Z2,... are IVs or OBIs

Note: String addition and other string manipulation operations are not supported. However, it is possible to print concatenated strings using the Print statement.

Print: There are several types of Print statements:

1) PRINT (Line feed and carriage return)
2) PRINT X1 [;] [X2] [;] ...
X1, X2, X3,...: SPEs or SVs or Ss
3) PRINT @ X,Y1 [;] [Y2] [;] ...
X: PI in the range 0–1023 or IV
Y1, Y2, Y3,...: SPEs or SVs or Ss
4) PRINT @ X,Y
X: PI in the range 0–1023 or IV
Y: CHR$(OBI)[+ CHR$(OBI)[+ ...

Note: The Print statements do not support tabs in the form of commas. Executing PRINT@X,Y (#4 above) does not affect the cursor's position, in variance with the corresponding function of the interpreter. The interpreter advances the cursor one position after printing a number but the code produced by the compiler when translating the Print statements 2 and 3 above does not.

If...Then...Else: The format of this statement is

If X rel Y Then (line #) [:] [Else...]
where
rel is any one of =, <, >, =<, <=, =>, >=, <>, ><
X is an IV or a SPE that does not begin with an IV
Y is a SPE, but if X is an IV then Y must be an IV or a PI
Then can be replaced by GOTO or by Then GOTO
Else can be followed by any other legal statements including another If...Then statement.

Note: If X is an integer variable and Y is a SPE which is not an IV or a PI the compiler will give an error. If you compare an IV with a SPE other than the above type, code the statement as in (I%) rel SPE or SPE rel I%. Note that an If...Then statement involving integers will execute much faster than one involving SPEs.

GOTO (line #):

GOSUB (line #):

RETURN:

For X = Y1 To Y2:

X: IV
Y1, Y2: IV or PI

Note: Y1 must have a value less than or equal to that of Y2 and the Step option is not supported. If Y1 has a larger value than Y2, the program will get caught in an infinite loop, give incorrect results, or hang up. The compiler does not check for this error.

Next X:

X: IV

Notes: The integer variable X must be explicitly stated. An unlimited number of nested For...Next loops is allowed but the loops and the corresponding variables must be properly matched and nested. For example the code

```
FOR I% = 1 TO 10:FOR J% = 1 TO 10:NEXT I%:NEXT J%
```

will be compiled with no indication of error but will crash upon execution. It is not legal to jump to a line outside the range of a For...Next loop from a line inside the loop. Code that violates this rule will be compiled with no indication of error but crash upon execution. The value of the loop control variable X is available for use and can be changed during execution of the loop. It is incremented from its current value each time a pass through the loop ends.

Input X:

X: IV or SPV. The constant keyed in should not have more than six digits. If X is an IV, it is not necessary that the constant keyed in is an integer. The code automatically truncates it to an integer. If the absolute value of the constant is larger than 32767 and X is an IV a fatal error will occur.

POKE X, Y:

X: IV or PI
Y: IV or OBI

SET(X,Y); RESET(X,Y):

X,Y: IV or OBI within the legal range of the Set and Reset functions

CLS:

Rem (or '):

The compiler skips over lines beginning with Rem or '.

End:

It is mandatory to have an End statement at each point where you wish the USR to return to Basic. This statement is translated as a Return to the point where the USR was called.

Table 2. Program statements that can be compiled

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N%	Interpreted Basic	Compiled Basic	Fortran
10	32	3	5
20	234	21	35
30	768	65	106

Table 3

piling, set memory size one less than MC and when running the compiled program, set memory size one less than VN. If you have 32K or 48K of memory and you change the storage parameters in the program, the variable storage area should not extend into the bottom 16K of RAM (VN should be larger than minus 32768).

The dimensions of arrays L1, L2, and A defined in line 1000 determine the maximum size of a program that can be compiled. The dimension of L1 and L2 is the maximum number of Basic program lines that can be compiled. The dimension of A is the maximum number of jumps (GOTOs and GOSUBs) that can be compiled. Change these dimensions to suit your needs. Listing 1 allows 100 program lines and 50 jump statements.

Syntax

It is important that each statement to be compiled follow certain rules. The compiler will indicate an error most of the time, but some errors may go undetected. Upon execution, your compiled program may give you incorrect results or crash altogether. The following points will help you avoid this pitfall.

- Each correctly coded statement will produce (except for inessential differences in the print statement described later) the same results in Basic as in machine code. Be sure to read carefully the notes regarding single precision expressions.
- You must initialize each variable before you use it in the right side of an assignment statement or in a print statement. In contrast, the interpreter automatically initializes all variables to zero (or to the empty string, in the case of a string variable).
- The compiler generally ignores blanks in coded statements as does the interpreter, but no blanks should appear in a variable name or on either side of an = symbol.
- Multiple statement lines are allowed.

Table 1 lists definitions and abbreviations that will make statement description easier.

Table 2 lists the types of program statements that can be compiled.

Exchanging Variables

Because many normal functions of the Basic interpreter cannot be compiled (disk and cassette I/O or Print Using, for example) it is essential to be able to interface the machine code harmoniously with the Basic code. One (but not the best) way of doing this is based on the fact that machine code

Program Listing 1

```
0 ' *** PROGRAM LINES 10-500 AND 10000-10090 ARE A SAMPLE PROGRA
M READY FOR COMPILATION
10 ' *** NUMERICAL ARRAY SORTING (FROM LEVELII MANUAL)
20 ' *** PASS ARRAY AB FROM BASIC TO USR ***
30 N%=0+N%
40 FOR I%=1 TO N%:I%=1*I%:A(I%)=0+AB(I%):NEXT I%
50 ' *** SORTING PROGRAM BEGINS ***
60 D%=1
70 D%=D%+D%:IFD%<N%THEN70
80 D%=INT((D%-1)/2):IFD%=0 THEN 140
90 T%=N%-D%:FORI%=1TOT%:J%=I%
100 L%=J%+D%:IFA(L%)>A(J%)THEN 120
110 T=A(J%):A(J%)=A(L%):A(L%)=T:J%=J%-D%:IFJ%>0 THEN100
120 NEXTI%:GOTO80
130 ' *** PASS ARRAY A FROM USR TO BASIC ***
140 FOR I%=1 TO N%:I%=1*I%:A(I%)=1*AB(I%):NEXT I%
500 END
501 '**************** BASIC COMPILER *********************
502 '** COPYRIGHT 1981 BY D. P. BERTSEKAS, BELMONT, MASS.
503 '** PERMISSION TO USE; NOT TO SELL
510 '************* PEEK & POKE ROUTINES *****************
512 POKEM,P:PRINTP;:M=M+1:RETURN
514 PC=PEEK(Q):PN=PEEK(Q+1):Q=Q+1:IFPC=32THEN514ELSEIFPC=0C=2:RE
TURNELSERETURN
518 IFPC<65ORPC>90THEN522ELSERETURN
520 IFPN<>37THEN522ELSEQ=Q+1:RETURN
522 PRINT:PRINT"ERROR LINE #";L1(L-1):END
524 PRINT@0,F$;:PRINT@64,CHR$(30):RETURN
529 ' ******** SINGLE PRECISION ASSIGNMENT ROUTINES ********
530 ' ROUTINE TO FIND VAR. ADDRESS PARAMETERS
535 GOSUB514:GOSUB518:V1=PC-65:IFPN<48ANDPN>57ANDPN<>213ANDPN<>4
0ANDCF<>1THEN522
538 IFPN>47ANDPN<58MI=PN-47:GOSUB514ELSEMI=0
```

Program Listing 1 Continues

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Program Listing 1 Continued

```
540 IFPN=213Z1=1:RETURN
545 IFPN=40GOSUB514:GOSUB514:GOSUB518:V2=PC-65:GOSUB520:GOSUB514
ELSEIFCF=1Z1=1:RETURN
550 IFPC<>41ANDPC<>44THEN522
555 IFPC=41Z1=2:RETURN
560 IFPC=44GOSUB514:GOSUB518:V3=PC-65:IFV1<0ORV1>=NTTHEN522ELSEG
OSUB520:Z1=3:GOSUB514:IFPC<>41OR(PN<>213ANDCF<>1)THEN522ELSERETU
RN
564 ' ADDRESS COMPUTATION ROUTINE
565 ONZ1GOSUB570,575,580:RETURN
570 IFMI>ISTHEN522ELSEC1=VF+(V1+MI*26)*4:GOSUB836:GOSUB902:RETUR
N
575 V7=V1:V8=V2:GOSUB610:RETURN
580 V7=V1:V8=V2:V9=V3:GOSUB620:RETURN
600 ' ARRAY PORTION OF ADDRESS ROUTINE
610 V0=V8:GOSUB912:GOSUB906:C1=VA+V7*DO*4:GOSUB836:GOSUB900:GOSU
B904:RETURN:' 1-D ARRAY
620 V0=V9:GOSUB912:P=41:GOSUB512:C1=VD+4*NT*DT*DT+2*V7*DT:GOSUB8
36:GOSUB900:GOSUB904:P=94:GOSUB512:P=35:GOSUB512:P=86:GOSUB512:V
0=V8:GOSUB912:GOSUB906:GOSUB904:RETURN:' 2-D ARRAY
699 ' ROUTINE TO EVALUATE SINGLE PRECISION EXPRESSIONS
700 GOSUB514:IFPC<>206GOTO704
702 E1=0:D1=0:GOSUB902:GOSUB926:GOSUB926:GOTO714:'TAKES CARE OF
LEADING <-> SIGN
704 GOSUB730
706 GOSUB514:IFC=20RPC=41ORPC=58ORPC=59ORPC=212ORPC=213ORPC=214O
RPC=141ORPC=202THENRETURN:'PEEK NEXT BYTE; IF TERMINATOR RETURN
708 GOSUB934:'MOVE INTERIM RESULT FROM 4121H STORAGE AREA TO STA
CK
710 ' MOVE NEW VARIABLE TO 4121H AREA; POP BCDE; OPERATE
712 IFPC=205GOSUB514:GOSUB730:GOSUB936:GOSUB940:GOTO706:'ADD
714 IFPC=206GOSUB514:GOSUB730:GOSUB936:GOSUB942:GOTO706:'SUBTRAC
T
716 IFPC=207GOSUB514:GOSUB730:GOSUB936:GOSUB944:GOTO706:'MULTIPL
Y
718 IFPC=208GOSUB514:GOSUB730:GOSUB936:GOSUB946:GOTO706:'DIVIDE
720 IFPC=209GOSUB514:GOSUB730:GOSUB936:GOSUB948:GOTO706:'EXPONEN
TIATE
722 GOTO522:'ERROR TRAP
729 ' ROUTINE TO EVALUATE CONSTANTS, VARIABLES & FUNCTIONS IN SI
NGLE PRECISION EXPRESSION & MOVE THEM TO 4121H STORAGE AREA
730 IF(PC<58ANDPC>47)ORPC=46GOSUB845:RETURN:'CONVERT CONSTANT TO
 4-BYTE REPRESENTATION; MOVE IT & RETURN
732 IFPC=222GOSUB514:IFPC<>40THEN522ELSEGOSUB514:IFPC<>48THEN522
ELSEGOSUB514:IFPC<>41THEN522ELSEP=205:GOSUB512:P=240:GOSUB512:P=
20:GOSUB512:RETURN:'RND(0)
734 IF(PC>220ANDPC<229)ORPC=217ORPC=40THEN756ELSEIFPC<65ORPC>90T
HEN522:'IF FUNCTION GOTO 758
736 V4=PC-65:IFPN>47ANDPN<58THENME=PN-47:GOSUB514:Z2=1:GOTO746EL
SEIFPN<>40ANDPN<>37THENME=0:Z2=1:GOTO746ELSEIFPN=37THENZ2=4:GOSU
B514:GOTO746
738 GOSUB514:GOSUB514:GOSUB518:V5=PC-65:GOSUB520:GOSUB514
740 IFPC<>41ANDPC<>44THEN522
742 IFPC=41Z2=2:'1-D ARRAY
744 IFPC=44GOSUB514:GOSUB518:V6=PC-65:GOSUB520:Z2=3:GOSUB514:IFP
C<>41THEN522:'2-D ARRAY
746 ONZ2GOTO748,750,752,754
748 IFME>ISTHEN522ELSEC1=VF+(V4+ME*26)*4:GOSUB836:GOSUB902:GOSUB
932:RETURN
750 V7=V4:V8=V5:GOSUB610:GOSUB932:RETURN
752 V7=V4:V8=V5:V9=V6:GOSUB620:GOSUB932:RETURN
754 V0=V4:GOSUB912:P=34:GOSUB512:P=33:GOSUB512:P=65:GOSUB512:P=2
05:GOSUB512:P=204:GOSUB512:P=10:GOSUB512:RETURN:' CONVERT INTEGE
R VAR. TO SINGLE PRECISION
756 IFPC=40THEN776:'PARENTHESIS
758 Q=Q+1
760 IFPC=221THEN778:'SQR
762 IFPC=217THEN780:'ABS
764 IFPC=223THEN782:'LOG
766 IFPC=224THEN784:'EXP
768 IFPC=225THEN786:'COS
770 IFPC=226THEN788:'SIN
772 IFPC=227THEN790:'TAN
774 IFPC=228THEN792:'ATN
776 GOSUB700:GOTO794
778 GOSUB700:GOSUB952:GOTO794
780 GOSUB700:GOSUB954:GOTO794
782 GOSUB700:GOSUB956:GOTO794
784 GOSUB700:GOSUB958:GOTO794
786 GOSUB700:GOSUB960:GOTO794
788 GOSUB700:GOSUB962:GOTO794
790 GOSUB700:GOSUB964:GOTO794
792 GOSUB700:GOSUB966
794 IFPC<>41THEN522
796 RETURN
800 ' ************** CONVERSION ROUTINES ***********
809 ' ROUTINE TO FIND LSB & MSB OF INTEGER NUMERIC STRING
```

Program Listing 1 Continues

stores its variables in fixed locations. It is possible for the Basic code to POKE appropriate values in these locations, where they are picked up by the machine code. For example, since we know the integer variable A% is stored by the machine code in locations VT and (VT + 1) we can pass the value of an integer variable AB% from Basic into the variable A% with the statements

```
I% = VARPTR(AB%):POKE VT,PEEK(I%):POKE
  VT + 1,PEEK(I% + 1).
```

Upon return from execution of the machine code we can perform the reverse process via the statement

```
AB% = PEEK(VT) + 256*PEEK(VT + 1)
```

This method can be useful but is generally slow and cumbersome.

We can also exchange variable values using the two special statements X = 0 + Y, X = 1*Y, where X is an integer or single precision variable of the machine code, and Y is an integer or single precision variable of the Basic code. The number of characters of the name of Y should be less than or equal to SL (see line 1010). Note that X and Y must be variables of the same type (both integer or both single precision).

When compiled and executed the statement A% = 0 + AB% finds the address where the Basic interpreter stores the variable AB% and transfers the current value of AB% into the location where the machine code stores its variable A%. The statement A% = 1*AB% performs the reverse process: It transfers the current value of the machine code variable A% into the Basic variable AB% (from where it can be picked up for disk or cassette I/O, for example, upon return from the machine code). If the Basic variable AB% has not yet been established the machine code automatically creates it with the corresponding ROM routine of the interpreter. As an example, consider the following two lines:

```
10 FOR I% = 0 TO 10:I% = 1*I%:A(I%) = 0 + VECTOR
  (I%):NEXT I%
20 FOR I% = 0 TO 10:I% = 1*I1%:FOR J% = 0 TO 10:J%
  = 1*J1%: A(I%,J%) = 1*MATRIX(I1%,J1%):NEXT
  J%:NEXT I%
```

When compiled and executed, the first line transfers the elements 0-10 of the Basic one-dimensional array VECTOR into the corresponding elements of the machine code array A. The second line transfers the specified elements of the machine code array A into the corresponding elements of the Basic array MATRIX. If MATRIX or the integer variables I1% and J1% have not yet been established they will be created.

If the names of X and Y are identical, the statements X = 0 + Y and X = 1*Y when executed in Basic while you are debugging will not interfere with the program's operation.

How to Use the Compiler

It takes planning and preparation to use the compiler. First, write your program in Basic, test it and debug it using the interpreter. During this stage try to use state-

ments and variables that the compiler will accept, and structure the program so it requires few modifications later. Then decide whether you will compile the entire program or only a part. Isolate that part and introduce interfaces for exchanging variables with the remaining parts using the statements X=0+Y and X=1*Y described earlier. Duplicate any subroutines used by both parts since the machine code cannot call Basic subroutines.

Renumber the part to be compiled so its line numbers are in the range 0-500 while the remaining part has numbers 10000 or higher. Test the program again by introducing GOTO statements at appropriate points to make sure it works after renumbering. Save the renumbered program, load the compiler and merge with it the renumbered Basic program. The utilities for carrying out the above are standard in disk systems. They can also be found in recent articles published in *80 Micro*.

At this point the long program in memory should include the compiler occupying lines 501-7200, the part of the Basic program you wish to compile occupying lines up to 500, and the remaining part of your Basic program (if any) occupying lines 10000 and above, as shown in Listing 1. Adjust the storage parameters in lines 1005 and 1010 if necessary, set memory size below MC and run 1000. The program first creates code to store addresses associated with two-dimensional arrays. This code needs to be executed only once in the compiled program and only if you use two-dimensional arrays. It will be created only if the number of available two-dimensional arrays NT (see lines 1010 and 1021) is not zero.

Following this preliminary code each line up to 500 will be successively compiled and the corresponding machine code will scroll on your screen preceded by the address where it gets stored. One or more colons separate the codes for multiple statements within the same line. After coding all lines the compiler adjusts jump addresses and then displays the start and end addresses of the machine code. If there is no Basic part in your program (in line 10000 and above) you can execute the machine code by pressing Enter. If there is a Basic part you should introduce a USR statement where you wish the program to branch to the machine code (see Listing 1, line 10060). You should then set memory size below VN (see line 1010) and run 10000. You may want to practice this procedure with the example sorting program given in Listing 1.

You can save the machine code with the Dump command if you have a disk system. You can then bring it back into memory at execution time by using the Load command. You can also embed the machine code in data statements with the Encoder or the Datagen programs (*80 Micro*, May 1981 and August 1981 respectively) and POKE it into memory from Basic whenever you want to execute it. You can create programs containing several USRs that share the same variable storage area. Each USR, of course, should be compiled separately and

Program Listing 1 Continued

```
810 C$="":IFPC=206THENPC=45:GOSUB818ELSEGOSUB816:IFC$=""THENC1=-
1:RETURN
812 C1=VAL(C$)
814 D1=C1/256:E1=C1-D1*256:IFC1<0THEND1=D1+256:C1=-C1:RETURN:ELS
ERETURN
816 IFPC<48ORPC>57THENRETURN
818 C$=C$+CHR$(PC):GOSUB514:GOTO816
835 ' ROUTINES TO FIND LSB & MSB OF ADDRESSES ABOVE 1ST 32K
836 D1=C1/256:E1=C1-D1*256:D1=D1+256:RETURN
840 Z=VT+V1+V1:P1=Z/256:P=Z-P1*256:P1=P1+256:RETURN
844 ' ROUTINE TO CONVERT NUMERIC STRING TO 4-BYTE SINGLE PRECISI
ON REPRESENTATION
845 C$=CHR$(PC)
846 GOSUB514:IF(PC<58ANDPC>47)ORPC=46C$=C$+CHR$(PC):GOTO846
847 R=VAL(C$):GOSUB848:E1=33:D1=65:GOSUB902:C1=B3:GOSUB910:P=35:
GOSUB512:C1=B2:GOSUB910:P=35:GOSUB512:C1=B1:GOSUB910:P=35:GOSUB5
12:C1=BE:GOSUB910:Q=Q-1:RETURN
848 IFR=0THENBE=0:B1=0:B2=0:B3=0:RETURN
849 Y1=1:Y2=2:N=1:IFY1>RTHEN852
850 IFY2<=RTHENY1=Y1+Y1:Y2=Y2+Y2:N=N+1:GOTO850
851 GOTO853
852 IFR<Y1THENY1=Y1/2:Y2=Y2/2:N=N-1:GOTO852
853 BE=N+128:X1=0:R=R-Y1:GOSUB856:B1=B
854 GOSUB857:X1=X:GOSUB856:B2=B
855 GOSUB857:X1=X:GOSUB856:B3=B:RETURN
856 GOSUB857:X2=X:GOSUB857:X3=X:GOSUB857:X4=X:GOSUB857:X5=X:GOSU
B857:X6=X:GOSUB857:X7=X:GOSUB857:X8=X:B=X1+X1+X2:B=B+B+X3:B=B+B+
X4:B=B+B+X5:B=B+B+X6:B=B+B+X7:B=B+B+X8:RETURN
857 Y1=Y1/2:RT=R-Y1:IFRT<0X=0:RETURN:ELSEX=1:R=RT:RETURN
879 ' ROUTINE TO POKE STRING IN TEMPORARY STORAGE AREA
880 C1=MF:GOSUB836:GOSUB900:NN=1
881 IFPC=34GOSUB890:RETURN
882 GOSUB889
883 IFFP=1ANDPEEK(Q)=32Q=Q+1:PC=32:NN=NN+1:GOTO885
884 GOSUB514:NN=NN+1
885 IFFP=1AND(PC=34ORC=2)GOSUB890:RETURN
886 IFFP=0AND(PC=58ORC=2)GOSUB890:RETURN
888 GOTO882
889 P=62:GOSUB512:P=PC:GOSUB512:P=18:GOSUB512:IFPC<>0THENP=19:GO
SUB512:RETURN:ELSERETURN
890 Q=Q-1:C=0:PC=0:GOSUB889:IFNN>SLTHENPRINT:PRINT"STRING TOO LO
NG":GOTO522:ELSERETURN
899 ' *********** FREQUENTLY USED MACHINE CODES ************
900 P=17:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB512:RETURN:'LD DE,E1D1

902 P=33:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB512:RETURN:'LD HL,E1D1

904 P=25:GOSUB512:RETURN:'ADD HL,DE
906 P=41:GOSUB512:P=41:GOSUB512:RETURN:' ADD HL,HL: ADD HL,HL
908 P=235:GOSUB512:RETURN:' EXC HL,DE
910 P=54:GOSUB512:P=C1:GOSUB512:RETURN:'LD (HL),C1
912 C1=VT+V0+V0:GOSUB836:P=42:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB5
12:RETURN:' LD HL,(C1)
914 P=42:GOSUB512:GOSUB840:GOSUB512:P=P1:GOSUB512:RETURN:'LD HL,
(P1P)
916 P=34:GOSUB512:GOSUB840:GOSUB512:P=P1:GOSUB512:RETURN:'LD (PP
1),HL
918 P=195:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB512:RETURN:'JP E1D1
920 P=183:GOSUB512:P=237:GOSUB512:P=82:GOSUB512:RETURN:'OR A: SB
C HL,DE
922 P=40:GOSUB512:P=3:GOSUB512:RETURN:'JR Z,3
924 P=225:GOSUB512:RETURN:'POP HL
926 P=229:GOSUB512:RETURN:'PUSH HL
928 P=209:GOSUB512:RETURN:'POP DE
930 P=213:GOSUB512:RETURN:'PUSH DE
932 P=205:GOSUB512:P=177:GOSUB512:P=9:GOSUB512:RETURN:'MOVE VARI
ABLE TO 4121H AREA
934 P=205:GOSUB512:P=164:GOSUB512:P=9:GOSUB512:RETURN:'MOVE FROM
 4121H TO STACK
936 P=193:GOSUB512:GOSUB928:RETURN:'POP BC & DE
938 ' ARITHMETIC OPERATION & FUNCTION ROUTINES
940 P=205:GOSUB512:P=22:GOSUB512:P=7:GOSUB512:RETURN
942 P=205:GOSUB512:P=19:GOSUB512:P=7:GOSUB512:RETURN
944 P=205:GOSUB512:P=71:GOSUB512:P=8:GOSUB512:RETURN
946 P=205:GOSUB512:P=162:GOSUB512:P=8:GOSUB512:RETURN
948 P=205:GOSUB512:P=247:GOSUB512:P=19:GOSUB512:RETURN
950 P=205:GOSUB512:P=12:GOSUB512::P=10:GOSUB512:RETURN
952 P=205:GOSUB512:P=231:GOSUB512:P=19:GOSUB512:RETURN
954 P=205:GOSUB512:P=239:GOSUB512:P=10:GOSUB512:P=205:GOSUB512:P
=119:GOSUB512:P=9:GOSUB512:RETURN
956 P=205:GOSUB512:P=9:GOSUB512:P=8:GOSUB512:RETURN
958 P=205:GOSUB512:P=57:GOSUB512:P=20:GOSUB512:RETURN
960 P=205:GOSUB512:P=65:GOSUB512:P=21:GOSUB512:RETURN
962 P=205:GOSUB512:P=71:GOSUB512:P=21:GOSUB512:RETURN
964 P=205:GOSUB512:P=168:GOSUB512:P=21:GOSUB512:RETURN
966 P=205:GOSUB512:P=189:GOSUB512:P=21:GOSUB512:RETURN
968 P=205:GOSUB512:P=167:GOSUB512:P=40:GOSUB512:RETURN
```

Program Listing 1 Continues

Program Listing 1 Continued

```
970 P=62:GOSUB512:P=4:GOSUB512:P=50:GOSUB512:P=175:GOSUB512:P=64
:GOSUB512:RETURN
972 P=205:GOSUB512:P=203:GOSUB512:P=9:GOSUB512:RETURN
999 ' ***************** MAIN PROGRAM **********************
1000 CLEAR200:DEFINTA-Q,S-X,Z:DIML1(100),L2(100),A(50),D(25),E(2
5):F$="BASIC COMPILER"+STRING$(50," "):T$=CHR$(32)+CHR$(58)+CHR$
(32):CLS
1005 Q=PEEK(16548)+256*PEEK(16549):L=1:K=0:FP=0:CF=0:MR=0:MS=-25
00-MR*16384:MC=-2500-MR*16384:M=MC:'MR SHOULD BE 0, OR 1 FOR 48K
, OR 32K SYSTEMS RESPECTIVELY
1010 IS=10:DO=20:DT=20:SL=40:NO=26:NT=2:NS=26:'IS=# OF ADDITIONA
L S.P. VARIABLES PER LETTER; DO=DIM OF 1-D ARRAYS; DT=DIM OF 2-D
 ARRAYS; SL=LENGTH OF STRINGS; NO=# OF 1-D ARRAYS ALLOWED; NT=#
OF 2-D ARRAYS ALLOWED; NS=# OF STRINGS ALLOWED
1015 VT=-2*26+MS:VF=-4*26*(1+IS)+VT:VA=-4*NO*DO+VF:VD=-4*NT*DT*D
T-2*NT*DT+VA:VS=-NS*(SL+1)+VD:VN=-(SL+1)+VS
1020 ' MS=END OF VARIABLE STORAGE AREA; MC=START OF MACHINE CODE
; VT=START OF INTEGER STORAGE; VF=START OF SIMPLE VARIABLE STORA
GE; VA=START OF 1-D ARRAY STORAGE; VD=START OF 2-D ARRAY STORAGE
; VS=START OF STRING STORAGE; VN=TEMP. STORAGE
1021 IFNT>0GOSUB7000:' GENERATE CODE TO STORE 2-D ARRAY ADDRESSE
S
1025 M1=PEEK(Q)+PEEK(Q+1)*256:L1(L)=PEEK(Q+2)+PEEK(Q+3)*256
1030 GOSUB524
1035 PRINT:PRINT@960,L1(L);M;":";:L2(L)=M:L=L+1:Q=Q+4
1040 IFL1(L-1)>500THEN1210
1045 C=0:GOSUB514:IFC=2THEN1140
1050 IFPC=133ORPC=134ORPC=136OR(PC>137ANDPC<140)ORPC=142ORPC=144
ORPC=148OR(PC>149ANDPC<177)OR(PC>178ANDPC<189)OR(PC>189ANDPC<202
)ORPC=203ORPC=204ORPC=210ORPC=211THEN522:'ERROR TRAP
1055 IFPC=215OR(PC>216ANDPC<221)OR(PC>228ANDPC<251)THEN522:'ERRO
R TRAP
1057 IFPC=140GOSUB514:' LET
1060 IFPC>64ANDPC<91ANDPN=37Q=Q-1:GOSUB2000:' INTEGER LET
1065 ' SINGLE PRECISION LET
1070 IFPC>64ANDPC<91ANDPN<>37ANDPN<>36Q=Q-1:GOSUB535:GOSUB514:GO
SUB514:IF(PC=49ANDPN=207)OR(PC=48ANDPN=205)GOSUB4000:ELSEQ=Q-2:G
OSUB514:IFPC<>213THEN522ELSEGOSUB700:GOSUB565:GOSUB972
1075 IFPC>64ANDPC<91ANDPN=36Q=Q-1:GOSUB4500:' STRING LET
1080 IFPC=178GOSUB2500:' PRINT
1085 IFPC=141GOSUB3500:' GOTO
1090 IFPC=143GOSUB3000:' IF ... THEN
1095 IFPC=145GOSUB3700:' GOSUB
1100 IFPC=146GOSUB3800:' RETURN
1105 IFPC=132THENP=205:GOSUB512:P=201:GOSUB512:P=1:GOSUB512:GOSU
B514:IFPC<>58ANDC<>2THEN522:' CLS
1110 IFPC=137GOSUB2700:'INPUT
1115 IFPC=129GOSUB5000:' FOR
1120 IFPC=135GOSUB5500:' NEXT
1125 IFPC=130ORPC=131GOSUB6000:' SET & RESET
1127 IFPC=177GOSUB6500:' POKE
1130 IFPC=128P=205:GOSUB512:P=157:GOSUB512:P=10:GOSUB512:P=201:G
OSUB512:' END
1135 IFPEEK(Q-1)=58ORPEEK(Q-1)=149PRINTT$;:GOTO1045:' TEST FOR T
ERMINATOR & ELSE TOKEN
1140 Q=M1:PRINT:GOTO1025:' START NEW LINE
1200 ' ********* ROUTINE TO ADJUST THE MACHINE CODE JUMPS ******

1210 GOSUB524:PRINT@960,"ADJUSTING JUMP ADDRESSES . . .";:IFK=0G
OTO1300
1220 FORI=1TOK:DN=PEEK(A(I))+256*PEEK(A(I)+1):DH=0
1230 FORJ=1TOL:IFDN=L1(J)THENDH=L2(J):PRINTL1(J);
1240 NEXTJ:C1=DH:GOSUB836:POKEA(I),E1:POKEA(I)+1,D1:NEXTI
1299 ' ****** ROUTINE TO EXECUTE THE MACHINE CODE DIRECTLY *****
***
1300 PRINT:MR=0:MC=-2500-MR*16384:DEFUSR0=MC:' MR SHOULD BE 0 FO
R 48K, 1 FOR 32K SYSTEMS
1310 CLS:PRINT@256,"START=";65536+MC;"OR ";MC:PRINT"END  =";6553
6+M+1;"OR ";M+1
1320 PRINT@960,"<ENTER> TO RUN MACHINE CODE . . .";
1330 A$=INKEY$:IFA$<>CHR$(13)THEN1330
1340 CLS:X=USR(0):END
1400 ' ********** END OF MAIN PROGRAM **************
1999 ' INTEGER ASSIGNMENT ROUTINE
2000 GOSUB514:GOSUB518:GOSUB520:V1=PC-65:GOSUB514:IFPC<>213THEN5
22
2010 GOSUB514:IF(PC=49ANDPN=207)OR(PC=48ANDPN=205)THEN2400
2020 IFPC=216GOSUB514:GOSUB700:GOSUB970:P=205:GOSUB512:P=61:GOSU
B512:P=11:GOSUB512:IFPC<>41THEN522ELSEGOSUB514:GOSUB916:RETURN:'
 INT
2025 IFPC<>229THEN2030ELSEV3=V1:GOSUB514:GOSUB514:GOSUB810:IFC1=
-1THENV1=PC-65:GOSUB518:GOSUB520:GOSUB514:GOSUB914:P=126:GOSUB51
2ELSEP=58:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB512:' PEEK
2027 P=38:GOSUB512:P=0:GOSUB512:P=111:GOSUB512:V1=V3:GOSUB916:GO
SUB514:RETURN:' PEEK
2030 IFPC=198THENV3=V1:GOSUB6000:P=42:GOSUB512:P=33:GOSUB512:P=6
5:GOSUB512:V1=V3:GOSUB916:RETURN:' POINT
```

Program Listing 1 Continues

stored in a different RAM area.

You may wish to experiment with short programs to familiarize yourself with the compilation process. Judge for yourself the relative execution speed of different statement types in machine code and interpreted Basic. In addition to integer operations and graphics, floating point operations involving arrays and constants are accelerated most. The sorting program in Listing 1 runs 20 times faster in machine code than in Basic. However, programs involving primarily exponentiations, trigonometric and transcendental functions will be accelerated by only a small amount (a factor of 2 to 3). In these cases the very slow ROM routines used to carry out these functions dominate computation. You will surely be impressed by running the following one-line program to white out the screen in machine code and Basic:

```
10 FOR I% = 0 TO 1023:PRINT @ I%,CHR$(191):NEXT I%
```

Generally, the command PRINT @ X,CHR$(OBI)[+...] or the POKE command will produce spectacularly fast graphics when compiled. Similarly Set, Reset and Point graphics programs will run much faster in machine code. Try the Pong program (see Program Listing 2) which has been adapted from one in the September 1980 issue of *80 Micro*. The program asks for an input value to control its speed. For a value of one the speed in interpreted Basic is barely adequate. Run it in machine code—you will not be able to see the ball. You must adjust the speed input value to several hundreds before you can play the game. This program also illustrates how the PEEK statement provides a Break key function and an INKEY$-like function in machine code.

Program Listing 3 is a matrix inversion program ready for compilation. It runs about 11 times faster in machine code than in Basic.

I did not compare the speed of the code produced by this compiler with those obtained with commercial Basic compilers. However, in some cases the compiler produces substantially faster code than Radio Shack's Fortran 80 compiler written by Microsoft. The following program defines a square matrix A of dimension N% and multiplies it with itself:

```
10 INPUT N%
20 FOR I% = 1 TO N%:FOR J% = 1 TO N%:A (I%,J%) =
   I% + J%:NEXT J%:NEXT  I%
30 FOR I% = 1 TO N%:FOR J% = 1 TO N%:B(I%,J%) =
   0:FOR K% = 1 TO N%:B(I%,J%) = A (I%,K%)*A(K%,
   J%) + B(I%,J%):NEXT  K%:NEXT  J%:  PRINT
   I%:NEXT I%
```

I ran this program in interpreted and compiled Basic, and also translated it into Fortran and ran it using the Radio Shack package. Table 3 shows the execution times in seconds for different values of N%.

It took about as much time to compile the Basic code as the Fortran code for this example. This compiler produced machine code 391 bytes long. The compiled (and library linked) Fortran program took 9 grans of disk space (over 10000 bytes).

I ran other comparative tests not involv-

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Program Listing 1 Continued

```
2032 V2=V1:Q=Q-1:GOSUB514:IFPC=206ANDPN>47ANDPN<58GOSUB810:GOSUB
902:GOTO2040ELSEIFPC=206THENE1=0:D1=0:GOSUB902:GOTO2040
2035 GOSUB810:IFC1<>-1GOSUB902ELSEV1=PC-65:GOSUB518:GOSUB520:GOS
UB914:GOSUB514
2040 IFPC=58ORC=2V1=V2:GOSUB916:RETURN
2045 IFPC=206ANDPN>47ANDPN<58SG=205ELSESG=PC:GOSUB514
2050 GOSUB2060:IFSG=205GOSUB904ELSEGOSUB920
2055 GOTO2040
2060 GOSUB810:IFC1<>-1GOSUB900:RETURNELSEV1=PC-65:GOSUB518:GOSUB
520:P=237:GOSUB512:P=91:GOSUB512:GOSUB840:GOSUB512:P=P1:GOSUB512
:GOSUB514:RETURN
2399 ' INTEGER VARIABLE TRANSFER ROUTINE
2400 IFPC=49ANDPN=207CM=1ELSECM=0
2410 Q=Q+1:GOSUB514:MF=VN:GOSUB880:Q=Q+1:GOSUB902:P=205:GOSUB512
:P=13:GOSUB512:P=38:GOSUB512
2420 IFCM=0P=26:GOSUB512:P=111:GOSUB512:P=19:GOSUB512:P=26:GOSUB
512:P=103:GOSUB512:GOSUB916:RETURN:' TRANSFER BASIC VARIABLE INT
O USR VARIABLE
2430 GOSUB914:P=125:GOSUB512:P=18:GOSUB512:P=19:GOSUB512:P=124:G
OSUB512:P=18:GOSUB512:RETURN:' TRANSFER USR VARIABLE INTO BASIC
VARIABLE
2499 ' PRINT ROUTINE
2500 GOSUB514:IFPC=58ORC=2P1=13:GOSUB2670:RETURN
2502 IFPC<>64ANDPC<>96THEN2600ELSEGOSUB514
2503 ' PRINT @
2504 IFPC<58Q=Q-1:GOSUB2580:C1=C1+15360:GOSUB514:GOSUB814:GOSUB9
02ELSEV1=PC-65:GOSUB518:GOSUB520:GOSUB514:GOSUB514:GOSUB914:D1=6
0:E1=0:GOSUB900:GOSUB904
2508 IFPC<>247P=34:GOSUB512:P=32:GOSUB512:P=64:GOSUB512:GOTO2600
ELSEGOSUB514:IFPC<>40THEN522ELSEGOSUB2580:GOSUB910
2510 GOSUB514:IFPC=205GOSUB514:IFPC<>247THEN522ELSEP=35:GOSUB512
:GOTO2508
2512 IFPC=59GOSUB514
2514 IFPC<>58ANDC<>2THEN522ELSERETURN
2580 C$=""
2585 GOSUB514:IFPC<>41ANDPC<>44THENC$=C$+CHR$(PC):IFPC<48ORPC>57
THEN522ELSEGOTO2585
2590 C1=VAL(C$):RETURN
2599 ' SINGLE PRECISION EXPRESSION & STRING PRINT ROUTINE
2600 IFPC>64ANDPC<91ANDPN=36Q=Q+1:V1=PC-65:C1=VS+V1*(SL+1):GOSUB
2680:GOTO2630
2610 IFPC=34PC=PEEK(Q):Q=Q+1:MF=VN:FP=1:GOSUB880:FP=0:GOSUB2680:
GOTO2630
2620 Q=Q-1:GOSUB700:GOSUB970:P=205:GOSUB512:P=189:GOSUB512:P=15:
GOSUB512:GOSUB968:' SINGLE PRECISION PRINT
2630 IFPC=44THEN522
2640 IFPC=59GOSUB514:IFPC<>58ANDC<>2THEN2600ELSERETURN
2650 IFPC=58ORC=2P1=13:GOSUB2670:RETURN
2660 GOTO522
2670 P=62:GOSUB512:P=P1:GOSUB512:P=205:GOSUB512:P=58:GOSUB512:P=
3:GOSUB512:RETURN:' SCREEN CONTROL ROUTINE
2680 GOSUB836:GOSUB902:GOSUB968:GOSUB514:IFPC=34GOSUB514:RETURNE
LSERETURN:' PRINT STRING
2699 ' INPUT
2700 P=205:GOSUB512:P=179:GOSUB512:P=27:GOSUB512:P=35:GOSUB512:P
=205:GOSUB512:P=108:GOSUB512:P=14:GOSUB512:GOSUB514
2710 IFPN=37P=205:GOSUB512:P=127:GOSUB512:P=10:GOSUB512:V1=PC-65
:GOSUB840:E1=P:D1=P1:GOSUB902:P=237:GOSUB512:P=75:GOSUB512:P=33:
GOSUB512:P=65:GOSUB512:P=113:GOSUB512:P=35:GOSUB512:P=112:GOSUB5
12:GOSUB514:GOSUB514:IFPC<>58ANDC<>2THEN522ELSERETURN
2720 Q=Q-1:CF=1:GOSUB535:CF=0:P=58:GOSUB512:P=175:GOSUB512:P=64:
GOSUB512:P=222:GOSUB512:P=4:GOSUB512:GOSUB922:P=205:GOSUB512:P=2
04:GOSUB512:P=10:GOSUB512:GOSUB565:GOSUB972:GOSUB514:IFPC<>58AND
C<>2THEN522ELSERETURN
2999 ' INTEGER IF - THEN ROUTINE
3000 GOSUB514:IFPN<>37THEN3100ELSEGOSUB520:V1=PC-65:GOSUB914:GOS
UB908:GOSUB514
3005 IFPC=212ANDPN=213ORPC=213ANDPN=212W1=1:Q=Q+1:GOTO3035
3010 IFPC=214ANDPN=213ORPC=213ANDPN=214W1=2:Q=Q+1:GOTO3035
3015 IFPC=212ANDPN=214ORPC=214ANDPN=212W1=3:Q=Q+1:GOTO3035
3020 IFPC=212W1=4
3025 IFPC=214W1=5
3030 IFPC=213W1=6
3035 GOSUB514:IFPC<58ORPC=206GOSUB810:GOSUB902ELSEGOSUB518:GOSUB
520:V1=PC-65:GOSUB914:GOSUB514
3040 IFPC<>202ANDPC<>141THEN522ELSEGOSUB514:IFPC=141GOSUB514
3045 GOSUB810:IFC1<0ORC1>500THEN522
3050 P=205:GOSUB512:P=57:GOSUB512:P=10:GOSUB512
3055 GOTO3150
3099 ' SINGLE PRECISION IF - THEN ROUTINE
3100 Q=Q-1:GOSUB700:GOSUB934
3105 IFPC=212ANDPN=213ORPC=213ANDPN=212W1=1:Q=Q+1:GOTO3135
3110 IFPC=214ANDPN=213ORPC=213ANDPN=214W1=2:Q=Q+1:GOTO3135
3115 IFPC=212ANDPN=214ORPC=214ANDPN=212W1=3:Q=Q+1:GOTO3135
3120 IFPC=212W1=4
3125 IFPC=214W1=5
3130 IFPC=213W1=6
```

Program Listing 1 Continues

ing matrices and found that in most cases this compiler and the Fortran compiler produce equally fast code. For example, the statements A% = I% – J%, A = 1.2*1.2/1.2 – 1.2 + 1.2, A = (B*B)/B + (B – B), A = B[2.3 + (B + B*B)/(B + B), A = SIN(B) + COS(B) in long loops executed almost equally fast in compiled Basic and Fortran (97, 6.5, 3, 1.3, and 1.25 times faster than interpreted Basic respectively). In some cases Fortran was slightly faster than this compiler and in other cases the reverse was true. However, within my limited set of programs I did not find any case where Fortran was more than 10 percent faster.

Troubleshooting

The compiler checks for many syntax errors during compilation. However, other errors remain undetected until you discover them the hard way during execution time.

If the compiled program runs but gives different results than its equivalent Basic program, there are two likely problems. Either the order of arithmetic operations in a single precision expression is carried out differently by the compiler and the interpreter, or some machine code variable appears in the right side of an assignment statement before being initialized. Note also that the compiler does not check whether the result of an integer LET statement lies within the legal range, another source of error or program crashes. Make sure all statements are written in a form compatible with the compiler.

If the compiled program crashes check the For...Next loops; make sure they are set up properly and that there is no jump out of a For...Next loop.

Modifications and Improvements

You can safely delete all remarks in the listing to save space, especially if you have less than 48K of memory. The program is straightforward except for the routines for evaluating single precision expressions. Fairly easy improvements are additional integer arithmetic, string manipulation features, and double precision arithmetic. Improvements in the For...Next statement are not hard either. Major projects are the expansion of the options in the If...Then...Else statement, and making compiler evaluation of the order of operations in single precision expressions fully compatible with interpreter evaluation. Finally you can improve the speed of the compiler by making it compile portions of itself.

You can use the program with a 16K cassette system with a few minor modifications. The parameter MR in lines 1000 and 1300 must be set to minus 2, the DEFUSR0 statement in line 1300 should be modified and the statements D1 = D1 + 256 and P1 = P1 + 256 should be deleted in lines 836 and 840. Storage space is critical in a 16K system, so delete all remarks from the program, and adjust the storage parameters. ■

Dr. Dimitri P. Bertsekas teaches Electrical Engineering and Computer Science at M.I.T.

Program Listing 1 Continued

```
3135 GOSUB700:GOSUB936:GOSUB950
3140 IFPC<>202ANDPC<>141THEN522ELSEGOSUB514:IFPC=141GOSUB514
3145 GOSUB810:IFC1<0ORC1>500THEN522
3150 D=D1:E=E1:ONW1GOTO3155,3160,3165,3170,3175,3180
3155 GOSUB3185:GOSUB3200:RETURN
3160 GOSUB3185:GOSUB3190:RETURN
3165 GOSUB3195:RETURN
3170 P=40:GOSUB512:P=3:GOSUB512:GOSUB3200:RETURN
3175 P=40:GOSUB512:P=3:GOSUB512:GOSUB3190:RETURN
3180 GOSUB3185:RETURN
3185 P=202:GOSUB3300:RETURN
3190 P=242:GOSUB3300:RETURN
3195 P=194:GOSUB3300:RETURN
3200 P=250:GOSUB3300:RETURN
3205 P=195:GOSUB3300:RETURN
3300 GOSUB512:K=K+1:A(K)=M:P=E:GOSUB512:P=D:GOSUB512:RETURN
3499 ' GOTO ROUTINE
3500 GOSUB514:GOSUB810:IFC1<0ORC1>500THEN522ELSED=D1:E=E1:GOSUB3
205:RETURN
3699 ' GOSUB ROUTINE
3700 GOSUB514:GOSUB810:IFC1<1ORC1>500THEN522ELSED=D1:E=E1:C1=M+7
:GOSUB836:GOSUB900:GOSUB930:GOSUB3205:RETURN
3799 ' RETURN
3800 GOSUB924:P=233:GOSUB512:RETURN
3999 ' SINGLE PRECISION VARIABLE TRANSFER ROUTINE
4000 IFPC=49ANDPN=207THENCM=1ELSECM=0
4010 GOSUB514:GOSUB514:MF=VN:GOSUB880:GOSUB514:GOSUB902:P=205:GO
SUB512:P=13:GOSUB512:P=38:GOSUB512
4020 IFCM=0GOSUB908:GOSUB932:GOSUB565:GOSUB972:RETURN
4030 GOSUB930:GOSUB565:GOSUB932:GOSUB924:GOSUB972:RETURN
4499 ' STRING ASSIGNMENT ROUTINE
4500 GOSUB514:V1=PC-65:MF=VS+V1*(SL+1)
4510 GOSUB514:IFPC<>36THEN522
4520 GOSUB514:IFPC<>213THEN522
4530 GOSUB514:IFPC=247THEN4600ELSEIFPC<>34THEN522
4540 PC=PEEK(Q):Q=Q+1:FP=1:GOSUB880:FP=0
4550 GOSUB514:IFPC=34GOSUB514
4560 RETURN
4599 ' STRING ASSIGNMENT USING CHR$
4600 C1=MF:GOSUB836:GOSUB902
4610 GOSUB514:IFPC<>40THEN522ELSEC$=""
4615 GOSUB514:IFPC>64ANDPC<91THENV1=PC-65:GOSUB520:GOSUB514:IFPC
<>41THEN522ELSEP=58:GOSUB512:GOSUB840:GOSUB512:P=P1:GOSUB512:P=1
19:GOSUB512:GOTO4660
4620 IF(PC<48ORPC>57)ANDPC<>41THEN522
4630 IFPC<>41THENC$=C$+CHR$(PC):GOSUB514:GOTO4620
4640 C1=VAL(C$)
4650 GOSUB910
4660 GOSUB514:IFPC=205GOSUB514:IFPC<>247THEN522ELSEP=35:GOSUB512
:GOTO4610
4670 IFPC=58ORC=2THENP=35:GOSUB512:C1=0:GOSUB910:RETURNELSEGOTO5
22
4999 ' FOR ROUTINE
5000 C1=M+7:GOSUB836:GOSUB514:GOSUB518:GOSUB520:V1=PC-65:GOSUB84
0:GOSUB514:D(V1)=D1:E(V1)=E1:IFPC<>213THEN522
5010 GOSUB514:IFPC<65ORPC=206GOSUB810:J1=0:ID=D1:IE=E1:ELSEJ1=1:
V2=PC-65:GOSUB520:C1=VT+V2*2:GOSUB836:ID=D1:IE=E1:GOSUB514
5020 IFPC<>189THEN522
5030 GOSUB514:IFPC<65ORPC=206GOSUB810:J2=0:FD=D1:FE=E1ELSEJ2=1:V
3=PC-65:GOSUB520:C1=VT+V3*2:GOSUB836:FD=D1:FE=E1:Q=Q+1
5040 IFJ2=0THENP=33ELSEP=42
5050 GOSUB512:P=FE:GOSUB512:P=FD:GOSUB512:GOSUB926
5060 IFJ1=1THENE1=IE:D1=ID:GOSUB902
5070 IFJ1=1THENP=42:GOSUB512:P=IE:GOSUB512:P=ID:GOSUB512
5080 GOSUB916:IFPEEK(Q-1)<>58ANDPEEK(Q-1)<>0THEN522ELSERETURN
5499 ' NEXT ROUTINE
5500 GOSUB514:GOSUB518:GOSUB520:V1=PC-65:GOSUB914:GOSUB928:GOSUB
930:GOSUB926:GOSUB920:GOSUB924:P=35:GOSUB512:P=194:GOSUB512:P=E(
V1):GOSUB512:P=D(V1):GOSUB512:GOSUB924:GOSUB514:RETURN
5999 ' POINT, SET & RESET
6000 IFPC=130THENW=1ELSEIFPC=131THENW=128ELSEIFPC=198THENW=0
6010 MA=M
6020 GOSUB514:IFPC<>40THEN522ELSEGOSUB514:GOSUB810:IFC1=-1GOSUB5
18:GOSUB520:V1=PC-65:GOSUB840:D2=P1:E2=P:C2=1ELSEE2=E1:C2=0:IFPC
<>44THEN522
6030 IFC2=1GOSUB514:IFPC<>44THEN522
6040 GOSUB514:GOSUB810:IFC1=-1GOSUB518:GOSUB520:V1=PC-65:GOSUB84
0:D3=P1:E3=P:C3=1ELSEE3=E1:C3=0:IFPC<>41THEN522
6050 IFC3=1GOSUB514:IFPC<>41THEN522
6060 GOSUB514:IFPC<>58ANDC<>2THEN522
6070 C1=MA+18+C2+C3:GOSUB836:GOSUB902:GOSUB926:E1=126:D1=7:GOSUB
902:P=62:GOSUB512:P=W:GOSUB512:P=245:GOSUB512
6080 IFC2=1THENP=58:GOSUB512:P=E2:GOSUB512:P=D2:GOSUB512:ELSEP=6
2:GOSUB512:P=E2:GOSUB512
6090 P=245:GOSUB512
6100 IFC3=1THENP=58:GOSUB512:P=E3:GOSUB512:P=D3:GOSUB512ELSEP=62
:GOSUB512:P=E3:GOSUB512
```

Program Listing 1 Continues

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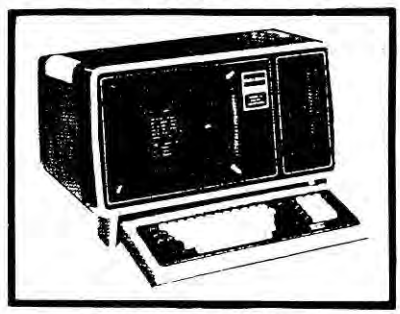

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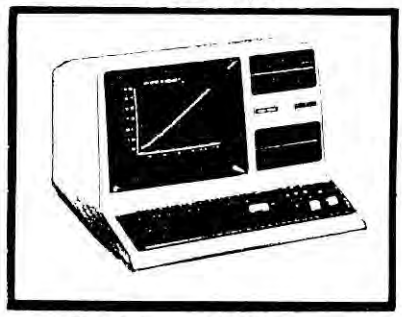

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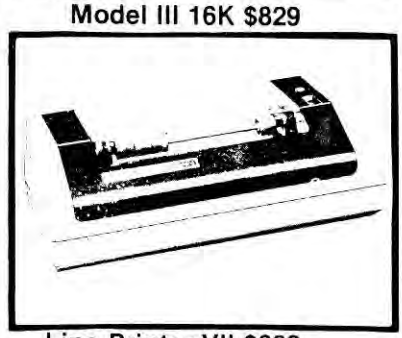

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Program Listing 1 Continues

```
6110 E1=80:D1=1:GOSUB918:RETURN
6499 ' POKE ROUTINE
6500 GOSUB514:GOSUB810:IFC1=-1THENGOSUB518:GOSUB520:V1=PC-65:GOS
UB914:GOSUB514ELSEGOSUB902
6510 IFPC<>44THEN522
6520 GOSUB514:GOSUB810:IFC1=-1GOSUB518:GOSUB520:V1=PC-65:GOSUB84
0:E1=P:D1=P1:P=58:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB512:GOSUB514E
LSEP=62:GOSUB512:P=E1:GOSUB512
6530 IFPC<>58ANDC<>2THEN522
6540 P=119:GOSUB512:RETURN
6999 ' ROUTINE FOR CODE TO STORE 2-D ARRAY ADDRESSES
7000 GOSUB524:PRINT"CODE TO STORE 2-D ARRAY ADDRESSES":PRINT:C1=
VD:GOSUB836:GOSUB902
7010 C1=VD+4*NT*DT*DT:GOSUB836:P=221:GOSUB512:GOSUB902:C1=4*DT:G
OSUB814:GOSUB900
7020 C1=NT*DT:GOSUB814:P=1:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB512
7030 P=221:GOSUB512:P=117:GOSUB512:P=0:GOSUB512
7040 P=221:GOSUB512:P=35:GOSUB512
7050 P=221:GOSUB512:P=116:GOSUB512:P=0:GOSUB512
7060 P=221:GOSUB512:P=35:GOSUB512:GOSUB904:P=13:GOSUB512
7070 C1=M-12:GOSUB836:P=194:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB512

7080 P=5:GOSUB512:P=14:GOSUB512:P=255:GOSUB512:C1=M-18:GOSUB836:
P=242:GOSUB512:P=E1:GOSUB512:P=D1:GOSUB512
7090 PRINT@640,"MAIN CODE BEGINS":RETURN
7200 ' ************* END OF THE COMPILER ***************
10000 ' ***** BASIC PORTION OF THE ARRAY SORTING PROGRAM *****
10010 DIM AB(400):INPUT "ARRAY DIMENSION";N%
10020 FOR I%=1 TO N%:AB(I%)=200*RND(0):NEXT I%
10030 FOR I%=1 TO N%:PRINT AB(I%);:NEXT I%:PRINT
10040 PRINT "PRESS A KEY TO RUN"
10050 A$=INKEY$:IF A$="" THEN 10050
10060 X=USR(0)
10070 PRINT:PRINT "DONE":PRINT:PRINT "PRESS A KEY TO PRINT THE S
ORTED ARRAY"
10080 A$=INKEY$:IF A$="" THEN 10080
10090 FOR I%=1 TO N%:PRINT AB(I%);:NEXT I%
```

Program Listing 2

```
5 ' ***** PONG; ADAPTED FROM 80 MICROCOMPUTING SEPT. 80
10 Q%=20:A%=25
15 L%=25:O%=20
20 CLS:PRINT"HOW FAST (1 TO 1000)?":INPUT D%:CLS:M%=0:S%=0:PRINT
 @ 132,M%:PRINT @ 186,S%
25 FOR Y%=9 TO 39:SET(0,Y%):SET(127,Y%):NEXT Y%
30 C%=1
35 PRINT @ 158,"PONG";
40 K%=1
45 FOR I%=20 TO 25:SET(7,I%):SET(120,I%):NEXT I%
50 FOR X%=1 TO 126:SET(X%,9):SET(X%,39):NEXT X%
55 Y%=10:Z%=INT(100*RND(0)):X%=Z%+10
60 SET(X%,Y%)
65 FOR I%=1 TO D%:NEXT I%
70 RESET(X%,Y%)
75 V%=PEEK(14337):U%=PEEK(14338):W%=PEEK(14340):Z%=V%+U%+W%
80 IF Z%=0 THEN 105
85 IF U%<>128 THEN 90:ELSE GOSUB 205:' PRESS <O> TO MOVE RIGHT P
ADDLE UP
90 IF U%<>16 THEN 95:ELSE GOSUB 210:' PRESS <L> TO MOVE RIGHT PA
DDLE DOWN
95 IF W%<>2 THEN 100:ELSE GOSUB 215:' PRESS <Q> TO MOVE LEFT PAD
DLE UP
100 IF V%<>2 THEN 105:ELSE GOSUB 220:' PRESS <A> TO MOVE LEFT PA
DDLE DOWN
105 Z%=PEEK(14400):IF Z%=4 THEN 500:' PRESS BREAK TO STOP
110 X%=X%+C%
115 Y%=Y%+K%
120 IF Y%>=39 THEN 125 ELSE IF Y%>9 THEN 140
125 IF X%>122 THEN 185
130 IF X%<6 THEN 180
135 B%=POINT(X%,Y%):IF B%<0 THEN 160
140 IF X%>122 THEN 185
145 IF X%<5 THEN 180
150 B%=POINT(X%,Y%):IF B%<0 THEN 170
155 GOTO 60
160 K%=-K%
165 GOTO 115
170 C%=-C%
175 GOTO 110
180 S%=S%+1:PRINT @ 186,S%;:IF S%>15 THEN 190:ELSE GOTO 55
185 M%=M%+1:PRINT @ 132,M%;:IF M%>15 THEN 190 ELSE GOTO 55
190 PRINT @ 982,"PLAY AGAIN? (Y/N)";
```

Program Listing 2 Continues

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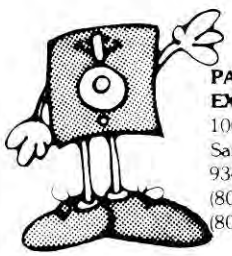

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Program Listing 2 Continued

```
195 Z%=PEEK(14344):IF Z%=2 THEN 20
200 Z%=PEEK(14338):IF Z%=64 THEN 500 ELSE GOTO 195
205 RESET(120,L%):O%=O%-1:L%=L%-1:SET(120,O%):RETURN
210 RESET(120,O%):O%=O%+1:L%=L%+1:SET(120,L%):RETURN
215 RESET(7,A%):Q%=Q%-1:A%=A%-1:SET(7,Q%):RETURN
220 RESET(7,Q%):Q%=Q%+1:A%=A%+1:SET(7,A%):RETURN
500 END
```

```
10 ' ****** MATRIX INVERSION ******
15 ' ***** PASS MATRIX FROM BASIC TO USR *****
20 R%=0+R%
25 FOR I%=1 TO R%
30 I%=1*I%
35 FOR J%=1 TO R%
40 J%=1*J%
45 A(I%,J%)=0+A(I%,J%)
50 B(I%,J%)=0
55 NEXT J%
60 B(I%,I%)=1
65 NEXT I%
70 ' ******************************************
75 ' ***** BEGINNING OF MATRIX INVERSION *****
80 FOR J%=1 TO R%
85 D%=0
90 FOR I%=J% TO R%
95 IF A(I%,J%)=0 THEN 105
100 D%=I%
105 NEXT I%
110 IF D%<>0 THEN 120
115 PRINT "SINGULAR":J%=R%:GOTO 225
120 FOR K%=1 TO R%
125 S=A(J%,K%)
130 A(J%,K%)=A(D%,K%)
135 A(D%,K%)=S
140 S=B(J%,K%)
145 B(J%,K%)=B(D%,K%)
150 B(D%,K%)=S
155 NEXT K%
160 T=1/A(J%,J%)
165 FOR K%=1 TO R%
170 A(J%,K%)=T*A(J%,K%)
175 B(J%,K%)=T*B(J%,K%)
180 NEXT K%
185 FOR L%=1 TO R%
190 IF L%=J% THEN 220
195 T=-A(L%,J%)
200 FOR K%=1 TO R%
205 A(L%,K%)=T*A(J%,K%)+A(L%,K%)
210 B(L%,K%)=T*B(J%,K%)+B(L%,K%)
215 NEXT K%
220 NEXT L%
225 NEXT J%
230 ' ****** PASS INVERSE MATRIX TO BASIC ******
235 FOR J%=1 TO R%
240 J%=1*J%
245 FOR I%=1 TO R%
250 I%=1*I%
255 B(J%,I%)=1*B(J%,I%)
260 NEXT I%
265 NEXT J%
500 END
10000 ' ****** BEGINNING OF BASIC PORTION OF MATRIX INVERSION PR
OGRAM
10010 MR=0:MC=-2500-MR*16384:DEFUSR0=MC:CLS
10020 DIM A(20,20),B(20,20)
10030 INPUT "DIMENSION";R%
10040 FOR J%=1 TO R%:FOR I%=1 TO R%:A(J%,I%)=0.015*RND(200):PRIN
T A(J%,I%);
10050 NEXT I%:PRINT:NEXT J%
10060 PRINT "PRESS A KEY TO RUN"
10070 A$=INKEY$:IF A$="" THEN 10070
10080 X=USR(0)
10090 PRINT:PRINT "DONE":PRINT:PRINT "PRESS A KEY TO PRINT THE I
NVERSE"
10100 A$=INKEY$:IF A$="" THEN 10100
10110 FOR I=1 TO R%
10120 FOR J=1 TO R%
10130 PRINT B(I,J);:PRINT " ";
10140 NEXT J
10150 PRINT
10160 NEXT I
10170 GOTO 10030
```

Program Listing 3

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Both compilers will run under virtually any MOD I/MOD III DOS. At least 48 K and one disk drive are required to use BASIC/S. Two drives are certainly preferable.

Note: BASIC/S II does NOT run under MOD III TRSDOS.

It will compile up to a 260 line program - compiles directly into a /CMD file, no linking or run time module needed. No royalties are required for programs you write and compile with BASIC/S. The /CMD files created by BASIC/S are very reasonably sized - typically, they are only 1.2 - 2 times the size of your original BASIC source file. Quite often, if your source file is only 1 granule, then so is the /CMD file made by BASIC/S.

The name BASIC/S means BASIC/Subset - it doesn't complete full blown BASIC. It DOES support most of Level II Basic as well as the essential elements of sequential and random disk I/O, including LRL 256. BASIC/S allows dimensioning arrays of all variable types, with up to two dimensions; any one program can have up to 20 arrays. Also, BASIC/S compiled programs can chain from one to another with no loss of variables.

$89.95 *(Includes BASIC/S and BASIC/S II)*
BASIC/S Compiler System Manual is available for $25.00 of which $10.00 is applicable toward the purchase of the BASIC/S System.

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Regular saving and the compounding of interest can accrue a great many dollars, especially if they are sheltered from tax while being accumulated. There's also an unhappy corollary: Continued borrowing and the compounding of interest expense can accrue a huge debt.

FINMOD/BAS is a program in Model III Disk Basic that permits you to visualize the effects of compound interest in building an estate, and demonstrates how important it is to shelter savings from taxes to the extent the law allows. It also shows you what excessive borrowing can do to your retirement plans, how much starting out with a nice inheritance from Aunt Maude helps, and how much paying off a huge loan obtained for education or for the professional equipment you may need to get started handicaps you.

The Key Box

Disk Basic
Model III
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Some Illustrations

John Q. Jones is 27 years old. He earned $18,000 last year. Let's assume that his salary will increase by five percent each year until he retires at age 65, and that he's going to save five percent of that salary each year and invest it at a return of 10 percent annually. In this case, we'll assume that he does not use a tax-sheltered savings plan. Thus, the return on his savings will be taxable at whatever marginal income tax rate each year's income calls for. We'll also assume that Jones at age 27 had no savings, but owed nothing to anyone.

Figure 1 shows a detailed printout from FINMOD. Let's look at some interesting points.

- Jones' salary at age 65 is projected at $120,685. Don't laugh at five percent raises, provided you can count on them year after year (and provided that inflation doesn't erode all of their value).
- Jones' total salary earned over the 39-year period will be $2,283,110.
- His accumulated savings will be $262,570, even though the 10 percent rate of return was actually only five percent after he reached the 50 percent marginal tax bracket.
- Of the total amount Jones saved, $154,750 came from interest earned on his savings, and only $107,820 from the savings themselves.

By varying the assumptions, we can produce some interesting comparisons:

- If Jones had earned 15 percent on savings instead of 10 percent, his accumulation would be $453,200, rather than $262,570. Make it only a five percent return, and he's down to $161,831.
- If Aunt Maude had remembered him in her will so he could have started with $50,000 in savings instead of with nothing, he would retire with $667,665 instead of $262,570 with the 10 percent rate of return we first assumed.
- If the 10 percent he earned on savings under our original assumptions had been tax free through an IRA or tax-free securities, but all other assumptions were the same, Jones would accumulate $716,303 instead of $262,570. Avoiding Uncle Sam is even better than having a loving Aunt Maude.
- If he had started saving at age 40, he would accumulate $166,288 instead of $262,570, even though his lifetime savings would be only $16,738 less. A 13-year head start is worth about as much as five percentage points in interest.

What are the effects of borrowing? Borrowing is more likely, at least in early years,

Figure 1

```
Case Description:
Lifelong savings at 5%, 10% taxable return, no loans

================== John Q. Jones -- Case # 1 ==================

Age at beginning of analysis                              27
Age at retirement                                         65
Salary at age 26                                $     18,000
```

Figure 1 continues

Figure 1 continued

```
Net savings at age 26 (- if net loans)                    $        0
Per cent annual rate of growth of salary                           5
Per cent or salary saved                                           5
Age at which savings begin                                        27
Age at which savings end                                          65
Per cent or salary borrowed                                        0


Per cent taxable return on investments                            10
Per cent deductible interest on loans                             12

================== John Q. Jones -- Case # 1 ==================

                                                    Accum        Net
Age   Salary      Saved   Borrowed   Interest      Interest     Savings
===   ======      =====   ========   ========      ========     =======
 27   18,900        945          0         72            72       1,017
 28   19,845        992          0        153           225       2,162
 29   20,837      1,042          0        231           455       3,434
 30   21,879      1,094          0        326           781       4,854
 31   22,973      1,149          0        432         1,213       6,435
 32   24,122      1,206          0        550         1,764       8,191
 33   25,328      1,266          0        643         2,407      10,101
 34   26,594      1,330          0        777         3,184      12,208
 35   27,924      1,396          0        925         4,109      14,529
 36   29,320      1,466          0      1,088         5,197      17,083



                                                    Accum        Net
Age   Salary      Saved   Borrowed   Interest      Interest     Savings
===   ======      =====   ========   ========      ========     =======
 37   30,786      1,539          0      1,173         6,370      19,795
 38   32,325      1,616          0      1,349         7,719      22,761
 39   33,942      1,697          0      1,541         9,260      25,998
 40   35,639      1,782          0      1,583        10,843      29,364
 41   37,421      1,871          0      1,780        12,624      33,015
 42   39,292      1,965          0      1,994        14,617      36,974
 43   41,256      2,063          0      2,225        16,843      41,262
 44   43,319      2,166          0      2,475        19,318      45,903
 45   45,485      2,274          0      2,746        22,064      50,923
 46   47,759      2,388          0      2,719        24,783      56,030
================== John Q. Jones -- Case # 1 ==================

                                                    Accum        Net
Age   Salary      Saved   Borrowed   Interest      Interest     Savings
===   ======      =====   ========   ========      ========     =======
 47   50,147      2,507          0      2,985        27,768      61,523
 48   52,655      2,633          0      3,272        31,040      67,428
 49   55,287      2,764          0      3,580        34,620      73,772
 50   58,052      2,903          0      3,910        38,530      80,585
 51   60,954      3,048          0      4,182        42,712      87,814
 52   64,002      3,200          0      4,551        47,263      95,565
 53   67,202      3,360          0      4,946        52,209     103,871
 54   70,562      3,528          0      5,370        57,579     112,769
 55   74,090      3,705          0      5,824        63,403     122,298
 56   77,795      3,890          0      6,309        69,712     132,497



                                                    Accum        Net
Age   Salary      Saved   Borrowed   Interest      Interest     Savings
===   ======      =====   ========   ========      ========     =======
 57   81,685      4,084          0      6,829        76,541     143,410
 58   85,769      4,288          0      7,385        83,926     155,083
 59   90,057      4,503          0      7,979        91,905     167,566
 60   94,560      4,728          0      8,615       100,520     180,908
 61   99,288      4,964          0      9,294       109,814     195,166
 62  104,253      5,213          0     10,019       119,833     210,398
 63  109,465      5,473          0     10,794       130,626     226,665
 64  114,938      5,747          0     11,621       142,247     244,032
 65  120,685      6,034          0     12,503       154,750     262,570


================== John Q. Jones -- Case # 1 ==================

Ratios:
======
  Net accumulated as percent of total salary                    11.5  %
  Interest as per cent of net accumulated                       58.9  %
  Ending salary as percent of beginning                        670.5  %
  Net savings first achieved at age                               27

Summary:
=======
  Total salary                                          $2,283,110
  Net interest                                          $  154,750
  Net accumulated                                       $  262,570
```


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than the disciplined savings program we just examined. Let's assume that Jones has the same starting salary, increasing at the same rate. But let's assume that he goes into debt by borrowing an amount equal to five percent of his salary in each of the years from age 27-39. Beginning at age 40, and continuing through age 65, we will assume that he will put five percent of his salary toward reducing his debt and, when the debt is fully paid, into savings. He will earn 10 percent, fully taxable, on interest income and pay 12 percent, fully tax deductible, on interest expense.

Figure 2 shows the result:

- His accumulated savings at age 65 are now projected at $46,211, $216,359 less than in the first case we looked at. The interest expense makes the difference.
- Although he switches from borrowing to savings at age 40, it is not until age 58 that he leaves the red.

What would the projections look like if Jones had started out $40,000 in debt? We'll return to the assumptions we used in the first example—five percent of salary saved from age 27-65, 10 percent taxable return on savings and 12 percent tax deductible interest on loans. His savings will reduce his debt, but interest costs add to it. If savings are less than interest costs, the debt simply gets bigger. Figure 3 shows the projected result:

- Despite regular savings, Jones never gets out of debt. Savings of five percent of salary are never enough to cover ever-increasing interest expense on an ever-increasing debt, even though his salary reaches a peak of $120,685 at age 65.
- Accumulated debt at age 65 is up to $283,316, with interest paid by then reaching a total of $351,135.

Figure 2

```
Case Description:
Borrow 5% at age 40, then save 5% -- 10% taxable return

================== John Q. Jones -- Case # 2 ==================

Age at beginning of analysis                                  27
Age at retirement                                             65
Salary at age 26                                    $     18,000
Net savings at age 26 (- if net loans)              $          0
Per cent annual rate of growth of salary                       5
Per cent ot salary saved                                       5
Age at which savings begin                                    40
Age at which savings end                                      65
Per cent ot salary borrowed                                    5
Age at which borrowing begins                                 27
Age at which borrowing ends                                   39
Per cent taxable return on investments                        10
Per cent deductible interest on loans                         12

================== John Q. Jones -- Case # 2 ==================

                                                    Accum       Net
Age   Salary      Saved   Borrowed   Interest      Interest    Savings
===   ======      =====   ========   ========      ========    =======
 27   18,900          0        945        86-           86-     1,031-
 28   19,845          0        992       185-          271-     2,208-
 29   20,837          0      1,042       281-          552-     3,531-
 30   21,879          0      1,094       400-          951-     5,024-
 31   22,973          0      1,149       533-        1,484-     6,706-
 32   24,122          0      1,206       684-        2,168-     8,596-
 33   25,328          0      1,266       852-        3,020-    10,714-
 34   26,594          0      1,330       983-        4,003-    13,027-
 35   27,924          0      1,396     1,177-        5,180-    15,600-
 36   29,320          0      1,466     1,393-        6,572-    18,459-

                                                    Accum       Net
Age   Salary      Saved   Borrowed   Interest      Interest    Savings
===   ======      =====   ========   ========      ========    =======
 37   30,786          0      1,539     1,632-        8,204-    21,630-
 38   32,325          0      1,616     1,897-       10,101-    25,143-
 39   33,942          0      1,697     2,029-       12,130-    28,869-
 40   35,639      1,782          0     2,048-       14,178-    29,135-
 41   37,421      1,871          0     2,061-       16,239-    29,325-
 42   39,292      1,965          0     1,871-       18,111-    29,232-
 43   41,256      2,063          0     1,858-       19,969-    29,027-
 44   43,319      2,166          0     1,837-       21,806-    28,699-
 45   45,485      2,274          0     1,807-       23,614-    28,232-
 46   47,759      2,388          0     1,768-       25,381-    27,612-

================== John Q. Jones -- Case # 2 ==================

                                                    Accum       Net
Age   Salary      Saved   Borrowed   Interest      Interest    Savings
===   ======      =====   ========   ========      ========    =======
 47   50,147      2,507          0     1,717-       27,098-    26,821-
 48   52,655      2,633          0     1,480-       28,579-    25,669-
 49   55,287      2,764          0     1,402-       29,981-    24,306-
 50   58,052      2,903          0     1,310-       31,291-    22,714-
 51   60,954      3,048          0     1,204-       32,494-    20,870-
 52   64,002      3,200          0     1,081-       33,575-    18,751-
 53   67,202      3,360          0       923-       34,499-    16,314-
 54   70,562      3,528          0       767-       35,266-    13,553-
 55   74,090      3,705          0       591-       35,857-    10,440-
 56   77,795      3,890          0       393-       36,250-     6,943-

                                                    Accum       Net
Age   Salary      Saved   Borrowed   Interest      Interest    Savings
===   ======      =====   ========   ========      ========    =======
 57   81,685      4,084          0       172-       36,421-     3,030-
 58   85,769      4,288          0        63        36,359-     1,321
 59   90,057      4,503          0       291        36,067-     6,115
 60   94,560      4,728          0       542        35,525-    11,386
 61   99,288      4,964          0       817        34,708-    17,167
 62  104,253      5,213          0     1,119        33,589-    23,499
 63  109,465      5,473          0     1,449        32,140-    30,421
 64  114,938      5,747          0     1,808        30,332-    37,976
 65  120,685      6,034          0     2,201        28,131-    46,211
```

Figure 2 continues

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Figure 2 continued

```
================== John Q. Jones -- Case # 2 ==================

Ratios:
======
  Net accumulated as percent of total salary              2.0  %
  Interest as per cent of net accumulated                60.9- %
  Ending salary as percent of beginning                 670.5  %
  Net savings first achieved at age                          58

Summary:
=======
  Total salary                                        $2,283,110
  Net interest                                        $   28,131-
  Net accumulated                                     $   46,211
```

Figure 3

```
Case Description:
Same as Case #1, but start out $40,000 in debt

================== John Q. Jones -- Case # 3 ==================

Age at beginning of analysis                                  27
Age at retirement                                             65
Salary at age 26                                      $   18,000
Net savings at age 26 (- if net loans)                $  -40,000
Per cent annual rate of growth of salary                       5
Per cent of salary saved                                       5
Age at which savings begin                                    27
Age at which savings end                                      65
Per cent of salary borrowed                                    0

Per cent taxable return on investments                        10
Per cent deductible interest on loans                         12


================== John Q. Jones -- Case # 3 ==================

                                                Accum       Net
Age  Salary     Saved  Borrowed  Interest  Interest    Savings
===  ======     =====  ========  ========  ========    =======
 27  18,900       945         0     3,562-    3,562-     42,617-
 28  19,845       992         0     3,796-    7,358-     45,421-
 29  20,837     1,042         0     4,047-   11,405-     48,426-
 30  21,879     1,094         0     4,317-   15,722-     51,649-
 31  22,973     1,149         0     4,606-   20,328-     55,106-
 32  24,122     1,206         0     4,916-   25,243-     58,816-
 33  25,328     1,266         0     5,248-   30,492-     62,798-
 34  26,594     1,330         0     5,311-   35,803-     66,779-
 35  27,924     1,396         0     5,649-   41,452-     71,032-
 36  29,320     1,466         0     6,010-   47,462-     75,576-

                                                Accum       Net
Age  Salary     Saved  Borrowed  Interest  Interest    Savings
===  ======     =====  ========  ========  ========    =======
 37  30,786     1,539         0     6,397-   53,859-     80,434-
 38  32,325     1,616         0     6,431-   60,290-     85,249-
 39  33,942     1,697         0     6,818-   67,108-     90,369-
 40  35,639     1,782         0     7,229-   74,337-     95,816-
 41  37,421     1,871         0     7,666-   82,003-    101,611-
 42  39,292     1,965         0     8,131-   90,134-    107,778-
 43  41,256     2,063         0     7,992-   98,126-    113,707-
 44  43,319     2,166         0     8,433-  106,559-    119,974-
 45  45,485     2,274         0     8,898-  115,457-    126,597-
 46  47,759     2,388         0     8,496-  123,953-    132,705-

================== John Q. Jones -- Case # 3 ==================

                                                Accum       Net
Age  Salary     Saved  Borrowed  Interest  Interest    Savings
===  ======     =====  ========  ========  ========    =======
 47  50,147     2,507         0     8,906-  132,858-    139,103-
 48  52,655     2,633         0     9,335-  142,193-    145,805-
 49  55,287     2,764         0     9,784-  151,977-    152,825-
 50  58,052     2,903         0    10,255-  162,231-    160,177-
 51  60,954     3,048         0     9,616-  171,848-    166,746-
 52  64,002     3,200         0    10,009-  181,857-    173,555-
 53  67,202     3,360         0    10,416-  192,273-    180,610-
 54  70,562     3,528         0    10,837-  203,110-    187,920-
 55  74,090     3,705         0    11,274-  214,384-    195,489-
 56  77,795     3,890         0    11,496-  225,880-    203,095-
```

Figure 3 continues

If Jones' initial debt were $20,000 instead of $40,000, his savings will be enough to cover the interest and make a dent in the debt. Even in this case, debt continues to increase until he is 41, and he is not in the black until he reaches the age of 58. An assumption of a bigger starting salary, or of faster salary growth, would make the picture much brighter. For example, assuming that he starts with $40,000 in debts, but earns salary increases at a 10 percent annual rate instead of five percent, he accumulates $336,262 at age 65. Even in these circumstances, however, his debts continue to increase until he is 41, and he's not in the black until he is 55.

Running the Program

For easier reading, there is only one statement to a program line (see the listing), but you need enter a new line number only when a line number appears in the listing. You may also omit remarks without worrying about undefined-line-number errors.

When you run the program you will be asked for a case number and a case description, so you can differentiate each set of assumptions from others. Then you will be asked to provide assumptions on 15 different variables, as shown below. Default values are read into memory when the program loads; if these are satisfactory, you need only enter N (for no change).

Variables

Enter your name. A default name of John Q. Jones is embedded in the program as the string variable AN. You can change this and other default values by changing line 280.

Enter the beginning age at which the analysis is to start. You'll probably want to use your present age instead of the default value of N1 equals 27.

Enter the age at which the analysis is to end—the default value N2 equals 65.

Enter your salary in the year before the analysis is to begin. The default value of XS is $18,000.

Enter the savings or debts you had at the end of the year in which the analysis begins. That's set up initially as zero (variable XZ).

Enter the compound rate at which your salary will grow, now set as five percent (XG equals 0.05).

Enter the proportion of your salary that you intend to save, in years in which you are able to save. The default value is also 5 percent (XV equals 0.05).

Enter the age at which you will begin saving. It's now set at 27 (NV equals 27), the year in which the analysis begins.

Enter the age after which you will stop saving. It's set initially at 65 (NE equals 65).

Enter the proportion of your salary that you plan to borrow in years in which you will be borrowing. XB is set initially at zero.

Enter the ages at which you will start and stop borrowing. The initial values are NB equals 27 and NF equals 65. They have no effect if the proportion borrowed remains at zero and there is no initial debt.

Enter the rate of interest you will receive

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Figure 3 continued

```
 Age   Salary      Saved   Borrowed   Interest   Accum Interest   Net Savings
 ===   ======      =====   ========   ========   ==============   ===========
  57   81,685      4,084          0     11,941-        237,821-       210,952-
  58   85,769      4,288          0     12,400-        250,220-       219,063-
  59   90,057      4,503          0     12,874-        263,094-       227,434-
  60   94,560      4,728          0     13,362-        276,456-       236,068-
  61   99,288      4,964          0     13,866-        290,323-       244,970-
  62  104,253      5,213          0     14,385-        304,708-       254,143-
  63  109,465      5,473          0     14,920-        319,628-       263,590-
  64  114,938      5,747          0     15,471-        335,099-       273,313-
  65  120,685      6,034          0     16,037-        351,135-       283,316-


================== John Q. Jones -- Case # 3 ==================

Ratios:
======
  Net accumulated as percent of total salary                  12.4- %
  Interest as per cent of net accumulated                     123.9  %
  Ending salary as percent of beginning                       670.5  %
  No savings achieved by age                                      65

Summary:
=======
  Total salary                                          $2,283,110
  Net interest                                          $  351,135-
  Net accumulated                                       $  283,316-
```

Program Listing

```
100 '    ****************************
110 '    ****************************
120 '    ******** FINMOD/BAS ********
130 '    ****************************
```

Program continues

on savings. The default value of variable XI is set at 0.10, or 10 percent.

Is interest taxable? There is no default value here. You must respond Y or N when asked.

Enter the rate of interest you will pay on money borrowed. The default value of variable XB is 12 percent (0.12). This assumption has no effect unless there are debts.

Is the interest tax deductible? As in the case of return on savings, there is no default value.

When your entries are complete, the program automatically computes the projected results and then displays them one CRT page at a time. You can press P (for print) to obtain a printout of any display, or press any other key to continue without printing.

Modifying the Program

I use a crude estimate of the effects of income tax. You may want to improve it. Income tax effects are figured in lines 480–520. Income is figured as current salary, plus or minus interest paid or received in the preceding year, minus 10 percent of salary in excess of $20,000 (on the assumption that itemized deductions will approximate that 10 percent of salary). Taxes on interest income (and tax savings on interest expense) are figured at the marginal tax rate set for joint returns in 1981. Exemptions, state taxes, and taxes on long-term capital gains are not considered.

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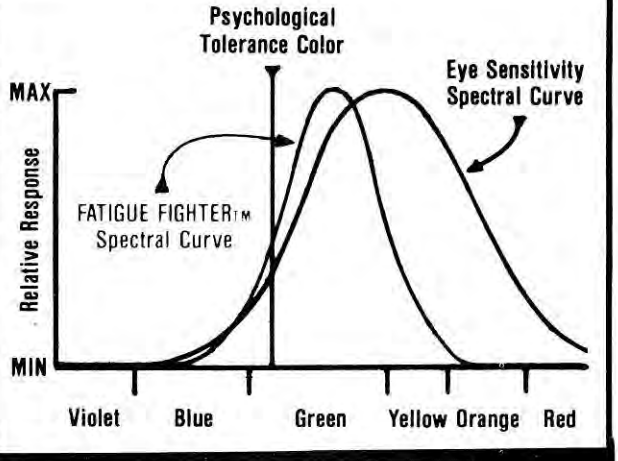

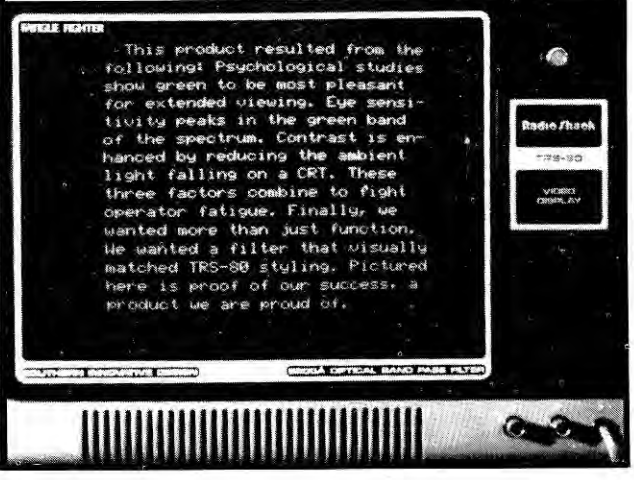

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Keough plans are limited to 15 percent of salary (with exceptions) and IRAs to amounts between $2,000-$4,000. There are no such limits in the model, and you may want to build them in, or provide for automatic projection of the results of such plans.

There is no estimate of the tax effect on salary, and thus no estimate of after-tax income. If you provide these latter data, you may wish to calculate and print the total taxes paid each year and in total.

Inflation effects can be approximated in the model (by using higher rates of growth for salary, for example). Continued inflation will probably mean lower tax rates on the same number of dollars, as Congress reacts to its constituents' complaints about bracket creep. In addition, if you revise the model to calculate the effects of an IRA or Keough plan, you may wish to take into account the likelihood of higher limits on the amounts you may put aside. You may also want to deflate the projection of accumulated savings to reflect inflation's effect on the buying power of your savings.

Remember, this is a very unsophisticated model, with important limitations. Life doesn't work out in so orderly a fashion as is assumed here. There will be financial emergencies, and there may be windfalls. Continuous saving is one thing to project and quite another thing to accomplish in the real world. Nevertheless, the results are worth thinking about in planning your own financial future.■

Program continued

```
140 '     ********* 01/05/82 *********
150 '     ****************************
160 '     ****** Copyright 1982 ******
170 '     *** Robert C. Montgomery ***
180 '     ****************************
190 '
200 CLEAR1000:CLS:PRINT@412,"FINMOD/BAS":DEFSTRA-B:DEFINTC-W:DEF
FNA(I)=STRING$(I,61):DIMXS(100),XV(100),XP(100),XT(100),XI(100),
XB(100),XX(100),XY(100)
210 ''''' ROM screen print routine, lower case
220 DEFUSR0=473:POKE16409,0
230 ''''' Check printer status
240 IFPEEK(14312)>127P=960:A="Printer not on line -- proceed (Y/
N)?":GOSUB390:IFA="y"ORA="Y"THENLP=1ELSEIFA="n"ORA="N"THEN1560EL
SEGOSUB360:GOTO240
250 ''''' Read tax table
260 FORI=1TO10:READXA(I):XA(I)=XA(I)/100:NEXT:FORI=1TO10:READXC(
I):XC(I)=XC(I)*100:NEXT:DATA16,18,21,24,28,32,37,43,49,50,55,76,
119,160,202,246,299,352,458,600
270 ''''' Read default assumptions and specs
280 READAQ,AN,N1,N2,XS,XZ,XG,XV,NV,NE,XP,NB,NF,XI,XB:DATA"Lifelo
ng savings at 5%, 10% taxable return, no loans",John Q. Jones,27
,65,18000,0,.05,.05,27,65,0,27,65,.1,.12
290 GOTO560
300 ''''' Paging for 66 line pages
310 IFPEEK(16425)>47THENFORI1=1TO66-PEEK(16425):LPRINT" ":NEXT:P
P=1:POKE16425,0:RETURNELSERETURN
320 IFLPTHENRETURNELSEX=USR0(X):RETURN
330 ''''' Erase screen not desired in print
340 IFPEEK(16425)ANDPP=0PRINT@0,CHR$(30);:PRINT@64,CHR$(30);
350 PRINT@960,CHR$(30);:RETURN
360 PRINT@P,CHR$(31)"Please try again";:FORI1=1TO500:NEXT:PRINT@
P,CHR$(30);:RETURN
370 PRINT@960,"Press 'P' to print, any key to continue";
380 A=INKEY$:IFA=""THEN380ELSERETURN
390 PRINT@P,CHR$(30)A" ===> ";:GOTO380
400 A=" "+A+" ":A=FNA(32-LEN(A)/2)+A+FNA(32-LEN(A)/2):GOTO410
410 PRINT@P,CHR$(30)A;:A="":RETURN
```

Program continues

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Program continued

```
420 Q=0:R=0:K=LEN(A):GOSUB410:PRINT" now "AB" ==> ";:AA="":LINEI
NPUTAA:IFAA=""THENR=1:RETURNELSEIFAA="n"ORAA="N"THENQ=1:RETURNEL
SEPRINT@P+K,CHR$(30);:X=VAL(AA):RETURN
430 PRINT@P+K,CHR$(30):PRINT@P+63-LEN(AA),AA;:RETURN
440 PRINT@P+K,CHR$(30):PRINT@P+53,USING"$#,###,###";X;:RETURN
450 PRINT@960,"Enter 'N' if no change";:RETURN
460 ''''' Compute tax rate on salary less 10% of amt > $20000
470 ''''' plus or minus interest
480 XQ=XS(I):IFXQ>2E4XQ=2E4+.9*(XQ-2E4)+XV(I-1)
490 YA=0:FORJ=10TO1STEP-1:IFXQ>XC(J)THENYA=1-XA(J):J=0
500 NEXT:IFLEFT$(AT,1)="n"THENYC=1ELSEYC=YA
510 IFLEFT$(AD,1)="n"THENYB=1ELSEYB=YA
520 RETURN
530 '
540 ''''' Input case description and assumptions
550 P=960:A="Repeat display, next case or quit (R, N or Q)?":GOS
UB390:IFA="q"ORA="Q"THEN1560ELSEIFA="r"ORA="R"THENK7=1:GOTO1290E
LSEIFA<>"n"ANDA<>"n"GOSUB360:GOTO550
560 CLS:PRINTFNA(19)" Case description "FNA(19):GOSUB450
570 P=128:A="Case number now"+STR$(C+1):GOSUB410:PRINT@173,"New:
 ";:A="":INPUTA:IFA="n"ORA="N"THEN580ELSEC=VAL(A)-1:IFC<0ORC>1E3
GOSUB360:GOTO570
580 PRINT@139,CHR$(30)TAB(55)C+1;
590 P=256:A="Case description now:":GOSUB410:A=AQ:P=320:GOSUB410

600 P=448:A="New (<64 characters): ":GOSUB410:PRINT@512,"?";:A="
":LINEINPUTA:IFA="n"ORA="N"THEN610ELSEIFLEN(A)>63THENGOSUB360:GO
TO600ELSEAQ=A
610 P=512:A=AQ:GOSUB410
620 P=960:A="Corrections (Y/N)?":GOSUB390:IFA="y"ORA="Y"THEN560E
LSEIFA<>"n"ANDA<>"N"GOSUB360:GOTO620
630 POKE16425,0:C=C+1:P=0:CLS:A="Assumptions":GOSUB400:IFAN<>""G
OSUB450
640 ''''' Name
650 P=128:AB=AN:A="Name (<31 characters)":GOSUB420:IFQTHENAA=AN:
GOTO660ELSEIFRORLEN(AA)>30THENGOSUB360:GOTO650ELSEAN=AA
660 A=AA+" -- Case #"+STR$(C):P=0:GOSUB400
670 ''''' Age
680 P=128:AB=STR$(N1):A="Age at beginning of analysis":GOSUB420:
IFQTHENAA=AB
690 GOSUB430:IFQ=0N1=X:IFRORN1<1ORN1>100GOSUB360:GOTO680
700 P=192:AB=STR$(N2):A="Age at retirement":GOSUB420:IFQTHENAA=A
B
710 GOSUB430:IFQ=0N2=X:IFRORN2<N1ORN2>100GOSUB360:GOTO700
720 ''''' Salary
730 P=256:AB=STR$(XS):A="Salary at age"+STR$(N1-1):GOSUB420:IFQT
HENX=XS
740 GOSUB440:IFQ=0XS=X:IFRORXS<0ORXS>1E6GOSUB360:GOTO730
750 P=320:AB=STR$(XZ):A="Net savings at age"+STR$(N1-1)+" (- if
net loans)":GOSUB420:IFQTHENX=XZ
760 GOSUB440:IFQ=0THENXZ=X:IFABS(XZ)>1E7GOSUB360:GOTO750
770 P=384:AB=STR$(XG*100):A="Per cent annual rate of growth of s
alary":GOSUB420:IFQTHENAA=AB
780 GOSUB430:IFQ=0XG=X/100:IFRORABS(XG)>1GOSUB360:GOTO770
790 ''''' Savings
800 P=448:AB=STR$(XV*100):A="Per cent of salary saved":GOSUB420:
IFQTHENAA=AB
810 GOSUB430:IFQ=0XV=X/100:IFRORXV<0ORXV>1GOSUB360:GOTO800
820 IFXV=0THEN880
830 P=512:AB=STR$(NV):A="Age at which savings begin":GOSUB420:IF
QTHENAA=AB
840 GOSUB430:IFQ=0NV=X:IFRORNV<N1ORNV>N2GOSUB360:GOTO830
850 P=576:AB=STR$(NE):A="Age at which savings end":GOSUB420:IFQT
HENAA=AB
860 GOSUB430:IFQ=0NE=X:IFRORNE<NVORNE>N2GOSUB360:GOTO850
870 ''''' Borrowings
880 P=640:AB=STR$(XP*100):A="Per cent of salary borrowed":GOSUB4
20:IFQTHENAA=AB
890 GOSUB430:IFQ=0XP=X/100:IFRORXP<0ORXP>1THENGOSUB360:GOTO880
900 IFXP=0THEN960
910 P=704:AB=STR$(NB):A="Age at which borrowing begins":GOSUB420
:IFQTHENAA=AB
920 GOSUB430:IFQ=0NB=X:IFRORNB<N1ORNB>N2GOSUB360:GOTO910
930 P=768:AB=STR$(NF):A="Age at which borrowing ends":GOSUB420:I
FQTHENAA=AB
940 GOSUB430:IFQ=0NF=X:IFRORNF<NBORNF>N2GOSUB360:GOTO930
950 ''''' Return on investment
960 P=832:AB=STR$(XI*100):A="Per cent return on investments":GOS
UB420:IFQTHENAA=AB
970 IFQ=0XI=X/100:IFRORABS(XI)>1GOSUB360:GOTO960
980 IFXI=0THENGOSUB430:GOTO1010ELSEPRINT@960,CHR$(30);:A="Taxabl
e (Y/N)?":GOSUB390:IFA="y"ORA="Y"THENAT="taxable"ELSEIFA="n"ORA=
"N"THENAT="nontaxable"ELSEGOSUB360:GOTO980
990 A="Per cent "+AT+" return on investments":K=LEN(A):GOSUB410:
AA=STR$(XI*100):GOSUB430
1000 ''''' Cost of borrowing
```

Program continues

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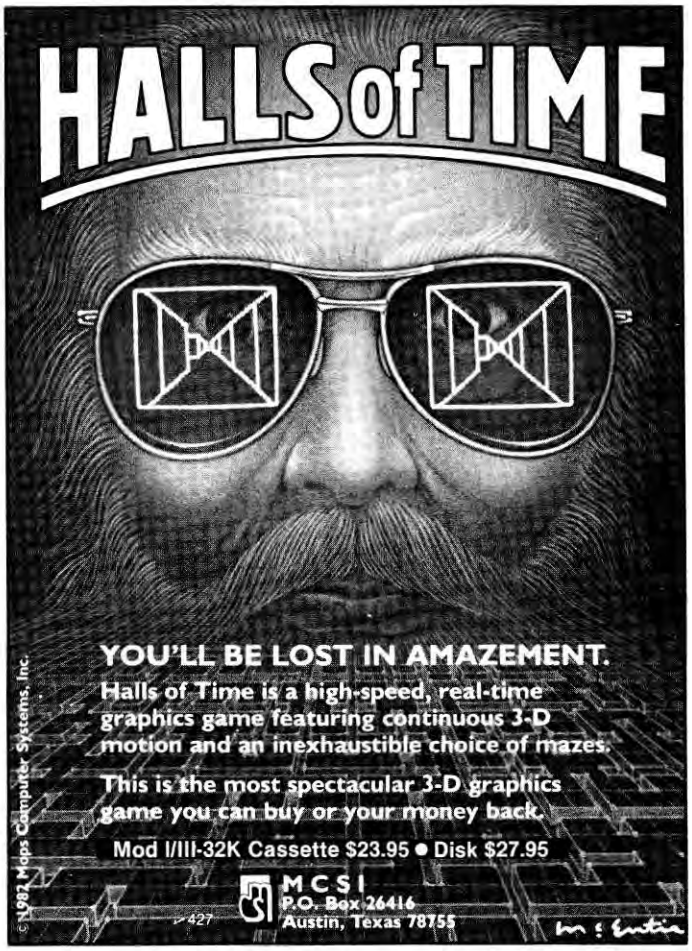

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Program continued

```
1010 GOSUB450:P=896:AB=STR$(XB*100):A="Per cent interest on borr
owings":GOSUB420:IFQTHENAA=AB
1020 IFQ=0XB=X/100:IFRORXB<0ORXB>1GOSUB360:GOTO1010
1030 IFXB=0THENGOSUB430:GOTO1050ELSELPRINT@960,CHR$(30);:A="Tax
deductible (Y/N)?":GOSUB390:IFA="y"ORA="Y"THENAD="deductible"ELS
EIFA="n"ORA="N"THENAD="nondeductible"ELSEGOSUB360:GOTO1030
1040 A="Per cent "+AD+" interest on loans":K=LEN(A):GOSUB410:AA=
STR$(XB*100):GOSUB430:AA=STR$(XB*100):GOSUB430
1050 P=960:A="Corrections (Y/N)?":GOSUB390:IFA="y"ORA="Y"THENC=C
-1:GOTO630ELSEIFA<>"n"ANDA<>"N"GOSUB360:GOTO1050
1060 '
1070 ''''' Print heading and case assumptions
1080 GOSUB370:IFA="p"ORA="P"THENLPRINT" ":LPRINTTIME$:LPRINT" ":
LPRINT"Case Description:":LPRINTAQ:LPRINT" ":GOSUB350:GOSUB310:G
OSUB320
1090 A="Computing":P=960:GOSUB410:X=0:XT(0)=XZ:XS(0)=XS:FORI=1TO
N2-N1:XS(I)=0:XV(I)=0:XT(I)=0:XP(I)=0:XX(I)=0:XY(I)=0:XB(I)=0:XI
(I)=0:NEXT
1100 '
1110 ''''' Compute
1120 FORI=1TON2-N1+2
1130 ''''' Salary
1140 XS(I)=XS(I-1)*(1+XG):X=X+XS(I):XT(I)=XT(I-1)
1150 ''''' Savings
1160 IFI>NV-N1ANDI<=NE-N1+1XI(I)=XS(I)*XV:XT(I)=XT(I)+XI(I):XX(I
)=XX(I)+XI(I)
1170 ''''' Borrowings
1180 IFI>NB-N1ANDI<=NF-N1+1XB(I)=XS(I)*XP:XT(I)=XT(I)-XB(I):XY(I
)=XY(I)+XB(I)
1190 ''''' Interest income or expense
1200 GOSUB480:IFXT(I)<0THENXV(I)=XT(I)*XB*YB:ELSEXV(I)=XT(I)*XI*
YC
1210 ''''' Accumulation after tax
1220 XT(I)=XT(I)+XV(I):XP(I)=XP(I-1)+XV(I)
1230 NEXT
1240 '
1250 '
1260 ''''' Print
1270 '
1280 ''''' New page
1290 IFK7POKE16425,19:K7=0
1300 PP=1:K=0:CLS
1310 ''''' Heading
1320 P=0:A=AN+" -- Case #"+STR$(C):GOSUB400:IFR1THENRETURNELSEPR
INT@173,"Accum"TAB(57)"Net":PRINT"Age"TAB(5)"Salary"TAB(16)"Save
d"TAB(23)"Borrowed"TAB(33)"Interest"TAB(43)"Interest"TAB(55)"Sav
ings
1330 PRINT"==="TAB(5)FNA(6)TAB(16)FNA(5)TAB(23)FNA(8)TAB(33)FNA(
8)TAB(43)FNA(8)TAB(55)FNA(7):IFRRRRETURN
1340 ''''' Lines
1350 FORI=1TON2-N1+1
1360 PRINTUSING"### ###,### #,###,### #,###,### #,###,###-#,###,
###- #,###,###-";I+N1-1,XS(I),XI(I),XB(I),XV(I),XP(I),XT(I)
1370 ''''' New CRT page after 10 lines
1380 K=K+1:IFK<10THEN1400ELSEGOSUB370:IFA="p"ORA="P"GOSUB310:GOS
UB340:GOSUB320:PP=0
1390 RR=1:GOSUB1320:RR=0:PRINT@320,CHR$(31);:K=0
1400 NEXT:GOSUB370:IFA="p"ORA="P"GOSUB310:GOSUB340:GOSUB320:PP=1

1410 CLS:R1=1:GOSUB1320:R1=0
1420 ''''' Ratios
1430 A="####.#- %":K=N2-N1+1:IFXS(K)>0PRINT@128,"Ratios:":PRINTF
NA(6):PRINT"  Net accumulated as percent of total salary";TAB(54
)USINGA;100*XT(K)/X
1440 IFXY(K)<>0PRINT"  Investment as percent of borrowings"TAB(5
4)USINGA;100*XX(K)/XY(K)
1450 IFXT(K)<>0PRINT"  Interest as per cent of net accumulated"T
AB(54)USINGA;100*XP(K)/XT(K)
1460 IFXS(0)>0PRINT"  Ending salary as percent of beginning"TAB(
54)USINGA;100*XS(K)/XS(0)
1470 KB=0:FORI=1TON2-N1+1:IFXT(I)>XZANDXT(I)>0KB=I:I=100
1480 NEXT:IFKB=0THENAA="No savings achieved by age":N=N2ELSEAA="
Net savings first achieved at age":N=KB+N1-1
1490 PRINT"  ";AATAB(60)USING"###";N
1500 PRINT:PRINT"Summary:":PRINTFNA(7):PRINT"  Total salary"TAB(
53)USING"$#,###,###-";X;:PRINT"  Net interest"TAB(53)USING"$#,##
#,###-";XP(N2-N1+1);:PRINT"  Net accumulated"TAB(53)USING"$#,###
,###-";XT(N2-N1+1)
1510 GOSUB370
1520 IFA="p"ORA="P"GOSUB310:GOSUB350:GOSUB320:FORI=1TO66-PEEK(16
425):LPRINT" ":NEXT
1530 POKE16425,0:PP=1:GOTO550
1540 '
1550 ''''' Exit
1560 P=960:A="OK to quit (Y/N)?":GOSUB390:IFA="y"ORA="Y"THENCLS:
ENDELSEIFA="n"ORA="N"THEN550ELSEGOSUB360:GOTO1560
```

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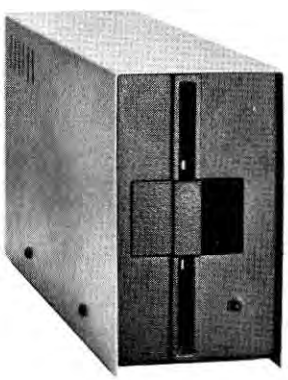

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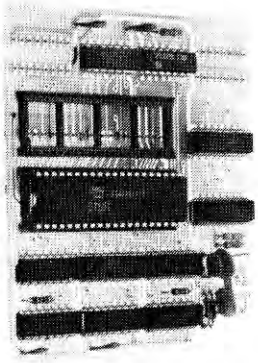

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If you have the yen for state-of-the-art hardware, here's a machine for you.

QCS Hard Disk

QuCeS Hard Disk Sub-system
Quality Computer Services
178 Main Street
Metuchen, NJ 08840

by G. Michael Vose
80 Micro staff

The technological evolution of data-storage devices for microcomputers has seen the development of tape-based units, which evolved into string-floppy devices, then to single-density floppy disks, to double-density floppy disks—and now to hard disks. Video disks are on the immediate horizon but what the future will bring after that is open to speculation.

The amazing thing about the evolutionary stages of a new technology is that, as you become accustomed to a new level of machinery, you can't imagine how you ever got along without it. When you move up from tape to floppy disks, for example, you will not consider moving back.

But if you plan to make the move up to hard disks, be prepared to pay the price!

What is a Hard Disk?

A hard disk is made of a rigid material, usually a lightweight metal like aluminum, and coated with a metal oxide in the same manner as the Mylar plastic used to make tapes and floppy disks. The coated disk is then mounted and sealed into a drive mechanism, which in turn is placed inside a protective outer housing. It can now be used in the same manner as a tape or floppy disk for storing magnetically encoded information.

The main difference between a hard disk and a standard floppy disk is that the hard disk rotates at much higher speeds and holds much more information. Because the disk rotates at a higher speed, typically around 3,600 revolutions per minute (rpm), hard disks have faster access times than floppy disks. The read/write head does not physically touch the surface of the disk, as in floppy-disk operation, because the high rpms would remove the disk's oxide coating. But the head does ride very close to the surface to enable the digital information to be tightly packed on the disk, or platter as it is referred to by the manufacturers. Hard-disk platters are usually either 5.25, 8, or 14 inches in diameter.

The heads that read and write the information on the platters are slightly different than those used in floppy-disk drives. Using technology originally developed by IBM, the close read/write head to disk surface tolerance is possible because the platters are sealed to prevent even the most minute contaminant particles from entering the mechanism. To prevent head travel across the platter, the heads read and write on both sides of a platter at once—the top of the platter and the bottom are seen as one continuous data-storage area. The QCS hard disk drive uses two platters with a total of four surfaces that comprise the record storage area. This storage area is called a cylinder.

The unique head design and sealed-platter arrangement of hard disks is commonly called Winchester technology. The name is derived from the earliest hard-disk design, which foresaw storage capacities of 30 megabytes on 30 tracks; this 30/30 arrangement reminded someone of a Winchester rifle, commonly called a 30/30, and the associative name stuck.

Hard disks come in a wide variety of sizes. The smallest hard disks hold about 5 million characters of digital information. One million characters, or bytes, is a megabyte. These smaller units hold, therefore, 5 megabytes of information. From there, the sizes go up to 8 megabytes, 10, 12, 15, 20 megabytes, and eventually to as high as 80 megabytes. Microcomputer hard disks seldom hold more than 20 megabytes.

Hard disks cost from $2,000 to $8,000, but these prices are changing rapidly with increased competition and advances in design and manufacturing techniques.

The QCS Hard Disk System

My introduction to the world of hard disks came from Quality Computer Services of Metuchen, NJ. They manufacture a variety of hard-disk units. I reviewed the DSK52—5-inch MiniScribe Hard Disk, which is available for the Models I and III. For $3,195, you receive a cabinet containing all the hardware (drive mechanism, platters, motors, power supply, and cooling fan), a cable, and one of two operating systems on a floppy disk. The standard unit uses floppy disks for back-up, but QCS will have an optional 10-megabyte tape-drive back-up in the same cabinet available by the fourth quarter of this year (for another $2,400).

The available operating systems are Micro-System Software's DOSPLUS 4.0/g, which comes with a full operating system plus utilities and manual, or Logical Systems Inc.'s LDOS. The free LDOS system comes with hard-disk drivers only—the buyer must already have purchased LDOS separately—and DOSPLUS costs an extra $225.

In addition, Quality Computer Services provides a manual with installation instructions for LDOS plus hardware technical specifications for the advanced Assembly-language programmer. The hardware is warranteed for 12 months. QCS will not war-

ranty the software and cannot offer recompense for any data lost due to equipment failure. (In other words, do not neglect the importance of making back-up copies of all data files!)

I tested the system using both operating systems. Each works well and I won't discuss their respective merits. The operating systems have two major differences—LDOS was the easier of the two to install but DOSPLUS ran slightly faster.

One of the major advantages of a hard-disk system is that it is substantially faster than floppy disks and this was evident no matter which operating system I used.

The first noticeable difference between a hard-disk and a floppy-disk system is sound—a minor, but psychologically significant difference. One who is used to the whirring and clanking of floppy disks will be amazed, and possibly put off, by the almost total absence of sound generated by the hard disk. Other than the steady white noise sound made by the cooling fan, there is hardly a sound from the hard disk when it reads and writes information.

Next comes the most startling discovery of all. The first time you perform a series of read and write operations, you will be astounded at how quickly they take place. Floppy disks will seem slow once you've seen a hard disk move data. The QCS hard disk can move data at the rate of 5 megabits per second!

And all that room! Imagine reading a directory and finding 5000K free on each of two hard-disk platters. I determined that the QCS 10-megabyte drive will hold the information on 45 double-density or 125 single-density disks! I have trouble imagining just how much information that is.

Software Compatibility

Most of your current software will work just fine using a hard disk. The only exceptions are programs such as Adventure International's data-base manager called Maxi-Manager or Radio Shack's Profile. This software has routines that call specific disk drives and will not run on the hard disk. Adventure International is reportedly developing a hard-disk version of Maxi-Manager.

Evaluation

The QCS hard disk performed flawlessly in the two months I tested it. The manual contains step-by-step instructions to install the hardware, which involves plugging in the power cord and attaching a cable to the Model III's 50-pin edge connector, and to install the LDOS driver programs. I had the system up and running in less than half an hour.

Both operating systems require you to engage a specially configured floppy disk when you first turn the system on. The hard disk then becomes the master drive, and all operations originate with hard-disk pseudo-drive number 4. (The LDOS system actually makes the hard-disk platters function as drives 0 and 1, while DOSPLUS calls them drives 4 and 5.)

The only serious omission in the manual was a mention of the fact that a hard-disk unit takes about a minute to warm up, obtain the necessary rpm, and stabilize. Any attempts to load an operating system loader before the drive is ready causes an error. This caused some consternation on my part for a day or two until I learned of this peculiarity of hard-disk units.

DOSPLUS installation is a little more difficult than LDOS installation only because the DOSPLUS manual contains the instructions in separate places throughout its pages. You must use the HFORMAT, SYSGEN, TRANSFER and CONFIG commands of DOSPLUS to install the system. It all requires a bit of study before you get it right.

DOSPLUS has a utility that lets you use floppy disks as the back-up media for the hard disk. In a remarkably short time all your data files can be placed on one or more floppy disks. This special back-up routine works so you need only remember on which disk you placed the end of the backed-up file; all other disks can be read in any order and the data will be placed on the hard disk in the correct order.

A Matter to Ponder

It is nice to be able to run your programs one after the other without having to remember which disk you stored them on. After all, on the hard disk you can store hundreds. The fast access time is also convenient. But the question occurs—is it necessary? Especially at $3,195?

While I enjoyed the increased speed of the hard disk, I admit I don't need it. When working with data files of less than 32K, word processing files, or even Basic programs, the increase in speed is merely a minute or two per work session. However, I was able to appreciate just how much time *could* be saved in a business setting where large amounts of data were stored, updated, and accessed.

A problem generic to all hard disks is their unwieldy directories. After you have put 50 or more files on a platter, the directory gets mighty hard to read. DOSPLUS thoughtfully provided a solution to this problem by including on the operating system disk a Basic program to alphabetize your directories. This still leaves you with large directories to mull over, but at least you can more easily find a particular entry.

Another advantage of hard disks is that they will extend the life of your floppy-disk drives (which tend to be the most troublesome component of most microcomputer systems).

The QCS hard disk performs as advertised. Since there are versions for all major microcomputers, QCS equipment will no doubt become quite popular. This is good news for potential customers because it means service, if and when necessary, should be easy to obtain.

If you've got mountains of data, or mountains of money and a yen for state-of-the-art hardware, here's a new machine to solve your problem. ■

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This TRS-80 improved production-line efficiency.

Industry Saver

by Kerry Leichtman
80 Micro *staff*

In the movie, *The Graduate*, Dustin Hoffman, uncomfortably cradled in the armpit of a relative, was pulled aside and given some sound business advice. "Plastics," he was told, "Plastics." Hoffman's reply was a hesitant, "What?", to which he was answered with the same whispered word: "Plastics."

The 1966 world was discovering plastics. Had Hoffman played his cards right he would have ended the movie a millionaire rather than the back leg of a lover's triangle. But that was 1966. The 1980s, while as plastic dependent as ever, require more than a college degree, a comfortable armpit, and the desire to be rich. The plastics manufacturer of today needs consumer savvy and a good computerized production-monitoring system.

Manufacturing plants attempt the difficult balance of stamping out product after product after product, and maintaining enough worker enthusiasm to keep production levels profitable. For the most part, the attempts, while well intentioned, don't work.

The difference between doing business and filing Chapter 11 is plant efficiency. Efficiency is what computers are best suited for. Although the need has been great, the clamor to create computerized monitoring devices has been an underinspired rumble.

Systems now available to the industry range in cost from $86,000 to $150,000, according to William Davis of the Davis Core and Pad Company in Cave Spring, GA. Davis couldn't afford IBM's price, nor could he continue doing business as usual.

Forewarned by the demise of fellow manufacturers, he developed a monitoring system, based on TRS-80 microtechnology, that keeps track of every possible aspect of his business from product assembly to machine down-time to inventory stocks and accounts receivable. Although the project's development eventually cost Davis more than the low-end, he hopes to make his money back by offering the complete monitoring system to other plant manufacturers for only $20,000.

Davis is not exactly a crusader, but one of the reasons he is offering this computer system to other manufacturers, competitors included, is to keep his type of business from going the way of dinosaurs and mainframes. "People are going under all around me; it hurts to hear of someone else closing their door because they couldn't afford the help they needed."

The nerve center of Davis' operation is a smart box capable of monitoring 48 production machines or 160 production areas. The box is Z80-based (convertible to Z80A) and has full communication capabilities with the office Model III through an RS-232 port.

The box was conceived and developed by Ed Castro of Precision Medical Products in Atlanta, GA. Each circuit board has eight 28-pin memory sockets configured to accept 2732, 2764, 6116, or the new 8K-byte CMOS RAM 6262 memory chips.

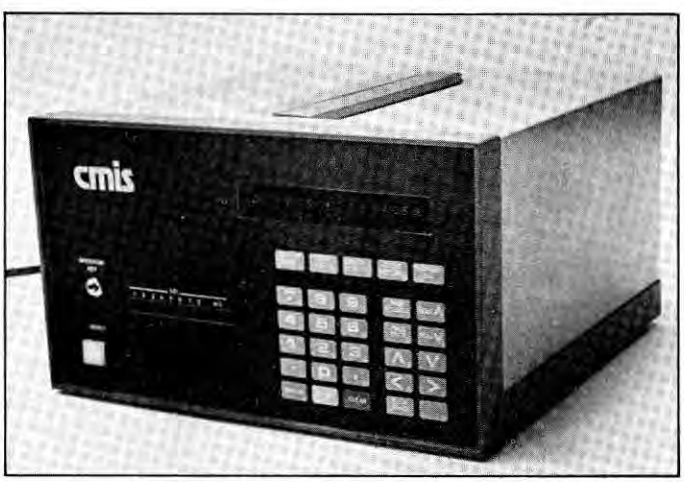

Photo 1. Z80 smart box

Photo 2. Davis communicating with the smart box through his office computers.

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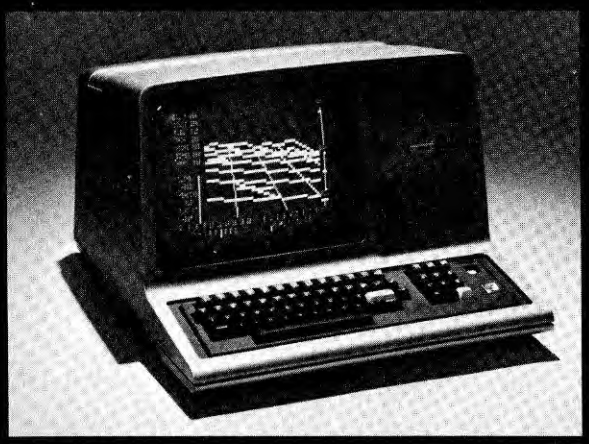

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Aging Report 01/31/82 Page 1

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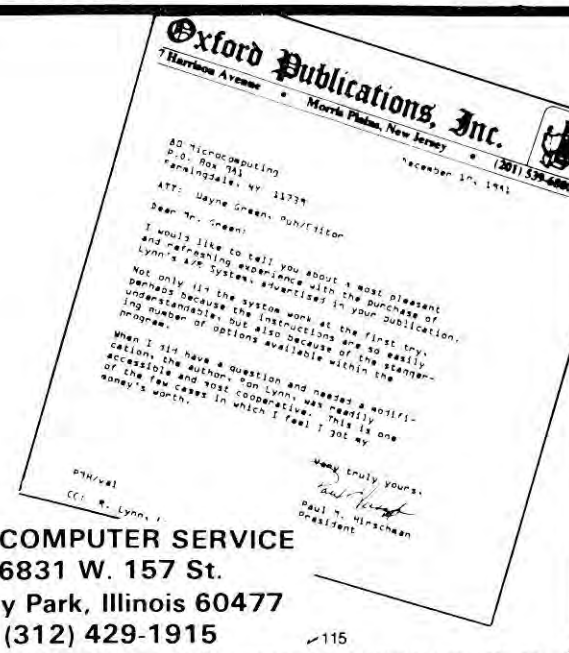
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The memory board has a slot for an additional CRT controller, memory mapped to start at F000, setting aside 4K for the CRT. An additional 512 bytes are set aside for control of the real-time clock and a 76489 sound chip. The CMOS real-time clock runs off a lithium battery. With it, the operator never has to enter the time and date. On cold starts or in the case of power shutdowns, the clock won't miss a beat, ensuring accurate records and data loads.

Castro chose the lithium battery because of its dependability. "The lithium battery is a new device," Castro explained. "Most lithium cells have a three-year shelf life. These are totally sealed and have a 10-year shelf life. That doesn't mean it'll last 10 years in the system, but it will be very dependable. It backs up all memory and the real-time clock."

Castro and Davis' smart box uses a 16-character alphanumeric display with a 30-character membrane keyboard. The standard unit has one I/O board. But the unit is capable of handling any number of additional boards.

The motherboard uses a Z80 UART capable of handling two asynchronous channels. One channel is dedicated to the host computer by way of either an RS-232 or 20-milliamp consoles, which are jumper selectable. The other channel is printer or modem dedicated.

A 76489 sound chip produces audible alarms for every occasion. The programmable chip has a built-in 100-milliwatt audio driver making it capable of a wide variety of sounds.

System operation is fast. Ed Castro explains, "The software was developed by Max Norman, a computer analyst with the Bordon Company, using C, which is very close to machine language. We're running 4K starting at 0 to 0FFF. The rest is CMOS RAM. We're downloading off a disk, from a host computer, the software to run on the system. Any changes that need to be made can be made in the host, recompiled, and loaded down. The system's memory can be either EPROM or RAM or any mix. So it can run as a stand-alone with its own video driver. In that case most of the memory would be EPROM."

While computer enthusiasts might get carried away by the mechanics of the system, the businessman's interests are more likely to be with the printouts.

Printout information is available to Davis at any time. The compiled statistics direct Davis to production problems as they occur. "To duplicate by hand the complexity and accuracy of these printouts would be nearly impossible," Davis said. "And if someone were to attempt it, by the time he figured out where the problem was occurring it would be too late to do anything about it."

The printouts are all menu driven, leaving plant operators free to run their business without having to become computer experts. Printout page categories are broken down into many specific areas. The Part

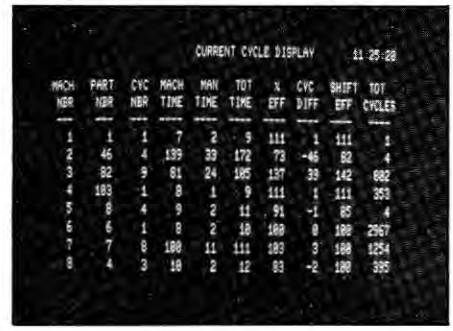


Photo 3. Instant information

Utilization section sets up columns for code number, part name, computer inventory, value of inventory, manual inventory, manual value, variance in inventories, dollar variance, beginning inventory, parts added, parts sold, and ending inventory.

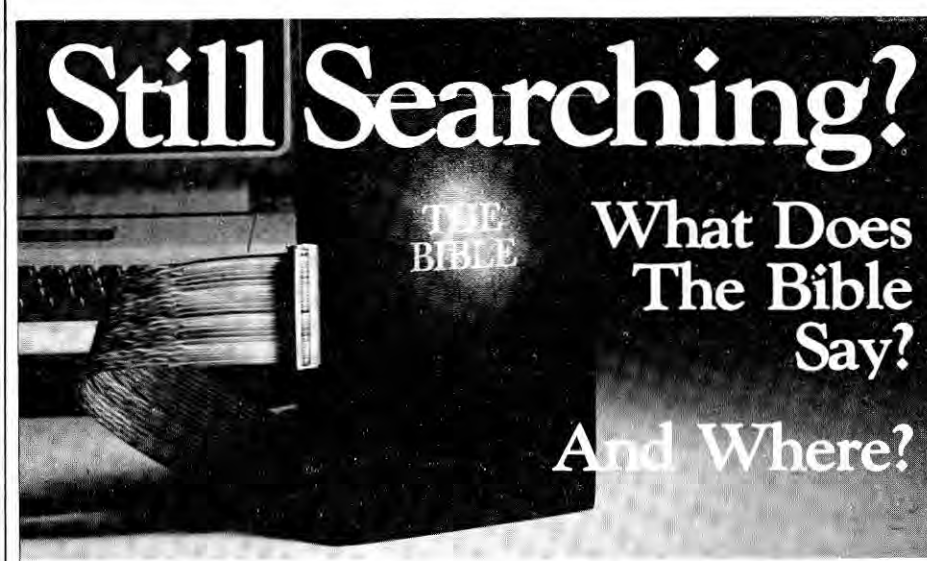
Davis says the key to the system is the accuracy in the inventory count. "For each machine run, you need to input the parts added to inventory and the parts lost. That is the system. If that information is accurate, the rest of the system is accurate," Davis said.

Another page breaks down machine utilization. Each machine is assigned an initial number designation. The page is broken down by shifts: first, second, third, and all shifts combined. Column categories include hours ran, down hours, mold-change time, off hours, and lost dollars. Proper use of this information can inspire unenthused employees to keep their machines productively on-line.

A third aspect of the printed information also stands out as an aid to help the manufacturer better plan his machine-use time and parts inventory. The page, labeled Scheduling by Machine Number, has the following column headings: order number, purchase-order number, part code/description, quantity on order, ship date, machine number/hours, material box/beads, inventory balance, hours needed, and beads needed.

Of course the software also keeps track of accounts payable and receivable, parts inventory, paid invoices, sales histories, product sales, customer sales, material cost records, bank account maintenance, product scheduling, and more.

A successful computerized business application is one that takes a particular business' needs and makes the computer work for it in a way the businessman can easily deal with. Staying ahead in today's economically depressed times is tough enough. William Davis recognized the computer as the difference between continuing to operate and bending to fiscal hard times. Nothing feels more threatening to the businessman than the feeling of things getting out of control. Nothing, then, could be more satisfying than having that control at the touch of a button on a computer keyboard. ■



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CAU's editor/assembler for disk systems.

MZAL

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Computer Applications Unlimited (CAU) made its debut a short time ago with a Basic full screen editor named XBE (see "80 Reviews," November 1981). At the time I said XBE was the best full screen editor for Basic around; that is still true. Now CAU is marketing an editor/assembler, MZAL.

MZAL is for disk systems only. The package includes a thick manual in a large three-ring binder and a disk full of programs, including a full-screen text editor, an assembler, a linking loader, several demonstration programs and a small but useful library of assembler routines.

The Manual

The large manual provides much information. It will not teach you Assembly-language programming, and expects a certain amount of sophistication on your part. Beginners can use it, but they will not appreciate the more advanced features. The manual comes with a Z80 technical manual from Zilog, which covers the commands on the Z80 in detail.

The manual has one glaring problem—no index. The table of contents is good, but an indexed reference is essential. Fortunately, this is the only major error I found in the entire package.

The manual is divided into two sections, since there are now two releases. The first section discusses the changes made to the first release to produce the second release, and the second section covers what you need to know to operate the assembler.

The manual is well printed and easily read. In general, it is also well written and informative.

An MZAL Overview

MZAL stands for Modular Z80 Assembly Language. MZAL is a modular system that promotes modular programming. You write programs using a full screen text editor, assemble them using a separate assembler, and link them together using a separate linking loader. As a result, your Assembly-language programs are limited only by a 30,000-byte symbol table, or on-line disk storage. You can write some mighty big programs even using only one disk drive!

Release 2.0 allows a variety of powerful programming options:

- Changing Assembly source programs from one assembler format to another;
- Eight-character labels;
- Recursive and symbolic substitutive macro constructs;
- Conditional assembly;
- Linking after assembly with linking loader; and
- Specifying ORG of object code linking time.

TXEDIT

The TXEDIT program is a full-screen editor similar to XBE in screen format and command syntax. I greatly prefer full-screen editing to line editing, as it greatly speeds writing and editing programs.

One major difference between TXEDIT and XBE, besides the type of source program, is that XBE supports macro key definitions: A single keystroke can print an entire Basic command. For example, shift, P prints the word print. TXEDIT does not support this feature, presumably because Assembly-language mnemonics for the Z80 are so short. TXEDIT does not take lowercase input. XBE also limits the number of lines you may insert, move or copy between lines. XBE requires that there is room for new line numbers (between the current line and the one following it) with the current increment value. For example, if your current increment value is five you can only put one line between lines 10 and 20. TXEDIT does not have this constraint; you may put as many lines as you like between any other two lines. This feature eliminates the necessity of renumbering your program every time you want to insert 10 lines. Except for these two differences the syntax for TXEDIT and XBE is very similar.

When you execute TXEDIT from DOS, you are asked for the disk file name of the program to edit. If you enter an asterisk (*) instead of a file name, you may start anew. Release 2.0 also allows a warm restart by entering a plus sign (+) for a file name—handy if you have occasional reboots or if you accidentally reenter DOS by using an incorrect command. This is one way around an error in the TXEDIT program. If a DOS error occurs, TXEDIT returns an error number and waits. Then any key returns you to DOS. This is very inconvenient. CAU plans to change this to allow reinput of the file name. Currently, if you try to load a file not on the disk, you must exit to DOS.

Another peculiar error message is DOS ERROR 26H. If you look up in your DOS manual, this is a FILE NOT OPEN error. According to one of the program's authors this means there is insufficient memory space in the text buffer. CAU will correct that confusing error message in their next release. The warm-start option does allow you to recover your text if you rather inconveniently leave the text editor. Version 2.0 also displays the amount of free space left in your text buffer.

TXEDIT loads in your file and presents the first page. You may use the repeating-arrow keys to move the cursor about on the lines. At the far left of the screen, the first five columns are the line numbers of the source file. You can not move the cursor here to directly change them, but you can selectively renumber blocks of lines to move them around in your program.

Interestingly, the line length of source programs is 127 characters. How is this possible on a 64-column screen? Initially, TXEDIT displays the first 64 columns. Shift, right arrow moves the cursor right one tab position and the normal arrow moves it a

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single column position to the right. When you get to the far right of the screen, if you hold down the right arrow key, the text lines all move to the left, showing the hidden characters on the rest of the line. Shift, left arrow places the cursor at the far left of the current display or, if already there and not at the start of the line, it moves back to the first position of the line. The down arrow key advances the cursor to the next line and the up arrow key moves the cursor to the preceding line. Using the shift key with these latter arrow keys advances or backs up a page of programs (about 12 lines). To change a character on a line, simply position the cursor over the offending character and type over it. That is much nicer than the normal line-editing procedures.

To insert a character in a line, press shift, I. The text on the line will move over one space, and a non-flashing cursor will indicate that you are in the insert mode. Type the necessary characters, and press the enter key to get back into the normal non-destructive cursor mode. Pressing enter in the normal mode moves the cursor to the first position of the next line.

To delete a character, position the cursor over the offending character and press shift, D. TXEDIT deletes the character and the rest of the text on the line moves over to take up the space. This is an auto-repeating function. The manual includes instructions on adjusting the repeat speed of this or any other auto-repeating function. TXEDIT's paging and scrolling commands save hours of writing time! TXEDIT lacks a Lastline command to position the cursor on the last line; CAU should have included it.

Similar to XBE, TXEDIT has a command mode called the Clear Command Mode (CCM). It is called this because you enter it by pressing the clear key. When you enter this mode, a graphics block is lit next to the line where the cursor currently resides. You may now enter one of several commands:

- I—Inserts a line with current increment value;
- D—Deletes the current line(s);
- C—Copies line(s);
- M—Moves line(s) to the current lines;
- H—Moves line(s) to the current cursor location;
- B—Starts Block of lines for the copy, move, or delete functions;
- T—Scrolls to the top of your program;
- F—Finds the next occurrence of the search string;
- Space—Enters the Extended Clear Command Mode; and
- E—Exits TXEDIT.

You enter the Extended Clear Command Mode (ECCM) with the command sequence clear, space. The bottom line displays the prompt Command? and you may now enter:

- N n1,n2—Renumbers your program with first line = n1 and an increment n2;
- F string1—Searches for the first occurrence of string1;
- C string2—Changes all subsequent occurrences of string1 to string2;
- P n1—Prints n1 lines on this page on your line printer;
- L file name—Loads the file with that name from tape; and
- W file name—Writes the file with that name to tape.

These are powerful editing commands. You may search for any string and optionally change it to any other string. You may renumber your program, or copy or move single lines or blocks of lines much easier than with the normal EDTASM or Basic line editor.

To exit the TXEDIT program press clear, E. You are then presented with a menu of options that are all single key commands:

- Clear—Returns to TXEDIT (leaves the text buffer intact);
- R—Restarts TXEDIT (clears the text buffer);
- D—Returns to DOS;
- S (followed by a file name)—Saves the text buffer to disk; and
- A (followed by a file name)—Adds text from disk.

The Assembler

A program does very little good until you assemble it. MZAL's multi-pass assembler ASMBLR takes the Assembly-language text file you created with TXEDIT and assembles it into executable Z80 object code or into a relocatable module for the linking loader (if you wish to link different modules together).

When you enter the assembler, you are given another full-screen menu of things to do. You may choose several parameters; an accompanying X indicates their default or current values. To select an option, move the cursor to the option and press X; to deselect an option press the space bar. When you get to the file name option, you are expected to enter the name of the source file on disk that is to be assembled. The assembler uses default file extensions. To load an assembly file, you need not specify that the extension is /ASM; the assembler already knows.

To begin assembly press the down arrow. You may cancel an assembly in progress by pressing the clear key or pause it by pressing the space bar. To return to the menu after pressing the clear key press enter. To continue assembly after you have pressed the space bar, press enter as well. You may return to DOS at any time by pressing the up arrow key.

The options you may select/deselect at the assembler menu are:

- Object to disk/tape;
- Pause on error;
- List to printer/video;
- List symbol table; and
- Generate an /RLD file.

Special Assembler Pseudo-ops

The MZAL assembler accepts the standard Z80 opcodes. It also supports a variety of operation codes, not standard for the Z80, that set assembler options and control how the assembler generates the code.

You may label statements, as with most assemblers. MZAL permits eight-character labels, while many others permit only six. You may use certain math operators in expressions. The $ symbol is special and represents the current memory location. Thus, LD HL, $+50H loads the HL register pair with the current memory address plus 50H. You may use the operators +, −, &, and < in this way. The & stands for a binary And, while the < stands for a logical shift. If the operand to the right of the < is positive, the number is shifted left by the number of binary places of the operand. If it is negative, the number is shifted to the right. For example, LD A,1<3 loads register A with a binary 1 shifted three places left, giving 00001000B or 8.

MZAL supports a Words pseudo-op, which specifies a number of two-byte words and an optional value for them. If you omit a value, MZAL initializes this block of memory to zeros.

The Entry pseudo-op specifies a label to be considered an external entry point into the program. A label defined this way may be accessed by other program modules which have the same label defined as an external label. The pseudo-op EXTRN indicates an external label—it will be assigned a value some time after the program's assembly. The linker uses them to link the modules together. The assembler places the EXTRN labels into an /RLD file, along with the various program references to it. The linker uses this special file to make the necessary modifications to the program /CMD file at link time.

Besides these special pseudo-ops, you may embed a number of assembler commands. An asterisk precedes these special commands to indicate their special status. The assembler commands include:

- *List Off;
- *List On;
- *Eject;
- *Space n;
- *Title 'string of characters';
- *Pause; and
- *INCL 'file name'.

The first two commands control whether you wish a listing of your program lines during assembly. These commands also control execution of the following three commands, since they are not active unless a listing is taking place.

Eject sends a page ejection to the line printer. Space n prints n blank lines. Title prints a title at the top of each listed page. Pause pauses assembly when the assembler reaches it. You can continue assembly by pressing the enter key or terminate assembly by pressing clear.

The most powerful of these pseudo-ops is the INCL command. It allows you to include another Assembly-language file immediately following the INCL command. You can nest INCL commands four deep; that is, a file may load in another by the INCL command. This second file may indicate to the assembler to load in another with another INCL command, and so on, up

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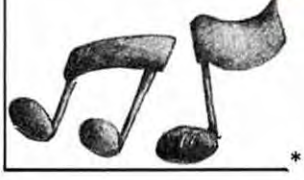

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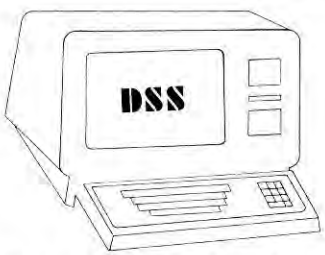
```
BEGIN    Call xxxx
FLAG 1   EQU 01H
FLAG 2   EQU 00H
FLAG 3   EQU 01H
         IF FLAG 1      ; continue assembly
           .
           .
           .
         IF FLAG 2      ; stop assembly
           .
           .
           .
         IF FLAG 3      ; still no assembly
           .
           .
           .
         ENDIF          ; not yet
           .
           .
         ENDIF          ; ok, now resume assembly
           .
         ENDIF          ; continue assembly
```

Table 1. Conditional assembly

```
ASCII    MACRO    ?CHAR
         LD       A,?CHAR
         ENDM

         ASCII    'A'
causes the invocation:
         LD       A,'A'
```

Table 2. Symbolic substitution in macro definition



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to four deep. Do not finish any of these included programs with an End pseudo-op, or the assembler will finish the assembly there without returning to the original file (remember, only one End to a program). This capability allows you to write and directly assemble a very large Assembly-language program.

Release 2 of MZAL allows some even more impressive pseudo-ops. These include recursive macros and conditional assembly.

MZAL's conditional-assembly feature means you can selectively assemble blocks of your program depending on some condition. The format of this command involves use of the If. . . Endif construct. The line IF (expression) indicates to the assembler that in the event (expression) does not evaluate to zero, continue assembly. If the expression does evaluate to zero, then do not assemble the code between the If and its matching Endif. You can nest these as deeply as you like, and all subnested Ifs will not be evaluated if any supernested expression was evaluated to zero. That is, if you have the situation that occurs in Table 1 then the center section is not assembled even though its expression evaluated to non-zero. Assembly resumes after the matching Endif to the If expression that evaluated to zero.

Because the MZAL assembler is multipass, you must define the label before the assembler reaches the If pseudo-op.

Why would you want to do this? Suppose you are writing a large program and put in code to help debug it. You can enclose your debugging sections within If. . . Endif statements. To get your program running you can set the conditional-assembly flag to a non-zero value so that the debugging routines will be assembled into the test versions of your program. Rather than delete this code when your program is finally running you can change the conditional-assembly flag to a zero value and omit those debugging routines from the final assembly. This allows you to include many debugging routines and remove them all with a single command.

A macro is not the same as a subroutine call, but a defined set of Z80 opcodes. Every time you invoke a macro in a program, all those opcodes are stuck into that place.

Not only does MZAL allow you to define your macros as a set of static Z80 opcodes, but you can also use recursive macros and even use symbolic substitution in your macros.

Symbolic substitution means you can use variables in your macro definition, and when the assembler assembles a particular macro invocation, the value of the variable may be substituted into the macro itself. This gives you custom macros in that each time a macro is assembled it is customized for that invocation.

You indicate symbolic parameters, or variables, by preceding them with a question mark. Table 2 is an example.

Admittedly, this is a very simple example, but it should fire your imagination. With MZAL's INCL command, you can create a library of macros and include them anytime you need them in a program. You can have any number of variables in your macro definition.

A special concatenation operator (.) lets you combine characters with other characters. For example, if you have a program with parts to label and you want your name to appear in each, you can define the sample macro shown in Table 3.

The manual provides several simple examples to help you see the inherent power of this type of macro.

You may turn the listing of the macros on or off during assembly. It may be inconvenient to see the expansion of the macro each time it is called, so MZAL arranges it so you can use the pseudo-ops *MACLIST Off and *MACLIST On.

You can nest macros; one macro can call another. A macro which invokes itself is a recursive macro. You can even use the macro ability to redefine the Z80 opcodes! If you do not like the way LDIR works you can make a macro called LDIR and redefine it to do what you want. This is a potentially powerful (and dangerous) ability. It allows you to create your own (pseudo-) Assembly language!

The assembler menu also allows you to generate a symbol table or a cross-reference table. If you request a table but do not indicate a device, the assembler will display the list on the screen. The symbol table is a list of your symbolic labels and their values. The cross-reference table lists your symbolic labels and all the line numbers in which they appear.

Assembly takes place in three phases. In the first phase, all the labels are resolved; that is, they are all assigned values. One of the powerful features of MZAL's assembler is that makes as many passes as necessary to either resolve the labels or to determine that they cannot be resolved. Thus, unlike other assemblers I am familiar with, you can define all your labels anywhere in your program, and the definition need not precede the first reference. (Yet another small but unwelcome thorn is removed from the programmer's paw.) It also detects recursive label definitions and returns an error when this occurs.

The second phase generates the object and RLD files, and the third phase takes place only if you send the object code to tape, or if you request a symbol table or cross-reference table.

The Linker

A linker is a program that takes CMD machine-language modules and links them together into a single program. It allows you to relocate a program without having to reassemble it.

These features are accomplished through the existence of an /RLD file. It contains all the necessary information for the linker to process the machine-language program. It also serves as an additional way to build up

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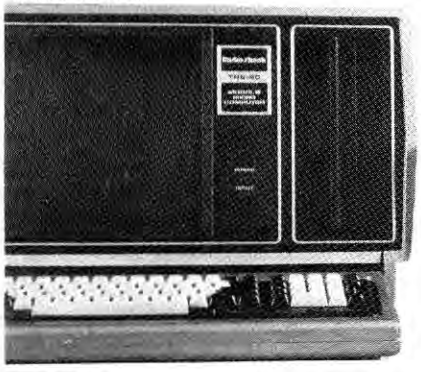

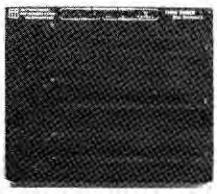

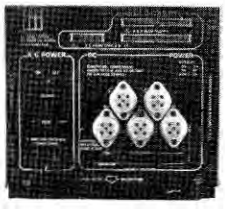

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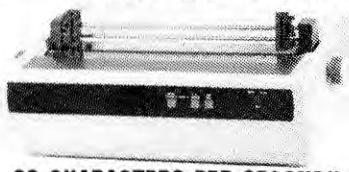

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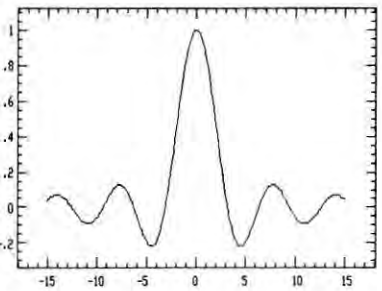

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```
TITLE   MACRO   ?STRING
        DEFM    '?STRING, BY BRUCE'
        ENDM
; which will expand:
        TITLE   SECTION ONE
; into:
        DEFM    'SECTION ONE BY BRUCE'
```

Table 3. Concatenation

complex machine-language programs with as little pain as possible.

You execute the linker from DOS by typing LINKER. It initializes and prompts for a command; several are available:

- Build—Creates a composite CMD file from the modules currently loaded;
- End—Returns to DOS;
- EXEC—Executes the linker commands from a control file;
- INIT—Initializes the linker;
- LoadA—Loads a file into memory without relocating it;
- LoadR—Loads a file and relocates it;
- Map—Displays all the modules currently loaded;
- ORG—Defines the origin for next module to be loaded;
- Set—Allows manual adjustment of labels in a loaded module;
- Tape—Creates a composite tape file;
- TRAN—Defines the main execution address of your module; and
- XREF—Creates a cross-reference table of symbols.

The linker provides information to three essential variables: ORG, TRANS, and Unresolved. The ORG is the next address to which the linker will relocate the next program module. TRANS is the current transfer address (entry point), and Unresolved is the number of unresolved labels left (the number of EXTRN lables not yet matched up to an Entry).

Release 2 added more power to the linker as well. The Display command allows you to examine the modules that have been loaded into memory, and the number of bytes to be displayed. An optional parameter allows you to send the output to the printer. The format is DISPLAY xxxx yyyy (P), where xxxx is the address you wish to examine, and yyyy is the number of bytes to be displayed. It can only display bytes within a single module at a time, and may not cross module boundaries.

Release 2 includes a zap capability. It allows you to modify the bytes of a module in memory. The syntax is ZAP xxxx yyzz, where xxxx is the address of the byte, and yyzz is a four-digit hexadecimal number.

The last new command is for Model III users. The Speed command allows them to dynamically switch the cassette speed while using the linker.

Why do you need a linking loader if you already have the INCL command? The difference between the assembler's INCL command and the ability to use a linker loader is significant. Suppose you have a program working all except for a certain module. You want to be able to reassemble it and link the other modules together quickly to test your module. Without a linker, you must reassemble the entire program each time you want to test it. With a linker, you can keep /CMD and their associated /RLD files on disk, and link them into your programs without reassembling them. You can link them into different memory locations easily. All editor/assembler packages should include the INCL command and a linker. Even though you can use one to simulate the other, they are designed with different purposes in mind; having both their capabilities at your disposal is a tremendous aid to program development.

LEXCONV

The LEXCONV program was included in Release 2 of MZAL. It allows MZAL users to read disk files created by other assemblers. It converts any of four file formats (MZAL, Apparat EDTASM, Macro-80 or unnumbered ASCII) to any other of the four.

LEXCONV is menu-driven and easy to use. You input the source file name and its file-type number. Then you input the target file name and file-type number. You can use the same file name since the entire text file will be read into memory for the surgery. Should you accidentally enter an incorrect reply, the clear key restarts the program. You are also given the option of compressing blanks into tabs. Normally, you would do so, but since some word processors do not support these tab characters, CAU thoughtfully provided the option.

After LEXCONV reads in your source file you are asked if you wish to perform the lexical conversion. If you answer Y, the program processes each line into the proper format. This lexical conversion is very useful since some editor/assemblers use colons in their labels. MZAL does not support colons in labels, so LEXCONV removes them in converting the program into MZAL format.

The LEXCONV program loads the entire text file into memory and then processes it. Currently, it does not allow you to swap disks, but begins writing the output file immediately. This is a slight fault.

LEXCONV does not always work correctly. I disassembled a large program using Tasmon. The disassembly took up 35 granules of disk space. I then executed LEXCONV to convert the file, and wrote it to another file name. I did this knowing that there was not enough room on the disk for the converted source code. While running under NEWDOS80, LEXCONV kept looking and looking for a track on which to write the output. It never stopped looking nor did it return an OUT OF DISK SPACE message. I moved the file to a disk with enough room, and it performed the conversion in approximately 2½ minutes. The most interesting thing about this entire exercise was that the converted file only required 25 grans! The manual states that the MZAL files are the most efficient storage form for line-num-

bered ASCII files, but this states just how efficient it is! In this particular instance, the savings was 10 granules, or a storage reduction of 29 percent.

MZAL's ability to convert unnumbered ASCII files allows flexible programming. For example, suppose you need a long look up table or message buffer. The most convenient way to get it is to generate it from Basic. You can save it into a sequential ASCII file using the Basic commands DEFM, DEFB or DEFW (whatever is appropriate). Then you can use the LEXCONV program to change your file into a form that may be linked or included directly into your Assembly-language program.

Final Thoughts

The TXEDIT program fits into 32K. The manual provides information for using the linker to modify it to reside in the top of 48K. You may also change the speed which the repeat keys in TXEDIT operate, by using the linker's Set command.

The other appendices give information on the format of the text files, /CMD files, /RLD files, and System tapes. The last two appendices refer to the subroutine packages that accompany MZAL. These are provided as demonstration packages, which are useful in other capacities.

The HEXCONV subroutine package contains four conversion subroutines:

- HA2CONV—Converts the contents of Register A to ASCII characters;
- HA4CONV—Converts the contents of Register Pair DE to ASCII characters (hexadecimal equivalent);
- AH2CONV—Converts two ASCII characters representing a hex number into a binary value; and
- AH4CONV—Converts four ASCII characters representing a hex number into a binary value.

The other demonstration package does the same for ASCII characters that represent decimal numbers.

If you are a casual Assembly-language coder, do not buy this package. It is expensive, and except for the text editor, its most powerful features will remain unused for a long while. It is meant to aid the production of long, complex Assembly-language programs, and it performs this task well. If you just want to write an occasional sound subroutine or white out the screen quickly, then MZAL is hardly worth the cost. However, if you want to write programs whose Assembly-language source code exceeds memory, or other constraints (such as the programmer's sanity) demand that you write it in modular form, then MZAL is well worth the cost.

MZAL is an extremely powerful program-development tool. It requires a bit of sophistication to use, but is a very great aid to the Assembly-language programmer. If you are a professional programmer, you owe it to yourself to buy this package from Computer Applications Unlimited. ■

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Accountants regularly use commercial computer services for their clients' income tax returns. Income tax programs are also available for microcomputer systems.

The average small businessman does not use his own computer for the job, however. The Internal Revenue Service has thousands of different forms, rules and regulations, and it is difficult to write a single computer program which fits the tax situation of a large number of users. Programs that cover all the possibilities are very large, quite expensive, and require big computers. This puts them within reach of the professional, but makes them impractical for the user who needs such a program just once a year.

Moreover, since tax regulations change every year the programs themselves require yearly updates. Again this is practical for the professional, but not for the hobbyist or small businessman.

Still, for those whose tax situation stays relatively stable from year to year, a simple program which quickly calculates a rough estimate of tax liability can be quite useful. This article describes such a program, written for the Color Computer with Color Basic and at least 16K of RAM.

The Key Box

Color Computer
16K RAM
Color, Extended Color, or Disk Basic

The Basic Idea

This program is designed for the entrepreneur who may have a salary (with withholding tax statements), or a small business (requiring Schedule C and possibly estimated tax payments), or both.

The program and data are organized in roughly the same order as one would have to fill out the forms in Table 1. If you find some of these forms unnecessary, or should you need other forms, you can easily customize the program. If you have no need for a given form (such as Schedule C, for example), just set its entries equal to zero.

Schedule C—Profit or loss from business or profession
Form 2441—Child care expenses
Form 3468—Investment tax credit
Schedule A—Itemized deductions
Schedule B—Interest and dividend income
form 1040—Income tax return, front and back

Table 1. Forms Included

The numbers used in the calculations are inserted into data statements. Because they are loaded and saved along with the program itself you do not need a separate tape or disk data file. (To allow you to test the program, the program listing has sample numbers inserted in its data statements. These are the numbers used in computing the sample printout. Please don't accidentally use these numbers on your own tax forms!)

Each time the program is run it prints out an entire series of calculations for all the above forms down to the bottom line: tax refund or tax due and the amount. Figure 1 shows a sample run, using the numbers in the Program Listing.

Do not blindly transfer your program results to the appropriate IRS forms. Keep in mind that this is simply an estimating program, not designed to replace an intelligent human being. (Neither the author nor *80 Micro* can be responsible for the accuracy of this program, or any difficulties you may get yourself into with the IRS as a result of using or misusing this program.)

Due to Basic's floating-point errors many amounts printed by this program may be in error by a penny or two.

Output

The printout follows the IRS form almost line by line. If you have a Schedule C form handy, compare it with the beginning of Fig. 1.

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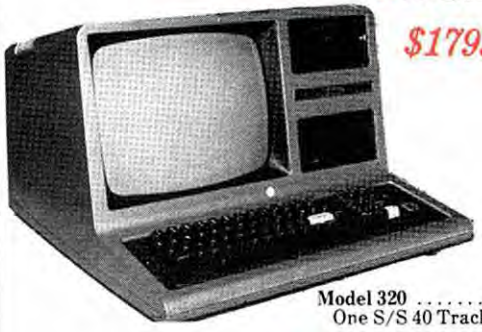

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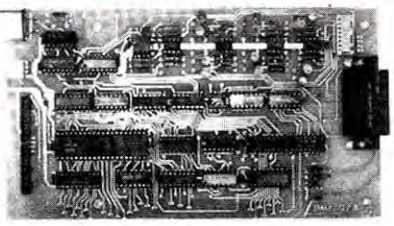

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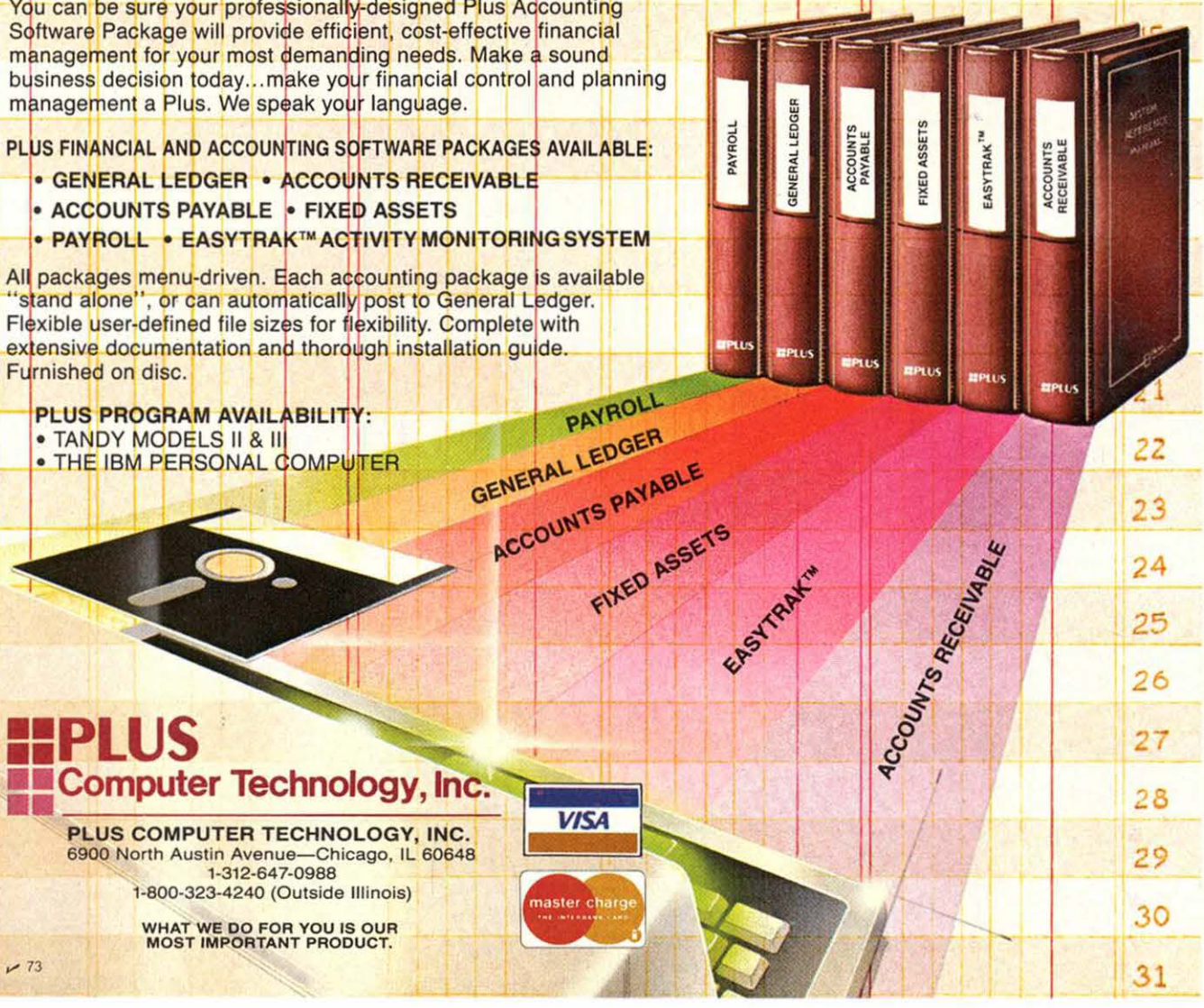

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The descriptions at the left of Fig. 1 tell what each line covers. Some lines are followed by the line number on the form.

The numbers at the right are dollar amounts for each line. At the far right are grand totals, which will eventually appear on the tax form. The middle column of figures includes sub-totals which will also probably appear on the form. The left column of figures includes individual items.

For example, Fig. 1 starts with four lines listing sales of $2,000 for each of four categories of items. These four $2,000 items add up to gross receipts or sales of $8,000. The next line shows $100 of returns or allowances, while the following line shows a resulting balance of $7,900.

How It Works

The program consists of three parts: the main program (lines 10–1710), two subroutines to read and print data (lines 6000–6280), and a set of data statements which contain all the data liable to change from year to year (lines 7000 to the end).

Because all the variable data is in data statements rather than in a separate file, the program can be used even on cassette systems.

Once you have customized the program, doing your taxes each year becomes a cinch. Simply cross out the old numbers and fill in the new ones.

Data Statement Organization

The data statements (lines 7000 and on) are of three types: First, major headings and data separators separate major categories of items. All of these data lines are identified by two asterisks after the word Data.

```
7000 DATA ** SCHEDULE C **
7010 DATA ** INCOME **
7100 DATA ** DEDUCTIONS **
7450 DATA ** 2441—CHILD CARE EXPENSES **
```

In this example, line 7000 is the beginning of all Schedule C entries: everything from lines 7010–7100 is income for Schedule C; everything from 7100–7450 is a deduction on Schedule C; line 7450 ends Schedule C entries and begins another form, Form 2441.

A number of program steps check that these data lines are read at the right times. For example, line 0140 of the program reads:

```
0140 IF N$<>"** SCHEDULE C **" THEN STOP
```

If N$, which has just been read from the data statement in line 7000, does not agree with the expected major heading, the program stops. Second, minor headings and data separators separate minor categories of items. All these lines are identified by a plus sign after the word Data, followed by the letter S or the letter E (+S is the start of a minor category, and +E is the end of such a category). Here are some typical minor category separators:

```
7020 DATA +S GROSS RCPTS/SALES
7070 DATA +E GROSS RCPTS/SALES
```

All the lines between these two are gross receipts or sales. Third, individual data items which have neither asterisks nor plus signs contain a description of the item followed by a dollar amount. Here are some typical data items:

```
7030 DATA SELLING CIGARS,2000
7040 DATA SELLING MAG,2000
7050 DATA SELLING BOOKS,2000
7060 DATA OTHER SALES,2000
7080 DATA RET/ALLOW 1B,100
```

Some of these lines are keyed to specific lines of forms (such as the last line in the above example, where 1B applies to line 1B of the tax form, Returns and Allowances). These individual data items may be inside or outside minor categories of items.

(Line 8040 lists the number of exemptions allowable to the taxpayer rather than a dollar amount.)

To fit the data statements into the 32-character line width of the Color Computer, some descriptions are very abbreviated. If you run this program on another system (it should work without change on a Model I or III), you might expand these descriptions.

With one exception, all the data statements are read by a single subroutine starting at line 6050. The subroutine treats the three kinds of data statements in different ways:

- Major headings and separators (those starting with **) are read into the variable N$, and the subroutine returns to the main

Fig. 1. Sample Run

```
** SCHEDULE C **
** INCOME **
     SELLING CIGARS          $ 2000.00
     SELLING MAG             $ 2000.00
     SELLING BOOKS           $ 2000.00
     OTHER SALES             $ 2000.00
   GROSS RCPTS/SALES                    $ 8000.00
   RET/ALLOW 1B                         $  100.00
 BALANCE                                           $ 7900.00
   COST OF GOODS SOLD                   $  100.00
 GROSS PROFIT                                      $ 7800.00
 TOTAL INCOME                                      $ 7800.00
   ADVERTISING 6                        $  100.00
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   DEPRECIATION 14                      $  100.00
     ALLSTATE              $   20.00
     STATE FARM            $   20.00
     1/10 OF HOME INS      $   20.00
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   HOME OFFICE EXP                      $  235.00
 TOTAL DED                                         $ 1755.00
 SCH C NET P/L                                     $ 6045.00

** 2441 - CHILD CARE EXPENSES **
   AMOUNT SPENT                         $ 5000.00

** 3468 INVESTMENT TAX CREDIT **
   AMOUNT SPENT                         $ 1000.00
 ACT INV TAX CR                                    $  100.00

** SCHEDULE A - DEDUCTIONS **

** MEDICAL AND DENTAL **
   1/2 OF PREMIUMS                      $  100.00
** TAXES **
     HUSB STATE INC        $  500.00
     HUSB CITY INC         $    5.00
```

Figure 1 continues

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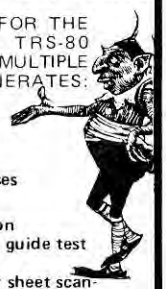

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Figure 1 continued

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      STATE/LOCAL INC                       $ 1010.00
      REAL ESTATE                           $ 1000.00
        5% SALES TAX            $  100.00
        8% SALES TAX            $  100.00
        SUPERMKT SALES TAX      $   10.00
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        OTHER SALES TAX         $   10.00
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      OTHER TAX                             $   10.00
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      OTHER INT                             $ 1000.00
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      INSURANCE REIMB                       $    0.00
    LINE 27 DIFF                                        $  200.00
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      PROF                                  $  100.00
      OTHER                                 $    0.00
      INC TAX PREP                          $   30.00
      EMPLOYEE EXP                          $   50.00
    MISC DEDUCT                                         $  330.00
    GROSS DEDUCT                                        $ 5380.00
    STAT CREDIT                                         $-3400.00
    TOTAL DEDUCT                                        $ 1980.00

** SCHEDULE B **
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        FIRST CTY BANK  $   50.00
      INTEREST INC                  $   60.00
        ITTY BITTY MACH CO  $   10.00
      DIVIDEND INC                  $   10.00

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    WAGES ETC L.7                               $20000.00
    INTEREST L.8A                               $   60.00
    DIVID L.8B                                  $   10.00
    TOTAL L.8C                                  $   70.00
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    GROSS-DEDUC L.32C                           $24587.00
NO OF EXEMPT     3
    EXEMP'N L.33                                $ 3000.00
    TAX'LE INC L.34                             $21587.00
LOOK UP TAX ON $ 21587
IN TAX TABLE AND ENTER IT.
? 3612.00
    GROSS TAX                                   $ 3612.00

** FORM 2441 **
    LINE 3 AMTS                                 $ 5000.00
    LINE 4 MAX                                  $ 4000.00
    L.12 CREDIT                                 $  800.00

    1040 L.40 CH CARE CR                        $  800.00
    INV TAX CR L.41                             $  100.00
    RES ENERGY CR                               $   15.00
    TOTAL CREDITS                               $  915.00
```

Figure 1 continues

Figure 1 continued

```
      BALANCE L.47                                          $ 2697.00
      TOT TAX L.54                                          $ 2697.00
          HUSB                          $ 2000.00
          WIFE                          $ 2000.00
        FED TAX WITHHELD                          $ 4000.00
      TOT TAX WITH L.55                                     $ 4000.00
    ** ESTIMATED TAX PAYMENTS **
          APRIL                         $   10.00
          JULY                          $   10.00
          OCTOBER                       $   10.00
          JANUARY                       $   10.00
        FED EST TAX L.56                          $   40.00
      TOT TAX PMTS L.62                                     $ 4040.00

      TAX REFUND                                            $ 1343.00


    READY
```

NAME	USED IN LINES...											
A$	20	30										
A	420	480	6090	6110	6120	6200	6220	6230				
C1	360	1260	1280									
C2	420	1460	1490									
D	190	210	240	270	300	330	360	490	680	760	890	920
	1020	1040	1070	1080	1190	1200	1220	1222	1225	1250	1260	1280
	1297	1340	1350	1370	1380	1400	1440	1460	1470	1490	1520	1530
	1540	1550	1560	1610	1660	1670	1690	1700	6020			
D1	600	700	770	820	920	1020	1040	1060	1080	1340	1350	
D2	1130	1220	1221	1222	1224	1225	1240					
I	270	360										
I1	480	490	1530	1550								
I2	1120	1200	1221									
K$	220	250	260	350	370	500	690	760	900	930	1030	1050
	1070	1080	1190	1200	1220	1222	1225	1250	1260	1290	1300	1330
	1340	1360	1370	1390	1400	1440	1460	1480	1490	1510	1530	1540
	1550	1560	1570	1610	1660	1690	1700	6010				
L$	6060	6070	6080									
N$	140	150	170	290	320	390	400	450	460	550	560	580
	620	630	720	730	790	800	840	850	950	960	990	1100
	1110	1160	1170	1590	1630	1640	6050	6060	6100	6150	6170	6180
	6190	6210	6250	6260								
PR	30	150	170	380	400	430	460	530	560	580	630	730
	800	850	960	1090	1110	1140	1170	1310	1320	1370	1450	1500
	1640	1680	6010	6020	6100	6110	6210	6220	6260	6270		
T	190	210	240	330	600	640	650	660	670	740	750	820
	870	890	1000	1120	1130	1190	1224	1240	1250	1280	1297	1610
	1660	6120	6160	6230	6270							
T1	640	650	660	670	680	700	740	750	760	770	870	890
	910	920	970	1000	1020	1520	1550	1560				
W	1190	1240	1280	1297	1350	1380	1400	1410				
X	1430	1440	1560	1670	1690	1700						

Fig. 2. Variable Index

Variable	Used
A	Dollar amount read from last data statement
C1	Schedule C income or loss
C2	Amount spent for child care
D	Variable used to send data to subroutine at line 6000
D1	Total of itemized deductions from Schedule A
D2	Dividend income
I	Schedule C income
I1	Investment tax credit
I2	Interest income
K$	Variable used to send text to subroutine at line 6000
L$	Temporary use with line 6050 subroutine
N$	Variable used to input text from subroutine at line 6050
PR	Equals 0 for screen, −2 for printer
T	Variable used to input data from subroutine at line 6050
T1	Used to subtotal amounts on Schedule A and back of Form 1040
W	Gross and taxable income
X	Tax

Fig. 3. Variable Functions

See List of Advertisers on page 371

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program without printing N$. The main program then either tests N$ (to make sure that the data is in sync with the program) or prints it.

- Minor data separators (those starting with +) are used to group a category of items together. Each data item in the category is printed (both item name and dollar amount). At the end of the minor category (when a data line starting with +E is read) the subroutine prints the description in the Data +E statement, followed by the total dollar amount. The description is returned to the program in variable N$, and the total dollar amount is returned in variable T.
- Other individual data items (those not contained within a minor category) are printed. The description is then returned to the program in variable N$, and the dollar amount in variable T.

An entire minor category (data lines from a +S line to the following +E line) is treated the same as an individual item outside it, and each of these is read by a single call to the subroutine. This has two effects: First, more items can be added into a minor category without changing the program. For example, we could add the following new line between lines 7030 and 7040:

```
7035 DATA SELLING FRISBEES,1000
```

That item would simply become part of the "gross receipts or sales" category. The line would be listed separately on the printout, and the $1,000 amount would be added into the category total.

Likewise, lines within minor categories can be deleted. For instance, if line 7030 were deleted, the program would still run without change.

Second, items outside minor categories can be broken down further, again without changing the program. For example, line 7090 could be changed from 7090 DATA COST OF GOODS SOLD, 100 to:

```
7090 DATA +S COST OF GOODS SOLD
7091 DATA CIGARS,20
7092 DATA MAGAZINES,20
7093 DATA COMIC BOOKS,20
7094 DATA OTHER SALES,40
7095 DATA +E COST OF GOODS SOLD
```

The program would list each item separately, but use the same total of $100 in later calculations as if the entire amount had been listed in one line.

In most instances, data lines are keyed to the lines on the applicable tax form. However, many types of deductions can be listed on Schedule C. To take care of any number of deductions, a loop in the main program (lines 310-340) keeps reading deduction items until it gets to the first DATA ** line, which in the sample case is line 7450.

The Main Program

The main program consists largely of calls to two subroutines—the read subroutine at line 6050, and a print subroutine at line 6000. As explained earlier, N$ and T are two variables used to input data (a description and a dollar amount) from the read subroutine. In the same way, the variables K$ and D are used to output data to the print subroutine at line 6000. (K$ holds a description string printed at the left of a line, and D holds a dollar amount printed to the right.)

For example, line 0130 calls the subroutine at line 6050 to read the next data line (7000). N$ should contain ** SCHEDULE C ** on return and T will be zero, since there is no dollar amount in that line. Line 0140 checks N$ to make sure that it has the expected string, and stops if not.

Line 0150 prints the string N$ (** SCHEDULE C **).

Lines 0160 and 0170 read the next data statement, and print the string ** INCOME **.

Line 0180 goes back to the same subroutine, and reads and prints all the data statements in lines 7020-7070. This printout results:

```
SELLING CIGARS          2000
SELLING MAG             2000
SELLING BOOKS           2000
OTHER SALES             2000
```

Program Listing

```
10 REM INCOME TAX ESTIMATOR PROGRAM
20 INPUT "OUTPUT TO PRINTER (Y/N)"; A$
30 IF LEFT$(A$,1)="Y" THEN PR=-2 ELSE PR=0
130 GOSUB 6050
140 IF N$<>"** SCHEDULE C **" THEN STOP
150 PRINT #PR, N$
160 GOSUB 6050
170 PRINT #PR, N$
180 GOSUB 6050 :REM SCHEDULE C GROSS RCPTS
190 D=T
200 GOSUB 6050 :REM RETURNS
210 D=D-T
220 K$="BALANCE" : GOSUB 6000
230 GOSUB 6050 :REM COST OF GOODS
240 D=D-T
250 K$="GROSS PROFIT" : GOSUB 6000
260 K$="TOTAL INCOME" : GOSUB 6000
270 I=D :REM SCHED C INCOME
280 GOSUB 6050
290 IF N$<>"** DEDUCTIONS **" THEN STOP
300 D=0
310 GOSUB 6050 :REM DEDUCTIONS
320 IF LEFT$(N$,2)="**" GOTO 350 :REM AT END OF DED
330 D=D+T
340 GOTO 310
350 K$="TOTAL DED" : GOSUB 6000
360 C1=I-D :D=C1
370 K$="SCH C NET P/L" : GOSUB 6000
380 PRINT #PR
390 IF N$<>"** 2441 - CHILD CARE EXPENSES **" THEN STOP
400 PRINT #PR, N$
410 GOSUB 6050
420 C2=A :REM CHILD CARE AMOUNT
430 PRINT #PR
440 GOSUB 6050
450 IF N$<>"** 3468 INVESTMENT TAX CREDIT **" THEN STOP
460 PRINT #PR, N$
470 GOSUB 6050
480 I1=INT(A*100+.5)/1000 :REM ACTUAL INV TAX CR
490 D=I1
500 K$="ACT INV TAX CR" : GOSUB 6000
530 PRINT #PR
540 GOSUB 6050
550 IF N$<>"** SCHEDULE A - DEDUCTIONS **" THEN STOP
560 PRINT #PR, N$
570 GOSUB 6050 :REM MEDICAL AND DENTAL
580 PRINT #PR, N$
590 GOSUB 6050
600 D1=T :REM ITEMIZED DEDUCTIONS
610 GOSUB 6050
620 IF N$<>"** TAXES **" THEN STOP
630 PRINT #PR, N$
640 GOSUB 6050 : T1=T :REM INCOME
650 GOSUB 6050 : T1=T1+T :REM REAL ESTATE
660 GOSUB 6050 : T1=T1+T :REM SALES
670 GOSUB 6050 : T1=T1+T :REM OTHER
680 D=T1
690 K$="TOTAL TAXES" : GOSUB 6000
700 D1=D1+T1
710 GOSUB 6050
720 IF N$<>"** INTEREST EXPENSE **" THEN STOP
730 PRINT #PR, N$
740 GOSUB 6050 : T1=T : REM HOME MORTGAGE
750 GOSUB 6050 : T1=T1+T :REM OTHER
```

Listing continues

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Listing continued

```
760 D=T1 : K$="TOTAL INTEREST" : GOSUB 6000
770 D1=D1+T1
780 GOSUB 6050
790 IF N$<>"** CONTRIBUTIONS **" THEN STOP
800 PRINT #PR, N$
810 GOSUB 6050 : REM CONTRIBUTIONS
820 D1=D1+T
830 GOSUB 6050
840 IF N$<>"** CASUALTY LOSSES **" THEN STOP
850 PRINT #PR, N$
860 GOSUB 6050
870 T1=T
880 GOSUB 6050 :REM INSURANCE REIMB
890 T1=T1-T : D=T1
900 K$="LINE 27 DIFF" : GOSUB 6000
910 T1=T1-100 : IF T1<0 THEN T1=0
920 D=T1 : D1=D1+T1
930 K$="TOT CAS/THEFT LOSS" : GOSUB 6000
940 GOSUB 6050
950 IF N$<>"** MISCELLANEOUS DEDUCTIONS **" THEN STOP
960 PRINT #PR, N$
970 T1=0
980 GOSUB 6050
990 IF LEFT$(N$,2)="**" GOTO 1020
1000 T1=T1+T
1010 GOTO 980
1020 D1=D1+T1 : D=T1
1030 K$="MISC DEDUCT" : GOSUB 6000
1040 D=D1
1050 K$="GROSS DEDUCT" : GOSUB 6000
1060 D1=D1-3400 : IF D1<0 THEN D1=0 :REM STATUTORY CREDIT
1070 D=-3400 : K$="STAT CREDIT" : GOSUB 6000
1080 D=D1 : K$="TOTAL DEDUCT" : GOSUB 6000
1090 PRINT #PR
1100 IF N$<>"** SCHEDULE B **" THEN STOP
1110 PRINT #PR, N$
1120 GOSUB 6050 : I2=T :REM INTEREST INCOME
1130 GOSUB 6050 : D2=T :REM DIVIDEND INCOME
1140 PRINT #PR
1150 GOSUB 6050
1160 IF N$<>"** FORM 1040 **" THEN STOP
1170 PRINT #PR, N$
1180 GOSUB 6050
1190 W=T : D=T : K$="WAGES ETC L.7" : GOSUB 6000
1200 D=I2 : K$="INTEREST L.8A" : GOSUB 6000
1220 D=D2 : K$="DIVID L.8B" : GOSUB 6000
1221 D2=I2+D2
1222 D=D2 : K$="TOTAL L.8C" : GOSUB 6000
1223 GOSUB 6050: REM EXCLUSION
1224 D2=D2-T : IF D2<0 THEN D2=0
1225 D=D2 : K$="TAXED D+I L.8E" : GOSUB 6000
1230 GOSUB 6050 : REM TAX REFUNDS
1240 W=W+D2+T :REM INCOME SO FAR
1250 D=T : K$="TAX REF L.9" : GOSUB 6000
1260 D=C1 : K$="BUS INCOME L.11" : GOSUB 6000
1270 GOSUB 6050 : REM OTHER INCOME
1280 W=W+T+C1 : D=W :REM TOTAL
1290 K$="TOT INCOME L.21" : GOSUB 6000
1295 GOSUB 6050 : REM ADJUSTMENTS
1297 W=W-T : D=W : REM INCOME LESS ADJ
1300 K$="ADJ GROSS L.31" : GOSUB 6000
1310 PRINT #PR
1320 PRINT #PR, "** SIDE 2 OF FORM 1040 **"
1330 K$="L.32A-ADJ GROSS" : GOSUB 6000
1340 D=D1 : K$="DEDUCT L.32B" : GOSUB 6000
1350 W=W-D1 : D=W
1360 K$="GROSS-DEDUC L.32C" : GOSUB 6000
1370 READ K$,D : PRINT #PR, K$,D
1380 D=1000*D : W=W-D
1390 K$="EXEMP'N L.33" : GOSUB 6000
1400 K$="TAX'LE INC L.34" : D=W : GOSUB 6000
1410 PRINT "LOOK UP TAX ON $";W
1420 PRINT "IN TAX TABLE AND ENTER IT."
1430 INPUT X
1440 D=X : K$="GROSS TAX" : GOSUB 6000
1450 PRINT #PR : PRINT #PR, "** FORM 2441 **"
1460 D=C2 : K$="LINE 3 AMTS" : GOSUB 6000
1470 IF D>4000 THEN D=4000
1480 K$="LINE 4 MAX" : GOSUB 6000
1490 C2=D/5 : D=C2 : K$="L.12 CREDIT" : GOSUB 6000
1500 PRINT #PR
1510 K$="1040 L.40 CH CARE CR" : GOSUB 6000
1520 T1=D :REM CREDIT
1530 D=I1 : K$="INV TAX CR L.41" : GOSUB 6000
1540 READ K$,D : GOSUB 6000
1550 T1=T1+D+I1 : D=T1 : K$="TOTAL CREDITS" : GOSUB 6000
```

Listing continues

Line 190 temporarily saves the $8,000 total in variable D. Line 0200 reads the next data statement and prints RET/ALLOW 100.

Lines 0210 and 0220 subtract the returns from the receipts and print BALANCE 7900.

As each data line is read, the program builds on the previous data. The subroutine at line 6050 plays an important part in collecting and summarizing data.

Customizing for Your Own Needs

You may want to customize the program for your own needs in two ways: change the tax calculations or functions, or make it work on a different system.

Figure 2 provides a complete index of all variables and where they are used in the program, and Fig. 3 describes the use of each variable.

The program currently assumes you itemize deductions. The statutory credit of $3,400 in line 1060 applies only to a married couple filing jointly. The sample figures are based on a home office which occupies 1/10 of the entire home.

Child-care credits are a complicated business: expenses are only allowed if both parents work, and if each makes more than the child care expense. Likewise, home office deductions are only allowable up to the amount of income, and so on.

If you are customizing the program for a different computer or system configuration, you may want to make these changes:

- To keep the display within the 32-character line of the Color Computer, some comments in the data statements are very terse. You may want to expand these to make them more understandable.
- Four program lines use the Tab function to align the numbers printed. If your system has a wider screen (or if you use a wider printer) change these tabs. For example, for an 80-character printer, change the TAB(21) in line 6210 to TAB(40); change TAB(22) in lines 6100 and 6260 to TAB(50); and change TAB(23) in line 6010 to TAB(60).
- When using Extended Color Basic or other Basics which permit the Print Using statement, add USING "$#####.##", to lines 6020, 6110, 6220 and 6270. (The sample printout in Fig. 1 was made with Print Using statements as well as the larger tab settings mentioned above.)
- If a printer is available, modify the print statements to LPRINT.
- Finally, when typing in the program, delete the extra spaces in all the data statements, and avoid spacing over as far right for the :REM at the ends of some lines.

In General

Plug last year's tax figures into the program, and get it to work properly with those. Then chances are quite good that it will also work for your current year's data.

But if some changes are necessary, with this program as a starter you should have no trouble getting things ready and working before next April 15.■

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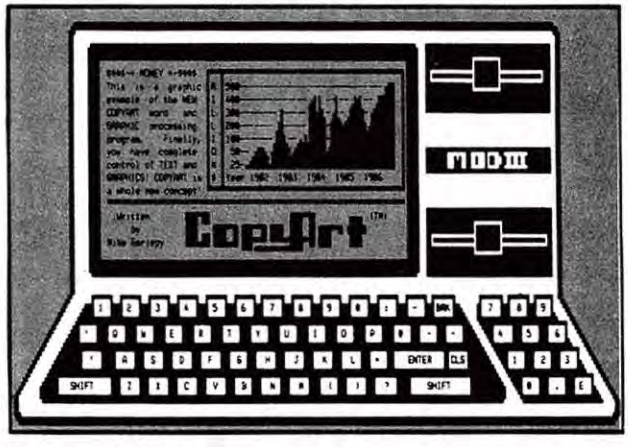

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Listing continues

```
1560 X=X-T1 : D=X : K$="BALANCE L.47" : GOSUB 6000
1570 K$="TOT TAX L.54" : GOSUB 6000
1580 GOSUB 6050
1590 IF N$<>"** TAXES WITHHELD **" THEN STOP
1600 GOSUB 6050
1610 D=T : K$="TOT TAX WITH L.55" : GOSUB 6000
1620 GOSUB 6050
1630 IF N$<>"** ESTIMATED TAX PAYMENTS **" THEN STOP
1640 PRINT #PR, N$
1650 GOSUB 6050 :REM EST TAX PAYMENTS
1660 D=T+D : K$="TOT TAX PMTS L.62" : GOSUB 6000
1670 X=X-D
1680 PRINT #PR
1690 IF X>0 THEN D=X : K$="TAX DUE" : GOSUB 6000
1700 IF X<0 THEN D=-X : K$="TAX REFUND" : GOSUB 6000
1710 END
6000 REM SUBROUTINE TO PRINT #PR, AMOUNT
6010 PRINT #PR, " "; K$;TAB(23);
6020 PRINT #PR, D
6030 RETURN
6040 REM SUBROUTINE TO READ DATA AND SUMMARIZE
6050 READ N$
6060 L$=LEFT$(N$,1) :REM FIRST CHARACTER OF DATA
6070 IF L$="*" THEN RETURN :REM MAJOR CATEGORY
6080 IF L$="+" GOTO 6150 :REM START OF MINOR CATEGORY
6090 READ A
6100 PRINT #PR, "  "; N$;TAB(22);
6110 PRINT #PR, A
6120 T=A :REM TOTAL
6130 RETURN
6140 REM ADD UP TOTAL MINOR CATEGORY
6150 IF LEFT$(N$,2)<>"+S" THEN STOP
6160 T=0
6170 READ N$
6180 IF LEFT$(N$,2)="+E" GOTO 6250 :REM MUST BE END
6190 IF LEFT$(N$,1)="*" THEN STOP
6200 READ A
6210 PRINT #PR, "   "; N$;TAB(21);
6220 PRINT #PR, A
6230 T=T+A
6240 GOTO 6170 :REM READ MORE
6250 N$=MID$(N$,4,32)
6260 PRINT #PR, "  "; N$;TAB(22);
6270 PRINT #PR, T
6280 RETURN
6990 REM DATA STATEMENTS FOLLOW
7000 DATA ** SCHEDULE C **
7010 DATA ** INCOME **
7020 DATA +S GROSS RCPTS/SALES
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25. Invoke the compiler by simply hitting these two keys: "<-"
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ZBASIC 2.2 DOES NOT SUPPORT THESE BASIC COMMANDS:

1. ATN, EXP, COS, SIN, LOG, TAN, and exponentiation. (However, subroutines are included in the manual for these functions.)
2. ERROR, ON ERROR GOTO, ERL, ERR RESUME.
3. No direct commands like AUTO, EDIT, LIST, LLIST ETC, although these commands may be used when writing programs.
4. Others NOT supported: CDBL, CINT, CSNG, DEFFN, FIX, FRE.
5. Normal CASSETTE I/O. (ZBASIC supports it's own SPECIAL CASSETTE I/O statements.)
6. SOME BASIC COMMANDS MAY DIFFER IN ZBASIC. For instance, END jumps to DOS READY, STOP jumps to BASIC READY etc.
7. MEMORY REQUIREMENTS: to approximate the largest BASIC program that can be compiled in your machine (at one time), enter BASIC and type: PRINT (MEM-6500)/2. Remember, you can merge compiled programs together to fill memory.

ZBASIC 2.2 SPEED COMPARISON DEMO

To help give you an idea how fast compiled programs are, we have included this demo program:

ZBASIC 2.2 DEMO PROGRAM

Time to compile and run complete program	**: 0 MIN. 2 SEC.**
BASIC Execution speed MOD 1, LEVEL II	**: 7 MIN. 34 SEC.**
ZBASIC Execution speed MOD 1, LEVEL II	**:0 MIN. 18 SEC.**
BASIC Program size (WITHOUT VARIABLES)	**: 895 BYTES**
ZBASIC Program size (WITHOUT VARIABLES)	**: 2733 BYTES**

(Remember that the ZBASIC program includes an 1879 byte subroutine package.) Program shown exactly as compiled and run in BASIC and ZBASIC.

```
10 '========== ZBASIC 2.2 EXAMPLE PROGRAM AND TIME TEST========
20 CLS:CLEAR100:DEFINT A-X:DEFSTR Z:DIM AA(64,24),Z(50):RANDOM
30 AA=100:BB=-1000:CC=3:DD=-3:EE=-9999:ST$="START TIME "+TIME$
40 FOR I=1TO127STEP2 :FOR J=47TO1STEP-3:XX=POINT(I,J):SET(I,J)
50 XX=(I-J)/CC*(7+I+J) :XX=ABS(INT(RND(I*J)-AA)+7) :RESET(I,J)
60 XX=PEEK(I+J) :POKE15360+I+J,J :OUT255,J AND (3*J):XX=INP(I)
70 AB$=STR$(I+J) :BA$=LEFT$(AB$,2) :AA(I/2,J/2)=VAL(BA$)+AA*3
80 BA$=BA$+RIGHT$(BA$,RND(3)) :XX=INSTR(1,BA$,"9"):XX=SQR(I*J)
90 BA$=MID$(BA$,2,2) :MID$(BA$,1,1)=Z :IF XX THEN 100 ELSE CLS
100 IF LEN(BA$))3 OR SGN(XX)=1 AND ASC(BA$)=32 THEN PRINT"+++";
110 IFPOS(0)>62 THEN TRON:TROFF:PRINT ELSE XX=NOT(RND(99))+100
120 A$=INKEY$:IF A$="Y" OR A$="y" AND I)120 THEN PRINT"TRUE.."
130 RESTORE :READA,C,Z(J),D:GOSUB170:GOSUB170:GOSUB170:GOTO210
140 NEXT :PRINT"*";:NEXTI:CLS:PRINT@512,ST$,"STOP TIME ";TIME$
150 STOP'============== END OF MAIN TEST LOOP ================
160 DATA 12345,-1,"TEST",-9999
170 ON RND(6) GOTO 180,190,200,180,190,200
180 RETURN
190 RETURN
200 RETURN
210 ON RND(9) GOSUB 180,190,200,180,190,200,180,190,200
220 GOTO140
```

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7620 DATA 8% SALES TAX,100
7630 DATA SUPERMKT SALES TAX,10
7640 DATA NEW CAR SALES TAX,100
7650 DATA OTHER SALES TAX,10
7660 DATA TAX ON YACHT,10
7670 DATA +E GENERAL SALES
7680 DATA OTHER TAX,10
7690 DATA ** INTEREST EXPENSE **
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7780 DATA UNION DUES,100
7790 DATA EDUC,50
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7810 DATA OTHER,0
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7830 DATA EMPLOYEE EXP,50
7840 DATA ** SCHEDULE B **
7850 DATA +S INTEREST INC
7860 DATA FED BANK,10
7870 DATA FIRST CTY BANK,50
7880 DATA +E INTEREST INC
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7910 DATA +E DIVIDEND INC
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7940 DATA HUSB WAGES,10000
7950 DATA WIFE WAGES,10000
7960 DATA +E WAGE/SAL/TIPS
7965 DATA DIV/INT EXCL L.8D,400
7970 DATA +S INC TAX REFUNDS
7980 DATA HUSB ST TAX REF,250
7990 DATA WIFE ST TAX REF,250
8000 DATA HUSB CITY TAX REF,5
8010 DATA WIFE CITY TAX REF,5
8020 DATA +E INC TAX REFUNDS
8030 DATA OTHER INC,12
8035 DATA ADJ TO INC,0
8040 DATA NO OF EXEMPT,3
8050 DATA RES ENERGY CR,15
8060 DATA ** TAXES WITHHELD **
8070 DATA +S FED TAX WITHHELD
8080 DATA HUSB,2000
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8100 DATA +E FED TAX WITHHELD
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G.E.A.P. is designed to enable the use of intricate video and printer graphics and text combinations so non-programmers can produce professional looking output. It is to graphics what a word processor is to text. The following review is based on the new versions of G.E.A.P., 1.3 and 2.0.

G.E.A.P. is a utility program that allows easy control of the cursor, drawing graphic displays anywhere on the CRT, moving sections of the display around the screen, the integration of text into the screen, programming input statements into the screen display.

It can also magnify, rotate, tilt and multiply the views of any part of the display; duplicate part of the screen so that only half of a picture need be drawn (a mirror image is created to produce a symmetrical display); shrink, expand and break apart portions of the screen; and reverse the display, changing all or part of the screen from light on dark, to dark on light. Expansion modules allow you to type normal keyboard characters, but have the screen display normal, medium or large sized letters at each keystroke. Add to that letters that are large and can be displayed on a block or a cube background (see Fig. 1). An expansion module allows the created screen graphics, as well as high-resolution, bit-image graphics, to be printed on a printer such as the Epson MX-80. This program can be used with a word processor like Prosoft's Newscript so the graphics and screen text can be integrated into a normal text processor.

G.E.A.P. also generates the Basic code to recreate the screen and can load a previously created screen display for editing. It is written in Basic and machine language and can be easily modified. It is easy enough for non-programmers to use effectively the first time out and still allows options so the experienced programmer can write expansion modules to meet his own personal needs.

Although G.E.A.P. requires a brief familiarization period, as would any word processor, the graphics processor is not difficult to learn and the rewards are excep-

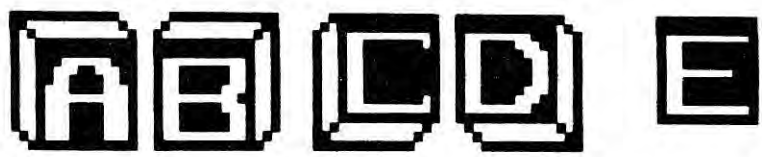

Fig. 1. Cube letters shown in four perspectives and with cube effect eliminated

Photo 1. G.E.A.P.-created video display shows cube letters, medium letters, graphics and normal text

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TRS80 Model III
Trsdos 1.3, Ldos 5.1, Newdos 2.0, Dosplus 3.3, 3.4

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  - Z80 code can be mixed with Pcode

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- Constants may be expressed in decimal or hexadecimal
- Characters within strings may be specified by ascii code
  - Allows non-printable characters in strings
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tional. Once mastered (it took me about an hour), you can sit down, draw a screen of graphics or text, and save the screen into a Basic program to be merged into the final game, application program or printout display. Photo 1 is the title screen to a program that I have been working on for some time. It took 20 minutes to create. I drew the screen with the 48K, disk version 2.0.

No one is perfect, right? G.E.A.P. was programmed so you can experiment with different layouts without damaging your original screen due to two screen storage areas called the temporary area and the permanent area. The temporary storage area is used automatically each time the menu is accessed. The permanent storage area is accessed by pressing the semicolon and enter. When finished, you can save the created program to tape, disk or Stringy-Floppy.

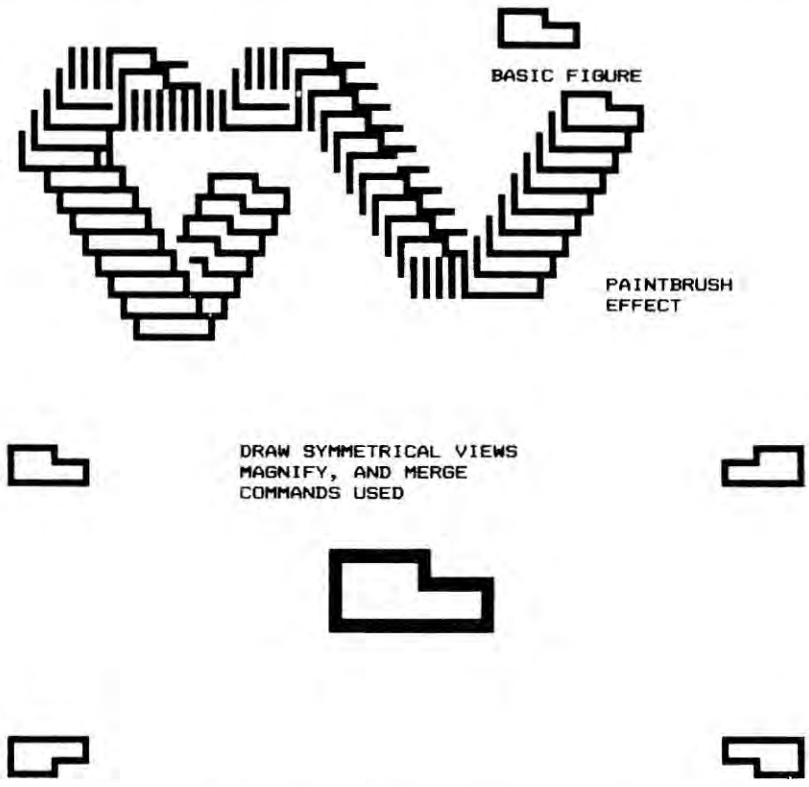

Fig. 2. Paintbrush effect, four symetrical views and magnified figure created by use of Merge command

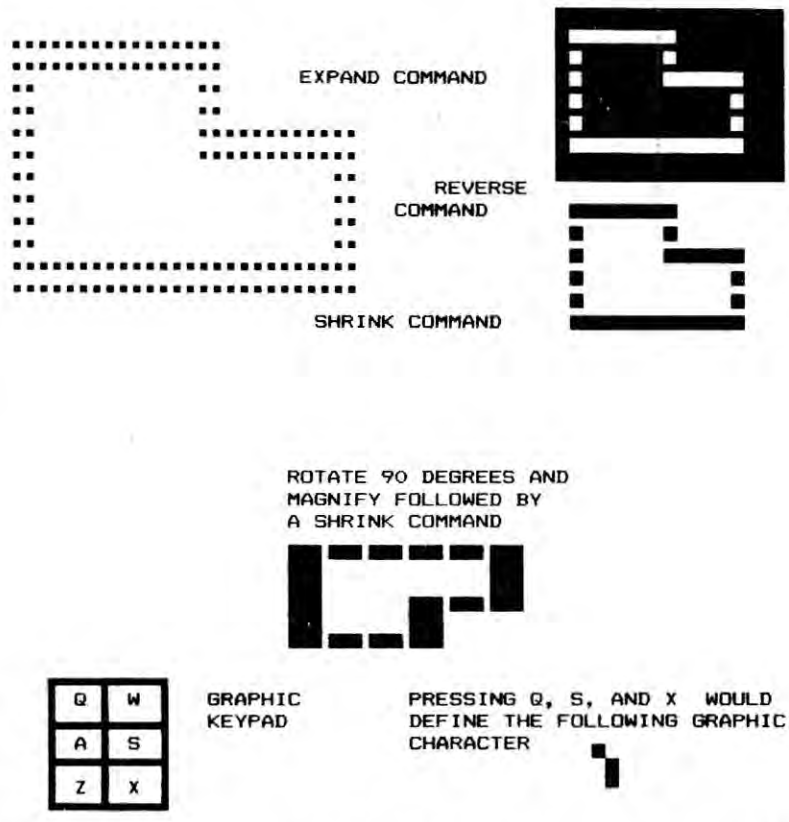

Fig. 3. Results of expand, reverse, shrink and 90 degree rotation commands. Also the graphic keypad and a resultant graphic figure

Documentation

The program's documentation is very good. Its step-by-step style starts with the basics and slowly guides you into the more advanced G.E.A.P. features.

One of the unique documentation features is that when an error is made, G.E.A.P. screen prints an error message directing you to the portion of the manual that will help in correcting the error. This feature, plus the well written manual, make for a very unique approach to program documentation, use and support.

The G.E.A.P. Modes

G.E.A.P. has four main operating modes. The first mode is called the regular mode. It is active when you turn the computer on and is signified by a flashing dot cursor that can be moved in any direction by use of the arrow keys. If the shift key is held at the same time the cursor is moved, a line is left behind in the trail of the cursor. To erase the line, simply go back over it with the cursor without holding the shift key.

The regular mode is also used to access the menu. (There is an additional menu in the 2.0 version that is accessed from the designate mode.) When used in conjunction with a designated figure, the regular mode can be used to move the figure to any location on the CRT or to create a paintbrush effect with the figure (see Fig. 2).

The second mode is the print mode. Its main function is placing text on the screen. Entry into the print mode is gained by hitting the asterisk key. Once in this mode the cursor changes to an asterisk. Now the non-destructive cursor can be moved about with the arrows, and anything that is typed appears on the screen. This is a simple mode to use. To exit the mode you must first enter the keypad mode by hitting clear. Once in the keypad mode the other modes are readily available by hitting the appropriate cursor key.

The keypad mode is available at the touch of the < symbol or by the clear key if you are in the print mode. The cursor for the keypad mode is the < symbol and is also non-destructive. The cursor is again positioned by the arrows.

Now look at your keyboard. Note the keys Q, W, A, S, Z and X. These form (a little distorted) a graphic block similar to the graphic blocks on the TRS-80. If you want to draw such a block, position the cursor to the right of the location that you want the graphic and hit the keys that correspond to

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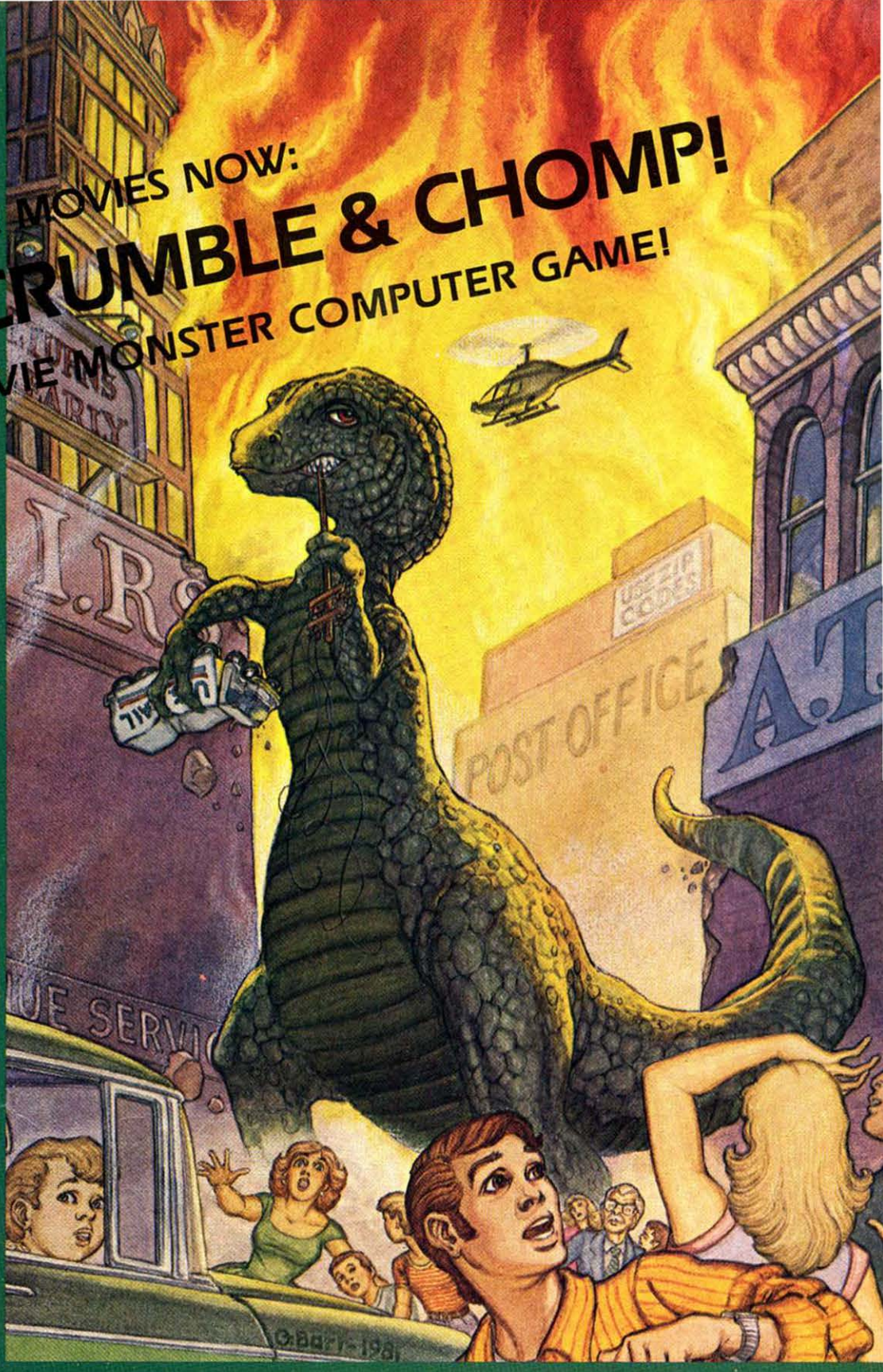

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EPYX

the portion you want lighted. If all six keys are hit in any order, a graphic block equal to CHR$(191) will be drawn on the screen. If only the Q is hit only the upper left corner of the graphic block will be lit (Fig. 3). Once selected, the graphic character can be used to fill in a designated area.

Another feature of the keypad mode is the print-location function. With the cursor positioned to the right of the location of interest, you can obtain the column, row and PRINT@ location of the point by simply hitting enter. The top of the screen will momentarily display the location coordinates of the point to the immediate left of the cursor and then restore the screen to its original design. This is an excellent way to determine the location of data entry points when designing a fill-in-the-blank style CRT display.

To exit the keypad mode hit the cursor key of the mode you want to be in.

The final mode, and the most interesting, is the designate mode. It is entered by hitting the hyphen key. A flashing hyphen is the cursor and it can be moved with the arrow keys. This cursor is also non-destructive.

The designate mode is the heart of the G.E.A.P. program. (Figures 2 and 3 show the results of some of the features possible.) While in this mode you can select any area of the screen; designate it in various ways; and then reverse it, move it, tilt or rotate it, multiply the views of it, magnify it, fill it in, shrink or expand it and save or cancel it You can draw half of a screen, duplicate the half and merge it into an entire screen.

Saving the Program

There are nine options available while in the regular mode (additional options are available in the 2.0 disk version). These options are entered by hitting the number 9 while in the regular mode. The dump program option brings up a ready prompt allowing you to save your creation or load another for reediting. This option is compatible with disk, cassette or Stringy-Floppy. When done, you can reenter G.E.A.P. with USR(x) statements.

You are also given the option of saving

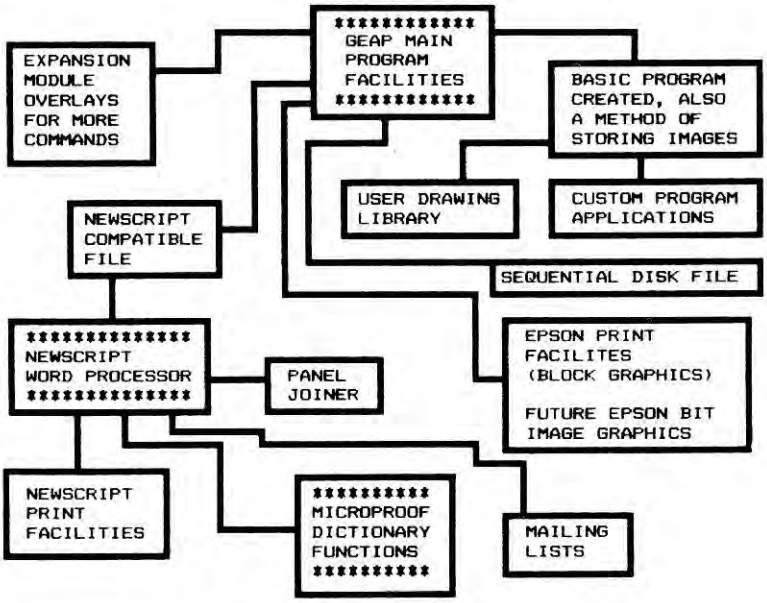

Fig. 4. Chart of G.E.A.P.'s interaction with other programs and its organizational chart

BEYOND-BASIC

```
10 REM          Beyond-BASIC In Action
20 GOSUB "CLEAR SCREEN"          ' See line 200
30 RESTORE 40 : DIM A(5) : MAT READ A
40 DATA  5,4,3,2,1               :' Data for array A
50 NU$="0123456789."             ' Allow digits only
60 INPUT LEN=3, USING NU$, "ACROSS";X
70 INPUT LEN=2, USING NU$, "DOWN";Y
80 PLOT (0,0)-(X,Y)              ' Draw a line
90 SHAPE$="PDPDPRPRPUPUPLP"      ' Define small square
100 INPUT USING NU$, "SCALE";A   ' 1=small, >1=large
110 INPUT USING NU$, "ROTATE";B  ' 0-360 degrees
120 PLOT (X,Y), S=A,R=B, SHAPE$  ' Draw the shape
130 DEF FNI (LO, HI, LOCAL N)    ' Define a function
140 INPUT "ENTER A NUMBER";N     '  to be this entire
150 IF N<LO OR N>HI THEN 140     '  subroutine
160 RETURN N : FNEND
170 PRINT FNI(1,10)+FNI(X,Y)     ' Input 2 nums, add
180 SORT A : PRINT "SORTED ARRAY: ";
190 MAT PRINT A; : DOS           ' Return to TRSDOS
200 'CLEAR SCREEN'               ' Named subroutine
210 CLS : POKE 3C00H, "BEYOND-BASIC DEMO"
220 MAT 1                        ' Ignore A(0) in MAT
230 RETURN
240 END
```

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the screen in compressed or non-compressed code, with the non-compressed code being fully accessible for editing with normal Basic-editing features. You can even specify the line numbers you want to use to store the screen, so you can merge it with a program more easily. G.E.A.P. keeps track of used line numbers so you can't make any mistakes.

Expansion Modules

The expansion modules are optional with version 1.3 and standard with version 2.0. They are special function programs that overlay part of G.E.A.P. memory without disturbing the program. They allow the use of the keyboard to type letters that are medium-sized, large-sized, and cubed. (The cube perspective goes in any of four directions or is completely deleted; see Fig. 1.) To use these module features you must call in the module you need and then type on the keyboard. The option style of letter will appear rather than the normal print.

Additional modules allow the use of the Epson MX-80 printer to reproduce the screen graphics on the printer and also allow the integration of G.E.A.P. and Newscript for producing some unique text and graphic effects. See Fig. 4 for a detailed organizational chart of G.E.A.P. and how it interfaces with software and hardware.

Modules are loaded in two ways. In the 1.3 version it is necessary to hit shift/D to delete any previously loaded module. (This step can be skipped if the first module load is under way.) You must then go to the main menu and select option number 3, the dump option. At the ready prompt simply @LOAD, CLOAD or Run "filespec" for the module desired, and run it once loaded. If you are using disk, the Run "filespec" runs as soon as it is loaded. In the other two options the run must be entered manually. The result in each case is the same, the G.E.A.P. program restarts with the new module in place and any display that was stored is still available. It is now possible to access the newly loaded module and add its special features to the display being created. Modules can be continually overlayed so that each is constantly available.

In the 2.0 version it is only necessary to go to the designate mode, hit I and O simultaneously and select the module desired from the menu displayed. In each module, regardless of the version, the cursor for the special feature selected will be as follows: C signifies cube letters (various perspective selections are made by shift, control letter), M signifies medium letters, and L is for the large letters. The Newscript module, available only in version 2.0, does not display a special cursor.

More Expansion?

Due to the use of expansion modules, an increase in memory size is not necessary to expand the G.E.A.P. program. Additional modules are receiving their finishing touches at this writing. Keep an eye out for them.

High-resolution graphics are available now for G.E.A.P. 2.0 or 2.1 users who also have any version of the Epson MX-series printers with any version of Graftrax. The program modules, called Dot Writer and Dot Printer, allow you to easily create your own high-resolution graphics for printout on the Epson. No hardware modifications are required. You can also write text using a common word processor and then print that text on the Epson using G.E.A.P. supplied fonts or user created fonts. Figure 6 shows some of the fonts presently available. The modules are available separately or as part of the G.E.A.P. package.

A G.E.A.P. user who creates an expansion module is welcome to submit it to J.F. Consulting or to publish it in any publication he may desire. Their goal is to get as many expansion modules as possible into the hands of users. The manual gives all the information needed for the programmer to write his own modules.

J.F. Consulting is also considering a user library consisting of a collection of screen displays designed by G.E.A.P. users. The library will be placed into public domain so that all G.E.A.P. users will be able to draw on the talents of other users.

Disk Version

Version 1.3 is compatible with cassettes or disks; however, if you have a 48K disk system you should get version 2.0. This version has all of the features of version 1.3 plus several more which allow you the full advantage of the disk system. Version 2.0 is compatible with LDOS, DOSPLUS, TRSDOS and NEWDOS80 1.0 and 2.0. Compatibility with other DOS types has not been tested, but it is likely that G.E.A.P. will work with all common DOS types.

Some of the added features are: automatic designate, automatic file save and recall, instant call-up of expansion modules, and Newscript compatibility.

Update and Upgrade Policies

As a G.E.A.P. 1.0 user, I was upset when I found out that the original had been replaced by a much better version. I figured more big bucks for the update to the 1.3 or 2.0 versions. But J.F. Consulting has very reasonable update and upgrade policies. In the case of updates, you're required to pay only the cost of production. In the case of upgrades, you are required to pay the difference between the price of your version and the version you wish to upgrade to.

All Play and No Work?

G.E.A.P. may appear to be a game creator or a toy rather than a workable tool. That's not the case. Figure 5 shows two styles of the same bar graph, both created for business presentations. As in the gaming and artistic aspects, G.E.A.P. is limited in business applications only by the user's imagination.

Conclusion

In my opinion G.E.A.P. is and will remain the most powerful utility of its kind.

There is so much to this program that I cannot list every advantage in this review. It's functional, fun and worth the money. If you would like to contact me regarding G.E.A.P., feel free to write, or contact me on CompuServe EMAIL at 70145,171. I will be pleased to share G.E.A.P. experiences.■

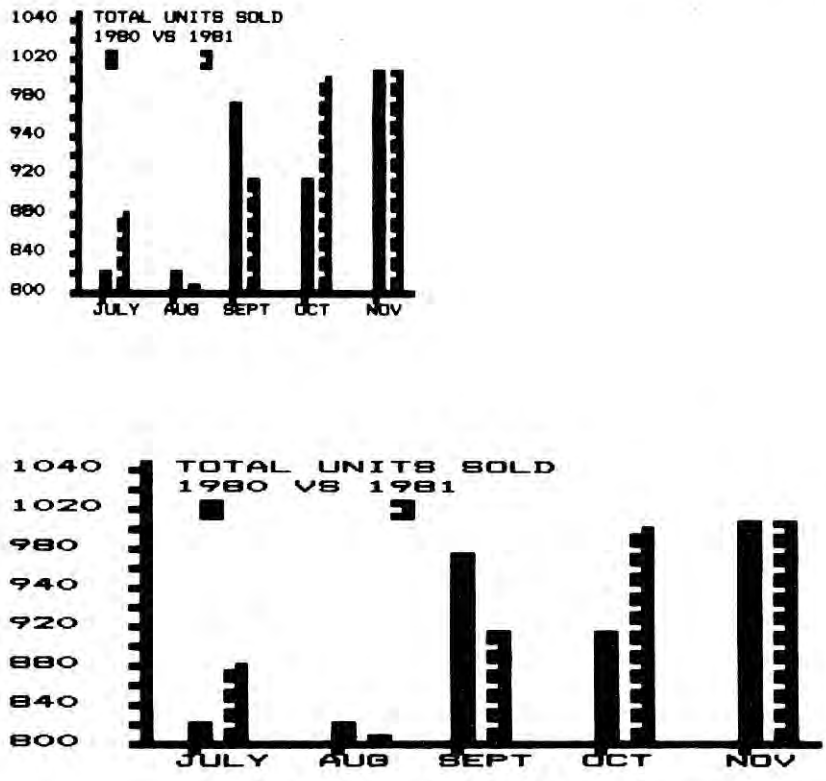


Fig. 5. Bar graphs for typical business presentation

The Key Box

Basic Level II
Model I
Jelly Bean Jar
Auto Dialer

A program Ronald Reagan will love!

Cybernetics and Jelly Bean Detection

Stephen Davids
P.O. Box 541, Station Z
Toronto, Ontario
Canada M5N 2Z6

The word robot is magical. Almost everyone has their own concept of what a robot is and what it should be able to do.

What is Cybernetics? To quote its founder, Norbert Wiener, "We have decided to call the entire field of control and communication theory whether in the machine or in the animal, by the name cybernetics, which we form from the Greek . . . for steersman."

The discipline of cybernetics breaks a robot down into three parts: sense, decide and act. All robot systems must be capable of sampling their environment (sense), making decisions using their internal programming based on data they gather (decide), and then act on the basis of the decision (See Fig. 1).

For example, suppose you have programmed your TRS-80 to monitor the amount of jelly beans in your cupboard. By devising a simple jelly bean level detector consisting of an infrared LED and a photo transistor you will know when your supply is getting low (see Fig. 2). When the level of jelly beans drops below the critical level, the infrared beam from the LED turns on the phototransistor causing a temporary high at port address 243. The TRS-80 notices this by checking the port address 243 for a high using the INP(243) command in a loop. Once a high is sensed at this address, the TRS-80 program outputs a command to an auto-dialer circuit which phones the local jelly bean emporium. The cassette is then turned on and an endless loop cassette orders more jelly beans continuously for at least three minutes (see Fig. 3 and Program Listing 1).

The point of this elaborate example is to illustrate a robot system without feedback. As the program is written, it will not check whether the conditions desired have been accomplished by the system. Specifically, it does not know for sure if the jelly beans have been replenished as a result of the phone call. This is useless. A robot system without feed-

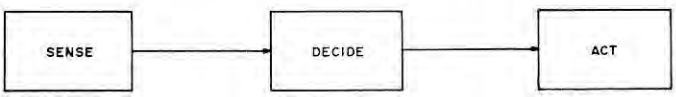
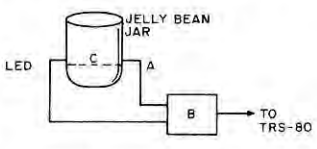


Figure 1

```
10 REM JELLY BEAN DETECTOR PROGRAM
20 REM PORT 243 IS THE JELLY BEAN LOW LEVEL DETECTOR
30 REM PORT 242 IS THE AUTO DIALER
40 REM PORT 241 IS THE PHONE HANDSET LIFT SOLENOID
50 REM PORT 255 IS THE CASSETTE RECORDER
60 DEFINT J, C, N
70 J=INP(243):IFJ<100THEN20:REM CHECK FOR JELLY BEANS
80 REM TURN ON PHONE HANDSET LIFT SOLENOID
90 OUT(241,255)
100 REM TURN ON AUTO DIALER
110 OUT(242,255):FORC=0TO17000:NEXTC
120 REM TURN OFF AUTO DIALER TURN ON CASSETTE
130 OUT(242,0):OUT(255,255)
140 REM 3 MINUTE DELAY
150 FORC=1TO3:FORN=0TO32766:NEXTN:NEXTC
160 REM HANG UP
170 OUT(241,0):OUT(255,0)
180 END
```

Program Listing 1



A = PHOTOTRANSISTOR
B = LOGIC BUFFER INTERFACE
C = LOWEST ACCEPTABLE LEVEL
D = FULL JAR LEVEL

Figure 2

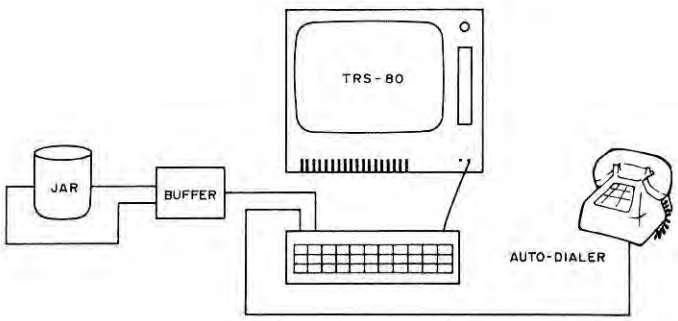


Figure 3

PROGRAMMING TOOLS FOR YOUR TRS-80™ MODEL I AND MODEL III

INSTANT ASSEMBLER

The INSTANT ASSEMBLER is a powerful disk or tape-based assembler and debugger for the TRS-80. Now you can assemble directly to memory and immediately debug your program with the built in single stepping debugger. Quickly switch from assembler to debugger and back again without losing the source code. This feature makes INSTANT ASSEMBLER an excellent learning tool for assembly language programming.

INSTANT ASSEMBLER is absolutely unique among tape based assemblers in that it produces relocatable code modules that can be linked with the separate LINKING LOADER, which is supplied in two versions for loading programs into either high or low RAM. This lets you build long programs with small modules. INSTANT ASSEMBLER also features immediate detection of errors as the source code is entered, a compactly coded source format that uses 1/3 as much memory as standard source, and many operational features including single stroke entry of DEFB and DEFW, pinpoint control of listings, alphabetic listing of symbol table, separate commands for listing error lines or the symbol table, block move function, and verification of source tapes.

INSTANT ASSEMBLER's debugger provides single stepping with full register displays, decimal or hex entry of addresses, forward or backward memory displays, disassembly of object code in memory, memory display in ASCII format, and hex-to-decimal or decimal-to-hex conversion. The single-stepper will step one instruction at a time or at a fast rate to any defined address.

INSTANT ASSEMBLER occupies less than 8400 bytes of memory. In a 16K machine this will leave you enough memory to write assembly language programs of around 2000 bytes. This and its module-linking feature make INSTANT ASSEMBLER ideal for users with only 16K machines. The instruction manual may be purchased separately for $3, which will apply towards the purchase of the INSTANT ASSEMBLER. In addition to disk I/O, the disk version includes a stand-alone version of the debugger.

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Cassette recordings are subject to several types of damage. Thin spots in the oxide, dirt, voltage fluctuations while recording, or stray magnetic fields can all contribute to lost or added bits. RESQ2 was written to provide a method of restoring tapes that can no longer be loaded for these reasons. It can restore BASIC, SYSTEM, ASSEMBLER, and DATA tapes. RESQ2 compares two copies of the damaged tape to attempt a restoration, though restoration can often be accomplished with only one copy. After the damaged data is corrected in memory, a new tape may be recorded and verified which does not contain the errors. The success rate of RESQ2 will depend on the severity and quantity of errors. RESQ2 comes with a comprehensive user manual and examples of two types of 'crashed' programs to practice on.

Specify Model I or Model III. RESQ2 ..... $19.95 on tape

RAM SPOOLER AND PRINT FORMATTER

This program is a full feature print formatting package featuring user defineable line and page length (with line feeds inserted between words or after punctuation), screen dump, printer pause control, and baud rate selection. In addition, printing is done from a 4K expandable buffer area so that the LPRINT or LLIST command returns control to the user while printing is being done. Works with cassette or disk systems. Ideal for Selectric or other slow printers. Allows printing and processing to run concurrently. Output may be directed to either the parallel port, serial port, or the video screen. 80 Microcomputing said "I can only give my highest recommendation of Spooler and Mumford Micro Systems."

Specify Model I or Model III. SPOOLER ..... $16.95 on tape, $21.95 on disk

DUPLICATE SYSTEM TAPES WITH CLONE

Make duplicate copies of almost any tape including Basic, SYSTEM, data lists, assembler source, or "custom loaders". The file name, load address, entry point, and every byte (in ASCII format) are displayed on the video screen. Model III version allows changing tape speed so you can load in a tape at 500 baud and write it out at 1500.

Specify Model I or Model III. CLONE ..... $16.95 on tape, $21.95 on disk

MACHINE CODE FAST FOURIER TRANSFORM

Written by Dr. A.H. Gray, Jr., co-author (with J.D. Markel) of the classic text "Linear Prediction of Speech", this complete package includes 3 versions of the machine language FFTASM routine assembled for 16, 32, and 48K machines, a short sample Basic program to access them, a 10K Basic program which includes sophisticated interactive graphing and data manipulation, and a manual of instructions and examples. The machine language subroutines use variables defined by a supporting Basic program to make data entry and retrieval automatic, without PEEKs and POKEs. They perform 20 to 40 times faster than their Basic equivalent (256 points in 12.5 seconds), and handle up to a 1024 point complex FFT. The FFT is useful in analyzing stock market and comodity trends as well as for signal analysis.

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INSIDE LEVEL II

The Programmers Guide to the TRS-80 ROMS

INSIDE LEVEL II is a comprehensive reference guide to the Model I and Model III ROMs which allows the machine language or Basic programmer to easily utilize the sophisticated routines they contain. Concisely explains set-ups, calling sequences, and variable passage for number conversion, arithmetic operations, and mathematical functions, as well as keyboard, tape, and video routines. Part II presents an entirely new composite program structure which loads under the SYSTEM command and executes in both Basic and machine code with the speed and efficiency of a compiler. In addition, the 18 chapters include a large body of other information useful to the programmer including tape formats, RAM useage, relocation of Basic programs, USR call expansion, creating SYSTEM tapes of your own programs, interfacing of Basic variables directly with machine code, and special precautions for disk systems. INSIDE LEVEL II was reviewed in the April 1982 issue of 80 Microcomputing which said "The book has no flaws; it is a perfect gem." Byte Magazine said "I recommend this book to serious machine language programmers."

Includes updates for Model III. INSIDE LEVEL II $15.95

SINGLE STEP THROUGH RAM OR ROM

STEP80 allows you to step through any Basic or machine language program one instruction at a time, and see the address, hexadecimal value, Zilog mnemonic, register contents, and step count for each instruction. The top 14 lines of the video screen are left unaltered so that the "target program" may perform its display functions unobstructed. STEP80 will follow program flow right into the ROMs, and is an invaluable aid in learning how the ROM routines function. Commands include step (trace), disassemble, run in step mode at variable step rate, display or alter memory or CPU registers, jump to memory location, execute a CALL, set breakpoints in RAM or ROM, write SYSTEM tapes, and relocate to any page in RAM. The display may also be routed to your line printer through the device control block so custom print drivers are automatically supported.

Specify Model I or Model III. STEP80 ..... $16.95 on tape, $21.95 on disk

SMART TERMINAL PROGRAM

This machine language program may be used as a smart terminal with time share systems or for high speed file transfers between two disk-based micros over modems or direct wire. It is menu driven and extremely simple to use. Functions include real-time terminal mode, save RAM buffer on disk, transmit disk file, receive binary files, examine and modify UART parameters, program 8 custom log-on messages, automatic 16-bit checksum verification of accurate transmission and reception, and many more user conveniences. Supports line printers and lowercase characters. With this program you will no longer need to convert machine language programs to ASCII for transmission, and you will know immediately if the transmission was accurate.

Specify Model I or Model III. TELCOM ..... $39.95 on disk

DISK INDEX VERSION 3.0

Our excellent disk indexing program has now been entirely rewritten in machine language. It will run on either a Model I or Model III and catalog disks for either machine regardless of which one is running it. (Model I owners must have double density to catalog Model III disks.) DISK INDEX will assemble an index of your entire program library by automatically reading program names and free space from each disk directory. The index may then be alphabetized or searched for any disk, program, or extension. Disks or programs may be added or deleted, and the whole index or any part may be sent to the printer. The index itself may also be stored on disk for future access and update. A 48K machine will hold over 2500 programs in each index, and you may build as many indexes as you need. Version 3.0 runs substantially faster than our previous version and works with any operating system written for the Model I or Model III except CP/M.

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4 SPEED OPTIONS FOR YOUR TRS-80

The SK-2 clock modification allows CPU speeds to be switched between normal, an increase of 50%, or a 50% reduction; selectable at any time without interrupting execution or crashing the program. Instructions are also given for a 100% increase to 3.54 MHz. The SK-2 may be configured by the user to change speed with a toggle switch or on software command. It will automatically return to normal speed any time a disk is active, requires no change to the operating system, and has provisions for adding an LED to indicate when the computer is not at normal speed. It mounts inside the keyboard unit with only 4 necessary connections for the switch option (switch not included), and is easily removed if the computer ever needs service. The SK-2 comes fully assembled with socketed IC's and illustrated instructions.

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back is worthless, because it cannot account for barriers to performance that exist in the real world.

Servosystems

Systems which include feedback are called servosystems. These are inherently more stable because the decision base (in our case, the TRS-80) is made aware, by some form of feedback, of the extent to which its instructions have been carried out (see Fig. 4).

We can modify our jelly bean program and hardware to include a feedback mode. By installing another LED/photo transistor pair (see Fig. 5) above the original pair in the container and modifying the program to as presented in Listing 2 we have the feedback we need along with an error correcting mode in the decide stage. After the jelly beans are ordered the program jumps to a counter clock routine that looks for a low at port address 244 which would exist if the infrared beam from LED1 was to be interrupted. This indicates either that the jelly beans have arrived or that someone is putting a hand into the jar. To eliminate this possible confusion, a switch on the inside edge of the jar checks to see when the lid is removed. If it is, the program enters a "wait and see" subroutine. It then goes back to monitoring the top phototransistor. When the jelly beans have been replaced, the computer receives the required low and it starts the program all over. However, if the jelly beans have not been replaced and a certain number of counter clock cycles go by, the computer calls the jelly bean store, curses them out for not delivering the order and reorders.

This system, though somewhat fanciful, illustrates the basic principles of cybernetics. It demonstrates a primitive servosystem and explains the importance of feedback for a stable robot system. These concepts, of course, are best applied to more serious applications—for example, TRS-80 control of backyard satellite antennae positioning on the basis of received signal strength or robot security applications. ■

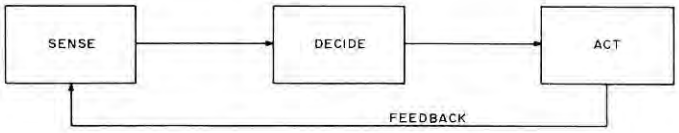
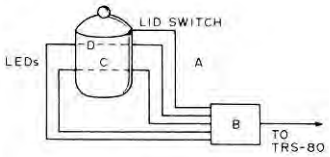


Figure 4

```
10 REM PORTS ARE THE SAME AS LISTING ONE EXCEPT-
20 REM PORT 244 IS THE FULL JAR LEVEL DETECTOR
30 REM PORT 240 IS THE JAR LID SWITCH
60 DEFINTJ, C, N
70 J=INP(243):IFJ<100THEN70
80 OUT(241,255)
90 OUT(242,255):FORC=0TO10000:NEXTC
100 OUT(242,0);OUT(255,255)
110 FORC=1TO3:FORN=0TO32766:NEXTN:NEXTC
120 OUT(241,0):C=1:OUT(255,0)
130 REM THE FEEDBACK LOOP
140 REM THE PROGRAM WILL WAIT FOR 1 MINUTE AT LEAST IF THE
    JAR LID IS REMOVED
150 C=C+1:IFC>32765THEN80
160 J=INP(240):IFJ<100THENFORN=0TO32766:NEXTN:GOTO140
170 J=INP(244):IFJ>100THEN140FLSE70
```

Program Listing 2



A = PHOTOTRANSISTOR
B = LOGIC BUFFER INTERFACE
C = LOWEST ACCEPTABLE LEVEL
D = FULL JAR LEVEL

Figure 5

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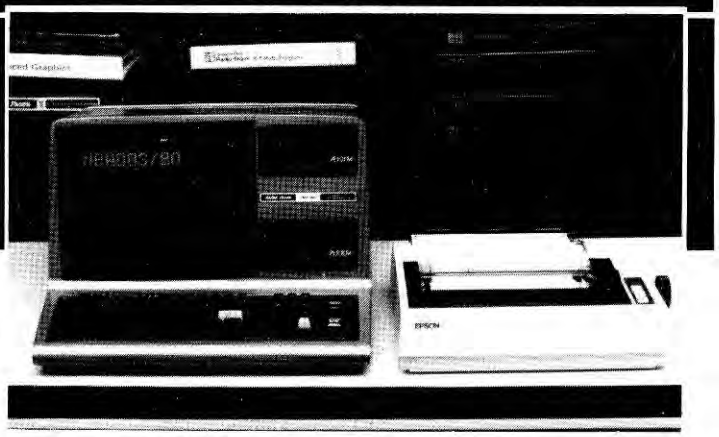
With the purchase of a TRS 80, Model III.



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RS-232-C INTERFACE:	connector fault, data transmission, framing, data loop, baud rate generator.
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8	DEPRSY	Sum of the digits depreciation
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10	DEPRDDB	Double declining balance depreciation
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21	PVAL	Present value of a future amount
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23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
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78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
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91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
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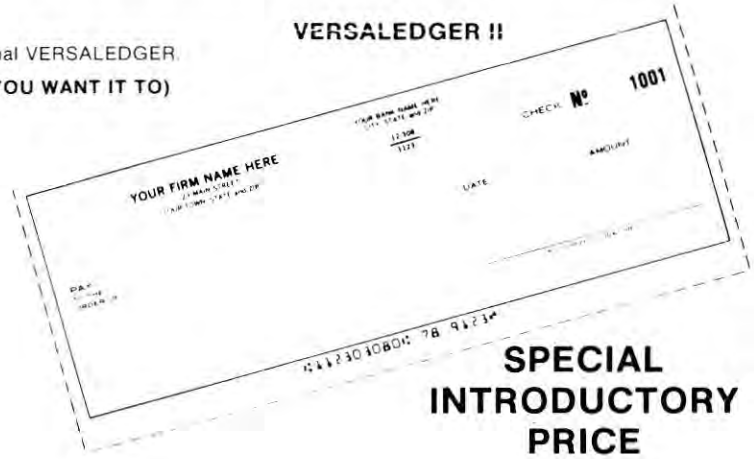
- VERSALEDGER II stores all check information forever. **(IF YOU WANT IT TO)**
- VERSALEDGER II can distribute one check to multiple expense accounts. **(IF YOU WANT IT TO)**
- VERSALEDGER II can handle more than one checkbook. **(IF YOU WANT IT TO)**
- VERSALEDGER II can be used to replace a general ledger. **(IF YOU WANT IT TO)**
- VERSALEDGER II prints balance sheets and income statements. **(IF YOU WANT IT TO)**
- VERSALEDGER II can interact with any of the other four modules of the VERSABUSINESS SYSTEM.



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($199.95 after Dec. 31, 1982)

- VERSALEDGER II comes with a professionally written manual (created for the first-time computer user), which includes sample report printouts.
- VERSALEDGER II HAS AN ALMOST UNLIMITED CAPACITY . . . .
  - (300 checks per month on single density 5¼" disk drives such as the TRS-80 Model I)
  - (500 checks per month on the Apple II)
  - (2400 checks per month on the TRS-80 Model III)
  - (6000 checks per month on the TRS-80 Model II)
  - (3000 checks per month on single density 8" CP/M)
  - (almost unlimited capacity on hard disk drive)
- VERSALEDGER II OUTPERFORMS ALL OTHER COMPETITIVE SYSTEMS NOW AVAILABLE TO MICROCOMPUTER USERS, AT A FRACTION OF THE COST (AND WE OFFER A 30-DAY MONEY BACK GUARANTEE TO BACK UP OUR CLAIM!)

— CAN BE USED WITH 1 or MORE DISK DRIVES with 48K —

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★ PERFECT FOR A SMALL BUSINESS

★ EXPANDS TO HANDLE LARGE CORPORATE PAYROLLS

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ALL MICROSOFT BASIC COMPUTERS

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HOW IT WORKS . . . .

VERSAPAYROLL is a complete menu driven payroll system that grows as you or your business grows. Your VERSA-PAYROLL acts as a simple payroll system keeping track of all government required payroll information. Just enter the employees, VERSAPAYROLL will perform all the necessary payroll calculations automatically and display to totals on your screen. The user has complete control to accept the totals, to print or not print out a check and to post or not post the total to our **VERSALEDGER** system.

- VERSAPAYROLL automatically prints out your PAYROLL checks. **(IF YOU WANT IT TO)**
- VERSAPAYROLL allows you to override any payroll deduction. **(IF YOU WANT IT TO)**
- VERSAPAYROLL automatically posts all checks written to our VERSALEDGER system. **(IF YOU WANT IT TO)**
- VERSAPAYROLL allows the user to print out PAYROLL checks one at a time. **(IF YOU WANT IT TO)**
- VERSAPAYROLL allows the user to print out all your PAYROLL checks at the same time. **(IF YOU WANT IT TO)**
- VERSAPAYROLL gives you a summary of any employee's year to date payroll totals or all employee totals at any time. **(IF YOU WANT IT TO)**
- VERSAPAYROLL will allow you to correct any error made at any time and automatically refigure all totals. **(IF YOU WANT IT TO)**
- VERSAPAYROLL works in every state. **(IF YOU WANT IT TO)**
- VERSAPAYROLL automatically calculates all federal and states taxes. **(IF YOU WANT IT TO)**
- VERSAPAYROLL allows for all of the standard deductions plus state, city and three miscellaneous deductions. **(IF YOU WANT IT TO)**
- VERSAPAYROLL prints all government required reports. **(IF YOU WANT IT TO)**
- VERSAPAYROLL permanently stores all PAYROLL transactions. **(IF YOU WANT IT TO)**
- VERSAPAYROLL HAS AN ALMOST UNLIMITED CAPACITY . . . .

  Can handle up to 300 employees on a TRS-80 MODEL I, 600 employees on a TRS-80 MODEL III, 1200 employees on a TRS-80 MODEL II, 500 employees on an APPLE II, 600 employees on any single density 8" CP/M computer and almost unlimited capacity on hard disk systems.

INTRODUCTORY PRICE
$99.95

CAN BE USED WITH 1 or MORE DISK DRIVES (AND 48K)

VERSAPAYROLL HAS BEEN CREATED WITH THE FIRST TIME COMPUTER USER IN MIND

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MATHEMATICAL APPLICATIONS SERVICE

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H & E COMPUTRONICS INC.

● ● ● EVERYTHING FOR YOUR TRS-80* ● ● ●
MODEL I, MODEL II & MODEL III

* **TRS-80**™ is a trademark of Tandy Corp.

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*** ESSENTIAL UTILITY PROGRAMS FOR EVERY TRS-80 OWNER ***

Facts About Racet Computes Utility Programs

*** ALL PROGRAMS ARE WRITTEN IN MACHINE LANGUAGE
*** ABSOLUTELY NO KNOWLEDGE OF MACHINE LANGUAGE IS NECESSARY TO USE ANY OF THE UTILITY PROGRAMS
*** EACH UTILITY PROGRAM IS CALLED UP FROM **BASIC** USING THE SIMPLE BASIC COMMANDS PROVIDED
*** EACH UTILITY PROGRAM COMES WITH A **RACET COMPUTES** INSTRUCTION MANUAL
*** EACH INSTRUCTION MANUAL INCLUDES SEVERAL EXAMPLES OF UTILITY USAGE
*** EACH UTILITY ALLOWS THE USER TO PERFORM CERTAIN BASIC OPERATIONS TEN, TWENTY OR MORE TIMES FASTER THAN THE EQUIVALENT BASIC ROUTINE (FOR EXAMPLE, **GSF** CAN SORT AN ARRAY OF 1000 RANDOM NAMES INTO ALPHABETICAL ORDER IN UNDER 9 SECONDS!!)

GSF (GENERALIZED SUBROUTINE FACILITY)

- SORTS 1000-ELEMENT ARRAYS IN 9 SECONDS
- SORTS UP TO 15 ARRAYS SIMULTANEOUSLY (MIXED STRING, FLOATING POINT AND INTEGER)
- SORTS SINGLE OR MULTIPLE SUBSTRINGS AS ASCENDING OR DESCENDING SORT KEYS
- READ AND WRITE ARRAYS TO CASSETTE
- COMPRESS AND UNCOMPRESS DATA IN MEMORY
- MOVE ARRAYS IN MEMORY
- DUPLICATE MEMORY
- FAST HORIZONTAL AND VERTICAL LINES
- SCREEN CONTROLS FOR SCROLLING THE SCREEN UP, DOWN, LEFT, RIGHT AND FOR GENERATING INVERSE GRAPHIC DISPLAYS
- ADDS PEEKS AND POKES (MOD-II VERSION ONLY)

MODEL-I VERSION $25.00
MODEL-II VERSION $50.00
MODEL-III VERSION $30.00

KFS-80 (KEYED FILE SYSTEM)

- CREATE ISAM FILES (INDEX SEQUENTIAL ACCESS METHOD)
- ALLOWS INSTANT ACCESS TO ANY RECORD ON YOUR DISKETTE
- INSTANTLY RETRIEVE RECORDS FROM MAILING LISTS, INVENTORY, ACCOUNTS RECEIVABLE OR VIRTUALLY ANY APPLICATION WHERE RAPID ACCESS IS REQUIRED TO NAMED RECORDS
- PROVIDES THE BASIC PROGRAMMER THE ABILITY TO RAPIDLY INSERT OR ACCESS KEYED RECORDS IN ONE OR MORE DATA FILES
- RECORDS ARE MAINTAINED IN SORTED ORDER BY A SPECIFIED KEY
- RECORDS MAY BE INSERTED OR RETRIEVED BY SUPPLYING THE KEY
- RECORDS MAY BE RETRIEVED SEQUENTIALLY IN SORTED ORDER
- RAPID ACCESS TO ANY FILE REGARDLESS OF THE NUMBER OF RECORDS
- MULTIPLE INDEX FILES CAN BE EASILY CREATED WHICH ALLOWS ACCESS OF A SINGLE DATABASE BY MULTIPLE KEYS (FOR EXAMPLE, BY BOTH NAME AND ZIP-CODE)

MODEL-I VERSION $100.00
MODEL-II VERSION $175.00
MODEL-III VERSION $100.00

DSM (DISK SORT MERGE)

- SORT AN 85K DISKETTE IN LESS THAN THREE MINUTES!
- SORTS LARGE MULTIPLE DISKETTE FILES ON A MINIMUM ONE DRIVE SYSTEM
- ALL RECORDS ARE PHYSICALLY REARRANGED-NO KEY FILES ARE REQUIRED
- SORTS RANDOM FILES CREATED BY **BASIC**, INCLUDING FILES CONTAINING SUB-RECORDS SPANNING SECTORS
- SORTS ON ONE OR MORE FIELDS IN ASCENDING OR DESCENDING ORDER
- FIELDS MAY BE STIRNGS, INTEGER, BINARY INTEGER OR FLOATING POINT
- THE SORTED OUTPUT FILE MAY OPTIONALLY HAVE FIELDS DELETED, REARRANGED OR PADDED
- SORT COMMANDS CAN BE SAVED FOR REUSE
- SINGLE SORT, MERGE, OR MIXED SORT/MERGE OPERATIONS MAY BE PERFORMED
- SORTED OUTPUT MAY BE WRITTEN TO A NEW FILE, OR REPLACE THE ORIGINAL INPUT FILE

MODEL-I VERSION $75.00
MODEL-II VERSION $150.00
MODEL-III VERSION $90.00

MAILLIST (A MAILING LIST DATABASE SYSTEM)

- IDEALLY SUITED FOR ORGANIZATION MAILING LISTS, PERSONAL ADDRESSBOOK, OR MAILING LISTS BASED ON DATES SUCH AS REMINDERS FOR BIRTHDATES OR DUES PAYABLE
- USED ISAM (INDEX SEQUENTIAL ACCESS METHOD) FOR RAPID ACCESS TIMES
- YOUR **MAILLIST** CAN ALWAYS BE SORTED AND MAINTAINED BY UP TO FOUR INDEX FILES (FOR EXAMPLE, NAME, ZIPCODE, DATE AND NUMBER)
- **MAILLIST** ALLOWS UP TO 30 ATTRIBUTES TO BE SPECIFIED (TO BE USED IN SELECTION OF SPECIFIED RECORDS WHEN GENERATING REPORTS OR MAILING LABELS
- **MAILLIST** SUPPORTS BOTH 5 OR 9-DIGIT ZIPCODES
- PRINTING MAY BE STARTED OR ENDED AT ANY POINT IN THE LIST. THE USER CAN SPECIFY FIELDS OR CODES TO BE PRINTED
- CAPACITY IS 600 NAMES FOR MODEL-I, 3500 NAMES FOR MODEL II, 38,000 NAMES FOR MODEL II WITH HARD DISK DRIVE, 1200 NAMES FOR MODEL III

MODEL-I VERSION $75.00
MODEL-II VERSION $150.00
MODEL-III VERSION $75.00

THE COMPUTRONICS INC.

HSDS HARD DISK DRIVE SOFTWARE

- MAKES TRSDOS COMPATIBLE WITH MOST HARD DISK DRIVES
- ADDS MANY EXTRA FEATURES TO TRSDOS $400.00

MODEL II FASTBACK — FULL DISK BACKUP IN 55 SECONDS

IN BUSINESS TIME IS MONEY, AND ONE BACKUP IS WORTH A THOUSAND TEARS.

- WORKS ON SYSTEMS WITH 2 OR MORE DRIVES
- CAN REPLACE YOUR EXISTING TRSDOS 1.2 or 2.0 BACKUP UTILITY

MODEL II ONLY $75.00

COMPROC (COMMAND PROCESSOR)

- AUTO YOUR DISK TO PERFORM ANY SEQUENCE OF INSTRUCTIONS THAT YOU NORMALLY GIVE FROM THE KEYBOARD (FOR EXAMPLE, INSERT THE DISKETTE, PRESS THE RESET BUTTON, YOUR COMMAND FILE COULD AUTOMATICALLY SHOW YOU THE DIRECTORY, SHOW THE FREE SPACE ON THE DIKSETTE, LOAD A MACHINE LANGUAGE SUBROUTINE, LOAD BASIC, LOAD AND RUN A BASIC PROGRAM, AND SELECT A GIVEN ITEM ON YOUR MENU... ALL WITHOUT TOUCHING THE KEYBOARD!)

MODEL-I VERSION $20.00
MODEL-III VERSION $30.00
NOT AVAILABLE FOR MODEL-II

DISCAT (DISKETTE CATALOG SYSTEM)

- THIS COMPREHENSIVE DISKETTE CATALOGUING/INDEXING UTILITY ALLOWS THE USER TO KEEP TRACK OF THOUSANDS OF PROGRAMS IN A CATEGORIZED LIBRARY. FILE INCLUDES PROGRAM NAMES AND EXTENSIONS, PROGRAM LENGTH, DISKETTE NUMBERS AND FREE SPACE ON EACH DISKETTE. KEEP A COMPLETE CATALOG OF THE DIRECTORIES ON ALL YOUR DISKETTES IN ALPHABETICAL ORDER (SORTED ON EACH DISKETTE) OR COMPLETE ALPHABETICAL LIST OF PROGRAMS ON ALL YOUR DISKETTES)

MODEL-I VERSION $50.00
MODEL-III VERSION $50.00
MODEL-II VERSION (SEE MODEL-II UTILITY PACKAGE)

BLINK (BASIC LINK FACILITY)

- LINK FROM **BASIC** PROGRAM TO ANOTHER SAVING ALL VARIABLES
- THE CHAINED PROGRAM MAY EITHER REPLACE THE ORIGINAL PROGRAM OR CAN BE MERGED BY STATEMENT NUMBER

MODEL-I VERSION $25.00
MODEL-III VERSION $50.00
MODEL-II VERSION (SEE MODEL-II UTILITY PACKAGE) $30.00

INFINITE BASIC

- ADDS OVER 80 COMMANDS TO BASIC
- SORTING...STRING CENTERING/ROTATION/TRUNCATION...JUSTIFICATION...DATA COMPRESSION...STRING TRANSLATION/COPYING...SCREEN DISPLAY SCROLLING...MATRIX OPERATIONS SIMULTANEOUS EQUATIONS (THROUGH MATRIX INVERSION)...DYNAMIC ARRAY RESHAPING

MODEL-I VERSION $50.00
MODEL-III VERSION $60.00
NOT AVAILABLE ON MODEL-II

INFINITE BUSINESS

- ADD ON PACKAGE TO **INFINITE BASIC** (REQUIRES INFINITE BASIC)
- ADDS PACKED DECIMAL ARITHMETIC WITH 127 DIGIT ACCURACY (+,0,*,/)
- COMPLETE PRINTER PAGINATION CONTROLS...AUTO HEADERS, FOOTERS AND PAGE NUMBERS
- BINARY SEARCH OF SORTED AND UNSORTED ARRAYS (INSTANT SEARCH OF AN ELEMENT WITHIN AN ARRAY)
- HASH CODES

MODEL-I VERSION $30.00
MODEL-III VERSION $30.00
NOT AVAILABLE ON MODEL-II

REMODEL-PROLOAD

- THE ULTIMATE RENUMBERING PROGRAM...RENUMBERS ALL OR PART OF A PROGRAM (ALLOWS PARTIAL RENUMBERING IN MIDDLE OF PROGRAMS)
- PARTIAL OR COMPLETE MERGE OF TWO CASSETTE PROGRAMS

MODEL-I VERSION $35.00
MODEL-III VERSION $35.00
NOT AVAILABLE ON MODEL-II

COPSYS

- COPY AND VERIFY ALL MACHINE LANGUAGE (SYSTEM) TAPES WRITTEN IN STANDARD FORMAT. IF YOU BUY A MACHINE LANGUAGE PROGRAM, **COPSYS** ALLOWS YOU TO EASILY COPY THE PROGRAM ONTO ANOTHER CASSETTE AS A BACKUP

MODEL-I VERSION $15.00
MODEL-III VERSION $20.00
NOT AVAILABLE ON MODEL-II

MODEL-II UTILITY PACKAGE

- ESSENTIAL FOR EVERY MOD-II OWNER
- RECOVER AND REPAIR FILES AND DIRECTORIES (BY JUST ENTERING A SINGLE COMMAND)
- XCOPY...SIMILAR TO COPY BUT CAN COPY ANY NUMBER OF FILES AT ONE TIME FASTER AND MORE ACCURATE THAN COPY SINCE RECORDS ARE COPIED IN GROUPS RATHER THAN ONE RECORDS AT A TIME. USING XCOPY YOU CAN COPY FILES THAT CAN NOT BE COPIED USING THE COPY COMMAND
- SZAP...PROVIDES THE CAPABILITY TO READ AND MODIFY ANY SECTOR ON A DISKETTE
- XHIT...CAN BE USED TO REPAIR A DISKETTE DIRECTORY
- DCS...DIRECTOR CATALOG SYSTEM IS A UTILITY FOR THE MANAGEMENT OF USER DISKETTES...SETS OF A MULTIPLE DISKETTE DIRECTORY FILE (WITH UP TO 1200 INDIVIDUAL FILE NAMES)...ALLOWS SELECTIVELY LISTED OR PRINTED LISTS OF DIRECTORY FILES IN COMBINED SORTED ORDER (FOR EXAMPLE, LISTED ALPHABETICALLY BY DISKETTE...OR A COMPOSITE ALPHABETICAL LIST OF ALL YOUR DISKETTES!)
- DEBUG-II...ADDS SEVERAL FEATURES TO THE PRESENT TRSDOS DEBUG UTILITY INCLUDING SINGLE INSTRUCTION CYCLE, AUTO (LOOP) BREAKPOINTS, SUBROUTINE CALLING, BREAK-KEY DETECTION AND MANY OTHERS

MODEL-II ONLY $150.00

MODEL-II DEVELOPMENT SYSTEM

- THIS PACKAGE IS A MUST FOR ASSEMBLY LANGUAGE PROGRAMMERS
- INCLUDES THE **MICROSOFT EDITOR ASSEMBLER PLUS** WITH ENHANCEMENTS FOR THE MODEL-II
- A COMPLETE DISASSEMBLER
- SUPERZAP FOR READING AND MODIFY ANY SELECTOR ON A DISKETTE

MODEL-II ONLY $125.00

MOD-II BASIC CROSS REFERENCE UTILITY

- LIST OR PRINT A SORTED CROSS REFERENCE TO ALL NUMBERS OR VARIABLES WITHIN A PROGRAM
- LIST OF PRINT ALL LINE NUMBERS CONTAINING A SPECIFIED STRING OF CHARACTERS

MODEL-II ONLY $50.00

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END USERS CALL:

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Experience Shows - S.B.S.G. has over 11,000 Installed Systems!

If you're not running Small Business Systems Group software . . . chances are you're not running!

GENERAL ACCOUNTING SYSTEM For TRS-80™

S.B.S.G. has created the first completely user-configurable accounting system available for the TRS-80™.

User configurable? Each S.B.S.G. General Accounting System Module (except Order Entry) can be operated independently, or any of the modules can be combined in any configuration, providing a complete, coordinated system to fit the needs of your business.

The S.B.S.G. System allows you the maximum efficient use of available disk space. Each module will run on a standard 1 disk drive system (except for Model I systems, which require 2 drives). As you add more disk drives to your system, the amount of on-line data storage increases. Now here's an important fact..... the S.B.S.G. General Accounting System "spans" your disk drives - that means that you can instantly access your data on any of **up to 8 disk drives** at any time! Since your S.B.S.G. Accounting System is user-configurable, it will work with 1, 2, 3, 4 or more disk drive systems - and it is fully compatible with most hard disk drive systems (at additional cost).

General Ledger

The General Ledger accounting system consolidates financial data from other accounting subsystems in an accurate and timely manner. Major reports include Trial Balance, Income Statement, Balance Sheet, a user-defined report, and more. All data is maintained and reported by month, quarter, year and previous three quarters. Transactions may be entered via direct posting and external posting generated by A/R, A/P, Payroll - or any other user source.

Accounts Receivable

The objective of a computerized A/R system is to prepare accurate and timely monthly statements to credit customers. Management can generate information required to control the amount of credit extended and the collection of money owed in order to maximize profitable credit sales while minimizing losses from bad debts. This system is invoice-oriented. Invoices can be entered before they're ready for billing, after billing, or even after they are paid. Accounts Receivable allows entry of new invoices, credit memos, debit memos, or modification or deletion invoice and allows for progress payment. The transaction information includes: type of A/R transaction, P.O. #, description of P.O., billing date, general ledger sales account #, invoice amount, shipping and transportation charges, tax charges, payment, and progress payment information. Reports include: summary or detail listing of invoices not yet billed, open items (unpaid invoices), closed items (paid invoices), and aging. Statements may be printed at any time and follow the format of nationally available forms.

Order Entry

The Order Entry Module was designed as a supplement to the Accounts Receivable Module, and will not operate independently. This system allows you to add, change, delete, list and print invoices; apply an invoice to correct customer account; generate computer assigned invoice numbers; note type (invoice credit memo, debit memo); record customer order number, invoice date, shipping date, FOB location, method of shipping, salesman, and payment terms; print selected number of shipping labels; enter, display and correct 10 lines of data per invoice, noting the part number, description, price, quantity ordered, extension, taxable or not. It also allows the user to enter, display and correct invoice totals, noting the invoice subtotal, taxes, shipping and handling, with disbursement up to 5 General Ledger accounts; print a transaction report; maintain a terms code file in the system; update Account Receivable and generate summary report totals. It automatically coordinates to the Inventory Module (if used) to determine description, price and out of stock status, and to immediately deplete inventory stock. Price fields are easily modified to include percent or dollar discount.

Payroll

Payroll involves many complex calculations and the production of reports and documents, many of which are required by government agencies. The Payroll system performs all necessary payroll tasks including file maintenance, pay data entry and verification, computation of pay and deduction amounts, and the printing of reports and checks. State and Federal Tax changes are easily implemented by the user via menu prompting. In its link to General Ledger, each employee's payroll information is distributed to as many as 12 different GL accounts; system automatically posts to cash account.

Accounts Payable

The Accounts Payable system receives data concerning purchases from suppliers and produces checks in payment of outstanding invoices. Several reports are available to supply information needed for the analysis of payments, expenses, purchases and cash requirements. The Accounts Payable system is invoice-oriented. It handles new invoices, credit memos and even debit memos and allows modification and deletion of invoices. The flexible check calculation procedures allows checks to be calculated for a set of vendors, specific vendors or even specific invoices. The reports include open item listings and closed item listings (both detail and summary), debit and credit memo listings, aging, check register report (to give an audit trail of checks printed), and vendor listing and vendor activity. Update reports are useful for audit trails and checking for accuracy. Checks may be printed at any time and follow the format of nationally available forms.

Inventory

Status reports and minimum reorder reports help to reduce the potential hazard of overstocking which results in cash flow problems. Program selection allows the user to store data for inventory located at up to five separate sites (divisions), coding up to 9 sales people. Available reports include inventory master list, price listings, period and year-to-date sales, stock status, minimum reorder point and commission information.

Model I, 48K and 2 Disk Drives . . . $195.00 Per Module
Model III, 48K . . . . . $195.00 Per Module
Model II, 64K . . . . . $295.00 Per Module
Sample Report Printouts . . . . . $ 10.00

H & E COMPUTRONICS Gives You A 30-Day Money Back Guarantee On All Modules

Experience Shows - S.B.S.G. has over 11,000 Installed Systems!

COMMUNICATIONS SYSTEMS

Small Business Systems Group markets a complete line of software which interfaces the TRS-80™ with ANY computer that communicates in ASCII. This family of products offers both terminal and host capabilities to users with even the most minimal hardware configurations. There has been wide interest in these products from "comm buffs," the educational community, and **businesses and individuals who need to communicate on a regular basis.** Our systems are among the most versatile and comprehensive on the market today for TRS-80™ microcomputers.

SMALL BUSINESS SYSTEMS GROUP

ST80-III™ -- The Ultimate Communications System

The "state of the art" in communications processors, designed for complex commercial applications. Included in this package is a set of programs that allow your TRS-80™ to talk to a timesharing computer, transfer files to and from your central business computer, and customize your ST80-III to your specific application.

Features include: Selectable RS232 Setting • Help Display • Echo Feedback • Job Log (LDOS Mod I, Mod III) • 2-User Translation Tables • Auto Logon • 10 Function Keys (Definable) • RUBOUT Key (Definable) • Warm Restart • Automatic I.D. • True Break • Direct Cursor Addressing • DOS Command Support • Transmit Line Feed • Printer Support • Video Display Modes: SCROLL, FORMAT, PAGE, REVERSE VIDEO (Mod II), CURSOR ON/OFF • Auto-answer • Autodial (certain modems) • Append to memory buffer • Big buffer for printer • Off hook / on hook • 10 predefined ASCII strings in translation tables, • Registered users include NASA, USN, UPS, Westinghouse, and many colleges, universities and major banks.

Minimum Requirements: One disk drive, RS232-C, 32K Model I or III, 64K Model II.

Model I or III **$150.00**
Model II **$250.00**

FORUM-80™ -- Communications Network

With Bill Abney's hot new communications product, you and your TRS-80™ can become part of one of the fastest growing communications networks in the country; your computer becomes an on-line bulletin board system: users can leave messages, get messages, swap information; exchange VisiCalc™ reports, charts, graphs or other correspondence with other computers.

Features Include: Security System • Constantly displayed time-in-use figure • User Friendly • User Configurable or can be modified for custom application • Future updates and upgrades available to register owners • Multiple command strings • Non-technical user and operator manuals.

Minimum Requirements: TRS-80™ (3-drive Mod I, 2-drive Mod III), 48K, RS232-C, Auto-answer modem.

Model I or III **$350.00**

ST-80-PBB™ -- Personal Bulletin Board

A small yet powerful bulletin board for the individual to gather and leave electronic mail. Messages reside in data base in memory, eliminating the problem of scanning magnetic media.

Features Include: Password Security System • Four levels of Access--Guest, Member, Owner, Operator • User Log • Four message types • Smart reverse scan to view messages from most recent to oldest.

Minimum Requirements: TRS-80™ (Mod I or III), 16K, Level II, Auto-answer modem, ST80-X10 Host Program ($50), RS232-C.

Model I or III **$50.00**

ST-80-CC™ -- Communications Center

More than a personal bulletin board, this is a complete communications system for low to moderate traffic. Like ST80-PBB™ it supports four levels of users and four levels of messages with text editing and reverse scan of messages.

Additional Features Include: Transmit same message to many individuals • Auto logon and multiple command scanning • Print messages on line printer, save messages in memory buffer, maintain database without user intervention.

Minimum Requirements: TRS-80™ (Mod I or III), Level II, 48K, one disk, Auto-answer modem, ST80-X10 Host Program ($50), RS232-C.

Model I or III **$100.00**

MouseNet™ -- Advanced Bulletin Board System

Designed to accommodate high volume traffic, to operate simply enough for novice users, yet is fast and powerful enough for experienced callers.

Features Include: Messages stored on disk in keyed file • Uses machine language subroutines for speed • Supports text editing commands • Help commands guide user • System bulletins display each time a user logs on • All messages are dated.

Minimum Requirements: TRS-80™ (Mod I or III), 48K, RS232-C, 3 Disks, Auto-answer modem, text editor (such as Scripsit).

Model I or III **$295.00**

DELUXE PERSONAL FINANCE For TRS-80™ Model II

This is a sophisticated and unique financial analysis package which can be readily customized to suit your personal financial situation. It will:

- Accept and apply transactions to user-formatted budget categories.
- Separate cash and check disbursements.
- Allows up to ten category disbursements per check.
- Credit income/deposits according to source.
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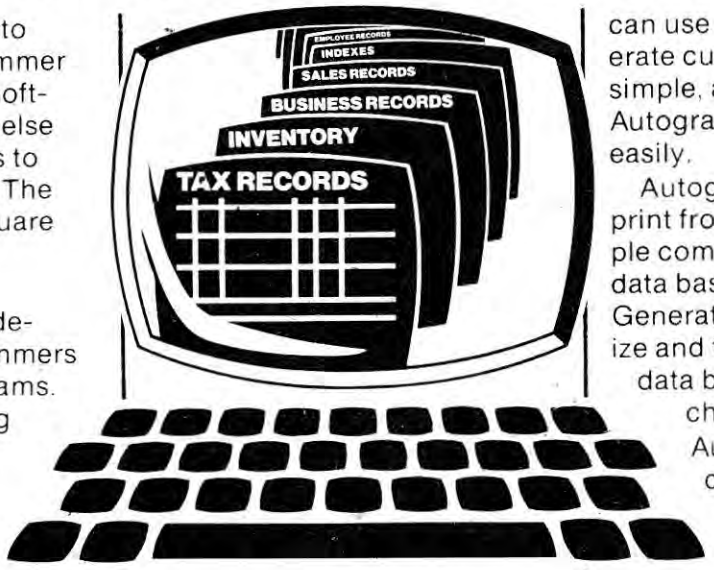

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When was your last oil change?

Autotrak

Robert James Lloyd
341½ Elkton Road
Newark, DE 19711

You work for a company using seven vehicles as company cars. It's late Friday afternoon, close to quitting time. Enter the boss: "Hey Joe, the accountant just called and needs an expense report for each company car. He said go back six months. Get them ready by noon Monday. Have a nice weekend." Recovering your wits, you run out for a jar of midnight oil, and upon returning, grab the receipt files. Your torture begins.

This is a hypothetical situation, but the work involved is real. Compiling six months' expenses for seven cars into orderly reports is a monumental task without Autotrak. With Autotrak, data stored on disk is accessed, selected and printed in several formats, all within minutes.

AUTOTRK1/BAS

Autotrak is actually two programs. AUTOTRK1/BAS creates a file (AUTOINT) containing the number of company cars, their description, and 10 user-defined auto codes. This information has to be available whenever AUTOTRK2/BAS runs.

AUTOTRK1/BAS begins by describing its operation, showing examples and giving prompts. All pre-defined auto codes are shown and you may enter 10 user-defined codes.

Pre-defined codes are:

1 —Gas
2 —Oil
3 —Tires
4 —Battery
5 —Lubrication
6 —Exhaust System
7 —Wheel Alignment
8 —Brakes
9 —Belts/Hoses

The 10 user-defined auto codes, lettered A through J, make the program flexible enough for companies unable to spend large sums of money on accounting firms. User codes could include tags and insurance, labor costs, wash/wax or tolls, for example.

At the completion of initial setup, AUTOTRK1/BAS writes data to disk using sequential output via buffer 1. Once AUTOINT is closed, AUTOTRK1/BAS requests that the disk containing AUTOTRK2/BAS be inserted in a drive. If you wish to make no expense entries at this time, press break to end AUTOTRK1/BAS.

Included within the program is an error-trapping routine that prints a message whenever AUTOTRK2/BAS cannot be found. Load the correct disk and press enter. (You may want to leave line 20 out of AUTOTRK1/BAS until it is debugged and runs properly. This effectively disables the error routine by eliminating the On Error GOTO command.)

Should you increase the fleet of cars, rerun AUTOTRK1/BAS to create a new AUTOINT file. Keep auto numbers and their descriptions in the same order as the original AUTOINT, or expense data may be

AUTOTRAK Expense Report by Auto Code
1980 Grand Prix, License 109751, White

Auto Codes: (Codes A-J are user defined)

0= Gas	5= Tune-up	A= Tags	F= Filters
1= Oil	6= Exhaust Sys.	B= Insurance	G= Wash/Wax
2= Tires	7= Wheel Align	C= Air Cond.	H= Transmission
3= Battery	8= Brakes	D= Body Work	I= Radiator
4= Lubrication	9= Hoses/Belts	E= Major Eng Wk	J= Differential

CODE	DATE	QUANTITY	COST	METHOD OF PAYMENT	RECEIPT NUMBER	DESCRIPTION
0	112280	13.6	17.67	CA	NONE	GAS PURCHASE
0	120380	17.8	23.94	CA	NONE	GAS PURCHASE
0	121580	16.8	22.60	CC	1356287	GAS PURCHASE
0	122880	15.4	20.00	CA	NONE	GAS PURCHASE
0	011081	12.4	16.10	CA	NONE	GAS PURCHASE
0	012281	16.9	21.95	CA	NONE	GAS PURCHASE
0	021081	16.3	21.92	CA	NONE	GAS PURCHASE
0	022081	13.8	18.56	CA	NONE	GAS PURCHASE
0	022581	17.9	24.07	CA	NONE	GAS PURCHASE
0	030381	10.0	12.99	CA	NONE	GAS PURCHASE
0	031781	15.7	21.12	CA	NONE	GAS PURCHASE
0	032681	17.3	22.47	CA	NONE	GAS PURCHASE
0	040581	15.7	20.39	CA	NONE	GAS PURCHASE
0	040981	10.8	14.53	CA	NONE	GAS PURCHASE
0	041581	17.7	23.00	CA	NONE	GAS PURCHASE
0	042381	16.8	21.82	CA	NONE	GAS PURCHASE
0	050581	15.9	20.65	CA	NONE	GAS PURCHASE
0	051081	13.3	17.28	CC	693827	GAS PURCHASE
0	061781	15.7	20.08	CA	NONE	GAS PURCHASE

Total Expenditures = 381.14

Fig. 1. Report by Auto Code

The Key Box

Model I or III
32K RAM
Disk Basic
One disk drive
Printer required

```
AUTOTRAK Expense Report by Month/Year
1980 Grand Prix, License 109751, White

Auto Codes:                        (Codes A-J are user defined)

0= Gas           5= Tune-up       A= Tags          F= Filters
1= Oil           6= Exhaust Sys.  B= Insurance     G= Wash/Wax
2= Tires         7= Wheel Align   C= Air Cond.     H= Transmission
3= Battery       8= Brakes        D= Body Work     I= Radiator
4= Lubrication   9= Hoses/Belts   E= Major Eng Wk  J= Differential

                                          METHOD OF    RECEIPT
 DATE    CODE     QUANTITY     COST        PAYMENT     NUMBER     DESCRIPTION
-------------------------------------------------------------------------------

030381     0         10.0       12.99        CA         NONE       GAS PURCHASE
031581     I                    14.50        CK         1408       DRAIN, FLUSH & REFILL RADIATOR
031781     0         15.7       21.12        CA         NONE       GAS PURCHASE
032281     C                    22.50        CK         1421       RECHARGE AIR CONDITIONING
032681     0         17.3       22.47        CA         NONE       GAS PURCHASE
032681     G                     6.50        CA         NONE       WASH
033081     2          1.0       1.50         CA         NONE       OIL PURCHASE

Total Expenditures =   101.58
```

Fig. 2. Report by Month and Year

```
AUTOTRAK Expense Report by Auto Code/Year
1980 Grand Prix, License 109751, White

Auto Codes:                        (Codes A-J are user defined)

0= Gas           5= Tune-up       A= Tags          F= Filters
1= Oil           6= Exhaust Sys.  B= Insurance     G= Wash/Wax
2= Tires         7= Wheel Align   C= Air Cond.     H= Transmission
3= Battery       8= Brakes        D= Body Work     I= Radiator
4= Lubrication   9= Hoses/Belts   E= Major Eng Wk  J= Differential

                                      METHOD OF    RECEIPT
CODE     DATE      QUANTITY     COST     PAYMENT     NUMBER     DESCRIPTION
-------------------------------------------------------------------------------

  0     112280       13.6       17.67      CA         NONE       GAS PURCHASE
  0     120380       17.8       23.94      CA         NONE       GAS PURCHASE
  0     121580       16.8       22.60      CC         1356287    GAS PURCHASE
  0     122880       15.4       20.00      CA         NONE       GAS PURCHASE

Total Expenditures =    84.21
```

Fig. 3. Report by Auto Code and Year

```
AUTOTRAK Expense Report by Auto Code/Month/Year
1980 Grand Prix, License 109751, White

Auto Codes:                        (Codes A-J are user defined)

0= Gas           5= Tune-up       A= Tags          F= Filters
1= Oil           6= Exhaust Sys.  B= Insurance     G= Wash/Wax
2= Tires         7= Wheel Align   C= Air Cond.     H= Transmission
3= Battery       8= Brakes        D= Body Work     I= Radiator
4= Lubrication   9= Hoses/Belts   E= Major Eng Wk  J= Differential

                                      METHOD OF    RECEIPT
CODE     DATE      QUANTITY     COST     PAYMENT     NUMBER     DESCRIPTION
-------------------------------------------------------------------------------

  0     030381       10.0       12.99      CA         NONE       GAS PURCHASE
  0     031781       15.7       21.12      CA         NONE       GAS PURCHASE
  0     032681       17.3       22.47      CA         NONE       GAS PURCHASE

Total Expenditures =    56.58
```

Fig. 4. Report by Auto Code, Month and Year

written to an incorrect file. Also, the 10 user-defined codes must remain the same to ensure correct expense reports.

AUTOTRK2/BAS

AUTOTRK2/BAS gives two options, one to enter expense data and one to print reports.

Enter expense data by inputting the date, using MMDDYY format, on which the purchase was made (for example, 052181 is May 21, 1981). Use leading zeroes for months and days whose numerical equivalent is less than 10.

Twenty auto codes are shown, followed by a prompt to select one. Continue entering expense data as each prompt occurs. AUTOTRK2/BAS ignores any incorrect entries and allows reentry.

When you wish to change the information, answer N to "Is all information correct?" This erases data just input.

If all information is correct, answer Y. Select a drive, being sure the file for the selected auto is in it. If not, the file is created, and you may end up with several files for the same auto. Output is made using random access via buffer 2.

Disk Format

Information stored includes an auto code, quantity bought (usually for gas and oil purchases), total cost, method of payment (cash, check or credit card), receipt number, and description.

Files are created and added as needed to maintain up-to-date expense records. Each entry is 255 bytes long, fielded as:

Code—1 byte
Date—6 bytes
Quantity—4 bytes
Cost—7 bytes
Method of Payment—2 bytes
Receipt Number—7 bytes
Description—36 bytes
Remaining bytes are blank

I selected this method for writing data, since you will probably key expenses in one day at a time.

I have not been using Autotrak long enough to estimate the number of entries per disk. You may wish to store each auto's records on a separate disk or set up new files semi-annually. Obviously, bigger businesses make more entries.

Report Generation

AUTOTRK2/BAS allows output of expense data to a 132-column printer. You may use an 80-column printer by changing lines 940 and 1800:

```
940 IF LEN(DSC$)>18 PRINT@768,CHR$(31);:GOTO910
1800 LPRINTSTRING$(80,95):IFP>1GOTO2230ELSE1830
```

```
AUTOTRAK Expense Report by Year
1980 Grand Prix, License 109751, White

Auto Codes:                    (Codes A-J are user defined)

0= Gas          5= Tune-up      A= Tags          F= Filters
1= Oil          6= Exhaust Sys. B= Insurance     G= Wash/Wax
2= Tires        7= Wheel Align  C= Air Cond.     H= Transmission
3= Battery      8= Brakes       D= Body Work     I= Radiator
4= Lubrication  9= Hoses/Belts  E= Major Eng Wk  J= Differential
```

DATE	CODE	QUANTITY	COST	METHOD OF PAYMENT	RECEIPT NUMBER	DESCRIPTION
112280	0	13.6	17.67	CA	NONE	GAS PURCHASE
112380	2		138.70	CK	1103	REPLACE REAR TIRES
112980	8		12.50	CA	NONE	ADJUST BRAKES
120380	0	17.8	23.94	CA	NONE	GAS PURCHASE
121080	6		73.75	CC	1352901	REPLACE MUFFLER AND TAILPIPE
121580	5		39.95	CK	1149	TUNE-UP
121580	1	5.0	7.50	CC	1356287	OIL CHANGE
121580	4		2.50	CC	1356287	LUBE
121580	F		4.95	CC	1356287	REPLACE OIL FILTER
121580	F		5.75	CC	1356287	REPLACE AIR FILTER
121580	F		3.79	CC	1356287	REPLACE GAS FILTER
121580	0	16.8	22.60	CC	1356287	GAS PURCHASE
121780	G		6.50	CA	NONE	WASH
122380	H	29.0	28.95	CC	7652190	ADJUST TRANSMISSION
122880	0	15.4	20.00	CA	NONE	GAS PURCHASE

Total Expenditures = 409.05

Fig. 5. Report by Year

```
AUTOTRAK Expense Report by All entries in file
1980 Grand Prix, License 109751, White

Auto Codes:                    (Codes A-J are user defined)

0= Gas          5= Tune-up      A= Tags          F= Filters
1= Oil          6= Exhaust Sys. B= Insurance     G= Wash/Wax
2= Tires        7= Wheel Align  C= Air Cond.     H= Transmission
3= Battery      8= Brakes       D= Body Work     I= Radiator
4= Lubrication  9= Hoses/Belts  E= Major Eng Wk  J= Differential
```

DATE	CODE	QUANTITY	COST	METHOD OF PAYMENT	RECEIPT NUMBER	DESCRIPTION
112280	0	13.6	17.67	CA	NONE	GAS PURCHASE
112380	2		138.70	CK	1103	REPLACE REAR TIRES
112980	8		12.50	CA	NONE	ADJUST BRAKES
120380	0	17.8	23.94	CA	NONE	GAS PURCHASE
121080	6		73.75	CC	1352901	REPLACE MUFFLER AND TAILPIPE
121580	5		39.95	CK	1149	TUNE-UP
121580	1	5.0	7.50	CC	1356287	OIL CHANGE
121580	4		2.50	CC	1356287	LUBE
121580	F		4.95	CC	1356287	REPLACE OIL FILTER
121580	F		5.75	CC	1356287	REPLACE AIR FILTER
121580	F		3.79	CC	1356287	REPLACE GAS FILTER
121580	0	16.8	22.60	CC	1356287	GAS PURCHASE
121780	G		6.50	CA	NONE	WASH
122380	H	29.0	28.95	CC	7652190	ADJUST TRANSMISSION
122880	0	15.4	20.00	CA	NONE	GAS PURCHASE
011081	0	12.4	16.10	CA	NONE	GAS PURCHASE
011481	1	2.0	3.00	CA	NONE	OIL PURCHASE
011781	9		4.98	CK	1239	REPLACE LOWER RADIATOR HOSE
012281	0	16.9	21.95	CA	NONE	GAS PURCHASE
012981	B		170.80	CK	1310	INSURANCE (6 MONTHS)
020581	A		20.00	CK	1324	STATE INSPECTION FEE
021081	0	16.3	21.92	CA	NONE	GAS PURCHASE
021081	7		12.50	CK	1337	FRONT END ALIGNMENT
021681	2		2.50	CA	NONE	REPAIR FLAT TIRE
022081	0	13.8	18.56	CA	NONE	GAS PURCHASE
022581	3		49.50	CC	A-13579	REPLACE BATTERY
022581	0	17.9	24.07	CA	NONE	GAS PURCHASE
022981	2	1.0	1.50	CA	NONE	OIL PURCHASE
030381	0	10.0	12.99	CA	NONE	GAS PURCHASE
031581	I		14.50	CK	1408	DRAIN, FLUSH & REFILL RADIATOR
031781	0	15.7	21.12	CA	NONE	GAS PURCHASE
032281	C		22.50	CK	1421	RECHARGE AIR CONDITIONING
032681	0	17.3	22.47	CA	NONE	GAS PURCHASE
032681	G		6.50	CA	NONE	WASH
033081	2	1.0	1.50	CA	NONE	OIL PURCHASE
040381	2		140.00	CK	1462	REPLACE SNOW TIRES
040581	G		6.50	CA	NONE	WASH
040581	0	15.7	20.39	CA	NONE	GAS PURCHASE
040981	0	10.8	14.53	CA	NONE	GAS PURCHASE
041581	0	17.7	23.00	CA	NONE	GAS PURCHASE
042181	G		6.50	CA	NONE	WASH
042281	9		4.50	CC	1396281	REPLACE FAN BELT
042381	0	16.8	21.82	CA	NONE	GAS PURCHASE

Fig. 6. Report Showing All Entries in File

Line	Description
10	Clears 500 bytes for string storage and manipulation
20	Defines line number for error-trapping routine
30 - 340	Gives brief description and examples
350	Begins initial setup
360 - 370	Input number of vehicles—maximum = 10
380 - 430	Input vehicle descriptions—maximum length = 40
440 - 490	Input user-defined codes—maximum length = 12
500 - 640	Writes initial setup information to selected drive using sequential output
650 - 670	Loads AUTOTRK2/BAS
680 - 710	Error-trapping routine—Code 54 = File cannot be found. If code is not equal to 54, print line number and stop

Fig. 7. AUTOTRK1/BAS Data Flow

A$	Option selection
AE$	Another entry? (Y/N)
AN	Flag for another entry (0/1)
CT	Cost input
D	Time delay loop
DATE$	Date input—MMDDYY format
DSC$	Description input
DN$	Drive number
F$	PRINTUSING format
G$	PRINTUSING format
I	Last entry in file plus one
L	Loop to input information
LC$	Report format descriptions
NV	Number of vehicle
P	Page flag
PC$	Pre-defined codes
PY$	Method of payment
QT	Quantity
RE$	Receipt number
TC	Total cost
UC$	User-defined codes
V$	Vehicle description
VN	Vehicle number
YR$	Year

The following field buffer 2:

CD$	Code
CST$	Cost
DESC$	Description
DT$	Date
KEY$	Code and date
PAY$	Method of payment
QNT$	Quantity
RCPT$	Receipt number

Fig. 8. Strings and Variables in AUTOTRK1/BAS and AUTOTRK2/BAS

The only difference is the expense description is shortened to 18 characters.

Report formats are:

- Auto Code (prints all data for selected code)
- Month/Year (prints all data for selected month and year)
- Auto Code/Year (prints all data for selected code during year)
- Auto Code/Month/Year (prints all data for selected code during month and year)
- Year (prints all data for selected year)
- All entries in file (prints all data)

Figures 1-6 are examples of each format using information input over a period of time.

If you want to know how much gasoline vehicle 1 used during 1980, simply select report option 5 (Fig. 5). Done on a monthly basis, you can determine which auto needs to be weaned from the pump, or perhaps, find the one hooked on oil.

To generate expense reports for vehicles, enter the correct auto number. Select the desired format from the list displayed. Continue as shown below:

- Report Format 1— Enter code.
- Report Format 2—Enter month using two-digit format, then enter two-digit year.
- Report Format 3—Enter code and two-digit year.
- Report Format 4—Enter code, two-digit month and two-digit year.
- Report Format 5—Enter two-digit year.
- Report Format 6—Done automatically; no user entries required.

If the line printer is not on-line, a message is displayed. Ready your printer and reselect the report format desired.

Program Breakdown

AUTOTRK1/BAS is comprised mainly of print statements; Fig. 7 gives a rough data flow.

AUTOTRK2/BAS needs some explaining. I have included numerous remark statements to help you decipher the program. You can remove them all without affecting program operation.

Enough memory must be cleared for string storage and manipulation. Because I used the On Error GOTO command, a line number must be specified should errors occur. Strings for Print Using commands are defined by lines 110 and 120.

AUTOTRK2/BAS opens AUTOINT for sequential input via buffer 1. The number of vehicles is read, followed by vehicle descriptions and user-defined codes.

Lines 260-300 include all pre-defined codes. Should you wish to change any, they are contained in array PC$(1-5). Report format descriptions LC$(1-8) are used both in screen display and printed reports (on printed reports, only the first 20 characters are given).

I handled the task of checking correct input in two manners. The VAL function checks for correct numeric input, and ASC checks for correct input by comparing the ASCII equivalence of the entry. Because you may unintentionally press the enter key, the program checks for a null string

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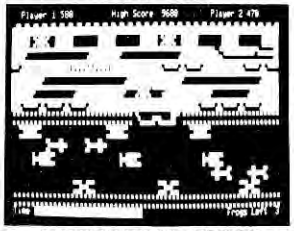

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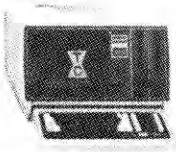

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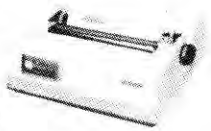

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when character input is expected.

Several lines contain CHR$(31). This code erases from the cursor location to end of screen. I could have used CHR$(30) (erase to end of line), but I did not want the screen format destroyed by redo errors. (Does anyone know how to disable redo so it can be incorporated in an error-trapping routine? Drop me a line.)

Fielding buffer 2 is accomplished in two stages. All fields are set, the KEY$ is reset equal to the auto code and date. This method allows checking selected months and years using LEFT$ and RIGHT$.

No provision is made for sorting data since entries should be made in chronological order. Information prints in the order entered—organize all receipts before you enter any.

All filespecs are defined automatically as needed to avoid creating unnecessary or duplicate files.

Extensions are not used for data files, but you can easily add them by changing lines 630 and 1300.

Figure 8 gives a list of strings and variables used in both AUTOTRK1/BAS and AUTOTRK2/BAS.

Improvements

Since AUTOTRK2/BAS already allows entry of the number of gallons for gasoline purchase, why not incorporate mileage input? As gas purchases are entered, the program can compute MPG.

If you keep track of mileage for each vehicle, set flags within the program to indicate preventative maintenance, oil changes, brake replacement or tune-ups.

Alter the programs to read several vehicle files and determine total purchases for each auto code. This may mean a lot when forecasting expenses. Past expenditures may form a pattern, indicating more money is needed at certain times.

You could add code in the error-trapping routine to recover from disk-full or other types of errors, so data input is not lost. ■

Ed. note: To make these programs run on the Model III, change the first part of line 1430 of AUTOTRK2/BAS to IF (PEEK (14312) AND 240)<>48...

Program Listing 1. AUTOTRK1/BAS

```
10 CLEAR500
20 ONERRORGOTO680
30 CLS:PRINT"AUTOTRAK is designed to handle the expense accounti
ng of 10"
40 PRINT"vehicles.  There are twenty expense catagories, 10 pre-
defined"
50 PRINT"by the program and 10 defined by you, the user."
60 PRINT:PRINT"Monthly or yearly reports can be generated, showi
ng all ex-"
70 PRINT"penses incurred by a vehicle or only those of a selecte
d code."
80 PRINT:PRINT"For example, AUTOTRAK can search a file and find
all gasoline"
90 PRINT"purchases for vehicle #4 during the month of May, or, i
f"
100 PRINT"desired, during 1981."
110 PRINT:LINE INPUT"Press ENTER to continue";A$
120 CLS:PRINT"All information is contained on disk for easy acce
ss."
130 PRINT"It is advisable to make backup copies at the completio
n of"
140 PRINT"data entry.  You may wish to place each vehicle's file
 on a"
150 PRINT"separate disk to avoid DISK FULL messages."
160 PRINT:PRINT"AUTOTRAK Initial Setup (Description) --"
170 PRINT:PRINT"For initial setup, enter the number of vehicles
(1 to 10)."
180 PRINT"When prompted, give a brief vehicle description."
190 PRINT"(Example: 1978 Ford Van, License A13542, Blue)"
200 PRINT"Maximum length of description is 40 characters.  Becau
se"
210 PRINT"AUTOTRAK uses the LINE INPUT function of Basic, delimi
ters such"
220 PRINT"as commas and quotes may be used as part of the descri
ptions."
230 PRINT:LINE INPUT"Press ENTER to continue";A$
240 CLS:PRINT"Next, enter user defined auto codes A thRU J."
250 PRINT"Not all codes must be used.  Simply press ENTER for un
wanted"
260 PRINT"codes."
270 PRINT:PRINT"Program defined codes are:"
280 PRINT:PRINT"CODE       DESCRIPTION                CODE       D
ESCRIPTION"
290 PRINT"  0          Gas                          5          Tune-
up"
300 PRINT"  1          Oil                          6          Exhau
st Sys"
310 PRINT"  2          Tires                        7          Wheel
 Align"
320 PRINT"  3          Battery                      8          Brake
s"
```

Program Listing 1 Continues

Program Listing 1 Continued

```
330 PRINT"  4          Lubrication                9          Hoses
/Belts"
340 PRINT:LINE INPUT"Press ENTER to begin initial setup.";A$
350 CLS:PRINT"AUTOTRAK -- Initial Setup"
360 PRINT@128,"";:INPUT"How many vehicles";NV
370 IFNV<1ORNV>10PRINT@128,CHR$(31);:GOTO360
380 PRINT"Please enter descriptions (Maximum length is 40 charac
ters.)"
390 FORL=1TONV
400 PRINT@64*(L+4),"Auto #";L;" ? ";
410 LINE INPUTV$(L)
420 IFLEN(V$(L))>40PRINT@64*(L+4),CHR$(31);:GOTO400
430 NEXTL
440 CLS:PRINT"Enter user defined Auto Codes."
450 PRINT"Maximum length of codes is 12 characters."
460 PRINT:FORL=1TO10
470 PRINT@64*(L+2),CHR$(64+L);CHR$(199);:LINE INPUTUC$(L)
480 IFLEN(UC$(L))>12PRINT@64*(L+2);CHR$(31);:GOTO470
490 NEXTL
500 CLS:PRINT"Initial setup information is saved on disk using A
UTOINT"
510 PRINT"as the file specification.":PRINT
520 INPUT"Drive to be accessed";DN$
530 IFDN$=""PRINT@192,CHR$(31);:GOTO520
540 IFVAL(DN$)<0ORVAL(DN$)>3PRINT@192,CHR$(31);:GOTO520
550 FILESPEC$="AUTOINT"+DN$
560 OPEN"O",1,FILESPEC$
570 PRINT#1,NV
580 FORL=1TONV
590 PRINT#1,CHR$(34);V$(L);CHR$(34)
600 NEXTL
610 FORL=1TO10
620 PRINT#1,CHR$(34);UC$(L);CHR$(34)
630 NEXTL
640 CLOSE
650 CLS:PRINT"Please insert diskette containing AUTOTRK2/BAS in
a drive."
660 PRINT:LINE INPUT"Press ENTER when ready.";A$
670 LOAD"AUTOTRK2/BAS"
680 IFERR/2+1<>54PRINT"ERROR IN LINE ";ERL:STOP
690 PRINT:PRINT"AUTOTRK2/BAS cannot be found.  Please load"
700 PRINT"correct diskette."
710 RESUME660
```

Program Listing 2. AUTOTRK2/BAS

```
10 REM * AUTOTRAK--CONCEIVED AND WRITTEN BY ROBERT JAMES LLOYD *

20 REM * VERSION 1.0  DATED JUNE 20, 1981 *
30 REM * NOTE -- ALL REMARKS STATEMENTS MAY BE REMOVED WITHOUT *

40 REM *         AFFECTTING PROGRAM OPERATION *
50 REM * CLEAR 1000 BYTES OF MEMORY FOR STRING STORAGE *
60 REM * AND MANIPULATION *
70 CLEAR1000
80 REM * IF AN ERROR OCCURS BRANCH TO ERROR TRAPPING ROUTINE
90 ONERRORGOTO2350
100 REM * F$ AND G$ USED IN PRINTUSING COMMAND *
110 F$="#####.##"
120 G$="####.#"
130 REM * OPENS "AUTOINT" FOR SEQUENTIAL INPUT *
140 FILESPEC$="AUTOINT"
150 CLS:OPEN"I",1,FILESPEC$
160 REM * INPUTS NUMBER OF VEHICLES *
170 INPUT#1,NV
180 REM * FOR/NEXT LOOP USED TO INPUT VEHICLE DESCRIPTIONS *
190 FORL=1TONV
200 INPUT#1,V$(L)
210 NEXTL
220 REM * FOR/NEXT LOOP USED TO INPUT USER-DEFINED CODES *
230 FORL=1TO10
240 INPUT#1,UC$(L)
250 NEXTL:CLOSE
260 REM * SET PROGRAM-DEFINED CODES *
270 PC$(1)="0= Gas          5= Tune-up      A= "+UC$(1)+STRING$(
13-LEN(UC$(1)),32)+"F= "+UC$(6)
280 PC$(2)="1= Oil          6= Exhaust Sys. B= "+UC$(2)+STRING$(
13-LEN(UC$(2)),32)+"G= "+UC$(7)
290 PC$(3)="2= Tires        7= Wheel Align  C= "+UC$(3)+STRING$(
13-LEN(UC$(3)),32)+"H= "+UC$(8)
300 PC$(4)="3= Battery      8= Brakes       D= "+UC$(4)+STRING$(
13-LEN(UC$(4)),32)+"I= "+UC$(9)
```

Program Listing 2 Continues

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Program Listing 2 Continued

```
310 PC$(5)="4= Lubrication  9= Hoses/Belts  E= "+UC$(5)+STRING$(
13-LEN(UC$(5)),32)+"J= "+UC$(10)
320 REM * SET REPORT FORMAT DESCRIPTIONS *
330 LC$(1)="Auto Code               (All entries for selected cod
e)"
340 LC$(2)="Month/Year              (All entries for selected mon
th                                   during selected year)"
350 LC$(3)="Auto Code/Year          (All entries for selected cod
e"
360 LC$(4)="Auto Code/Month/Year    (All entries for selected cod
e                                    during selected month and ye
ar)"
370 LC$(5)="Year                    (All entries for selected yea
r)"
380 LC$(6)="All entries in file"
390 REM * ALLOW SELECTION -- ENTER INFO OR PRINT REPORT *
400 CLS:PRINT"Do you wish to:"
410 PRINT:PRINT"1 -- Enter expense information"
420 PRINT"2 -- Generate expense report"
430 PRINT:LINE INPUT"Select option ";A$
440 IFVAL(A$)<1ORVAL(A$)>2GOTO400
450 CLS:ONVAL(A$)GOTO470  ,530
460 REM * BEGINNING OF ENTER INFO SECTION *
470 CLS:LINE INPUT"Date using MMDDYY format ? ";DATE$
480 REM * CHECK ENTRY FOR CORRECT MMDDYY FORMAT *
490 IFVAL(LEFT$(DATE$,2))>12ORVAL(MID$(DATE$,3,2))>31ORVAL(RIGHT
$(DATE$,2))<80GOTO470
500 REM * VARIABLE AN IS SET TO 1 WHEN ANOTHER SELECTION IS CHOS
EN *
510 IFAN=1GOTO630
520 REM * FOR/NEXT LOOP TO PRINT VEHICLE DESCRIPTIONS ON SCREEN
*
530 PRINT:FORL=1TONV
540 REM * CHR$(195-(LEN(STR$(L)))) IS USED TO FORMAT SCREEN DISP
LAY *
550 REM * CHR$(195) IS A SPACE COMPRESSION CODE EQUAL TO 3 BLANK
S *
560 PRINT"Auto #";L;CHR$(195-(LEN(STR$(L))));"is ";V$(L)
570 NEXTL
580 PRINT:INPUT"Enter auto number ";VN
590 REM * CHR$(31) BELOW CLEARS TO END OF SCREEN *
600 IFVN<1ORVN>NVPRINT@64*(NV+2),CHR$(31);:GOTO580
610 ONVAL(A$)GOTO630  ,1290
620 REM * FILESPEC IS SET TO AUTO + VEHICLE NUMBER
630 FILESPEC$="AUTO"+RIGHT$(STR$(VN),LEN(STR$(VN))-1)
640 IFAN=1GOTO690
650 CLS:PRINT"Ensure diskette containing file ";CHR$(34);FILESPE
C$;CHR$(34);" has been placed"
660 PRINT"in a drive.  If it has not been created yet, RANDOM AC
CESS"
670 PRINT"automatically creates it when needed."
680 PRINT:LINE INPUT"Press ENTER when ready to input expense inf
ormation ";A$
690 AN=0:GOSUB710  :GOTO750
700 REM * PRINTS AUTO CODES ON SCREEN *
710 CLS:PRINT"Auto Codes:                        (Codes A-J are use
r defined)"
720 PRINTPC$(1):PRINTPC$(2):PRINTPC$(3):PRINTPC$(4):PRINTPC$(5)
730 RETURN
740 REM * PRINTS 63 DASHES ACROSS SCREEN *
750 PRINTSTRING$(63,"-")
760 PRINT@448,"";
770 REM * BEGIN ENTRY OF EXPENSE DATA *
780 INPUT"Code Number ";CODE$
790 IFVAL(CODE$)<10GOTO820
800 IFCODE$=""PRINT@448,CHR$(31);:GOTO780
810 IFASC(CODE$)<65ORASC(CODE$)>74PRINT@448,CHR$(31);:GOTO780
820 INPUT"Quantity ";QT
830 IFQT>99.9PRINT@512,CHR$(31);:GOTO820
840 INPUT"Total cost ";CT
850 IFCT>99999.99PRINT@576,CHR$(31);:GOTO840
860 REM * NOTE---METHOD OF PAYMENT MUST BE ENTERED *
870 INPUT"Method of payment (CA=cash CK=check CC=crd. card) ";PY
$
880 IFPY$="CA"ORPY$="CK"ORPY$="CC"GOTO900
890 PRINT@640,CHR$(31);:GOTO870
900 INPUT"Receipt number ";RE$
910 IFLEN(RE$)>8PRINT@704,CHR$(31);:GOTO900
920 LINE INPUT"Description of transaction ? ";DSC$
930 REM * FOR 80 COLUMN PRINT CHANGE LEN(DSC$)>36 TO LEN(DSC$)>1
8 *
940 IFLEN(DSC$)>36PRINT@768,CHR$(31);:GOTO920
950 LINE INPUT"Is all information correct (Y or N) ? ";AN$
960 IFAN$="N"PRINT@448,CHR$(31);:GOTO780
970 IFAN$<>"Y"PRINT@832,CHR$(31);:GOTO950
980 LINE INPUT"Write information to drive #? ";DN$
```

Program Listing 2 Continues

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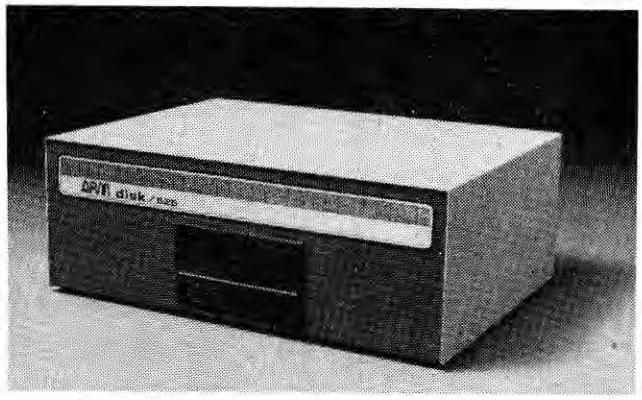

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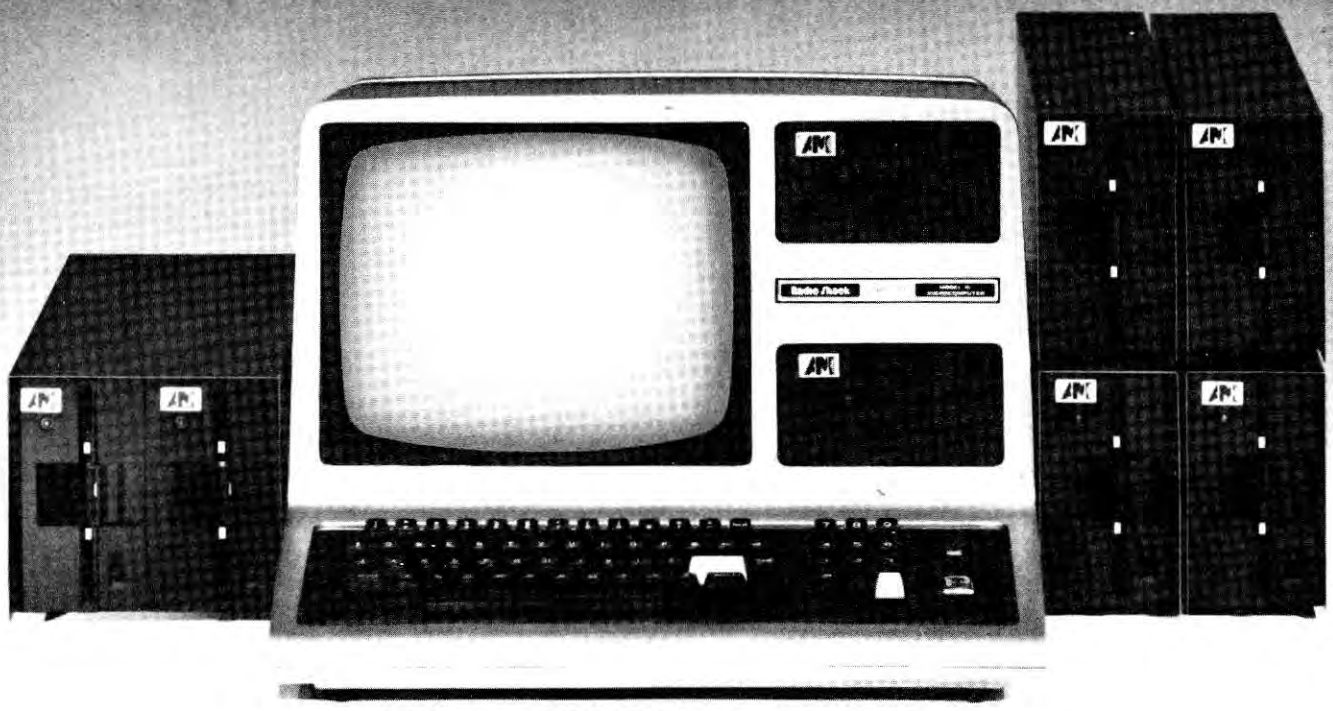
Program Listing 2 Continued

```
990 IFDN$=""PRINT@896,CHR$(31);:GOTO980
1000 IFVAL(DN$)<0ORVAL(DN$)>3PRINT@896,CHR$(31);:GOTO980
1010 REM * FILESPEC IS NOW EQUAL TO AUTO + VEHICLE NUMBER + DRIV
E NUMBER *
1020 FILESPEC$=FILESPEC$+":"+DN$
1030 REM * OPENS FILESPEC--RANDOM ACCESS USING BUFFER 2 *
1040 OPEN"R",2,FILESPEC$
1050 FIELD 2,7 AS KEY$, 4 AS QNT$, 8 AS CST$, 2 AS PAY$, 8 AS RC
PT$, 36 AS DESC$
1060 REM * VARIABLE I IS SET TO LAST ENTRY IN FILE +1 *
1070 I=LOF(2)+1
1080 REM * LSET PLACES DATA IN BUFFER *
1090 REM * NOTE---KEY$ IS EQUAL TO CODE$ + DATE$ *
1100 LSETKEY$=CODE$+DATE$
1110 LSETQNT$=MKS$(QT)
1120 LSETCST$=MKD$(CT)
1130 LSETPAY$=PY$
1140 LSETRCPT$=RE$
1150 LSETDESC$=DSC$
1160 REM * PUT COMMAND WRITES DATA TO SELECTED DRIVE *
1170 PUT2,I
1180 CLOSE
1190 REM * RESET VALUES TO EITHER NULL OR ZERO *
1200 CODE$="":DATE$="":QT=0:CT=0:PY$="":RE$="":DSC$=""
1210 REM * ALLOW ANOTHER ENTRY FOR SELECTED VEHICLE ONLY *
1220 CLS:PRINT"Another entry for Auto #";VN" (Y or N) ";:LINE IN
PUTAE$
1230 IFAE$=""GOTO1220
1240 IFAE$="Y"PRINT@448,CHR$(31);:CLS:AN=1:GOTO470
1250 IFAE$="N"GOTO400  ELSEPRINT@960,CHR$(31);:GOTO1220
1260 REM * BEGINNING OF REPORT GENERATION SECTION *
1270 REM * SET PRINT VALUES -- POKE16424=NUMBER OF LINES PER PAG
E *
1280 REM *                          POKE16425=SETS LINE COUNTER TO ON
E*
1290 POKE16424,66:POKE16425,1:PRINT
1300 FILESPEC$="AUTO"+RIGHT$(STR$(VN),LEN(STR$(VN))-1)
1310 CLS:PRINT"Do you want a report by --"
1320 REM * PRINTS REPORT FORMAT DESCRIPTIONS *
1330 PRINT"1 -- ";LC$(1)
1340 PRINT"2 -- ";LC$(2)
1350 PRINT"3 -- ";LC$(3)
1360 PRINT"4 -- ";LC$(4)
1370 PRINT"5 -- ";LC$(5)
1380 PRINT"6 -- ";LC$(6)
1390 PRINT
1400 LINE INPUT"Select option ";A$
1410 IFVAL(A$)<0ORVAL(A$)>7PRINT@448,CHR$(31);:GOTO1400
1420 REM * CHECK IF LINE PRINTER IS ONLINE -- PEEK(16412) MUST E
QUAL 63 *
1430 IFPEEK(14312)<>63PRINT:PRINT"LINE PRINTER IS NOT READY.....
"ELSEGOTO1450
1440 FORD=1TO750:NEXTD:GOTO1310
1450 ONVAL(A$)GOTO1460 ,1520 ,1460 ,1460 ,1560 ,1590
1460 GOSUB710  :PRINT
1470 INPUT"Code ";CODE$:PRINT
1480 IFVAL(CODE$)<10THEN1510
1490 IFCODE$=""PRINT@448,CHR$(31);:GOTO1470
1500 IFASC(CODE$)<65ORASC(CODE$)>74PRINT@448,CHR$(31);:GOTO1470

1510 ONVAL(A$)GOTO1590 ,1520 ,1560 ,1520 ,1560 ,1590
1520 LINE INPUT"Enter month by 2 digit code. Ex: 01=Jan, 06=Jun,
 etc.) ";DATE$
1530 IFVAL(DATE$)<1ORVAL(DATE$)>12ORLEN(DATE$)<2
LS:GOTO1520
1540 IFVAL(A$)=2ORVAL(A$)=4PRINT:GOTO1560
1550 GOTO1590
1560 LINE INPUT"Enter year by 2 digit code.  Ex: 81=1981 86=1986
, etc.) ";YR$
1570 IFLEN(YR$)<2ORVAL(YR$)<80CLS:GOTO1560
1580 REM * OPEN FILESPEC FOR RANDOM ACCESS VIA BUFFER 2 *
1590 OPEN"R",2,FILESPEC$
1600 REM * FIELD BUFFER 2 *
1610 FIELD 2,7 AS KEY$, 4 AS QNT$, 8 AS CST$, 2 AS PAY$, 8 AS RC
PT$, 36 AS DESC$
1620 REM * ALSO FIELD FIRST 7 BYTES OF BUFFER 2 AS CODE AND DATE
 *
1630 FIELD 2,1 AS CD$,6 AS DT$
1640 REM * SET VARIABLE P (PAGE COUNTER) TO 1 *
1650 P=1
1660 LPRINT:LPRINT:GOSUB1670 :ONVAL(A$)GOTO1780 ,1810 ,1780 ,178
0 ,1810 ,1810
1670 LPRINT"AUTOTRAK Expense Report by ";
1680 REM * WRITE APPROPRIATE REPORT FORMAT DESCRIPTION TO PRINTE
R *
1690 LPRINTLEFT$(LC$(VAL(A$)),20)
```

Program Listing 2 Continues

BORN TO RUN



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Program Listing 2 Continued

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1700 REM * PRINT VEHICLE DESCRIPTION AND AUTO CODES *
1710 LPRINTV$(VN):LPRINT:LPRINT"Auto Codes:
(Codes A-J are user defined)"
1720 LPRINT
1730 LPRINTPC$(1):LPRINTPC$(2):LPRINTPC$(3):LPRINTPC$(4):LPRINTP
C$(5)
1740 LPRINT
1750 LPRINTSTRING$(39,32);"METHOD OF";STRING$(4,32);"RECEIPT"
1760 RETURN
1770 REM * PRINT APPROPRIATE COLUMN HEADINGS DEPENDING ON REPORT
 FORMAT *
1780 LPRINT"CODE     DATE     QUANTITY     COST     PAYMENT
NUMBER     DESCRIPTION"
1790 REM * FOR 80 COLUMN PRINT CHANGE STRING$(132,95) TO STRING$
(80,95) *
1800 LPRINTSTRING$(132,95):IFP>1GOTO2280 ELSE1840
1810 LPRINT" DATE     CODE     QUANTITY     COST     PAYMENT
NUMBER     DESCRIPTION"
1820 GOTO1800
1830 REM * FOR/NEXT LOOP USED TO GET INFORMATION FROM OPEN FILE
*
1840 FORL=1TOLOF(2)
1850 IFEOF(2)CLOSE:GOTO2310
1860 GET 2,L
1870 REM * DEPENDING ON REPORT FORMAT, CHECK EITHER CODE OR DATE
 *
1880 ONVAL(A$)GOTO1900 ,2050 ,2020 ,1990 ,1960 ,2080
1890 REM * DOES CODE SELECTED MATCH CODE FOUND? *
1900 IFCD$<>CODE$GOTO2280
1910 GOTO2080
1920 REM * DO CODE, MONTH AND YEAR MATCH ONES FOUND? *
1930 IFCD$=CODE$ANDLEFT$(DT$,2)=DATE$ANDRIGHT$(DT$,2)=YR$GOTO208
0
1940 GOTO2280
1950 REM * DO CODE AND MONTH MATCH ONES FOUND? *
1960 IFRIGHT$(DT$,2)<>YR$GOTO2280
1970 GOTO2080
1980 REM * DO CODE AND MONTH MATCH ONES FOUND?
1990 IFCD$=CODE$ANDLEFT$(DT$,2)=DATE$GOTO2080
2000 GOTO2280
2010 REM * DO CODE AND YEAR MATCH ONES FOUND? *
2020 IFCD$=CODE$ANDRIGHT$(DT$,2)=YR$GOTO2080
2030 GOTO2280
2040 REM * DO MONTH AND YEAR MATCH ONES FOUND? *
2050 IFLEFT$(DT$,2)=DATE$ANDRIGHT$(DT$,2)=YR$GOTO2080
2060 GOTO2280
2070 REM * VARIABLE TC (TOTAL COST) KEEPS A CUMLATIVE TOTAL OF E
XPENSES AS PRINTED *
2080 TC=TC+CVD(CST$)
2090 REM * PRINT EXPENSE INFORMATION IN COLUMNAR FORMAT *
2100 ONVAL(A$)GOTO2120 ,2140 ,2120 ,2120 ,2140 ,2140
2110 REM * PRINT CODE AND DATE *
2120 LPRINTSTRING$(2,32);CD$;STRING$(5,32);DT$;STRING$(4,32);:GO
TO2170
2130 REM * PRINT DATE AND CODE *
2140 LPRINTDT$;STRING$(5,32);CD$;STRING$(6,32);
2150 REM * NOTE-- CVS AND CVD ARE USED TO CONVERT STRING DATA TO
 NUMERIC *
2160 REM * PRINT QUANTITY *
2170 IFCVS(QNT$)>0LPRINTUSINGG$;CVS(QNT$);:LPRINTSTRING$(4,32);:
GOTO2190
2180 LPRINTSTRING$(10,32);
2190 REM * PRINT COST *
2200 LPRINTUSINGF$;CVD(CST$);
2210 REM * PRINT METHOD OF PAYMENT AND RECEIPT NUMBER *
2220 LPRINTSTRING$(6,32);PAY$;STRING$(8,32);RCPT$;
2230 REM * PRINT DESCRIPTION *
2240 LPRINTSTRING$(3,32);DESC$
2250 REM * HAVE 60 LINES BEEN PRINTED? *
2260 IFPEEK(16425)=60P=P+1:LPRINTCHR$(11):GOTO1660
2270 REM * NOTE--CHR$(11) ABOVE ADVANCES PAPER TO TOP-OF-FORM *
2280 NEXTL
2290 CLOSE
2300 REM * PRINT TOTAL EXPENDITURES FOR REPORT FORMAT SELECTED *

2310 LPRINT:LPRINT"Total Expenditures = ";:LPRINTUSINGF$;TC
2320 REM * RESET VARIABLES TO ZERO, ADVANCE PAPER TO TOP-OF-FORM
 *
2330 TC=0:P=0:LPRINTCHR$(11):GOTO400
2340 REM * ERROR TRAPPING ROUTINE.  ERROR 54 IS FILE CANNOT BE F
OUND *
2350 IFERR/2+1=54GOTO2370
2360 REM * CHR$(34) IS QUOTE MARKS *
2370 CLS:PRINTCHR$(34);FILESPEC$;CHR$(34);" cannot be found.  Pl
ease insert correct diskette."
2380 PRINT:LINE INPUT"Press ENTER when ready.";A$
2390 RESUME150
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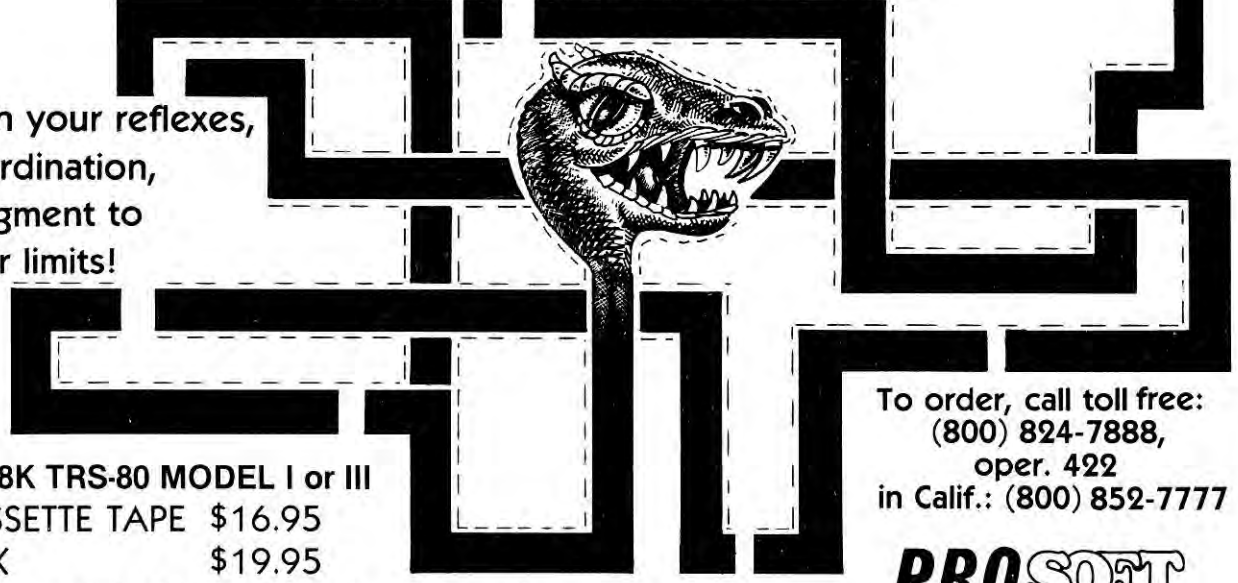

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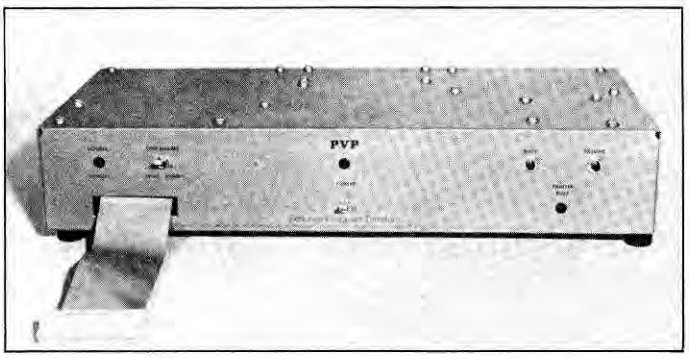

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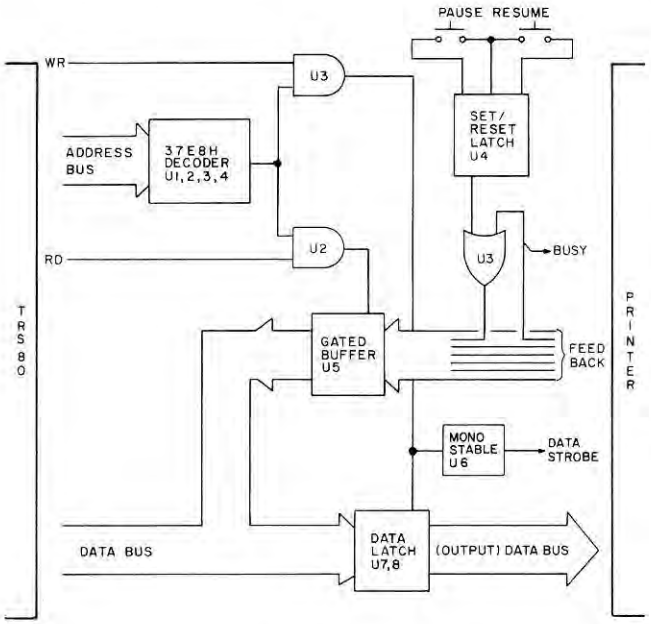

Fig. 1. Printer Interface Logic Circuitry

Philip M. Van Praag
1630 West Jagged Rock Road
Tucson, AZ 85704

Over the next four months, I will present a series of articles detailing design and construction of a hardware support system for the Model I TRS-80. This Peripheral Support Interface™ (PSI) contains a Centronics-compatible printer interface, 32K RAM memory, and a compatible single/double density disk controller. Each item may be built and used independently. The integration of all three functions into a common system will be presented in the fourth article.

No adjustments are required in any circuitry, and therefore no test equipment is needed to build or operate any part of the system. (An ohmmeter or simple continuity tester would be helpful, however, to double-check wiring before initial powerup.) Required skills are a basic familiarity with electronic components (resistor color codes, IC pin orientation, for example); a degree of manual dexterity to enable soldering small wires and contacts; and patience. (Of these three skills, patience is by far the most important.)

No special tools are required, but you must use a low wattage soldering iron (25 watts maximum) and fine solder (.031 diameter maximum).

The Key Box

Basic Level II
Model I
16K RAM

This article describes the design and construction of a printer interface connecting any Centronics-compatible printer with the TRS-80 Model I keyboard connector. With this interface the user can halt the print operation at any time and resume printing at the same place in the text.

Centronics-compatible interface refers to a particular method of matching required operating signals between a printer and the TRS-80. This method defines required signals, the logic level of these signals, and the parallel manner in which data is transferred to the printer. The Centronics interface method is available on virtually all microcomputer printers.

Printers storing only one character (the Selectric) can stop at any character position on any line. Printers storing an entire line of characters before printing (the MX-80) will halt printing after the current line. To re-start

printing precisely where you left off, just tap the resume button. This feature is compatible with any program that does not print out transient data gathered and deleted as part of a timed sequence.

A small outboard cabinet houses all printer interface circuitry except the power supply. A single double-sided printed circuit board allows quick assembly of the project and provides a connector card-edge for mating with the printer cable. A 40-conductor ribbon cable/connector assembly plugs into the expansion port card edge at the keyboard rear of the TRS-80. A simple wall plug-in transformer supply backed up with voltage regulation on the PC board provides power. The TRS-80 needs no modifications.

How the Circuit Works

The Centronics interface method uses parallel data transfer; all eight data bits defining a particular character to be printed or instruction to be followed are sent to the printer at once. The advantage of this system is potentially greater data transfer speed compared to the serial transfer system RS-232 in which data is sent one

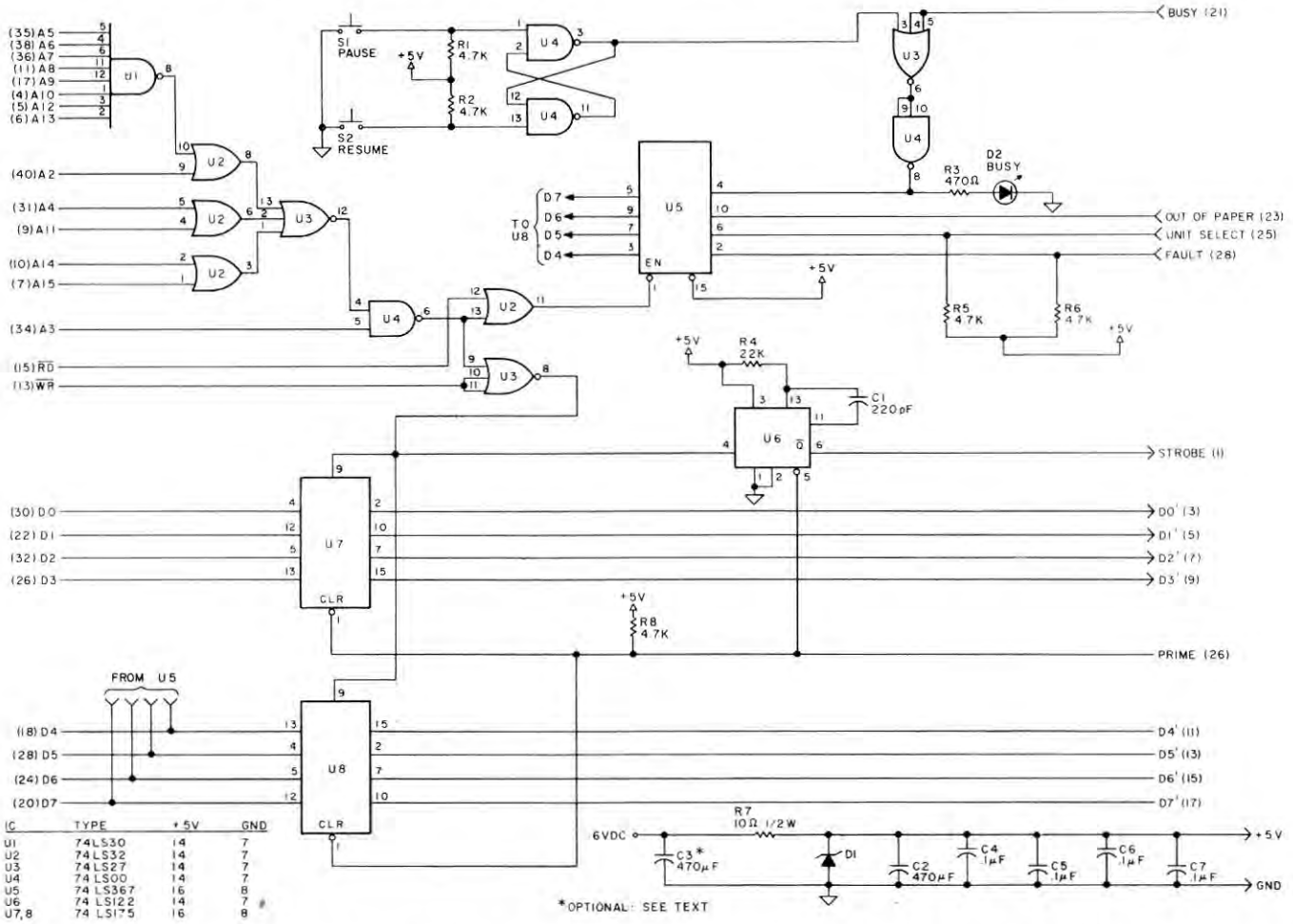

Fig. 2. Schematic diagram. Parenthetical numbers on the left denote keyboard connector pins. Numbers on the right are for printer connector pins.

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bit at a time.

Print speed is dictated by the mechanical ability of the printer; maximum print rates vary between printers. A busy signal tells the TRS-80 not to send more data until the printer is ready to receive it. The IBM Selectric requires about 75 milliseconds to print a character, whereas a carriage return can take 500 milliseconds. The MX-80 contains a data memory storage buffer which takes an entire line of data at a time, puts out a busy signal to halt further data influx, and then feeds data to the print mechanics one character at a time. (Remember one character equals eight bits which equals one byte of data.)

Table 1 contains the bit code used by the TRS-80 to define alpha characters, numbers, symbols, and printer instructions. The eighth data bit D7 is not needed to convey any of this information. It is used to carry the busy signal from the printer to the TRS-80.

Initiating Printing

How does the printer know when to start printing? The printer must be turned on, on-line, and connected (via an interface) to the TRS-80 which is teeming with activity on its data bus. What keeps it from trying to print everything? The trigger is the address 37E8H (14312 in decimal). When that data-bit combination is present on the address bus and a low-level logic signal appears on the write signal line, two things cause the printer to accept the next data character or instruction: An eight-bit data latch stores the character/instruction code presently on the TRS-80's data bus, and a data strobe pulse clocks the latched data into the printer. The data strobe pulse nudges the printer into an active state; the printer then processes the data byte and initiates a busy signal to tell the TRS-80 not to send another data byte.

Printer Status

The TRS-80 surveys printer status right after it sends out a data byte. The address 37E8H is produced again along with a logic-level-low on the read line. This combination inserts several feedback signals from the printer onto the bi-directional TRS-80 data bus, including the busy, out-of-paper, unit select, and fault signals.

Signal Storage

How are the data and feedback signals stored until needed? Assume location 37E8H is a part of memory; the contents of 37E8H would become identical to the data bus every time it was addressed in write mode. There is only one problem—37E8H is not part of RAM; in fact it is not part of anything in the TRS-80!

Recall that 37E8H plus a low-level write signal latch the data bus contents in the interface. When 37E8H is written to, the character/instruction data loads into that memory location. From then on, although 37E8H and write are removed from the data bus, the same data continues to be presented to the printer until

6 5 4 3210	Printer Instructions		Numbers/ Symbols		Upper Case Alpha		Lower Case Alpha	
0000			SP	0	@	P	\	P
0001			!	1	A	Q	a	q
0010			"	2	B	R	b	r
0011			#	3	C	S	c	s
0100			$	4	D	T	d	t
0101			%	5	E	U	e	u
0110			&	6	F	V	f	v
0111			'	7	G	W	g	w
1000	BS	BS	(	8	H	X	h	x
1001			)	9	I	Y	i	y
1010	LF	LF	*	:	J	Z	j	z
1011			+	;	K		k	
1100			,	<	L		l	
1101	CR		–	=	M		m	
1110			.	>	N		n	
1111			/	?	O		o	

BS = Backspace
CR = Carriage return*
LF = Line feed
SP = Space

*TRS-80 assumes that a line feed will be added externally to each CR, either by Radio Shack's Centronics parallel printer cable, or (in the MX-80) by printer mode set switches.

Table 1. TRS-80 binary bit code for alphanumerics, symbols, and printer instructions

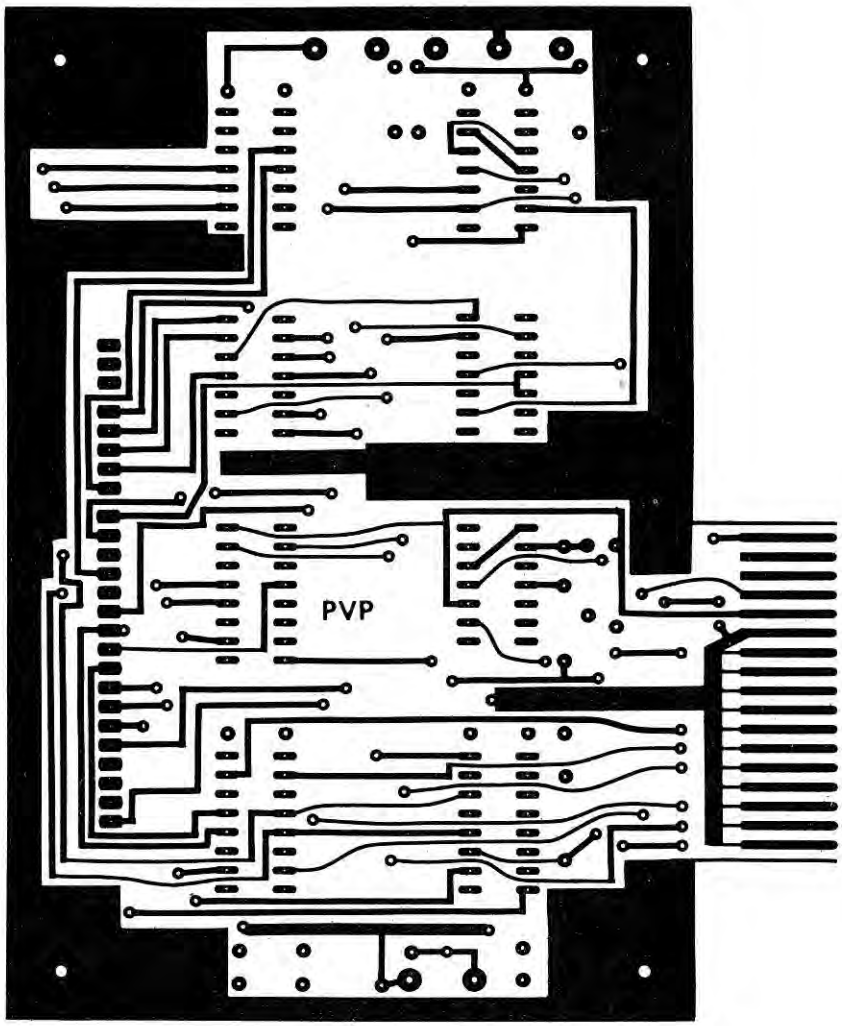
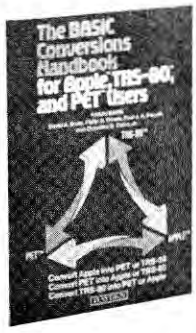
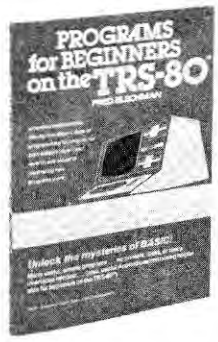


Fig. 3a. Component side of PC board

top titles





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the printer shuts off its busy signal to request the next character/instruction.

The transient occurrence of data is frozen-in-time as long as needed by the printer. The feedback signals from the printer are not transient because they continuously reflect status conditions. Since the TRS-80 needs to check this status for very brief intervals, the feedback information is only inserted onto the data bus when it is needed (via the 37E8H address in combination with a read signal). When location 37E8H is read, the feedback information appears on the data bus as the output of that memory location. The printer status is never stored in the printer interface data latch. PEEK at memory address 37E8H to determine printer status manually; the information you obtain comes directly from the printer, not the data latch. Table 2 summarizes all feedback signals and instructions processed in the printer interface.

See Fig. 1 for a functional block diagram of the printer interface. It presents the three primary functional blocks and illustrates the directions of signal flow. The decoder picks out the address 37E8H from all possible address combinations; the data latch acts as a scratchpad memory for the 8-bit data coming from the TRS-80; the gated buffer periodically allows printer status feedback signals to flow to the TRS-80 on the data bus. The decoded 37E8H address is ANDed with the write or read signal to activate the data latch or the gated buffer. The remaining block is the set/reset latch, actually an R/S flip-flop. Its output logic level changes each time a different one of the two switches is depressed. This latch creates an artificial busy signal (ORed with the printer's busy signal) to manually halt further data flow from the TRS-80 to the printer.

A schematic diagram of the circuitry, including the power supply, appears in Fig. 2. All logic functions are performed by eight Transistor-Transistor Logic (TTL) low power Schottky-type integrated circuits (IC's) which consume about 100 milliamperes (mA) of current. Because of the modest power supply demands, an ordinary 6V direct-current (dc) wall plug-in transformer supply is used. D1 regulates its output down to the required 5V. Make sure the dc transformer supply can provide about 150 mA of steady-state current. If you do not have access to an oscilloscope to check the ripple content at its output under a 150 mA load you must include capacitor C3 on your circuit board. C3 provides additional power supply filtering, not needed if you use a well filtered supply.

Construction

The parts list for this project is in Table 3. Use a printed circuit board to speed construction and debugging time. Since the parts layout is not critical, you may use wire-wrap or point-to-point soldering. See Fig. 3 for a full-size etch pattern for the printer interface board.

If you build your own board and cannot provide plated-through holes do not use IC sockets. Insert a wire into all pads that do not contain component leads and solder the wire on both sides of the board. This is necessary to transfer conductor paths from one side to the other. If you inserted IC sockets without plated-through holes, there would be no way to solder the pads on the component side of the board.

A parts layout guide for the

Signal/instruction	Enable level	Source	Function
Busy	High	Printer	Halts data flow to printer
Fault	Low	Printer	Error/fault in printer
Out of paper	High	Printer	Printer out of paper
Prime	Low	Printer	Initializes (resets) interface logic
Read	Low	TRS-80	Along with address 37E8H, outputs printer status to data bus
Strobe	Low	Interface	Pulse which clocks (transfers) data into printer
Unit select	High	Printer	Printer selected
Write	Low	TRS-80	Along with address 37E8H, latches data and starts strobe pulse in interface

Table 2. Feedback signals and instructions processed in the printer interface

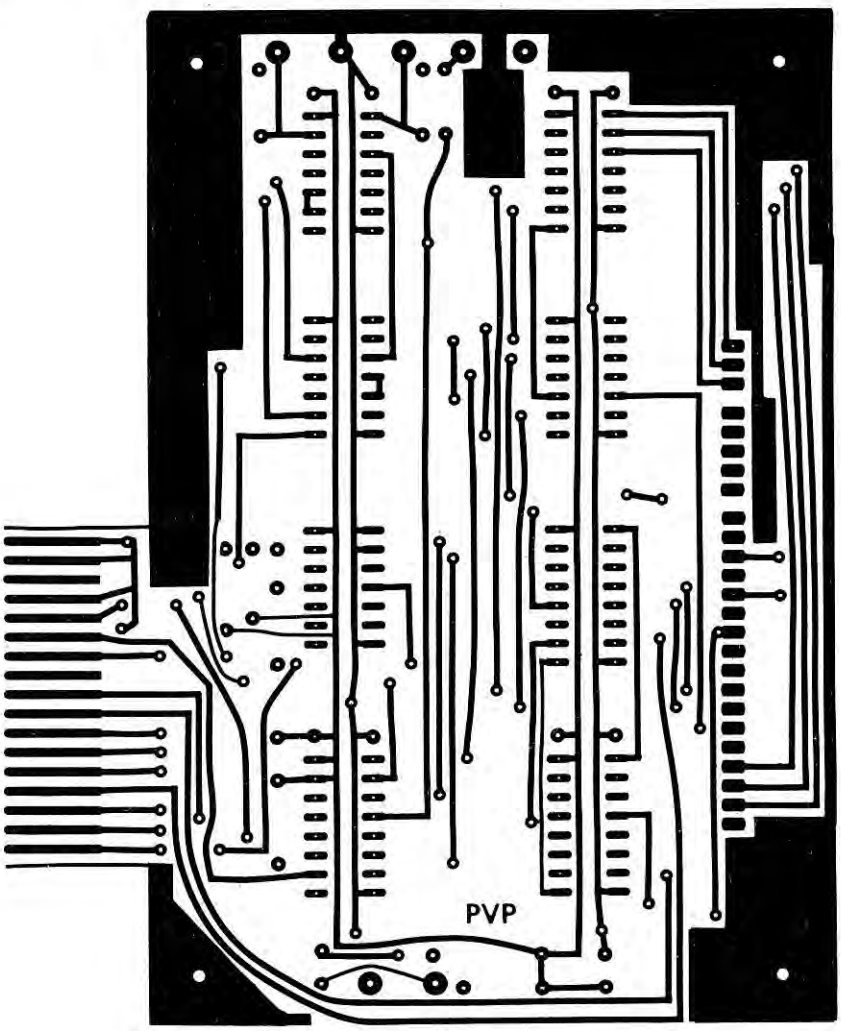

Fig. 3b. Reverse side of PC board

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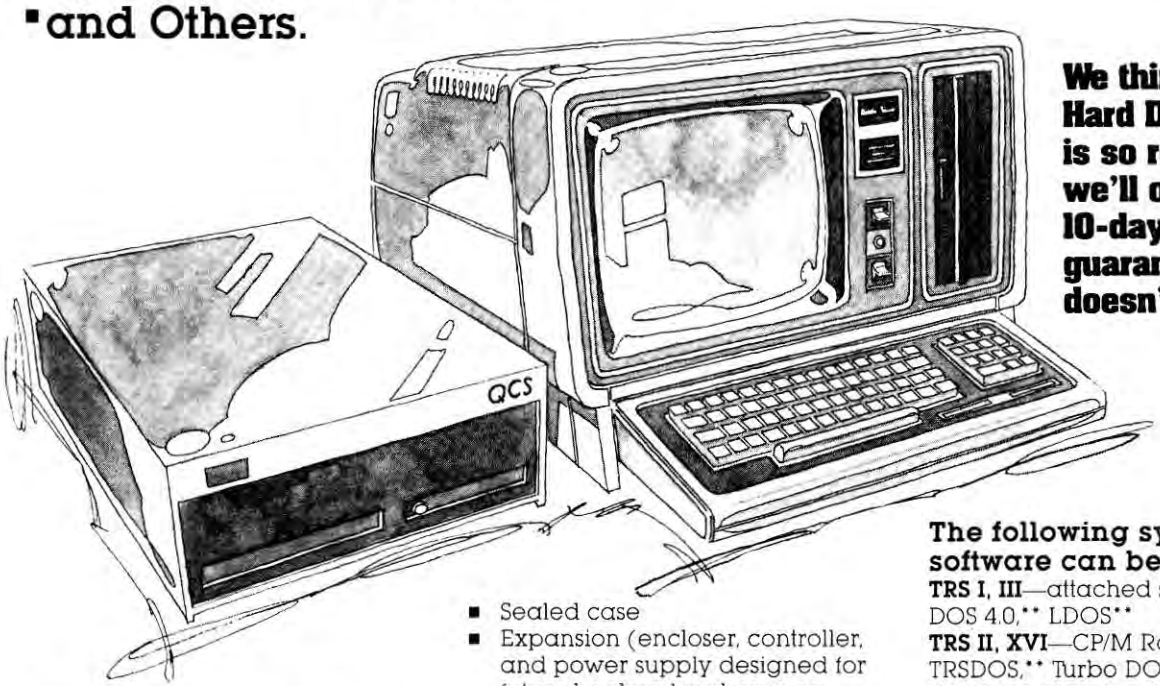

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C2,3	470 uF, 10 V, electrolytic capacitor (C3 optional—see text)
C4-7	.1 uF, 50 V, mylar capacitor
R1,2,5,6,8	4.7K ohm, ¼ W, resistor
R3	470 ohm, ¼ W, resistor
R4	22K ohm, ¼ W, resistor
R7	10 ohm, ½ W, resistor
S1,2	SPST momentary contact pushbutton switch

Miscellaneous

PC board, cabinet (Radio Shack 270-252 or equivalent), IC sockets (optional—see text), 6-volt dc wall plug-in power supply (must not produce more than 7.0 volts dc at a 150 milliamp load), 40-conductor ribbon cable with matching "TRS-80 keyboard card-edge compatible" connector (Radio Shack 278-771/276-1558 or equivalent), hardware (including 5/8" threaded standoffs to mount PC board).

Table 3. Parts List

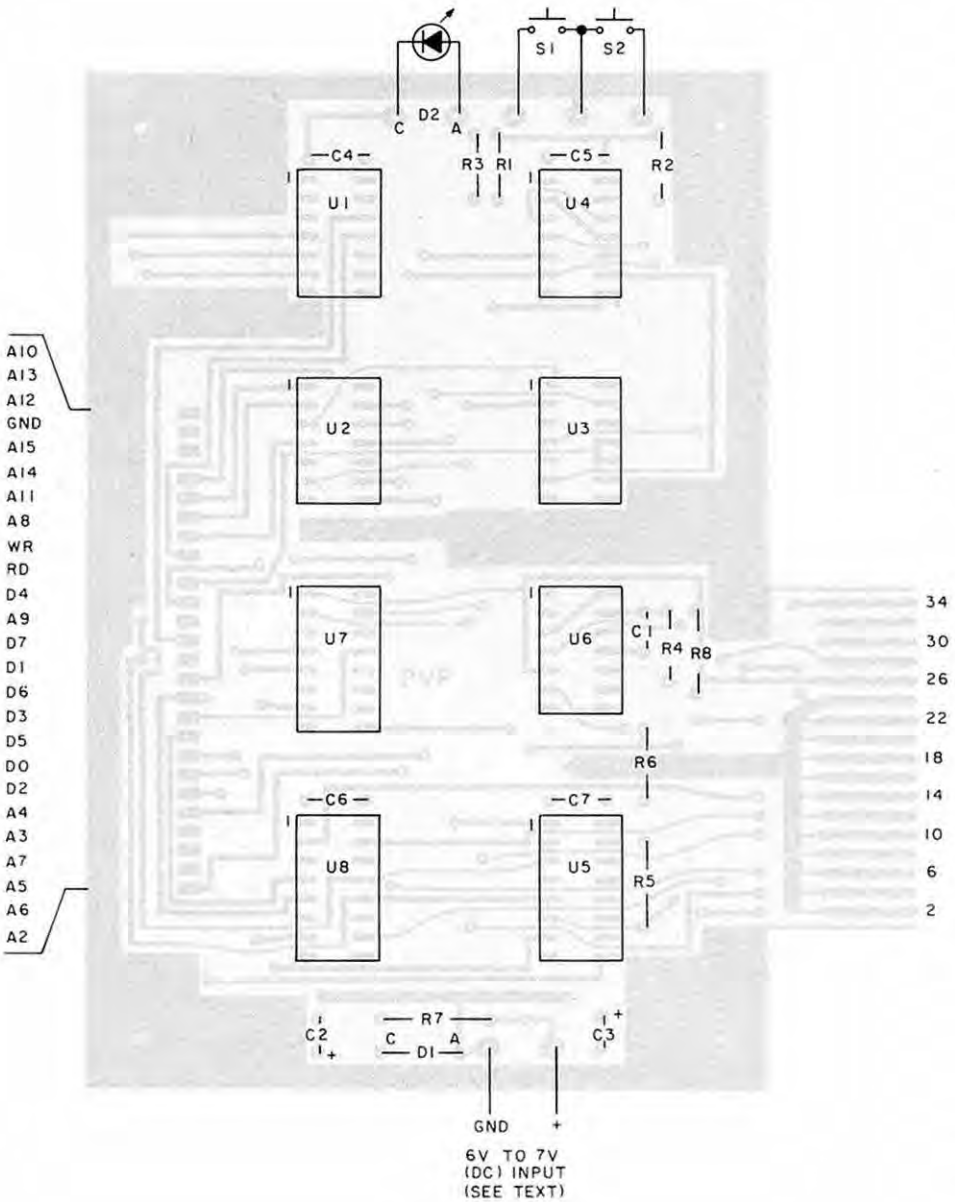

Fig. 4. Component placement

PC board appears in Fig. 4. Orient the ICs, diodes, and capacitors C2 and C3 as shown. If you use IC sockets, line up the dot or notch on the socket with Fig. 4 to aid subsequent IC insertion. Use a 25 watt iron with a fine pointed tip and .030 inch solder. If your board does not have plated-through holes, install the components first and use the component lead cuttings for the feed-through wires.

Orientation details for the ribbon cables with respect to the connectors, cabinet, and PC board appear in Fig. 5. Study this figure carefully before proceeding with this final phase of construction. Prepare the cabinet listed in Table 3 in three steps. First, drill four holes through the top to mount the board. Set the board on the cabinet top to serve as a template for locating the holes; allow 7/16" printer connector card edge protrusion outside the cabinet. Second, using a file or hacksaw blade file away the space between the two top-row slots on each side of the cabinet top, as shown in Fig. 5. Enlarge the slot height on the connector card-edge side using a file until it measures 3/16". Insulate the top and bottom edges of this slot with electrical tape or continuous grommet (a U-shaped plastic channel material). An alternative is to file the slot larger than 3/16 inch so the board cannot inadvertently short to the cabinet if flexed slightly. Third, drill holes in the cabinet bottom to mount the switches, Light Emitting Diode (LED), and a feed-through grommet for the incoming power cable. Wrap several layers of electrical tape over the ribbon cable where it feeds through the cabinet top to protect against abrasion. If you use the ribbon cable and connector listed in Table 3, attach the connector by slipping the cable through the slot in the connector rear. While holding the cable straight squeeze the connector closed using an ordinary vise. After trimming and stripping the ribbon cable end according to the listing in Fig. 5 insert the cable through the cabinet. Finally, insert the individual wires through the board and solder the pads on both sides.

Installation and Operation

I did not provide a power switch for the printer interface, since power would be applied to the plug-in transformer supply even with the power switch off. It will not harm the interface to be powered-up continuously, but for maximum safety (and convenience) connect all your computer equipment to a common switchable alternating current (ac) power outlet strip.

Turn *off* the TRS-80, printer, and printer interface before making any interconnections. Insert both the printer and the printer interface card-edge connectors with the ribbon cable exiting the bottom of the con-

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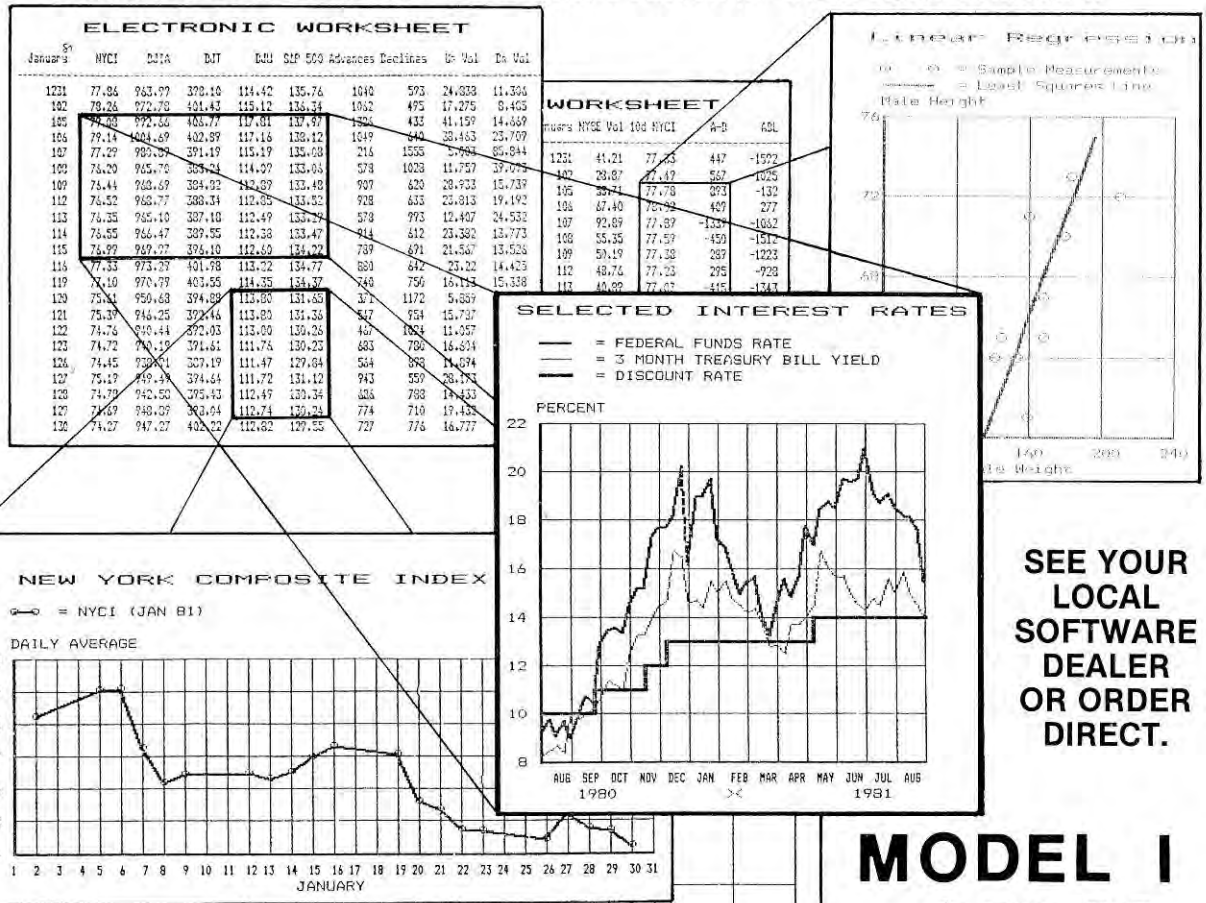

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nector. If you need to connect additional peripheral devices to the keyboard use Alpha Products' Expandabus, which allows connection of from one to four devices in addition to the printer interface.

The pause and resume switches may be used at any time while printing. If your printer stores an entire line of characters before printing the line it will complete the printout of that line before stopping. The "busy" LED appears to be on steadily during a printout; it is actually being turned on and off very rapidly.

With all equipment turned on but not in the print mode alternately depress the pause and resume switches to turn the LED on and off. This test of the voltage supply and a small portion of the logic circuitry works only if the interface is connected to a printer.

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Readers of 80 Micro *are welcome to use the etch patterns contained in this article to construct the Printer Interface for their personal use only.*

An etched and drilled epoxy-glass PC board with plated-through holes is available for $20.95 postpaid in the U.S. A complete kit of parts is also available, including PC board, cabinet (not predrilled—see text), IC sockets, and all other parts listed for $62.95, postpaid in the U.S. Arizona residents add 4 percent sales tax. Order from: PVP Industries, P.O. Box 35667, Tucson, AZ 85740.

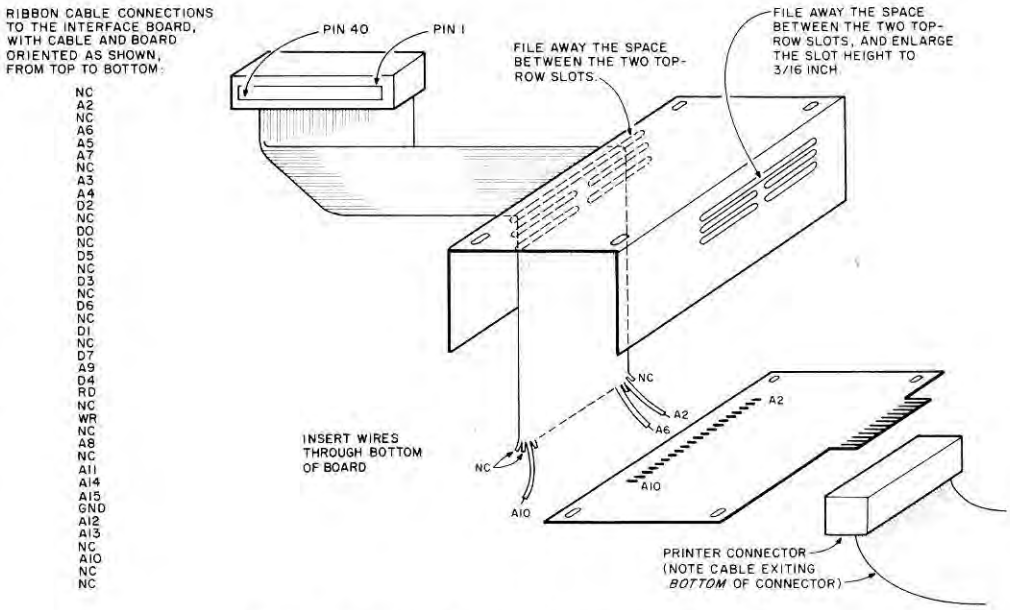

Fig. 5. Ribbon cable conductor usage and orientation

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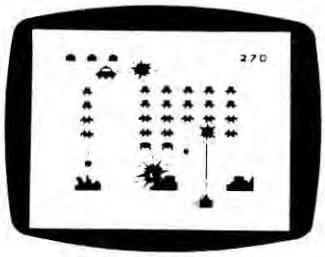

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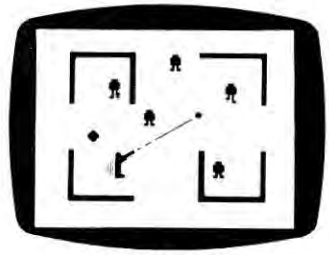

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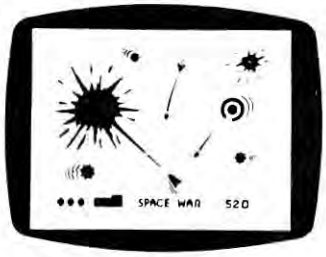

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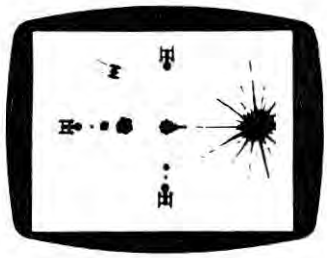

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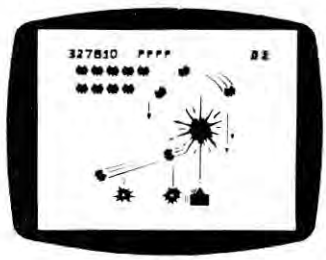

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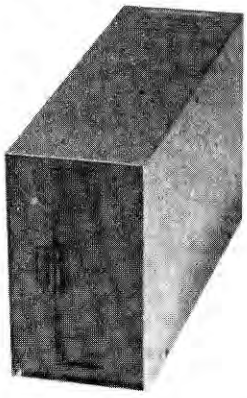

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LOAD 80

Better note timing and harmonic clarity.

Programming Pitch—Part III

Merton L. Davis
3A Palmetto Arms
Camden, SC 29020

Several months ago I wrote a program that uses a TRS-80 to generate music (see "Programming Pitch," *80 Micro*, May 1982 and June/July 1982). But a project like this is never really done. After programming some more (and listening to the same pieces of music on my TRS-80 over and over), I've come up with a new improved version. I have corrected mathematically inexact divisions in timing (from 32nd to whole notes) and the inferior harmonic clarity, particularly in the upper registers.

The Problems

The defect in note timing resulted from two problems. First, the note duration D is inversely proportional to a logarithmic function of the note period, P (rather than to P itself). Second, the interval of silence between notes is the same whether the note is of 1/32nd value or whole. Consequently, playing 32 32nd notes took considerably more time than one whole note. This problem is corrected by introducing the corrected B value, BC.

I improved note clarity by coding the machine-language music generator to permit greater dispersion of note periods in the range of the piano keyboard.

New Basic Program

The first 155 lines of the Basic driver (see Program Listing 1), like the original, load the keyboard and the music generator machine language in reserved space of upper memory in a 16K system. At line 160 the Basic driver sets the USR entry from Basic to the keyboard at 7A6CH (decimal 31340). The driver also sets certain parameters prior to the note-playing and rest-playing loops. Key parameters and variables of the original Basic driver and the new program are explained in Table 1. The parameters set in line 160 of the new Basic driver are:

- K—the proportionality constant for relating the duration D to B, and to the tempo AT. K varies from note to note because the logarithmic function of P that corrects timing is incorporated in K.
- X—VARPTR location of K that informs the machine-language keyboard the address to place the table value of K called for by the note string.
- D = one. The rest flag is recognized in the new machine-language program by D equals zero rather than by D equals one as in the original program. D must be given any value other than zero to start the music.
- AB = the time in B-value units between the end of one note and the beginning of the next. The value of 1.46 was experimentally determined.
- CK, DK and EK—the rest constants in the original program revised according to experimental data.

Line 170 is similar to line 130 of the original program. The repeat flag H is no longer included, and the multiplicative factor to obtain the tempo AT from AP has been changed to .03525 from .2. With .03525, a tempo selection of five will play the music at a metronome 84 for a quarter note (B equals 16).

Line 195 corrects the assigned B value (note value from Fig. 3 of the original article) with BC. With AB equal to 1.46, the new program will allow no B value lower than 1.5 (equivalent to 1/64th dot). If you desire more exact mathematical timing for notes equal

The Key Box

Model I or III
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Symbol	Explanation
A	Single Precision (SP) note duration
AD	SP rest duration
AP	SP tempo entered by user
AT	SP tempo calculated for program use
B	SP note value from 64 for a whole note to one for a 1/64th note
D	Integer value of note duration
CK,DK,EK	Constants of quadratic equation for rest duration as function of RK
NT$	3-character note string with first 2 characters describing note: AF = A Flat CN = C Natural FS = F Sharp Third character designates octave (zero to seven)
L	Numerical value if NT$ has one character L = 0 Directs to rest loop L = 1 Initiates reading of NT$ only if B>0; ends music if B<0 L = 2 Initiates special effects with B designating line number to go to L = 3-5 Lowers B-value during NT$-only reading L = 7-9 Proportionately increases B-value during NT$-only reading L = 6 Initiates reading of NT$ and associated "B" if in Read NT$ only
P	Period of a note or integer value of rest duration
RK	Integer product of B and tempo AP for a rest

Table 1. Key parameters and variables in original Basic driver

Program Listing 1. New Basic Driver

```
1 'MUSIC DRIVER V11 FOR MUSIC KEYBOARD AT 7A6CH AND MUSIC GENERA
TOR AT 7FBBH
2 'PROGRAM FOR TRS-80 MODEL I LEVEL II 16K
3 '       BY MERTON L. DAVIS
4 '          3A PALMETTO ARMS
5 '          CAMDEN S. CAROLINA 29020
6 'RUN FIRST TO LOAD KEYBOARD AND MUSIC GENERATOR
7 'THEN RUN TO PLAY MUSIC AT TEMPO OF YOUR CHOICE
8 '
9 DATA 205,127, 10,229, 33, 33,123,205, 13, 38
10 DATA 235, 94, 35, 86,225,122,179,202,210,127
11 DATA  35, 94, 35, 86,213,253,225,221, 33, 35
12 DATA 123, 42,254,127,  1,168,  0,253,126,  0
13 DATA 254, 65,202,190,122,221,  9,254, 66,202
14 DATA 190,122,221,  9,254, 67,202,190,122,221
15 DATA   9,254, 68,202,190,122,221,  9,254, 69
16 DATA 202,190,122,221,  9,254, 70,202,190,122
17 DATA 221,  9,  1, 56,  0,253,126,  1,254, 78
18 DATA 202,210,122,221,  9,254, 83,202,210,122
19 DATA 221,  9,  1,  7,  0,253,126,  2,254, 48
20 DATA 202,  9,123,221,  9,254, 49,202,  9,123
21 DATA 221,  9,254, 50,202,  9,123,221,  9,254
22 DATA  51,202,  9,123,221,  9,254, 52,202,  9
23 DATA 123,221,  9,254, 53,202,  9,123,221,  9
24 DATA 254, 54,202,  9,123,221,  9,221,126,  5
25 DATA 119, 35,221,126,  6,119, 33,187,127, 34
26 DATA 142, 64,221,102,  4,221,110,  3,195,154
27 DATA  10, 68,  0, 65, 78, 48, 76, 10, 13,  0
28 DATA  65, 78, 49, 38,  5, 26,  0, 65, 78, 50
29 DATA 147,  2, 52,  0, 65, 78, 51, 74,  1,101
30 DATA   0, 65, 78, 52,165,  0,199,  0, 65, 78
31 DATA  53, 82,  0,121,  1, 65, 78, 54, 41,  0
32 DATA 173,  2, 65, 78, 55, 21,  0,111,  4, 65
33 DATA  83, 48,184,  9, 14,  0, 65, 83, 49,220
34 DATA   4, 27,  0, 65, 83, 50,110,  2, 55,  0
35 DATA  65, 83, 51, 55,  1,108,  0, 65, 83, 52
36 DATA 156,  0,209,  0, 65, 83, 53, 78,  0,139
37 DATA   1, 65, 83, 54, 39,  0,203,  2, 65, 83
38 DATA  55, 19,  0,176,  4, 65, 70, 48,  0,  0
39 DATA   2,  0, 65, 70, 49,117,  5, 24,  0, 65
40 DATA  70, 50,186,  2, 48,  0, 65, 70, 51, 93
41 DATA   1, 96,  0, 65, 70, 52,175,  0,187,  0
42 DATA  65, 70, 53, 87,  0,100,  1, 65, 70, 54
43 DATA  44,  0,135,  2, 65, 70, 55, 22,  0, 51
44 DATA   4, 66, 78, 48, 45,  9, 15,  0, 66, 78
45 DATA  49,150,  4, 29,  0, 66, 78, 50, 75,  2
46 DATA  58,  0, 66, 78, 51, 38,  1,114,  0, 66
47 DATA  78, 52,147,  0,222,  0, 66, 78, 53, 73
48 DATA   0,164,  1, 66, 78, 54, 37,  0,226,  2
49 DATA  66, 78, 55, 18,  0,226,  4, 66, 83, 48
50 DATA 169,  8, 16,  0, 66, 83, 49, 85,  4, 31
51 DATA   0, 66, 83, 50, 42,  2, 61,  0, 66, 83
52 DATA  51, 21,  1,120,  0, 66, 83, 52,139,  0
53 DATA 234,  0, 66, 83, 53, 69,  0,184,  1, 66
54 DATA  83, 54, 35,  0, 17,  3, 66, 83, 55, 17
55 DATA   0,  0,  5, 66, 70, 48,184,  9, 14,  0
56 DATA  66, 70, 49,220,  4, 27,  0, 66, 70, 50
57 DATA 110,  2, 55,  0, 66, 70, 51, 55,  1,108
58 DATA   0, 66, 70, 52,156,  0,209,  0, 66, 70
59 DATA  53, 78,  0,139,  1, 66, 70, 54, 39,  0
60 DATA 203,  2, 66, 70, 55, 19,  0,176,  4, 67
61 DATA  78, 48,169,  8, 16,  0, 67, 78, 49, 85
62 DATA   4, 31,  0, 67, 78, 50, 42,  2, 61,  0
63 DATA  67, 78, 51, 21,  1,120,  0, 67, 78, 52
64 DATA 139,  0,234,  0, 67, 78, 53, 69,  0,184
65 DATA   1, 67, 78, 54, 35,  0, 17,  3, 67, 78
66 DATA  55, 17,  0,  0,  5, 67, 83, 48, 45,  8
67 DATA  16,  0, 67, 83, 49, 22,  4, 32,  0, 67
68 DATA  83, 50, 11,  2, 64,  0, 67, 83, 51,  6
69 DATA   1,127,  0, 67, 83, 52,131,  0,247,  0
70 DATA  67, 83, 53, 65,  0,208,  1, 67, 83, 54
71 DATA  33,  0, 52,  3, 67, 83, 55,132,  3, 38
72 DATA   0, 67, 70, 48, 45,  9, 15,  0, 67, 70
73 DATA  49,150,  4, 29,  0, 67, 70, 50, 75,  2
74 DATA  58,  0, 67, 70, 51, 38,  1,114,  0, 67
75 DATA  70, 52,147,  0,222,  0, 67, 70, 53, 73
76 DATA   0,164,  1, 67, 70, 54, 37,  0,226,  2
77 DATA  67, 70, 55, 18,  0,226,  4, 68, 78, 48
78 DATA 183,  7, 17,  0, 68, 78, 49,220,  3, 34
79 DATA   0, 68, 78, 50,238,  1, 68,  0, 68, 78
80 DATA  51,247,  0,135,  0, 68, 78, 52,123,  0
81 DATA   4,  1, 68, 78, 53, 62,  0,227,  1, 68
82 DATA  78, 54, 31,  0, 76,  3, 68, 78, 55, 37
83 DATA   0,217,  2, 68, 83, 48, 72,  7, 18,  0
84 DATA  68, 83, 49,164,  3, 37,  0, 68, 83, 50
```

Listing 1 continues

```
85 DATA 210,  1, 72,  0, 68, 83, 51,233,  0,143
86 DATA   0, 68, 83, 52,117,  0, 16,  1, 68, 83
87 DATA  53, 58,  0,251,  1, 68, 83, 54, 29,  0
88 DATA 122,  3, 68, 83, 55, 37,  0,217,  2, 68
89 DATA  70, 48, 45,  8, 16,  0, 68, 70, 49, 22
90 DATA   4, 32,  0, 68, 70, 50, 11,  2, 64,  0
91 DATA  68, 70, 51,  6,  1,127,  0, 68, 70, 52
92 DATA 131,  0,247,  0, 68, 70, 53, 65,  0,208
93 DATA   1, 68, 70, 54, 33,  0, 52,  3, 68, 70
94 DATA  55, 37,  0,208,  2, 69, 78, 48,224,  6
95 DATA  19,  0, 69, 78, 49,112,  3, 39,  0, 69
96 DATA  78, 50,184,  1, 77,  0, 69, 78, 51,220
97 DATA   0,150,  0, 69, 78, 52,110,  0, 30,  1
98 DATA  69, 78, 53, 55,  0, 21,  2, 69, 78, 54
99 DATA  27,  0,172,  3, 69, 78, 55, 37,  0,217
100 DATA   2, 69, 83, 48,125,  6, 20,  0, 69, 83
101 DATA  49, 62,  3, 41,  0, 69, 83, 50,159,  1
102 DATA  81,  0, 69, 83, 51,208,  0,159,  0, 69
103 DATA  83, 52,104,  0, 48,  1, 69, 83, 53, 52
104 DATA   0, 52,  2, 69, 83, 54, 26,  0,197,  3
105 DATA  69, 83, 55, 37,  0,208,  2, 69, 70, 48
106 DATA  72,  7, 18,  0, 69, 70, 49,164,  3, 37
107 DATA   0, 69, 70, 50,210,  1, 72,  0, 69, 70
108 DATA  51,233,  0,143,  0, 69, 70, 52,117,  0
109 DATA  16,  1, 69, 70, 53, 58,  0,251,  1, 69
110 DATA  70, 54, 29,  0,122,  3, 69, 70, 55, 37
111 DATA   0,217,  2, 70, 78, 48,125,  6, 20,  0
112 DATA  70, 78, 49, 62,  3, 41,  0, 70, 78, 50
```

Listing 1 continues

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Listing 1 continued

```
113 DATA 159,  1, 81,  0, 70, 78, 51,208,  0,159
114 DATA   0, 70, 78, 52,104,  0, 48,  1, 70, 78
115 DATA  53, 52,  0, 52,  2, 70, 78, 54, 26,  0
116 DATA 197,  3, 70, 78, 55, 37,  0,217,  2, 70
117 DATA  83, 48, 32,  6, 22,  0, 70, 83, 49, 16
118 DATA   3, 43,  0, 70, 83, 50,136,  1, 86,  0
119 DATA  70, 83, 51,196,  0,168,  0, 70, 83, 52
120 DATA  98,  0, 66,  1, 70, 83, 53, 49,  0, 84
121 DATA   2, 70, 83, 54, 24,  0,247,  3, 70, 83
122 DATA  55, 37,  0, 32,  3, 70, 70, 48,224,  6
123 DATA  19,  0, 70, 70, 49,112,  3, 39,  0, 70
124 DATA  70, 50,184,  1, 77,  0, 70, 70, 51,220
125 DATA   0,150,  0, 70, 70, 52,110,  0, 30,  1
126 DATA  70, 70, 53, 55,  0, 21,  2, 70, 70, 54
127 DATA  27,  0,172,  3, 70, 70, 55, 37,  0,217
128 DATA   2, 71, 78, 48,200,  5, 23,  0, 71, 78
129 DATA  49,228,  2, 46,  0, 71, 78, 50,114,  1
130 DATA  91,  0, 71, 78, 51,185,  0,177,  0, 71
131 DATA  78, 52, 92,  0, 82,  1, 71, 78, 53, 46
132 DATA   0,106,  2, 71, 78, 54, 23,  0, 25,  4
133 DATA  71, 78, 55, 37,  0,216,  2, 71, 83, 48
134 DATA 117,  5, 24,  0, 71, 83, 49,186,  2, 48
135 DATA   0, 71, 83, 50, 93,  1, 96,  0, 71, 83
136 DATA  51,175,  0,187,  0, 71, 83, 52, 87,  0
137 DATA 100,  1, 71, 83, 53, 44,  0,135,  2, 71
138 DATA  83, 54, 22,  0, 51,  4, 71, 83, 55, 37
139 DATA   0,218,  2, 71, 70, 48, 32,  6, 22,  0
140 DATA  71, 70, 49, 16,  3, 43,  0, 71, 70, 50
141 DATA 136,  1, 86,  0, 71, 70, 51,196,  0,168
142 DATA   0, 71, 70, 52, 98,  0, 66,  1, 71, 70
143 DATA  53, 49,  0, 84,  2, 71, 70, 54, 24,  0
144 DATA 247,  3, 71, 70, 55, 37,  0,218,  2,205
145 DATA 127, 10,229, 33, 33,123,205, 13, 38,235
146 DATA  94, 35, 86,225, 14,  1, 62,  3,169, 79
147 DATA 211,255,125,183,229,194,217,127, 44, 69
148 DATA  16,254,203,124, 32,  5, 37,250,235,127
149 DATA  36, 37, 46,254,195,217,127,122,179,225
150 DATA 202,245,127, 27,195,204,127, 33,108,122
151 DATA  34,142, 64,195,154, 10
153 POKE16562,122:POKE16561,107:CLEAR100:FORZ=31340TO32765:READX
:S=S+X:POKEZ,X:NEXT
155 IFS=97735THEN300 ELSE PRINT"BAD CHECKSUM IN DATA":STOP
160 DEFINTC-Z:POKE16527,122:POKE16526,108:K=2500:D=1:AB=1.46:CK=
-6:DK=1980:EK=-20335:X=VARPTR(K):POKE32766,PEEK(VARPTR(X)):POKE3
2767,PEEK(VARPTR(X)+1)
170 CLS:G=0:INPUT"TEMPO 1 TO 20 (1 IS FASTEST)";AP:AT=.03525*AP:
RESTORE
180 IF G=0 READ NT$,B ELSE READNT$
185 IF LEN(NT$)=2 ORLEN(NT$)>3 THEN PRINT NT$;" BAD":STOP: 'DELE
TE THIS LINE AFTER DEBUGGING
190 IFLEN(NT$)=1THEN230
195 BC=B-AB
200 P=USR(VARPTR(NT$)):A=K*BC*AT
205 IF A>65535 THEN PRINT"BC*AT PRODUCT";BC*AT;"TOO LARGE":STOP
'DELETE THIS LINE AFTER DEBUGGING
210 IFA<32768THEND=AELSED=A-65536
215 PRINTNT$;B,: 'DELETE THIS LINE AFTER DEBUGGING DATA
220 F=USR(P):GOTO180
230 L=VAL(NT$):IFL<>0THEN270
240 RK=B*AP:IFRK<15THENFORZ=1TO INT(2.74*RK):NEXT:D=1:GOTO180
250 AD=CK*RK*RK+DK*RK+EK:D=0
255 IF AD>65535 THEN PRINT"AD";AD;"IS TOO LARGE":STOP 'DELETE TH
IS LINE AFTER DEBUGGING DATA
260 IFAD<32768THENP=AD:F=USR(P):D=1:GOTO180 ELSEP=AD-65536:F=USR
(P):D=1:GOTO180
270 IFL=1ANDB>0THENG=1:GOTO180ELSEIFL=1THEN170
280 IFL=2THEN350
290 IFL=3THENB=.2*B:GOTO180ELSEIFL=4THENB=.5*B:GOTO180ELSEIFL=5T
HENB=.8*B:GOTO180ELSEIFL=6THENG=0:GOTO180ELSEIFL=7THENB=1.25*B:G
OTO180ELSEIFL=8THENB=2*B:GOTO180ELSEIFL=9THENB=5*B
300 CLS:PRINT"MUSIC GENERATOR READY FOR RUNNING":DELETE1-155
310 F=USR(USR(VARPTR(NT$))):FORZ1=1TODR:NEXT:RETURN
350 'SPECIAL EFFECTS FOR CHOPIN "BERCEUSE"--TREBLE CLEF--
351 ONBGOTO400,500,600,650,700
400 N=INT(.45*AP):D=13:DR=15:READN1$,N2$
410 FORZ=1TON
420 NT$=N1$:GOSUB310:NT$=N2$:GOSUB310:NEXTZ
430 NT$=N1$:GOSUB310:GOTO180
500 N=INT(.45*AP):D=13:DR=15:READN1$,N2$,N3$
510 FORZ=1TON
520 NT$=N1$:GOSUB310:NT$=N2$:GOSUB310:NEXTZ:N=N/2
530 FORZ=1TON
540 NT$=N3$:GOSUB310:NT$=N2$:GOSUB310
550 NEXTZ:NT$=N2$:D=32:GOSUB310:GOTO400
600 FORZ=1TO138:READNT$:P=USR(VARPTR(NT$)):D=3510/P:F=USR(P):FOR
Z1=1TODR:NEXT:NEXTZ
610 FORZ=1TO22:READNT$:P=USR(VARPTR(NT$)):D=3000/P:F=USR(P):FORZ
```

Listing 1 continues

to or shorter than 1/64th dot, you must use the special effects illustrated below.

Line 200 finds P (the period) in the machine-language keyboard, as in the original program. It also now finds the K value for the particular period as well. K is then used to determine the single-precision A in line 200, from which D (the duration integer) is derived in line 210.

Line 220 plays the note and returns for the next one. The Basic program no longer needs the time to POKE a new USR entry before playing the note, as in the original program.

The rest-treating loop, lines 240–260, is still accessed by reading 0 (via lines 190 and 230) into NT$, but now the RK value is determined in line 240 rather than in the note-playing loop. If the new RK value is less than 15, the quadratic equation of line 250 no longer applies. Line 240 will then send the program back to get the next note after a Basic timing delay.

Line 250 determines the rest duration and sets D equal to zero for the machine language to flag a rest. I calculated the constants CK, DK and EK, fixed in line 160, by linear regression from experimental data. I used a metronome to find the rest duration AD for a series of RK values. As before, the rest timing will no longer apply if you appreciably alter the note-playing or rest-playing loops in the Basic program.

Line 260 determines the rest period and plays the rest. In this new version, D must be set to some value other than zero before returning for the next note.

One additional line (line 310) facilitates handling special effects. The note-playing subroutine in line 310 is especially handy for trills.

Lines to Delete

Four lines in the new program must be deleted if the timing constants in line 160 and .03525 in line 170 are to apply. Lines 185, 205, 215 and 255 help find bugs in your musical data during the first playback. After debugging they serve no useful purpose and should be deleted.

Line 185 will catch bad data entries from reaching the machine language. Line 215 will tell you the offending sour note or B-value timing after the break key is depressed during initial playback. In the interest of keeping the B-value correction constant AB as small as possible, delete line 215 before the final performance.

Line 205 interrupts the music if the note duration exceeds the capacity of a two-byte integer. If this should occur, try a faster tempo. If you are still unsatisfied, lower the note B value a bit and make up the timing difference with a rest.

Line 255 interrupts if the rest duration exceeds capacity. You may play a faster tempo or divide the rest into two or more with B value totaling the B value of the original rest.

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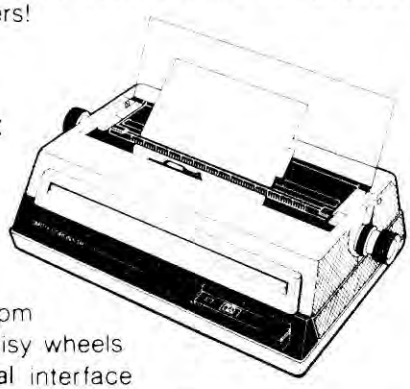

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Listing 1 continued

```
1=1TODR:NEXT:NEXTZ
620 GOTO180
650 FORZ=1TO9:READNT$:P=USR(VARPTR(NT$)):D=2600/P:F=USR(P):FORZ1
=1TODR:NEXT:NEXTZ:GOTO180
700 FORZ=1TO72:READNT$:P=USR(VARPTR(NT$)):D=3510/P:F=USR(P):FORZ
1=1TODR:NEXT:NEXTZ:GOTO180
1000 'DATA FOR CHOPIN "BERCEUSE" TREBLE CLEF
1010 DATAFN4,24,EF4,8,AF5,8,FN4,8,EF4,8,FN4,8,DF4,8,BF4,8,CN4,8,
EF4,8,AF4,8,DF4,14,1,8,EF4,GF4,BF5
1020 DATAAF5,GF4,FN4,EF4,DF4,EF4,FN4,CN4,BF4,EF4,AF5,FN4,EF4,FN4
,DF4,BF4,CN4,EF4,AF4,DF4,BF4,EF4,GF4,BF5,AF5,DF5,BF5,GF4,CN5,AF5

1030 DATAFN4,BF5,GF4,EF4,AF5,FN4,EF4,FN4,DF4,BF4,CN4,EF4,4,AF4,F
N3,DF4,EF3,DF3,DF4,EF4,CN4,GF4,BF4,BF5,GF4,AF5,FN4,DF5,EF4,BF5,D
F4,GF4,DN4,CN5,AF4,AF5,AF4,6
1040 DATAAF5,2,AF4,22,AF5,2,AF4,6,AF5,2,AF4,6,FN4,2,AF4,6,EF4,2,
AF4,6,FN4,2,AF4,6,DF4,2,AF4,6,BF4,2,AF4,6,CN4,2,AF4,6,EF4,2,AF4,
6,AF5,2,AF4,6,CN4,2,AF4,6,DF4,2,AF4,6
1045 DATADN4,2,AF4,6,EF4,2,AF4,6,EN4,2,AF4,6,FN4,2,AF4,6,BF5,2,A
F4,6,GN4,2,AF4,6,AF5,2,AF4,6,BF5,2,AF4,6,GF4,1.7,GN4,1.7,AF4,4.6

1050 DATAFN4,1.7,2,1,AF5,BF5,1,2,GN4,AF5,DF5,BF5,FN4,GF4,CN5,AF5
,EN4,FN4,BF5,GF4,DN4,EF4,AF5,FN4,CN4,DF4,GF4,EF4,BN4,CN4,FN4,DF4
,AN4,BF4,EF4,CN4,GN3,AF4,CN4,BF4,GN3,AF4,BF4,CN4,DF4,EF4,FN4,GF4

1060 DATAGN4,AF5,AN5,CF5,BF5,CN5,BN5,DF5,CN5,DN5,DF5,EF5,DN5,FF5
,EF5,FN5,EN5,GF5,FN5,GN5,GF5,AF6,GN5,BF6
1070 DATAAF6,FN6,EF6,DF6,FN5,DF6,CN6,BF6,DF5,BF6,AF6,GF5,BF5,GF5
,FN5,EF5,GF4,EF5,DF5,CN5,EF4,CN5,BF5,AF5,6
1075 DATAAF5,8,FN5,12,BF5,3,EF5,2.7,AF5,2.7,DF5,2.7,GF4,2.7,CN5,
2.7,FN4,2.7,BF5,1.7,EF4,1.7,AF5,1.7,DF4,1.7,GF4,1.7,CN4,1.7
1080 DATAFN4,12,CN4,4,FN4,4,BF4,4,FN4,3,BF4,3,FN4,3,BF4,3,FN4,3,
BF4,3,EF4,3,BF4,3,1,2.67,AF4,AN4,BF4,BN4,CN4,DF4,DN4,EF4,EN4,FN4
,FS4,GN4,AF5,AN5,BF5,BN5,CN5,DF5
1090 DATADN5,EF5,EN5,FN5,FS5,GN5,AF6,BF6,AF6,BF6,EF5,BF6,DF5,BF6
,CN5,BF6,BF5,BF6,AF5,DF6,6,0,5,0,5,1,2.67,DF6,AF5,0,GF5,CN6,0,GF
5,EF4,0,EF5,BF6,0
1100 DATABF6,EF4,0,DF5,AF6,0,FN5,DF4,0,AN5,FN5,0,EF5,CN4,0,GF4,C
N5,0,AF5,FN3,0,DF4,AF5,0,DF5,AF4,0,GF4,EF5,0,GF5,EF4,0,EF5,BF6,0
1110 DATABF6,EN4,0,DF5,AF6,0,DF6,AF5,0,GF5,EF6,0,FN6,CN5,0,EF5,C
N6,0,6,DF5,2,DF6,8.67,1,2.67,CN6,CN6,CF6,BF6,BF6,AN6,AF6,AF6,GN5
,GF5,GF5,FN5,FF5,FF5
1120 DATAEF5,DN5,DN5,DF5,CN5,CN5,CF5,BF5,BF5,AN5,AF5,AF5,GN4,GF4
,GF4,FN4,EF4,EN4,AF4,GF4,FN4,AF4,FN4,EF4,AF4,EF4,FN4,AF4,AF5,GF4
,AF4,GF4,FN4,AF4,FN4,GF4
1130 DATAAF4,GF4,GN4,AF4,GN4,AF5,AF4,AF5,AN5,AF4,AN5,AF5,AF4,AF5
,GN4,AF4,AF5,GF4,6,FN4,2,0,2,AF5,2,0,2,DF5,2,0,2,EF5,2,0,2,FN5,2
,0,2,GF5,2,0,2,FN5,2,0,2,EF5,2,0,2,CN5,2,0,2,BF5,2,0,2,AF5,2.67,
BF5,2.67,BF5,2.67
1140 DATAAF5,2,0,2,AF5,2,0,2,1,1.75,DF5,0,DF5,0,GF5,0,FN5,0,AF6,
0,DF6,0,DF6,0,CN6,0,BF6,0,AF6,0,EF5,0,FN5,0,CN5,0,BF5,0,AF5,0,6,
1,2,AF4,AF5,CN4,BF4,BF4,AF5,DF4,CN4,CN4,AF5
1145 DATAEF4,DF4,BF4,AF5,DF4,CN4,CN4,AF5,EF4,DF4,DF4,AF5,FN4,EF4

1150 DATADF4,BF5,FN4,FF4,EF4,CN5,GF4,FN4,FF4,DF5,GN4,GF4,FN4,DN5
,AF5,GN4,GF4,EF5,AN5,AF5,GN4,FF5,BF5,AN5,6
1160 DATAFN5,8,2,3,BF5,GF5,BF5,AF5,FN5,AF5,BF5,GF5,BF5,FN4,DF5,F
N4,AF5,FN5,AF5,GF4,EF5,GF4,AF5,FN5,AF5,EF4,CN5,EF4,GF4,EF5,GF4,F
N4,DF5,FN4
1170 DATAGF4,EF5,GF4,DF4,BF5,DF4,FN4,DF5,FN4,EF4,CN5,EF4,FN4,DF5
,FN4,CN4,AF5,CN4,EF4,CN5,EF4,DF4,BF5,DF4,EF4,CN5,EF4,BF4,GF4,BF4
,DF4,BF5,DF4,CN4,AF5,CN4
1180 DATAAF4,FN4,AF4,AN4,FS4,AN4,BF4,GN4,BF4,BN4,AF5,BN4,CN4,AN5
,CN4,DF4,BF5,DF4,DN4,BN5,DN4,EF4,CN5,EF4,EN4,CS5,EN4,FN4,DN5,FN4
,FS4,EF5,FS4,GN4,EN5,GN4
1190 DATAAF5,FN5,AF5,AN5,FS5,AN5,BF5,GN5,BF5,BN5,AF6,BN5,CN5,AN6
,CN5,DF5,BF6,DF5,DN5,BN6,DN5,EF5,CN6,EF5,EN5,CS6,EN5,FN5,DN6,FN5
,FS5,EF6,FS5,GN5,EN6,GN5
1200 DATAAF6,FN6,FF6,EF6,DF6,CN6,BF6,AF6,GF5,FN5,FF5,EF5,DF5,CN5
,BF5,AF5,GF4,FN4,FF4,EF4,DF4,CN4,CF4,2,2,2,AN4,BF4,AF4,AF4,BF4,2
,4,FN3,AF4,DF4,FN4,BF5,AF5,AF5,AF5,BF6,AF6,2,0,2
1205 DATABF4,2,2,1,AF4,BF4,2,4,GN3,AF4,EF4,GF4,BF5,AF5,AF5,AF5,B
F6,AF6,2,0,2
1210 DATA2,5,DF6,BF6,DF6,AF6,DF6,FN5,DF6,GF5,DF6,FN5,DF6,DF5,DF6
,FN5,CN6,DF5,CF6,FN5,BF6,CN5,AN6,GF5,AF6,CN5,GN5,EF5,GF5,AN5,FN5
,CN5,EF5,AF5,GF5,GF4,CN5,AF5
1220 DATADF5,BF5,DF5,AF5,DF5,FN4,DF5,GF4,DF5,FN4,DF5,DF4,DF5,FN4
,CN5,DF4,CF5,FN4,BF5,CN4,AN5,GF4,AF5,CN4,GN4,EF4,GF4,AN4,FN4,CN4
,EF4,AF4,GF4,GF3,CN4,AF4
1230 DATADF4,16,DF4,8,CN4,4,DF4,4,EF4,4,GF4,4,BF5,4,BF4,4,AF4,16
,AF4,8,GF3,4,AF4,4,CN4,4,EF4,4,GF4,4,GF3,4,FN3,4,0,4,AF5,4,GN4,4
,AF5,4,BF5,4,AF5,4,CN4,4,GF4,4,CN5,4,GF5,4
1240 DATAFN5,4,EF5,4,DF5,4,FN4,4,AF5,4,CN5,4,BF5,4,GF4,4,EF4,4,B
F4,4,CN4,4,EF4,4,AF4,24,1,2.67,GN3,AF4,BF4,CN4,DF4,EF4,FN4,GF4,B
F5,6,AF5,24,1,2.67,GN4,AF5,CN5,BF5,AF5,GF4,EF4,BF4,CN4
1250 DATABF4,AF4,EF4,DF4,EF4,GF4,FN4,GF4,BF5,AF5,AF6,BF5,AF6,DF5
,AF6,CN5,AF6,FN5,EF5,DF5,DF6,CN6,BF6,AF6,FN5,EF5,DF5,CN5,BF5,AF5
,FN4,EF4,DF4,CN4,BF4,AF4,6
```

Listing 1 continues

the new program because the music includes special effects not required of *Carmen's March*. These include an extended passage of cadenzas and trills played at a rate considerably faster than the lower limit of B value (1.5) allows.

Lines 400–550 show how trills are handled with the new program. It is no longer necessary to read the note period directly from the data for trills because the new program does not require change of USR call vector after finding the period and before playing the note. Therefore each note involved in the trill is read as a three-character string. Line 1050 directs the program to line 400, which reads two trill notes, N1$ and N2$, which follow the 2,1 combination. This reading occurs immediately after setting the N, D and DR parameters required for trill duration.

Lines 420–430 play the trill before returning to line 180 for the next note. Each note of the trill is played by a GOSUB 310. The subroutine requires, before the call, the note string (NT$), a note duration D, and a duration between notes DR.

Lines 600–700 handle the cadenzas and trills. Line 700, for example, plays a cadenza of 72 notes. They are read by the 72-note strings that follow the 2,5 combination in line 1210. The 2,5 now directs the program to line 700. After each note is read, the period P is found, the duration D calculated, and the note played. The subroutine at 310 is not used in this case because the cadenza covers such a wide range of the keyboard that a duration D must be calculated as a function of P for each note. The constant (3510 in the case of line 700) used to calculate D may be adjusted to time the cadenza to the measure-to-measure beat you wish.

The form of the data section of *Berceuse* is similar to that of *Carmen March* except the special effect call is followed with three-character note strings rather than with periods. In a number of places I had to shade the timing division to allow for the BC value in line 195. For example, the 1.75 following the one in line 1140 directs the program to read only NT$ (via lines 190, 230, 270 and 180) and to use a 1.75 B value for the series of notes and rests that follow. Exact mathematical timing required a B value of 1.33 but this would have resulted in a note of negative duration (−.08). If the time shading is contained within one measure, such as for grace notes, then the longer duration note that follows or precedes may be shaded in the opposite direction. For example, if the total shading of two grace notes preceding a quarter note amounts to .4 B value, then the quarter note may be given a B value of 15.6 rather than 16. In the case in line 1140 of *Berceuse*, the shading extends over several measures. If precise timing is critical, such as for an accompanying bass, then the B values in the accompanying bass must be adjusted in accord with the measures in the treble.

Toward the end of line 1140 is a six between a rest reading of zero and a pair 1,2. The six directs the program to read notes

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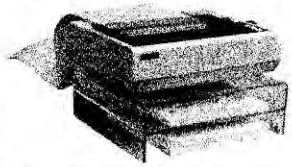

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Listing 1 continued

```
1260 DATADF4,24,1,4,CF4,DF4,FN4,BF5,AF5,EF4,CF4,FN3,CF4,EF4,AF4,
DF4,CF4,DF4,FN4,BF5,AF5,EF4,CF4,FN3,CF4,EF4,AF4,DF4,CF4,DF4,FN4,
AF5,CF5,DF5
1270 DATAEF5,GF5,FN5,EF5,CF5,AF5,EF4,GF4,FN4,DF4,CF4,AF4,6,BF4,2
4,1,4,DF4,GF4,AF5,BF5,CF4,BF4,DF4,GF4,AF5,BF5,DF5,GF5,AF6,BF6,GF
5,EF5,DF5
1280 DATAFN5,EF5,BF5,CN5,EF5,DF5,AF5,BF5,DF5,CN5,GF4,AF5,CN5,BF5
,FN4,GF4,BF5,AF5,EF4,FN4,AF5,GF4,DF4,EF4,6,FN4,24,1,8,EF4,AF5,FN
4,EF4,FN4,DF4,BF4,DF4,AF4
1290 DATA BF4,DF4,AF4,GF3,DF4,FN3,6,0,6,0,6,0,6,0,6,FN3,8,AF4,8,
EF3,8,EF3,8,AF4,8,DF3,8,0,6,0,6,0,6,0,6,0,6,0,6,0,6
1300 DATA GF2,2,AF3,2,CN3,2,EF3,42,FN2,2,DF3,14,1,-1
```

Program Listing 2. Carmen March *Data*

```
347 'SPECIAL EFFECTS FOR CARMEN MARCH--USE WITH V11 MUSIC DRIVER

350 ONBGOTO400
400 N=2*AP:D=2*AP:DR=15:READ N1$, N2$, N3$
410 FOR Z=1 TO N
420 NT$=N1$:GOSUB 310:NT$=N2$:GOSUB 310:NEXT Z
430 NT$=N1$:GOSUB 310:NT$=N3$:GOSUB 310:NT$=N1$:GOSUB 310
440 GOTO180
1000 'DATA FOR 'CARMEN MARCH' BY GEORGES BIZET
1010 DATAAN5,8,AN5,2,0,2,AN5,2,0,2,AN5,2,0,2,EN4,2,0,2,DN4,2,0,2
,EN4,2,0,2,AN5,8,AN5,2,0,2,AN5,2,0,2,AN5,2,0,2,BN5,2,0,2,CS5,2,0
,2,BN5,2,0,2,AN5,4,0,4,AN5,2,0,2,AN5,2,0,2,BN5,2,0,2,AN5,2,0,2,G
S4,2,0,2,AN5,2,0,2,2,1,BN5,CS5,AS5
1020 DATADN5,4,0,4,DN5,2,0,2,DN5,2,0,2,DN5,2,0,2,AN5,2,0,2,GN4,2
,0,2,AN5,2,0,2,DN5,4,0,4,DN5,2,0,2,DN5,2,0,2,DN5,2,0,2,EN5,2,0,2
,FS5,2,0,2,EN5,2,0,2,DN5,4,0,4,DN5,2,0,2,CS5,2,0,2,BN5,4,0,4,BN5
,2,0,2,AN5,2,0,2,2,1,GS4,AN5,FS4
1030 DATAAN5,4,0,4,AN5,2,0,2,AN5,2,0,2,AN5,2,0,2,EN4,2,0,2,DN4,2
,0,2,EN4,2,0,2,AN5,4,0,4,AN5,2,0,2,AN5,2,0,2,AN5,2,0,2,BN5,2,0,2
,CS5,2,0,2,BN5,2,0,2,AN5,4,0,4,AN5,2,0,2,AN5,2,0,2,BN5,2,0,2,AN5
,2,0,2,GS4,2,0,2,AN5,2,0,2
1035 DATA2,1,BN5,CS5,AS5
1040 DATAEN5,4,0,4,EN5,2,0,2,EN5,2,0,2,EN5,4,DN5,4,CS5,2,0,2,DN5
,2,0,2,EN5,4,0,4,EN5,2,0,2,EN5,2,0,2,EN5,4,DN5,4,CS5,2,0,2,DN5,2
,0,2,EN5,8,EN4,4,FS4,4,GS4,8,EN4,4,CS5,4,BN5,16,AN5,8,0,8
1050 DATACS4,4,0,4,FS4,4,0,4,CS4,4,0,4,BN4,4,0,4,AN4,8,GS3,4,FS3
,4,GS3,4,0,4,CS3,4,0,4,FS3,8,GS3,8,AN4,8,CS4,8,ES4,8,DS4,4,ES4,4
,CS4,4,0,4,CS4,4,0,4
1060 DATACS4,8,FS4,4,0,4,CS4,4,0,4,BN4,4,0,4,AN4,8,GS3,4,FS3,4,G
S3,4,0,4,CS3,4,0,4,FS3,4,0,4,GS3,4,0,4,AN4,4,0,4,CS4,4,0,4,ES4,8
,DS4,4,ES4,4,CS4,8,0,8
1070 DATADN5,4,DN5,4,DN5,4,0,4,EN5,4,EN5,4,EN5,4,0,4,FS5,4,FS5,4
,FS5,4,0,4,DN5,4,DN5,4,DN5,4,0,4,CS5,4,0,4,GS4,4,0,4,CS5,4,0,4,D
N5,4,0,4,CS5,4,0,4,GS4,4,0,4,CS5,4,0,4,0,8,DN5,4,DN5,4,DN5,4,0,4
,EN5,4,EN5,4,EN5,4,0,4
1075 DATAFS5,4,FS5,4,FS5,4,0,4,DN5,4,DN5,4,DN5,4,0,4
1080 DATAGS2,4,GS4,2,GS5,2,GS1,4,GS4,2,GS5,2,AN2,4,GS4,2,GS5,2,A
N3,4,GS4,2,GS5,2,AS3,4,GS4,2,GS5,2,AS2,4,GS4,2,GS5,2,BN2,4,GS4,2
,GS5,2,BN3,4,GS4,2,GS5,2,BS3,4,GS4,2,GS5,2,BS4,4,GS4,2,GS5,2,CS2
,4,GS4,2,GS5,2,CS3,4,GS4,2,GS5,2
1085 DATADN3,4,GS4,2,GS5,2,GS4,4,0,4,GS4,4,0,4,AN5,4,0,4,AN5,2,0
,2,AN5,2,0,2,AN5,2,0,2,EN4,2,0,2,DN4,2,0,2,EN4,2,0,2,AN5,4,0,4,A
N5,2,0,2,AN5,2,0,2,AN5,2,0,2,BN5,2,0,2,CS5,2,0,2,BN5,2,0,2,AN5,4
,0,4,AN5,2,0,2,AN5,2,0,2,BN5,2,0,2
1087 DATAAN5,2,0,2,GS4,2,0,2,AN5,2,0,2
1090 DATA2,1,BN5,CS5,AS5,DN5,4,0,4,DN5,2,0,2,DN5,2,0,2,DN5,2,0,2
,AN5,2,0,2,GN4,2,0,2,AN5,2,0,2,DN5,4,0,4,DN5,2,0,2,DN5,2,0,2,DN5
,2,0,2,EN5,2,0,2,FS5,2,0,2,EN5,2,0,2,DN5,4,0,4,DN5,2,0,2,CS5,2,0
,2,BN5,4,0,4,BN5,2,0,2,AN5,2,0,2
1095 DATA2,1,GS4,AN5,FS4,AN5,4,0,4,AN5,2,0,2,AN5,2,0,2,AN5,2,0,2
,EN4,2,0,2,DN4,2,0,2,EN4,2,0,2
1100 DATAAN5,4,0,4,AN5,2,0,2,AN5,2,0,2,AN5,2,0,2,BN5,2,0,2,CS5,2
,0,2,BN5,2,0,2,AN5,4,0,4,AN5,2,0,2,AN5,2,0,2,BN5,2,0,2,AN5,2,0,2
,GS4,2,0,2,AN5,2,0,2
1110 DATA2,1,BN5,CS5,AS5,EN5,4,0,4,EN5,2,0,2,EN5,2,0,2,EN5,2,0,2
,DN5,2,0,2,CS5,2,0,2,DN5,2,0,2,EN5,4,0,4,EN5,2,0,2,EN5,2,0,2,EN5
,2,0,2,DN5,2,0,2,CS5,2,0,2,DN5,2,0,2
1120 DATAEN5,8,EN4,4,FS4,4,GS4,8,EN4,4,CS5,4,DN4,1.7,EN4,1.7,GS4
,1.7,BN5,10.9,AN5,4,0,6,0,6,FN3,4,0,4,FN3,2,0,2,FN3,2,0,2,FN3,2,
0,2,CN3,2,0,2,BF3,2,0,2,CN3,2,0,2,FN3,4,0,4,FN3,2,0,2,FN3,2,0,2,
FN3,2,0,2,GN3,2,0,2,AN4,2,0,2,GN3,2,0,2
1125 DATAFN3,4,0,4,FN3,2,0,2,FN3,2,0,2,CN3,2,0,2,BF3,2
,0,2,CN3,2,0,2,FN3,16,FN3,8,0,8
1130 DATAEF4,4,0,4,EF4,2,0,2,EF4,2,0,2,EF4,2,0,2,BF4,2,0,2,AF4,2
,0,2,BA4,2,0,2,EF4,8,EF4,4,EF4,4,EF4,4,FN4,4,GN4,4,FN4,4,EF4,8,E
F4,4,EF4,4,EF4,4,BF4,4,AF4,4,BF4,4,EF4,16,EF4,8,0,8,DF5,4,0,4,DF
5,2,0,2,DF5,2,0,2,DF5,2,0,2
1135 DATAAF5,2,0,2,GF4,2,0,2,AF5,2,0,2
```

Listing 2 continues

paired with B values, but now via line 190, 230, 270, 280, 290 and 180. The following 1,2 combination again directs to read NT$ only with a constant B value of two.

Carmen March Revisited

Listing 2 again presents the *Carmen March* data, but this time with the changes in special effects and data statements for the new Basic driver. Two changes should be pointed out. For the sake of program brevity, no provisions for repeats are in the new program. If you must repeat, use the data from lines 1010–1040 between lines 1040 and 1050.

The second change is in B values for arpeggio chords. The four notes beginning with DN4,1.7 in line 1120, for example, had an original series of B values of 1,1,1 and 13 for a quarter-note arpeggio chord. The new 1.7, 1.7, 1.7, 10.9 series still totals 16 in B value, but includes no B value lower than 1.5.

For a distinct improvement over the original, append the data in Listing 2 to the new Basic driver, to follow line 310 of Listing 1, and then play the new *Carmen March* at a tempo of 4 or 4.5 (don't forget to delete lines 185, 205, 215 and 255). The previous version would not play at a tempo much faster than 5 without timing distortions and sour notes in the upper registers.

New Machine-language Program

The machine-language program in Listing 3 permits operation of the streamlined Basic driver and offers improved tonal quality.

The new note table occupies lines 1000–6030. Each note now uses seven bytes of memory—three for the note string, two for the P value associated with that note, and two for the K value associated with the P value.

The set of periods (P values) is completely new. The frequency difference between intervals of the chromatic scale remains the same 1.05946 ratio (for the equally tempered diatonic scale), but the periods are now calculated from the frequency F by the formula P = 72500/F. I replaced the original 53800 constant with 72500; this was possible because I coded the delay loop in the music generator more tightly (lines 6250–6340). The net result is greater dispersion of periods and clearer and more harmonious tonal quality over the range of 88 notes. Greater dispersion is especially important in the higher note registers where the lower integer values for periods cause overlap in tone frequency between successive note intervals.

I determined the set of K values associated with P values experimentally. First, I gave middle C (CN3) a K-value 120. Then I adjusted the tempo constant (multiplicative factor of AP in line 170 of the Basic program) until a metronome of 84 sounded 24 beats during the play of six successive middle C notes with a B value of 64 and an AP tempo setting of five. (From there came the .03525 factor). Finally I played six succes-

Listing 2 continued

```
1140 DATADF5,4,0,4,DF5,2,0,2,DF5,2,0,2,DF5,2,0,2,EF5,2,0,2,FN5,2
,0,2,EF5,2,0,2,DF5,8,DF5,4,DF5,4,DF5,4,AF5,4,GF4,4,AF5,4,DF5,16,
DF5,8,0,8,BN4,4,0,4,BN4,2,0,2,BN4,2,0,2,BN4,2,0,2,FN3,2,0,2,EN3,
2,0,2,FN3,2,0,2
1145 DATABN4,4,0,4,BN4,2,0,2,BN4,2,0,2,BN4,2,0,2,CS4,2,0,2,DS4,2
,0,2,CS4,2,0,2,BN4,4,0,4,BN4,2,0,2,BN4,2,0,2,BN4,2,0,2,FN3,2,0,2
,EN3,2,0,2,FN3,2,0,2
1150 DATABN4,16,BN4,8,0,8,EN3,21.33,EN3,5.33,EN3,5.33,DN3,21.33,
DN3,5.33,DN3,5.33,CS3,21.33,CS3,5.33,CS3,5.33,BN3,21.33,BN3,5.33
,BN3,5.33,EN4,16,FS4,12,EN4,4,CS4,16,CS4,16
1160 DATACS4,12,BN4,4,CS4,12,DN4,4,CS4,24,0,8,DN4,16,BN4,12,EN4,
4,CS4,32,AN4,16,FS3,12,BN4,4,EN3,24,0,4,BN4,16,BN4,12,BN4,4,BN4,
8,FS4,8,EN4,8,DN4,8
1170 DATACS4,8,BN4,8,CS4,8,DN4,8,CS4,24,0,8,GS3,16,CS4,12,CS4,4,
CS4,16,BS4,12,DS4,4,GS4,16,ES2,8,0,8,GS2,8,0,8,CS2,8,0,8,BN3,8,F
S4,2.67,GS4,2.67,FS4,2.67,ES4,8,FS4,8
1180 DATABN4,8,CS4,8,DN4,16,EN2,8,CS4,2.67,DN4,2.67,CS4,2.67,AN4
,8,FS4,8,EN4,8,CS5,2.67,DN5,2.67,CS5,2.67,AN5,8,FS5,8,EN5,8,AN5,
2.67,BN5,2.67,AN5,2.67,EN4,8,DN5,8,CS5,16,BN5,16,1,2,AN5,0,0,0,A
N5,0,AN5,0,AN5,0,EN4,0,DN4,0,EN4,0
1190 DATAAN5,0,0,0,AN5,0,AN5,0,BN5,0,CS5,0,BN5,0,AN5,0,0,0
,AN5,0,AN5,0,AN5,0,EN4,0,DN4,0,EN4,0,AN5,0,0,0,AN5,0,AN5,0,AN5,0
,BN5,0,CS5,0,BN5,0,AN5,0,EN4,0,DN4,0,EN4,0,AN5,0,BN5,0,CS5,0,BN5
,0,AN5,0,EN4,0,DN4,0,EN4,0,AN5,0
1195 DATABN5,0,CS5,0,BN5,0
1200 DATAAN5,0,BN5,0,CS5,0,BN5,0,AN5,0,BN5,0,CS5,0,BN5,0,AN5,0,B
N5,0,CS5,0,BN5,0,AN5,0,BN5,0,CS5,0,BN5,0,AN6,EN2,AN3,EN2,AN6,AN3
,AN6,AN3,AN6,AN3,EN5,AN3,DN5,AN3,EN5,AN3,CS5,EN2,AN3,EN2,EN5,AN3
,EN5,AN3,EN5,AN3,CS5,AN3,BN5,AN3,CS5,AN3
1210 DATAAN5,EN2,AN3,EN2,CS5,AN3,CS5,AN3,CS5,AN3,AN5,AN3,GS4,AN3
,AN5,AN3,EN4,AN3,AN5,AN3,DN4,AN3,EN4,AN3,CS4,AN3,EN4,AN3,BN4,AN3
,CS4,AN3
1215 DATA6,AN4,8,0,4,AN5,4,AN5,8,0,4,AN5,4,AN5,8,0,4,AN5,4,AN5,8
,0,4,AN5,4,AN2,2,AN3,2,AN4,2,AN5,42
1220 DATA1,-1
```

Program Listing 3. Keyboard and Music Generator

```
                00100 ;PIANO KEYBOARD AND MUSIC GENERATOR VERSION XI
260D            00110 VARPTR  EQU     260DH
0A9A            00120 RETURN  EQU     0A9AH
0A7F            00130 ENTER   EQU     0A7FH
408E            00140 USR     EQU     408EH
7FFF            00150 ENDMEM  EQU     7FFFH   ;OR BFFFH OR FFFFH
7A6C            00160         ORG     ENDMEM-1427
7A6C CD7F0A     00170 KYBRD   CALL    ENTER   ;ARGUMENT IN HL
7A6F E5         00180         PUSH    HL      ;SAVE
7A70 21217B     00190         LD      HL,DVAR ;DETERMINE IF ARGU-
7A73 CD0D26     00200         CALL    VARPTR  ;MENT IS VARPTR
7A76 EB         00210         EX      DE,HL   ;LOCATION OF NOTE
7A77 5E         00220         LD      E,(HL)  ;STRING BY TESTING
```

Listing 3 Continues

sive notes of each of the 88 and adjusted the K value until the same metronome setting again sounded 24 beats with B set at 64 and AP at 5. I then assigned each K value its proper spot in the machine-language table.

Two other essential differences distinguish the new program from the original:

- Provision for only one USR entry called by Basic at the keyboard location of the machine-language program.
- Placing the K value in the location where Basic can find it.

Because the argument in the one entry at the keyboard section could either be the VARPTR location of a note string (as in the original program) or a rest period, the mechanism in lines 190–280 directs the rest case by the tone generator to line 6200. The P value, now with its K value, is obtained in a manner similar to the original program. But before execution returns to Basic from the keyboard section, the USR vector at 408EH is changed to direct the next entry to the music generator (in lines 930 and 940). Then after playing the note and before the second return to Basic the vector to the keyboard section is restored (lines 6410–6420).

The period P is returned to Basic by the path through A9AH after the period is placed in HL register (lines 950–970). For K, the Basic location of the variable is placed in HL register (line 360) and then the K value for the note is placed in that location before return to Basic (lines 880–920). As in the original program, the IX register holds the addresses in the note table, and in the new program, the IY register points to the Basic note string.

Concerning the new coding in the delay section of the music generator (lines 6250–6340) that defines the length of period, the coding now decrements the H and L registers individually rather than together as a 16-bit register. Because the period, in case of a rest, may occasionally be greater than 32767, bit 7 of the H register must be tested

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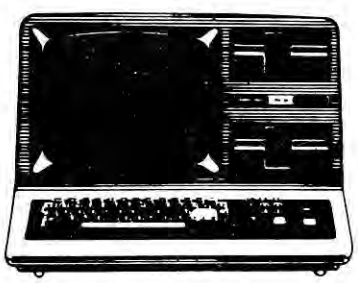

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for those occasions (lines 6270-6280) and the test for a completed period delay (lines 6290-6300) must be bypassed.

Using the New Program

Run Program Listing 1 and wait for the ready signal to indicate that the machine-language program is loaded. Connect the auxiliary lead from the keyboard to the cassette recorder to an auxiliary input of your stereo through a suitable adapter. Then play the music by entering Run and responding to the tempo query with entry of six or seven.

If the music plays without a false note, press break in response to the tempo query at the end of the piece and delete lines 185, 205, 215 and 255. Otherwise make the corrections in the data before you delete any lines. After all corrections are made, play the music and record it on your stereo if you wish. I have found a tempo of about six right for *Berceuse*.

For Model III Users

I have not tried this program on a Model III, but I foresee no major technical problem. I do expect that a Model III would be tuned to a higher pitch with the same periods as on a Model I. If you find that intolerable, change the pitch by calculating new periods for each note from the formula P = C/F. Lower the pitch by increasing the value C from the 72500 used in the Model I program. The frequency (F) for A above middle C is assigned 440 Hertz, and the multiplicative factor of 1.05946 is used for each half step (interval on the equally tempered chromatic scale) up from A. You may assign new K values by calculating differences from the associated P value proportionate to the differences between P and K for each note in Listing 3. Better still, redetermine experimentally the new K values by the procedure discussed under "New Machine-language Program."

Whether or not you alter the periods, I am sure the timing constants in line 160 of the Basic program will no longer accurately apply. The AB constant, for example, would be lowered by an amount that you could estimate from the difference in clock speed, but it should be experimentally determined. If the experimental value is below one, you may be able to eliminate line 195 altogether and use B in the equation for A in line 200 in place of BC. If you eliminate line 195, the CK and DK constants in line 160 will remain unchanged, the EK constant becomes more negative by about 10000, the multiplicative factor of .03525 in line 170 becomes .035, and 15 as the lower limit for RK in line 240 becomes 19.

For Systems Greater Than 16K

With the information in this article and no special hardware for music synthesis other than your 16K Level II TRS-80 and stereo, you can play over 50 percent of the classical music literature and many modern forms of musical expression as well. The main limitation is the amount of RAM available. If

Listing 3 Continued

```
7A78 23          00230          INC     HL       ;"D" FOR ZERO.
7A79 56          00240          LD      D,(HL)
7A7A E1          00250          POP     HL       ;GET ARGUMENT.
7A7B 7A          00260          LD      A,D      ;IF ZERO IN DE
7A7C B3          00270          OR      E        ;ARGUMENT IS REST
7A7D CAD27F      00280          JP      Z,BYTONE ;PERIOD. GO IF SO
7A80 23          00290          INC     HL       ;LO BYTE OF LOCATION
7A81 5E          00300          LD      E,(HL)   ;TO POINT DE TO
7A82 23          00310          INC     HL       ;FIRST BYTE OF
7A83 56          00320          LD      D,(HL)   ;NOTE STRING.
7A84 D5          00330          PUSH    DE       ;POINTER INTO
7A85 FDE1        00340          POP     IY       ;IY
7A87 DD21237B    00350          LD      IX,NOTES ;TABLE POINTER
7A8B 2AFE7F      00360          LD      HL,(KADRA) ;POINTS TO "K"
7A8E 01A800      00370          LD      BC,168   ;NO. BYTES A TO B
7A91 FD7E00      00380          LD      A,(IY+0) ;1ST BYTE
7A94 FE41        00390          CP      41H      ;ADD TO IX UNTIL
7A96 CABE7A      00400          JP      Z,SHARP  ;NOTE A TO G IS
7A99 DD09        00410          ADD     IX,BC    ;FOUND AND THEN
7A9B FE42        00420          CP      42H      ;PROCEED TO FIND
7A9D CABE7A      00430          JP      Z,SHARP  ;SECOND BYTE
7AA0 DD09        00440          ADD     IX,BC    ;MATCH.
7AA2 FE43        00450          CP      43H
7AA4 CABE7A      00460          JP      Z,SHARP
7AA7 DD09        00470          ADD     IX,BC
7AA9 FE44        00480          CP      44H
7AAB CABE7A      00490          JP      Z,SHARP
7AAE DD09        00500          ADD     IX,BC
7AB0 FE45        00510          CP      45H
7AB2 CABE7A      00520          JP      Z,SHARP
7AB5 DD09        00530          ADD     IX,BC
7AB7 FE46        00540          CP      46H
7AB9 CABE7A      00550          JP      Z,SHARP
7ABC DD09        00560          ADD     IX,BC
7ABE 013800      00570 SHARP    LD      BC,56    ;NO. BYTES NAT. TO SHARP
7AC1 FD7E01      00580          LD      A,(IY+1) ;2ND BYTE IN A
7AC4 FE4E        00590          CP      4EH      ;CONTINUE ADDITION
7AC6 CAD27A      00600          JP      Z,OCTAVE         ;UNTIL
7AC9 DD09        00610          ADD     IX,BC    ;NAT. OR SHARP OR FLAT IS
7ACB FE53        00620          CP      53H      ;FOUND AND THEN
7ACD CAD27A      00630          JP      Z,OCTAVE         ;PROCEED
7AD0 DD09        00640          ADD     IX,BC    ;TO THIRD BYTE
7AD2 010700      00650 OCTAVE   LD      BC,7     ;NOTE INTERVAL
7AD5 FD7E02      00660          LD      A,(IY+2) ;3RD BYTE IN A
7AD8 FE30        00670          CP      30H
7ADA CA097B      00680          JP      Z,FOUND  ;CONTINUE UNTIL
7ADD DD09        00690          ADD     IX,BC    ;OCTAVE MATCH IS
7ADF FE31        00700          CP      31H      ;FOUND
7AE1 CA097B      00710          JP      Z,FOUND
7AE4 DD09        00720          ADD     IX,BC
7AE6 FE32        00730          CP      32H
7AE8 CA097B      00740          JP      Z,FOUND
7AEB DD09        00750          ADD     IX,BC
7AED FE33        00760          CP      33H
7AEF CA097B      00770          JP      Z,FOUND
7AF2 DD09        00780          ADD     IX,BC
7AF4 FE34        00790          CP      34H
7AF6 CA097B      00800          JP      Z,FOUND
7AF9 DD09        00810          ADD     IX,BC
7AFB FE35        00820          CP      35H
7AFD CA097B      00830          JP      Z,FOUND
7B00 DD09        00840          ADD     IX,BC
7B02 FE36        00850          CP      36H
7B04 CA097B      00860          JP      Z,FOUND
7B07 DD09        00870          ADD     IX,BC
7B09 DD7E05      00880 FOUND    LD      A,(IX+5) ;LO BYTE OF 'PC'
7B0C 77          00890          LD      (HL),A   ;IN ADDRESS
7B0D 23          00900          INC     HL
7B0E DD7E06      00910          LD      A,(IX+6) ;HI BYTE OF 'PC'
7B11 77          00920          LD      (HL),A   ;IN ADDRESS
7B12 21BB7F      00930          LD      HL,MUSIC ;USR VECTOR POINTS
7B15 228E40      00940          LD      (USR),HL ;TO MUSIC
7B18 DD6604      00950          LD      H,(IX+4) ;RETURN WITH NOTE PER-
7B1B DD6E03      00960          LD      L,(IX+3) ;IOD IN HL
7B1E C39A0A      00970          JP      RETURN
7B21 44          00980 DVAR     DEFM    'D'
7B22 00          00990          DEFB    0
7B23 41          01000 NOTES    DEFM    'AN0'    ;TABLE OF NOTE DESIG-
7B26 4C0A        01010          DEFW    2636     ;NATION VS PERIOD
7B28 0D00        01020          DEFW    13
7B2A 41          01030          DEFM    'AN1'
7B2D 2605        01040          DEFW    1318
7B2F 1A00        01050          DEFW    26
7B31 41          01060          DEFM    'AN2'
7B34 9302        01070          DEFW    659
7B36 3400        01080          DEFW    52
7B38 41          01090          DEFM    'AN3'
7B3B 4A01        01100          DEFW    330
7B3D 6500        01110          DEFW    101
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Listing 3 Continues

YOU'VE JUST FOUND
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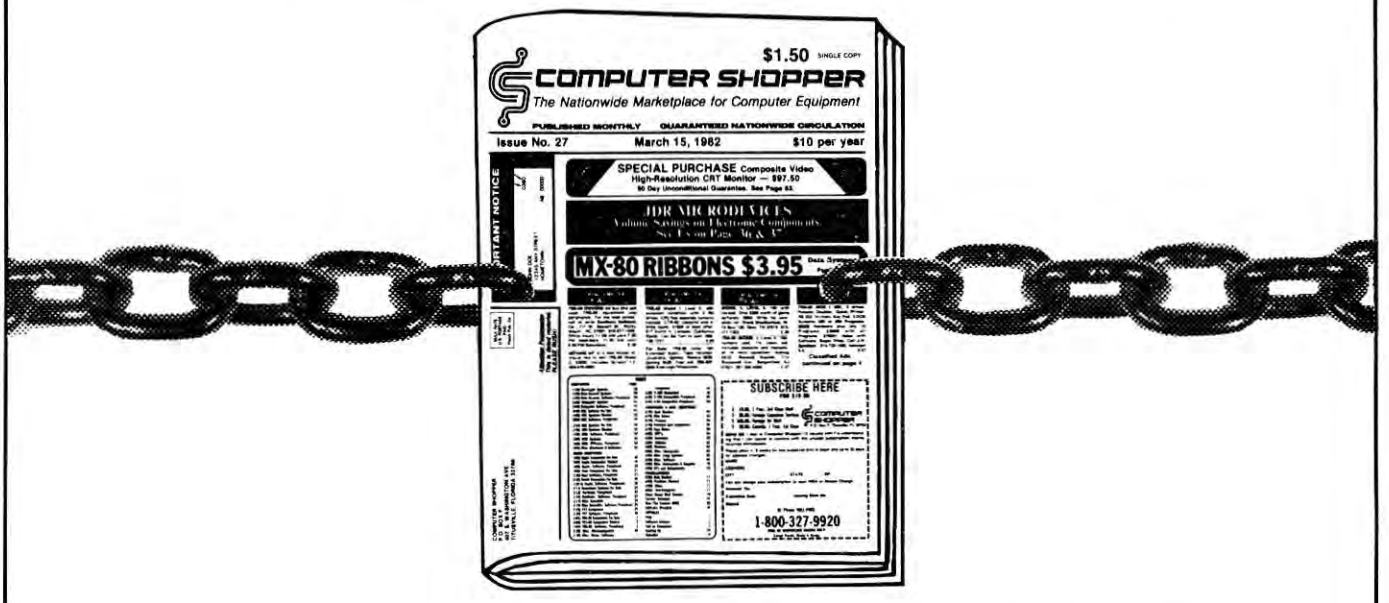

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Listing 3 Continued

```
7B3F 41        01120        DEFM    'AN4'
7B42 A500      01130        DEFW    165
7B44 C700      01140        DEFW    199
7B46 41        01150        DEFM    'AN5'
7B49 5200      01160        DEFW    82
7B4B 7901      01170        DEFW    377
7B4D 41        01180        DEFM    'AN6'
7B50 2900      01190        DEFW    41
7B52 AD02      01200        DEFW    685
7B54 41        01210        DEFM    'AN7'
7B57 1500      01220        DEFW    21
7B59 6F04      01230        DEFW    1135
7B5B 41        01240        DEFM    'AS0'
7B5E B809      01250        DEFW    2488
7B60 0E00      01260        DEFW    14
7B62 41        01270        DEFM    'AS1'
7B65 DC04      01280        DEFW    1244
7B67 1B00      01290        DEFW    27
7B69 41        01300        DEFM    'AS2'
7B6C 6E02      01310        DEFW    622
7B6E 3700      01320        DEFW    55
7B70 41        01330        DEFM    'AS3'
7B73 3701      01340        DEFW    311
7B75 6C00      01350        DEFW    108
7B77 41        01360        DEFM    'AS4'
7B7A 9C00      01370        DEFW    156
7B7C D100      01380        DEFW    209
7B7E 41        01390        DEFM    'AS5'
7B81 4E00      01400        DEFW    78
7B83 8B01      01410        DEFW    395
7B85 41        01420        DEFM    'AS6'
7B88 2700      01430        DEFW    39
7B8A CB02      01440        DEFW    715
7B8C 41        01450        DEFM    'AS7'
7B8F 1300      01460        DEFW    19
7B91 B004      01470        DEFW    1200
7B93 41        01480        DEFM    'AF0'
7B96 0000      01490        DEFW    0
7B98 0200      01500        DEFW    2
7B9A 41        01510        DEFM    'AF1'
7B9D 7505      01520        DEFW    1397
7B9F 1800      01530        DEFW    24
7BA1 41        01540        DEFM    'AF2'
7BA4 BA02      01550        DEFW    698
7BA6 3000      01560        DEFW    48
7BA8 41        01570        DEFM    'AF3'
7BAB 5D01      01580        DEFW    349
7BAD 6000      01590        DEFW    96
7BAF 41        01600        DEFM    'AF4'
7BB2 AF00      01610        DEFW    175
7BB4 BB00      01620        DEFW    187
7BB6 41        01630        DEFM    'AF5'
7BB9 5700      01640        DEFW    87
7BBB 6401      01650        DEFW    356
7BBD 41        01660        DEFM    'AF6'
7BC0 2C00      01670        DEFW    44
7BC2 8702      01680        DEFW    647
7BC4 41        01690        DEFM    'AF7'
7BC7 1600      01700        DEFW    22
7BC9 3304      01710        DEFW    1075
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7BD7 1D00      01770        DEFW    29
7BD9 42        01780        DEFM    'BN2'
7BDC 4B02      01790        DEFW    587
7BDE 3A00      01800        DEFW    58
7BE0 42        01810        DEFM    'BN3'
7BE3 2601      01820        DEFW    294
7BE5 7200      01830        DEFW    114
7BE7 42        01840        DEFM    'BN4'
7BEA 9300      01850        DEFW    147
7BEC DE00      01860        DEFW    222
7BEE 42        01870        DEFM    'BN5'
7BF1 4900      01880        DEFW    73
7BF3 A401      01890        DEFW    420
7BF5 42        01900        DEFM    'BN6'
7BF8 2500      01910        DEFW    37
7BFA E202      01920        DEFW    738
7BFC 42        01930        DEFM    'BN7'
7BFF 1200      01940        DEFW    18
7C01 E204      01950        DEFW    1250
7C03 42        01960        DEFM    'BS0'
7C06 A908      01970        DEFW    2217
7C08 1000      01980        DEFW    16
7C0A 42        01990        DEFM    'BS1'
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7C11 42        02020        DEFM    'BS2'
7C14 2A02      02030        DEFW    554
7C16 3D00      02040        DEFW    61
7C18 42        02050        DEFM    'BS3'
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7C1F 42        02080        DEFM    'BS4'
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7C24 EA00      02100        DEFW    234
7C26 42        02110        DEFM    'BS5'
7C29 4500      02120        DEFW    69
7C2B B801      02130        DEFW    440
7C2D 42        02140        DEFM    'BS6'
7C30 2300      02150        DEFW    35
7C32 1103      02160        DEFW    785
7C34 42        02170        DEFM    'BS7'
7C37 1100      02180        DEFW    17
7C39 0005      02190        DEFW    1280
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7C40 0E00      02220        DEFW    14
7C42 42        02230        DEFM    'BF1'
7C45 DC04      02240        DEFW    1244
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7C49 42        02260        DEFM    'BF2'
7C4C 6E02      02270        DEFW    622
7C4E 3700      02280        DEFW    55
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7C53 3701      02300        DEFW    311
7C55 6C00      02310        DEFW    108
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7C63 8B01      02370        DEFW    395
7C65 42        02380        DEFM    'BF6'
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7C6A CB02      02400        DEFW    715
7C6C 42        02410        DEFM    'BF7'
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7C71 B004      02430        DEFW    1200
7C73 43        02440        DEFM    'CN0'
7C76 A908      02450        DEFW    2217
7C78 1000      02460        DEFW    16
7C7A 43        02470        DEFM    'CN1'
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7C7F 1F00      02490        DEFW    31
7C81 43        02500        DEFM    'CN2'
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7C96 43        02590        DEFM    'CN5'
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7CA2 1103      02640        DEFW    785
7CA4 43        02650        DEFM    'CN7'
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7CA9 0005      02670        DEFW    1280
7CAB 43        02680        DEFM    'CS0'
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7CB2 43        02710        DEFM    'CS1'
7CB5 1604      02720        DEFW    1046
7CB7 2000      02730        DEFW    32
7CB9 43        02740        DEFM    'CS2'
7CBC 0B02      02750        DEFW    523
7CBE 4000      02760        DEFW    64
7CC0 43        02770        DEFM    'CS3'
7CC3 0601      02780        DEFW    262
7CC5 7F00      02790        DEFW    127
7CC7 43        02800        DEFM    'CS4'
7CCA 8300      02810        DEFW    131
7CCC F700      02820        DEFW    247
7CCE 43        02830        DEFM    'CS5'
7CD1 4100      02840        DEFW    65
7CD3 D001      02850        DEFW    464
7CD5 43        02860        DEFM    'CS6'
7CD8 2100      02870        DEFW    33
7CDA 3403      02880        DEFW    820
7CDC 43        02890        DEFM    'CS7'
7CDF 8403      02900        DEFW    900
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Listing 3 Continues

Listing 3 Continued

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7CE8 0F00      02940          DEFW    15
7CEA 43        02950          DEFM    'CF1'
7CED 9604      02960          DEFW    1174
7CEF 1D00      02970          DEFW    29
7CF1 43        02980          DEFM    'CF2'
7CF4 4B02      02990          DEFW    587
7CF6 3A00      03000          DEFW    58
7CF8 43        03010          DEFM    'CF3'
7CFB 2601      03020          DEFW    294
7CFD 7200      03030          DEFW    114
7CFF 43        03040          DEFM    'CF4'
7D02 9300      03050          DEFW    147
7D04 DE00      03060          DEFW    222
7D06 43        03070          DEFM    'CF5'
7D09 4900      03080          DEFW    73
7D0B A401      03090          DEFW    420
7D0D 43        03100          DEFM    'CF6'
7D10 2500      03110          DEFW    37
7D12 E202      03120          DEFW    738
7D14 43        03130          DEFM    'CF7'
7D17 1200      03140          DEFW    18
7D19 E204      03150          DEFW    1250
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7D1E B707      03170          DEFW    1975
7D20 1100      03180          DEFW    17
7D22 44        03190          DEFM    'DN1'
7D25 DC03      03200          DEFW    988
7D27 2200      03210          DEFW    34
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7D2C EE01      03230          DEFW    494
7D2E 4400      03240          DEFW    68
7D30 44        03250          DEFM    'DN3'
7D33 F700      03260          DEFW    247
7D35 8700      03270          DEFW    135
7D37 44        03280          DEFM    'DN4'
7D3A 7B00      03290          DEFW    123
7D3C 0401      03300          DEFW    260
7D3E 44        03310          DEFM    'DN5'
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7D43 E301      03330          DEFW    483
7D45 44        03340          DEFM    'DN6'
7D48 1F00      03350          DEFW    31
7D4A 4C03      03360          DEFW    844
7D4C 44        03370          DEFM    'DN7'
7D4F 2500      03380          DEFW    37
7D51 D902      03390          DEFW    729
7D53 44        03400          DEFM    'DS0'
7D56 4807      03410          DEFW    1864
7D58 1200      03420          DEFW    18
7D5A 44        03430          DEFM    'DS1'
7D5D A403      03440          DEFW    932
7D5F 2500      03450          DEFW    37
7D61 44        03460          DEFM    'DS2'
7D64 D201      03470          DEFW    466
7D66 4800      03480          DEFW    72
7D68 44        03490          DEFM    'DS3'
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7D6D 8F00      03510          DEFW    143
7D6F 44        03520          DEFM    'DS4'
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7D74 1001      03540          DEFW    272
7D76 44        03550          DEFM    'DS5'
7D79 3A00      03560          DEFW    58
7D7B FB01      03570          DEFW    507
7D7D 44        03580          DEFM    'DS6'
7D80 1D00      03590          DEFW    29
7D82 7A03      03600          DEFW    890
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7D87 2500      03620          DEFW    37
7D89 D902      03630          DEFW    729
7D8B 44        03640          DEFM    'DF0'
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7D90 1000      03660          DEFW    16
7D92 44        03670          DEFM    'DF1'
7D95 1604      03680          DEFW    1046
7D97 2000      03690          DEFW    32
7D99 44        03700          DEFM    'DF2'
7D9C 0B02      03710          DEFW    523
7D9E 4000      03720          DEFW    64
7DA0 44        03730          DEFM    'DF3'
7DA3 0601      03740          DEFW    262
7DA5 7F00      03750          DEFW    127
7DA7 44        03760          DEFM    'DF4'
7DAA 8300      03770          DEFW    131
7DAC F700      03780          DEFW    247
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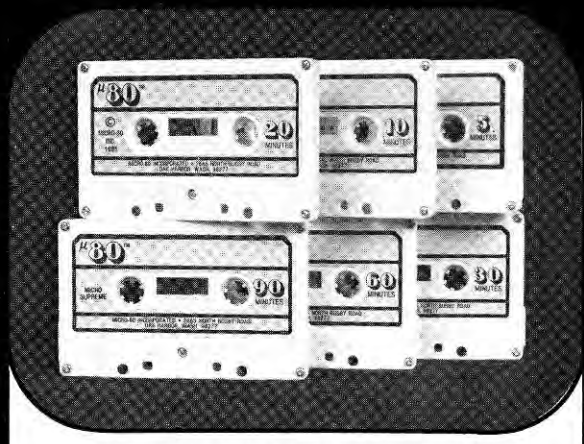

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Listing 3 Continued

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7DAE 44      03790      DEFM    'DF5'
7DB1 4100    03800      DEFW    65
7DB3 D001    03810      DEFW    464
7DB5 44      03820      DEFM    'DF6'
7DB8 2100    03830      DEFW    33
7DBA 3403    03840      DEFW    820
7DBC 44      03850      DEFM    'DF7'
7DBF 2500    03860      DEFW    37
7DC1 D002    03870      DEFW    720
7DC3 45      03880      DEFM    'EN0'
7DC6 E006    03890      DEFW    1760
7DC8 1300    03900      DEFW    19
7DCA 45      03910      DEFM    'EN1'
7DCD 7003    03920      DEFW    880
7DCF 2700    03930      DEFW    39
7DD1 45      03940      DEFM    'EN2'
7DD4 B801    03950      DEFW    440
7DD6 4D00    03960      DEFW    77
7DD8 45      03970      DEFM    'EN3'
7DDB DC00    03980      DEFW    220
7DDD 9600    03990      DEFW    150
7DDF 45      04000      DEFM    'EN4'
7DE2 6E00    04010      DEFW    110
7DE4 1E01    04020      DEFW    286
7DE6 45      04030      DEFM    'EN5'
7DE9 3700    04040      DEFW    55
7DEB 1502    04050      DEFW    533
7DED 45      04060      DEFM    'EN6'
7DF0 1B00    04070      DEFW    27
7DF2 AC03    04080      DEFW    940
7DF4 45      04090      DEFM    'EN7'
7DF7 2500    04100      DEFW    37
7DF9 D902    04110      DEFW    729
7DFB 45      04120      DEFM    'ES0'
7DFE 7D06    04130      DEFW    1661
7E00 1400    04140      DEFW    20
7E02 45      04150      DEFM    'ES1'
7E05 3E03    04160      DEFW    830
7E07 2900    04170      DEFW    41
7E09 45      04180      DEFM    'ES2'
7E0C 9F01    04190      DEFW    415
7E0E 5100    04200      DEFW    81
7E10 45      04210      DEFM    'ES3'
7E13 D000    04220      DEFW    208
7E15 9F00    04230      DEFW    159
7E17 45      04240      DEFM    'ES4'
7E1A 6800    04250      DEFW    104
7E1C 3001    04260      DEFW    304
7E1E 45      04270      DEFM    'ES5'
7E21 3400    04280      DEFW    52
7E23 3402    04290      DEFW    564
7E25 45      04300      DEFM    'ES6'
7E28 1A00    04310      DEFW    26
7E2A C503    04320      DEFW    965
7E2C 45      04330      DEFM    'ES7'
7E2F 2500    04340      DEFW    37
7E31 D002    04350      DEFW    720
7E33 45      04360      DEFM    'EF0'
7E36 4807    04370      DEFW    1864
7E38 1200    04380      DEFW    18
7E3A 45      04390      DEFM    'EF1'
7E3D A403    04400      DEFW    932
7E3F 2500    04410      DEFW    37
7E41 45      04420      DEFM    'EF2'
7E44 D201    04430      DEFW    466
7E46 4800    04440      DEFW    72
7E48 45      04450      DEFM    'EF3'
7E4B E900    04460      DEFW    233
7E4D 8F00    04470      DEFW    143
7E4F 45      04480      DEFM    'EF4'
7E52 7500    04490      DEFW    117
7E54 1001    04500      DEFW    272
7E56 45      04510      DEFM    'EF5'
7E59 3A00    04520      DEFW    58
7E5B FB01    04530      DEFW    507
7E5D 45      04540      DEFM    'EF6'
7E60 1D00    04550      DEFW    29
7E62 7A03    04560      DEFW    890
7E64 45      04570      DEFM    'EF7'
7E67 2500    04580      DEFW    37
7E69 D902    04590      DEFW    729
7E6B 46      04600      DEFM    'FN0'
7E6E 7D06    04610      DEFW    1661
7E70 1400    04620      DEFW    20
7E72 46      04630      DEFM    'FN1'
7E75 3E03    04640      DEFW    830
7E77 2900    04650      DEFW    41
7E79 46      04660      DEFM    'FN2'
7E7C 9F01    04670      DEFW    415
7E7E 5100    04680      DEFW    81
7E80 46      04690      DEFM    'FN3'
7E83 D000    04700      DEFW    208
7E85 9F00    04710      DEFW    159
7E87 46      04720      DEFM    'FN4'
7E8A 6800    04730      DEFW    104
7E8C 3001    04740      DEFW    304
7E8E 46      04750      DEFM    'FN5'
7E91 3400    04760      DEFW    52
7E93 3402    04770      DEFW    564
7E95 46      04780      DEFM    'FN6'
7E98 1A00    04790      DEFW    26
7E9A C503    04800      DEFW    965
7E9C 46      04810      DEFM    'FN7'
7E9F 2500    04820      DEFW    37
7EA1 D902    04830      DEFW    729
7EA3 46      04840      DEFM    'FS0'
7EA6 2006    04850      DEFW    1568
7EA8 1600    04860      DEFW    22
7EAA 46      04870      DEFM    'FS1'
7EAD 1003    04880      DEFW    784
7EAF 2B00    04890      DEFW    43
7EB1 46      04900      DEFM    'FS2'
7EB4 8801    04910      DEFW    392
7EB6 5600    04920      DEFW    86
7EB8 46      04930      DEFM    'FS3'
7EBB C400    04940      DEFW    196
7EBD A800    04950      DEFW    168
7EBF 46      04960      DEFM    'FS4'
7EC2 6200    04970      DEFW    98
7EC4 4201    04980      DEFW    322
7EC6 46      04990      DEFM    'FS5'
7EC9 3100    05000      DEFW    49
7ECB 5402    05010      DEFW    596
7ECD 46      05020      DEFM    'FS6'
7ED0 1800    05030      DEFW    24
7ED2 F703    05040      DEFW    1015
7ED4 46      05050      DEFM    'FS7'
7ED7 2500    05060      DEFW    37
7ED9 2003    05070      DEFW    800
7EDB 46      05080      DEFM    'FF0'
7EDE E006    05090      DEFW    1760
7EE0 1300    05100      DEFW    19
7EE2 46      05110      DEFM    'FF1'
7EE5 7003    05120      DEFW    880
7EE7 2700    05130      DEFW    39
7EE9 46      05140      DEFM    'FF2'
7EEC B801    05150      DEFW    440
7EEE 4D00    05160      DEFW    77
7EF0 46      05170      DEFM    'FF3'
7EF3 DC00    05180      DEFW    220
7EF5 9600    05190      DEFW    150
7EF7 46      05200      DEFM    'FF4'
7EFA 6E00    05210      DEFW    110
7EFC 1E01    05220      DEFW    286
7EFE 46      05230      DEFM    'FF5'
7F01 3700    05240      DEFW    55
7F03 1502    05250      DEFW    533
7F05 46      05260      DEFM    'FF6'
7F08 1B00    05270      DEFW    27
7F0A AC03    05280      DEFW    940
7F0C 46      05290      DEFM    'FF7'
7F0F 2500    05300      DEFW    37
7F11 D902    05310      DEFW    729
7F13 47      05320      DEFM    'GN0'
7F16 C805    05330      DEFW    1480
7F18 1700    05340      DEFW    23
7F1A 47      05350      DEFM    'GN1'
7F1D E402    05360      DEFW    740
7F1F 2E00    05370      DEFW    46
7F21 47      05380      DEFM    'GN2'
7F24 7201    05390      DEFW    370
7F26 5B00    05400      DEFW    91
7F28 47      05410      DEFM    'GN3'
7F2B B900    05420      DEFW    185
7F2D B100    05430      DEFW    177
7F2F 47      05440      DEFM    'GN4'
7F32 5C00    05450      DEFW    92
7F34 5201    05460      DEFW    338
7F36 47      05470      DEFM    'GN5'
7F39 2E00    05480      DEFW    46
7F3B 6A02    05490      DEFW    618
7F3D 47      05500      DEFM    'GN6'
7F40 1700    05510      DEFW    23
7F42 1904    05520      DEFW    1049
7F44 47      05530      DEFM    'GN7'
7F47 2500    05540      DEFW    37
7F49 D802    05550      DEFW    728
7F4B 47      05560      DEFM    'GS0'
```

Listing 3 Continues

Poor Man's Floppy

HIGH SPEED CASSETTE SYSTEM

FOR TRS-80*

Now the widely acclaimed JPC Cassette System is available for your TRS-80 computer. The price is only $90.00*

[Reprint of June 1980 Review, *80 Microcomputing*]

TC-8 Cassette System
JPC Products
Albuquerque, NM
Kit: $90
Assembled: $120

by Carl A. Kollar

I guess I don't have to tell any TRS-80 owners how frustrating the cassette system that comes with the computer can be. Even with the factory mod that's available, the annoyance of loading and checking programs becomes just barely tolerable.

If you're like me, after you've just plunked down a chunk of money for a Level II 16K machine, "you ain't got nuttin left" for even one disk drive at 500 bucks apiece. So you suffer.

A reasonable alternative is the Exatron Stringy Floppy (ESF). This will cost you about 250 bucks and totally eliminates your loading and saving problems, automatically and fast. I've had one of these for about six months and love it!

But, if the price is still too steep, have I got a device for you!

The Device

The February 1980 issue of *Microcomputing* had an ad that intrigued the hell out of me. It was a high-speed cassette system by JPC Products acclaimed as a "poor man's floppy." It made all sorts of seemingly ridiculous claims such as "loads five times faster," "stores 50,000 bytes on a 10-minute cassette," "less than one bad load in a million bytes with the volume control anywhere between one and eight."

All this for a measly [90] bucks? How could this be? A call to Albuquerque answered a few questions: Yes, it had its own power supply, and, it stored programs five times faster because it utilized higher density data. The computer outputs the information at a higher rate out of the rear keyboard connector.

The ad had even claimed anyone could build it even if you have never soldered before. JPC would make it work, if you couldn't—for free. I was sold. I placed my order, and it arrived about two months later (parts shortage).

I work in electronics, so I found the unit exceptionally easy to build. It took about an hour. The manual is superb. (That's better than great.) It was clear, concise and exact with no ambiguities. Important parts placements are stressed (polarity markings on electrolytics, bands on diodes, etc.).

JPC was right! With these instructions, you couldn't go wrong. The board quality is excellent. It is double-sided and parts locations are clearly marked on the component side of the board. There are no jumper wires to install. JPC utilizes PC traces and plated-through holes for connections to traces on the other side of the board.

Also, there are absolutely no adjustments or settings to bother with.

The documentation is a sheaf of 8½ × 11 papers stapled together. It is written in the nicest format I've seen in a while. Each command and/or subjects is covered on its own sheet in large type. All explanations are in easy to read English—not computerese.

Commands and Features

SAVE"filename": Saves your BASIC program on cassette.
LOAD: Reads the next BASIC program from the cassette.
LOAD"filename": Searches for and loads the specified file from cassette.
LOAD? and LOAD?"filename": Reads file from cassette, and compares contents to memory.
LOADN: Prints a list of all the programs on a cassette, until interrupted by the "break" key.
LOADN"filename": Same as above except the tape will stop at the end of the program named.
KILL: Removes the file manager program from memory so that the extra memory can be used by large programs.
RSET: Allows the operator to rewind and position the tape on tape recorders that have these functions tied to the motor control jack.
RUN"filename": TC-8 searches for a specified program and runs it immediately.
PUT"filename": Same as SAVE "filename", except it is for use with system tapes.
GET: Same as LOAD, except it is for use with system tapes.
GET"filename": Same as LOAD "filename", except it is for use with system tapes.
GET? and GET?"filename": Same as LOAD? and LOAD?"filename", except it is for use with system tapes.
GETN and GETN"filename": Same as LOADN and LOADN"filename", except it is for use with system tapes.
OPEN: Required before cassette input or output of a data file can be attempted.
CLOSE: Required to end a cassette data file.
PRINT#: Allows numerical or string data to be output to a cassette file.
INPUT#: Allows numerical or string data to be input from a cassette file.

I haven't counted them, so I don't know about the "one load in a million bytes" claim, but my son, Anthony (age 11), loaded about 30 of his programs from his Radio Shack format tape to a new TC-8 format tape. He's run them all and found no bad loads.

Unlike the standard tape system, you can position your tape anywhere before the program you want and not have to look for a blank spot between programs. The TC-8 patiently waits for the program you want and then starts loading without getting confused by the portion of the previous program you just fed it.

Try that on your regular cassette system; you'll wear out the reset button. ■

ORDER NOW

To order your TC-8 kit, send your check or money order for $90.00 plus $3.50 postage and handling to JPC PRODUCTS CO., 12021 Paisano Ct., Albuquerque, NM 87112 (New Mexico residents add 4% sales tax). Credit card orders accepted by phone or mail. Personal checks will delay shipment. We will otherwise immediately ship you the TC-8 kit, the cabinet, the ribbon cable, the power adapter, an instruction manual, and a cassette containing the software.

For Mod I Level II only.

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you have a 32K or 48K system, you may assemble, with the aid of EDTASM, the keyboard and music generator program of Listing 3 at top of memory. Save memory at 47723 for 32K or at 64107 for 48K. Then load the machine-language program and press break to load the Basic driver (lines 160–310 of Listing 1).

Two changes in line 160 of the Basic program are necessary. First, POKE 16527,186 for a 32K system (or POKE 16527,250 for 48K) for USR entries. The second change is the location for placing the K value address in memory. POKE locations −16386 with PEEK(VARPTR(X)) and −16385 with PEEK (VARPTR(X) + 1) for a 32K system. Likewise POKE locations −2 and −1 for a 48K system.

You should now be ready to append the special effects and note data for almost any piece of music. With 32K, I have programmed for computer play J.S. Bach's complete *Toccata and Fugue in D Minor*, and all three movements of Beethoven's *Moonlight Sonata* in two voices (treble and bass), by the stereo synchronization technique described in "Programming Pitch" (*80 Micro*, May 1982).

All you budding composers out there can let your imaginations run wild with musical effects not attainable with any musical instrument other than your computer. ■

Merton Davis, a retired chemist, enjoys piano, golf and chess.

Listing 3 Continued

```
7F4E 7505      05570          DEFW    1397
7F50 1800      05580          DEFW    24
7F52 47        05590          DEFM    'GS1'
7F55 BA02      05600          DEFW    698
7F57 3000      05610          DEFW    48
7F59 47        05620          DEFM    'GS2'
7F5C 5D01      05630          DEFW    349
7F5E 6000      05640          DEFW    96
7F60 47        05650          DEFM    'GS3'
7F63 AF00      05660          DEFW    175
7F65 BB00      05670          DEFW    187
7F67 47        05680          DEFM    'GS4'
7F6A 5700      05690          DEFW    87
7F6C 6401      05700          DEFW    356
7F6E 47        05710          DEFM    'GS5'
7F71 2C00      05720          DEFW    44
7F73 8702      05730          DEFW    647
7F75 47        05740          DEFM    'GS6'
7F78 1600      05750          DEFW    22
7F7A 3304      05760          DEFW    1075
7F7C 47        05770          DEFM    'GS7'
7F7F 2500      05780          DEFW    37
7F81 DA02      05790          DEFW    730
7F83 47        05800          DEFM    'GF0'
7F86 2006      05810          DEFW    1568
7F88 1600      05820          DEFW    22
7F8A 47        05830          DEFM    'GF1'
7F8D 1003      05840          DEFW    784
7F8F 2B00      05850          DEFW    43
7F91 47        05860          DEFM    'GF2'
7F94 8801      05870          DEFW    392
7F96 5600      05880          DEFW    86
7F98 47        05890          DEFM    'GF3'
7F9B C400      05900          DEFW    196
7F9D A800      05910          DEFW    168
7F9F 47        05920          DEFM    'GF4'
7FA2 6200      05930          DEFW    98
7FA4 4201      05940          DEFW    322
7FA6 47        05950          DEFM    'GF5'
7FA9 3100      05960          DEFW    49
7FAB 5402      05970          DEFW    596
7FAD 47        05980          DEFM    'GF6'
7FB0 1800      05990          DEFW    24
7FB2 F703      06000          DEFW    1015
7FB4 47        06010          DEFM    'GF7'
7FB7 2500      06020          DEFW    37
7FB9 DA02      06030          DEFW    730
               06040 ;MUSIC GENERATOR FOR USE WITH BASIC DRIVER
               06050 ;*****************************************
7FBB CD7F0A    06060 MUSIC    CALL    ENTER   ;PERIOD IN HL
7FBE E5        06070          PUSH    HL      ;SAVE IT
7FBF 21217B    06080          LD      HL,DVAR ;VARIABLE 'D'
7FC2 CD0D26    06090          CALL    VARPTR  ;POINTER IN DE
7FC5 EB        06100          EX      DE,HL   ;NOW IN HL
7FC6 5E        06110          LD      E,(HL)  ;LO BYTE IN E
7FC7 23        06120          INC     HL      ;AND
7FC8 56        06130          LD      D,(HL)  ;HI BYTE IN D
7FC9 E1        06140          POP     HL      ;GET PERIOD
7FCA 0E01      06150          LD      C,01    ;TO TOGGLE A
7FCC 3E03      06160 TONE     LD      A,03    ;TOGGLED FROM 2 TO 1
7FCE A9        06170          XOR     C       ;BY VALUE IN C
7FCF 4F        06180          LD      C,A     ;SAVE TOGGLE
7FD0 D3FF      06190          OUT     (0FFH),A ;SEND VIBRATION
7FD2 7D        06200 BYTONE   LD      A,L     ;IF REG. L HAS
7FD3 B7        06210          OR      A       ;ZERO, IT MUST BE
7FD4 E5        06220          PUSH    HL      ;INCREMENTED AFTER
7FD5 C2D97F    06230          JP      NZ,DELAY ;PERIOD IS SAVED
7FD8 2C        06240          INC     L       ;ON STACK.
7FD9 45        06250 DELAY    LD      B,L     ;LO BYTE OF PERIOD
7FDA 10FE      06260          DJNZ    $       ;FOR DELAY
7FDC CB7C      06270          BIT     7,H     ;IF >7FH IN H REG.
7FDE 2005      06280          JR      NZ,REST ;GO TO REST CASE.
7FE0 25        06290          DEC     H       ;ELSE DECREMENT H
7FE1 FAEB7F    06300          JP      M,FIN   ;UNTIL MINUS AND
7FE4 24        06310          INC     H       ;CONTINUE DELAY BY
7FE5 25        06320 REST     DEC     H       ;RELOADING 'L'
7FE6 2EFE      06330          LD      L,0FEH  ;WITH DELAY COUNT
7FE8 C3D97F    06340          JP      DELAY   ;AND LOOP BACK.
7FEB 7A        06350 FIN      LD      A,D     ;IF DE HAS REACHED
7FEC B3        06360          OR      E       ;ZERO THEN
7FED E1        06370          POP     HL      ;GET PERIOD AND
7FEE CAF57F    06380          JP      Z,BASIC ;RETURN TO BASIC
7FF1 1B        06390          DEC     DE      ;ELSE DECREMENT
7FF2 C3CC7F    06400          JP      TONE    ;AND CONTINUE TONE.
7FF5 216C7A    06410 BASIC    LD      HL,KYBRD ;VECTOR POINTS
7FF8 228E40    06420          LD      (USR),HL ;TO KEYBOARD
7FFB C39A0A    06430          JP      RETURN  ;BEFORE RETURN
0002           06440 KADRA    DEFS    2
7FBB           06450          END     MUSIC
```


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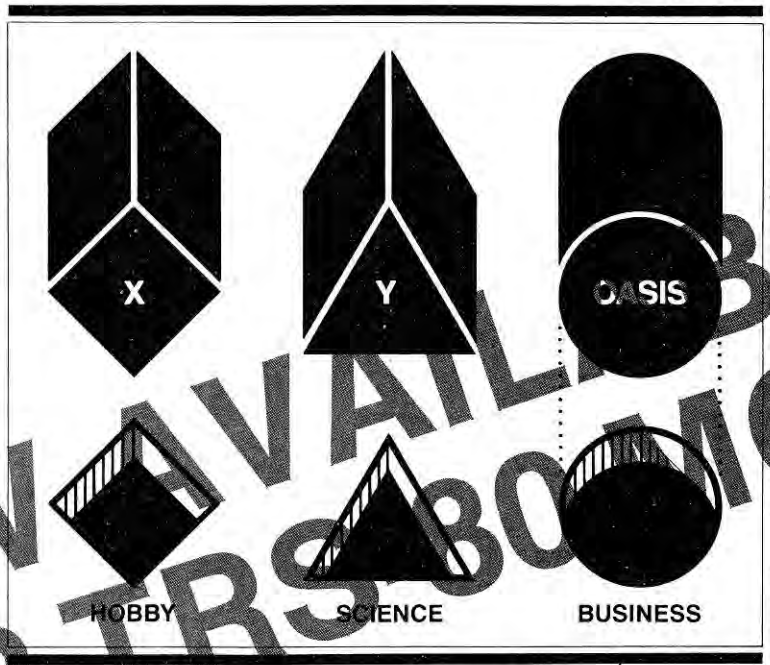

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Several new concepts are evident in DOSPLUS 3.4. One of these is the cylinder idea, replacing tracks on disks. This idea comes from hard-disk technology. (The DOSPLUS 3.4 manual is also the manual for DOSPLUS 4.0 which is Micro Systems' new hard-disk operating system.) On single-sided drives, a cylinder is equivalent to a track, and the owner of such drives might see no need for the new terminology, but on double-sided drives, there is a world of difference. DOSPLUS 3.3 handled double-sided drives as separate drives: The first side of the disk was called drive 0 or 0A, while the back side was referenced as drive 0B. This meant that each side had its own directory and files could not span both sides. On DOSPLUS 3.4 both sides are seen as one drive and files can span both sides. Track 1 goes around the first side of the disk and then continues on the back side, so that there are six granules per track (with six sectors per granule). One directory takes care of both sides. Thus a double-sided, 40-track drive is essentially identical to a single-sided 80-track drive. A double-sided 80-track drive would have over 700 kilobytes of space available.

DOSPLUS 3.4 can also read and write 40-track disks in an 80-track drive (with some restrictions). This is done by skipping every other track, and guidelines are given in the manual for carrying this out successfully. This ability partly removes one obstacle to using 80-track drives: the problem of compatibility with the more common 40-track drives. The only real difficulty remaining is its inability to read self-booting 40-track disks in an 80-track drive.

Another new concept implemented in DOSPLUS 3.4 is that of complete device-handling. The Force and Join commands allow you to tie devices together or redirect them. Even more important is it allows you to use disk files as devices, so all printer or video output could be sent to a disk file for later examination, for instance. It works the other way, too. You can specify a device in place of a file name, such as in a Copy command or in saving or loading from Basic. For example, in Basic you could type SAVE"*DO", which sends the current program to the video display—an interesting but pointless equivalent to List.

A far more important application is saving to the RS-232 device by typing SAVE"*RO". Assuming you were connected via an RS-232 to a friend's computer, also equipped with DOSPLUS 3.4, you could transfer a Basic program very simply. Using the copy command you can transfer practically anything (as long as it is an ASCII file). You could even type and have it appear on his video screen (assuming he was prepared appropriately) by typing COPY *KI TO *RO. To receive type COPY *RI TO *DO. By joining these devices to a disk file or the printer, you can have a permanent record of the conversation.

A third new concept introduced in DOSPLUS 3.4 is that of the wildcard disk file specification. When converting, transferring or purging (along with a few other utilities and functions), you may use a wildcard mask so all fields meeting the desired conditions (such as beginning with CRS or ending with /DAT) will receive the specified action.

The Convert utility (Model III only) now allows you to convert a single file from a TRSDOS disk, or a select group of files, rather than the whole disk.

To make it easier to remember which files are desired, it is now possible to read the directory of a TRSDOS disk from DOSPLUS.

The new command, CAT (catalog), produces a short directory of a disk (including TRSDOS disks, if specified) showing just the file names and extensions. This is handy if you don't want to wade through all the information that the normal directory gives.

Finally, DOSPLUS 3.4 allows you to save certain system parameters and make them a permanent part of the operating system. In DOSPLUS 3.3 you used the Forms and RS-232 interface parameters, respectively, but it was necessary to reenter these parameters each time you booted the system. In DOSPLUS 3.3 you used the Forms and RS-232 commands to set printer and RS-232 interface parameters, respectively. But it was necessary to reenter these parameters each time you booted the system. Under DOSPLUS 3.4 these parameters may be saved to disk, so the system will always boot up in the desired configuration. The Forms command also has the new option of configuring the printer driver specifically for the popular Epson MX-80 printer so that it will print TRS-80 graphics without sacrificing its other capabilities.

Other new features include the following: The last DOS command typed may be repeated without retyping by entering a slash. You can set the top of memory (HIMEM) from DOS using the clear command. Eight-inch drives are now supported, although appropriate controller hardware is necessary. The new tape utility transfers machine-language programs from tape to disk, allowing relocation and attaching an appendage where necessary to disable DOS upon program load.

There are two significant new additions

to Basic. The first is the INPUT@ command, which vastly improves input formatting. Using this command, you can place the input question anywhere on the screen, and more importantly, you can specify input field lengths so the input string will not overflow the desired length. For example, a program to store names and addresses might have a 15-character address field; using INPUT@128,"Enter the address:", 15,"$";AD$ would put an underline on the screen 15 units long, and would not accept any more than 15 characters. In fact, you have the option of directing the program to return as soon as the specified number of characters has been entered, even before enter is pressed. You can also tell it to accept only numeric input.

The other new Basic command is CMD"O", an array sorting utility. Its syntax is compatible with CMD"O" in Model III TRSDOS, but it is far more flexible. It sorts numeric as well as string arrays in ascending or descending order, and will sort other arrays in conjunction with the main array, as either key or tag arrays. For example, a mailing-list program might need all names and addresses sorted by zip code, with the names sorted alphabetically within any given zip-code group. The zip array would be the primary key array, with last names being a secondary key array, and first names and addresses being two tag arrays that would be sorted along with the key arrays. Even with all its flexibility, it is extremely fast. A 1,000-element string array and a 1,000-element numeric tag array will be sorted in about 15 seconds.

The manual is vastly improved. The manual no longer lists only the differences between DOSPLUS and TRSDOS; it now explains everything and gives plenty of examples. It also includes a 42-page technical section detailing the available DOSPLUS system calls.

Drawbacks

There are a few drawbacks to DOSPLUS 3.4. The authors have reverted to the ROM screen printer in the Model III version (in the interest of saving space), which means that graphics will not be sent to the printer. Diskzap, the disk editor, is not set up under the cylinder concept. To examine the back side of a disk you must ask for drive 0B—a fact not mentioned at all in the manual. Unfortunately, the price of DOSPLUS 3.4 has risen with its new capability: DOSPLUS 3.4 costs about $150, putting it in the same price category as NEWDOS80 and LDOS, thus removing one of the arguments in its favor.

All these new features, along with all the old DOSPLUS 3.3 strong points, such as complete Model I to Model III compatibility, automatic density recognition, variable-save option when chaining programs, all DOS commands available from Basic, print spooling, Basic shorthand commands, Diskzap, and so on, combine with its tremendous speed and ease of use to make it one of the best operating systems available for the TRS-80. ■

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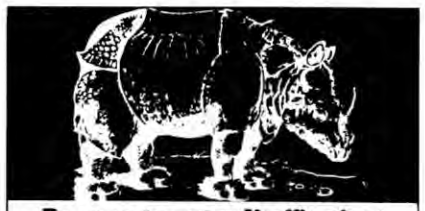

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Writing flowcharts and documentation.

Technological Destiny—Part V

Gary Dilllio
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The first four parts of this series have covered the system development process, from concept to program design. This article will demonstrate flowcharting and programming the initial program in our fictitious COMS system and discuss testing and implementation phases of the system development process.

From the documentation prepared so far—system flowcharts, functional statements and screens—the programmer has the necessary data to begin flowcharting. The flowchart of our COMS system appears in Fig. 1. This flowchart uses the four most common flowcharting symbols: the decision diamond, the continuation circle, the functional rectangle and the oblong terminator/initiator. The flowchart logic is straightforward, presenting the programmer with a good step-by-step guide.

The Program Listing is the result of the flowchart in Fig. 1. Table 1 defines the most common data elements used in the Listing.

It should be easy to follow the program's functions by comparing the flowchart to the Listing. The oblong Begin block in the flowchart symbolizes program and data field initialization and commentary. Program lines 10–30 correspond to the Begin block. The next three rectangular blocks—Display Title Screen, CLS, Display Instructions—are carried out in lines 40-60 and the timing subroutine is at line 340. The routines for retrieving cookie names and boxes sold are in lines 70 and 80. The program follows the flowchart very closely. This will allow simplified debugging during test and implementation.

Test Phases

The testing and implementation phase of the system development process can be further divided into five sub-phases: program testing; system compatibility testing; system concurrency testing; implementation; and maintenance documentation.

The first step in program testing is to prepare a reasonable sample of data designed to test each leg of the program. Too often test data simulates perfect input, giving the programmer a false sense of security. That security usually lasts only until the first batch of real production input is processed; production input is rarely perfect. Test data should simulate possible common errors as well as good entries.

Once the program has processed the test data, the computer system analyst inspects the input and output manually, performs the programming calculations and, if acceptable, approves the program's validity.

Next, all the programs that combine to make up the system are run together. Careful analysis of data bridges (outputs of one program that serve as inputs to another program) and other outputs usually allow the analyst and the programmers to iron out any compatibility bugs between programs before they are implemented. In this stage (system compatibility) the success or failure of the analyst begins to become apparent. Continuity links are often overlooked in the analyst's haste to develop a system. If this phase is successful during its first

ANS$	Yes or No reply
B	Boxes sold of each type last year
C	Boxes per case
G	Percent of last year's order to order initially
K	Number of children selling cookies last year
N	Number of cookie types
NM$	Cookie name
P	Price per box
Q	Current cost per case
R	Number of children selling cookies this year
TA	Total boxes sold last year
TT1	Total cases to order initially

Table 1

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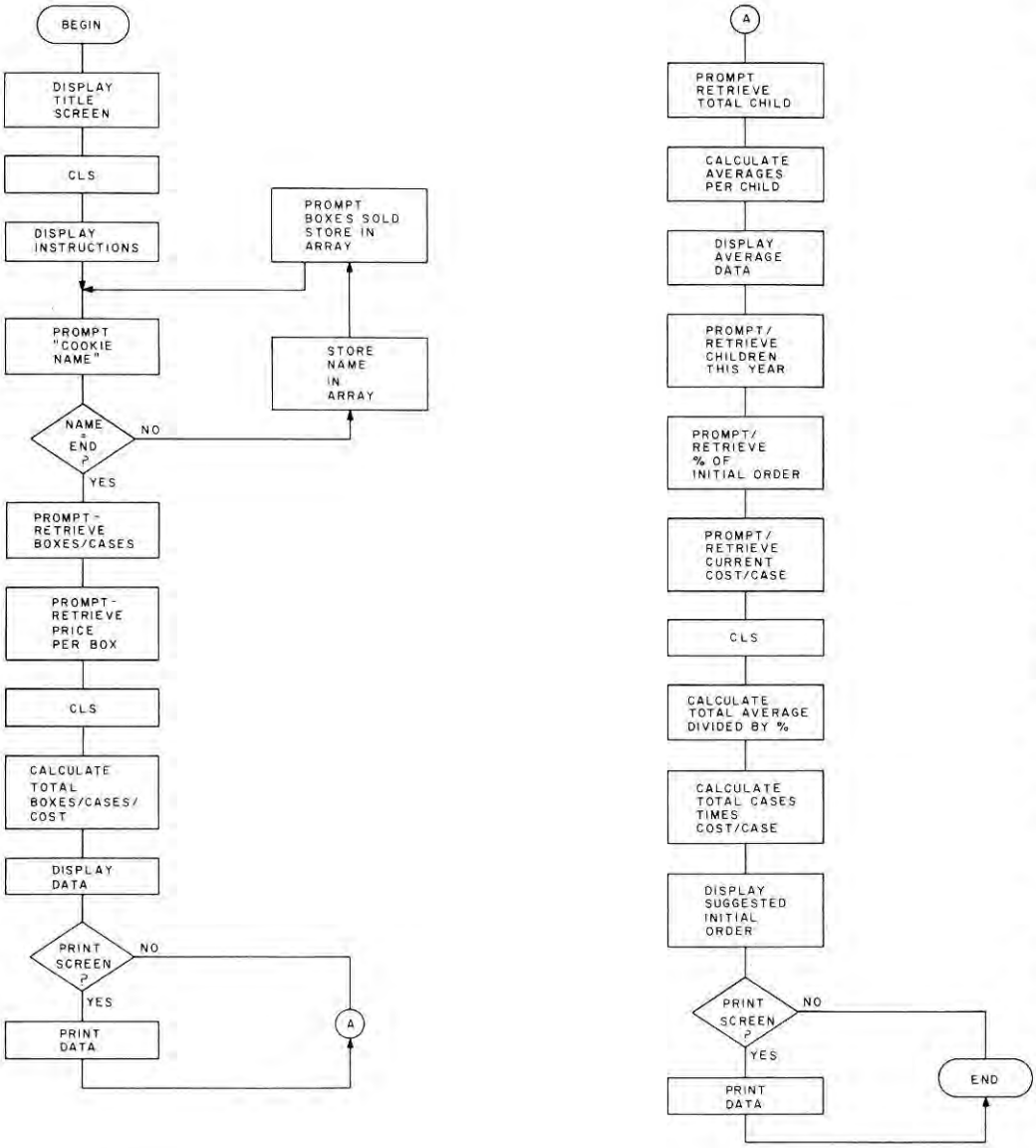

Figure 1

test, it usually indicates the analyst's planning and development was sound and logical.

With the first two sub-phases completed and changes initiated, sub-phase three (concurrency testing) begins. Concurrency testing is the process of running the newly developed system along with the system it is designed to replace. The current system, whether manual or mechanical, is processed as usual. Careful notes of system specifications are gathered, including total time spent to obtain meaningful reports, amount of manual effort and so on. The identical input is processed next through the newly developed system and accuracies of their products are compared. This phase is repeated until the programmer, analyst and user gain confidence in the new system.

Hopefully, during the comparison, the new system was found to be quicker, easier and more accurate than the old. If the products from the two systems differ, the new system's results should be more accurate. If the old system is quicker, easier, or more accurate, the design phase was probably at fault. As with every phase of the system development process, when the new system does not perform to expectations, retreat and redo any unacceptable phase. Finally, when concurrency testing has proven the new system to be superior, the current system can be scrapped and the new system implemented.

That will do for our Girl Scout cookie drive, but in developing a more complex system implementation is phased in. The old and new systems are broken down into phases so that the inputs and outputs of each phase in the systems produce the same data. A phase-initiator plan is drawn up similar to Fig. 2. This payroll system implementation plan details the phases to be taken over by the new system in stages and the proposed date of each takeover.

On February 4th the payroll operation is still being run entirely by the old system. Gradually, new phases are transferred into the system. Finally, on March 18th the old system is inactive and the new system is in place and fully operational. User, analyst and programmer collectively sigh in relief, adjourn to a nearby tavern and celebrate. It has been my observation that programmers celebrate with a greater abandon than do analysts and rightly so, because any mistake the analyst has made through the system development process usually results in the programmer doing a disproportionate share of the rework.

Documentation

After the celebration, the analyst and programmer face the most mundane and hated phase of the system development process: documentation. One has only to review some documentation to see just how hated this process is. A programmer, after debugging and creating a successful program, usually wants to go on to new programs and challenges, not reiterate his past program. Yet his successful program or system is compromised without good documentation. In business, where a program belongs not to the programmer but to the business itself, documentation is very important because the person designated to maintain and enhance the system is very often not the original programmer. The Department of the Navy has established a good guide to system documentation that includes, but is not limited to, the following documents:

- Functional Description—This is a document containing the original user concept of the proposed system, along with its developmental proposed costs and benefits over existing systems.
- System Specification—An extension of the functional description, the system specification describes the interfaces of the proposed system, the data necessary to accomplish each phase and a step-by-step description of the logic.
- Program Specifications—This document encompasses a complete description of record formats, magnetic media, file sizes, flowcharts, program listings and variable names and descriptions used within the pro-

gram. Each program in the system has its own programming specifications.

● Maintenance Manual—Written by the programmer, this contains any information not available in the program specifications that might aid a future programmer in enhancing the original program.

● Operations Manual—This manual is designed specifically for the system user, detailing in non-technical language step-by-step operating procedures.

Of all the packages detailed above, perhaps the most important is the Operations Manual. No matter how successful the system or its individual programs, the system is a failure if the user does not understand how to get the most out of it. There are dozens of good programs available for the TRS-80 in this issue of *80 Micro* alone, but much software available for microcomputers lacks effective user documentation. The programmer interested in marketing his own software should study some of the more successful efforts at documentation on the market today. Two I have found to be excellent cases of documentation are Lazywriter and Exador's Data Manager. Both are written clearly and effectively, and spiced with frequent examples and applications. Both are organized in a logical step-by-step instructional pattern and in plain English.

David Welsh's Lazywriter uses a technique I strongly recommend: The user manual is written by Welsh's wife, Theresa. The programmer is often so tied up in his program that he makes two major mistakes. He usually passes too much technical information to the user and not enough obvious information. If the program author wants to supply the user with technical information designed to enhance the utility of the program, he should do so in a technical section separate from the user instructional segment of the manual. Both Lazywriter and

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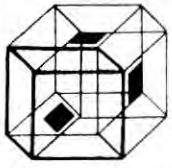

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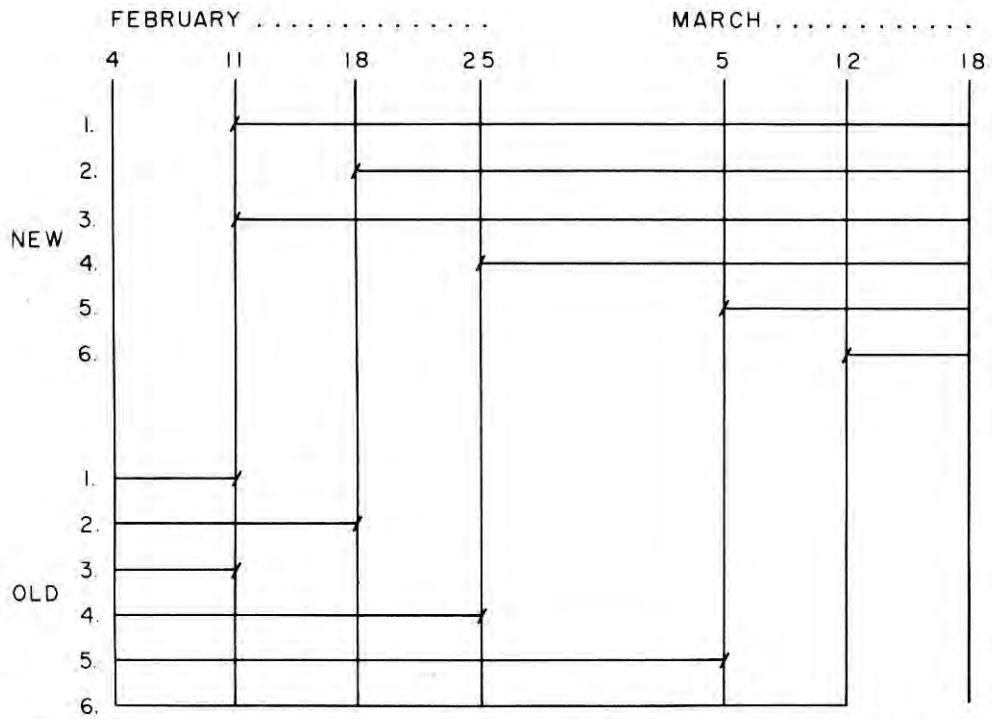

Fig. 2. New payroll system implementation phases: 1—tax statements; 2—other withholding statements; 3—sick time and vacation time; 4—social security; 5—check stub; 6—checks.

```
10 CLEAR500:DIMA$(15):DIMB(15)
20 TT1=0
30 REM  COOKIE MANAGEMENT SYSTEM  INITIAL ORDER PROGRAM
40 CLS:PRINT@341,"COOKIE MANAGEMENT SYSTEM"
50 PRINT@530,"INITIAL COOKIE ORDER PROGRAM":GOSUB340
60 CLS:PRINT"YOU WILL BE ASKED TO TYPE THE COOKIE NAME AND THE TOTAL NUMBER  OF
 BOXES SOLD LAST YEAR":PRINT"WHEN YOU ARE FINISHED ENTERING DATA ANSWER COOKIE N
AME WITH  AN 'END'":PRINT:PRINT
70 FORX=1TO10:INPUT"COOKIE NAME";NM$(X):IF NM$(X)="END"THEN GOTO 90
80 INPUT"BOXES SOLD";B(X):NEXT
90 N=X:CLS:INPUT"HOW MANY BOXES IN EACH CASE";C
100 INPUT"WHAT IS THE PRICE OF 1 BOX";P
110 CLS:PRINTTAB(5);"NAME";:PRINTTAB(16),"QUANTITY":PRINTTAB(5);"----";:PRINTTAB
(16),"--------";:PRINT
120 FORX=1TON-1:PRINTTAB(5);NM$(X);:PRINTTAB(20),B(X):TA=TA+B(X):NEXT
130 PRINTTAB(5)"TOTAL BOXES";:PRINTTAB(20),TA
140 PRINTTAB(5),"TOTAL CASES";:PRINTTAB(20),TA/C
150 PRINTTAB(30),"TOTAL VALUE $";TA*P:GOSUB340
160 PRINT@896,"DO YOU WANT THIS INFORMATION PRINTED (Y/N)";:INPUTANS$
170 IF ANS$="Y"THEN CMD"JKL" ELSE 180
180 CLS:INPUT"HOW MANY CHILDREN SOLD THESE COOKIES";K
190 CLS:PRINTTAB(10);"AVERAGE SALES PER CHILD"
200 FORX=1TON-1:PRINTTAB(5);NM$(X);:PRINTTAB(20);B(X)/K:AVB(X)=B(X)/K:NEXT
210 PRINT:PRINTTAB(15);"TOTAL PER CHILD";:PRINTTAB(30);TA/K
220 INPUT"PRESS ENTER TO CONTINUE";Z$
230 CLS:INPUT"HOW MANY CHILDREN ARE SELLING COOKIES THIS YEAR";R
240 INPUT"WHAT PERCENT OF AVERAGE SALES WOULD YOU LIKE TO ORDER INITIALY  (ENTER
 60% AS .6)";G
250 INPUT"WHAT IS THE CURRENT COST PER CASE";Q
260 CLS:PRINTTAB(20);"INITIAL ORDER - IN CASES":PRINTTAB(20);"----------------
-------"
270 PRINTTAB(5);"COOKIE";:PRINTTAB(20);"CASES":PRINTTAB(5);"------";:PRINTTAB(20
);"-----"
280 FORX=1TON-1:PRINTTAB(5);NM$(X);:Y=AVB(X)*R:S=Y/C:W=INT(S*G):TT1=TT1+W:PRINTT
AB(20);W:NEXT
290 PRINTTAB(10);"TOTAL CASES";:PRINTTAB(25);TT1
300 PRINTTAB(20);"TOTAL COST";:PRINTTAB(40);TT1*Q;" DOLLARS"
310 PRINT@896,"DO YOU WANT TO PRINT THIS INFORMATION (Y/N)";:INPUTZ$
320 IFZ$="Y"THEN CMD"JKL" ELSE 330
330 CLS:PRINT@475,"THE END":FORX=1TO2000:NEXT:END
340 FORX=1TO2000:NEXT:RETURN
```

Program Listing

Data Manager use this approach. Obvious information to the programmer is not always obvious to the user. By allowing his wife to write the Lazywriter manual, Welsh avoids this trap. In order to write the manual, Theresa Welsh had to understand the program from the user's standpoint. She successfully sorts extraneous information from pertinent information, resulting in a clear presentation of a complex and powerful program.

Beyond the user, the second reason for good complete documentation is maintenance. No system remains static; no program is ever completed. Design a good program, test and revise it until you feel it is perfect. Use it until you are satisfied with its operation. Then submit the program to a software house. Suddenly the program is no longer perfect. Pages of suggested changes arrive in the mail from the software publisher and you must begin again: Revise, edit, enhance and finally, your program submission is accepted. Do not rejoice yet! Before finishing the bottom third of that special bottle you've been saving for this occasion, a letter will arrive from Joe User complaining that you provided no print option for his unique modified toaster-printer. This is usually followed by a 3 a.m. phone call from a user interested in a program modification to allow his microwave oven to begin heating his dinner when the last report begins printing. Once again, with modification proposals littering your desktop, it's back to the drawing board.

Summary

These articles have attempted to broaden your understanding of a logical sequential approach to developing a system. While all of these steps may not be necessary for a simple system, any programmer should be able to benefit from some of the concepts presented. Remember, a slow, logical, deliberate approach to a new system assures the success of your efforts.

Describing the entire system development procedure in five articles can only superficially cover the subject. An in-depth review would take several volumes. It is my hope that this introduction will serve as a catalyst for you to investigate the many excellent data processing guides available in the field. I wish you success! ■

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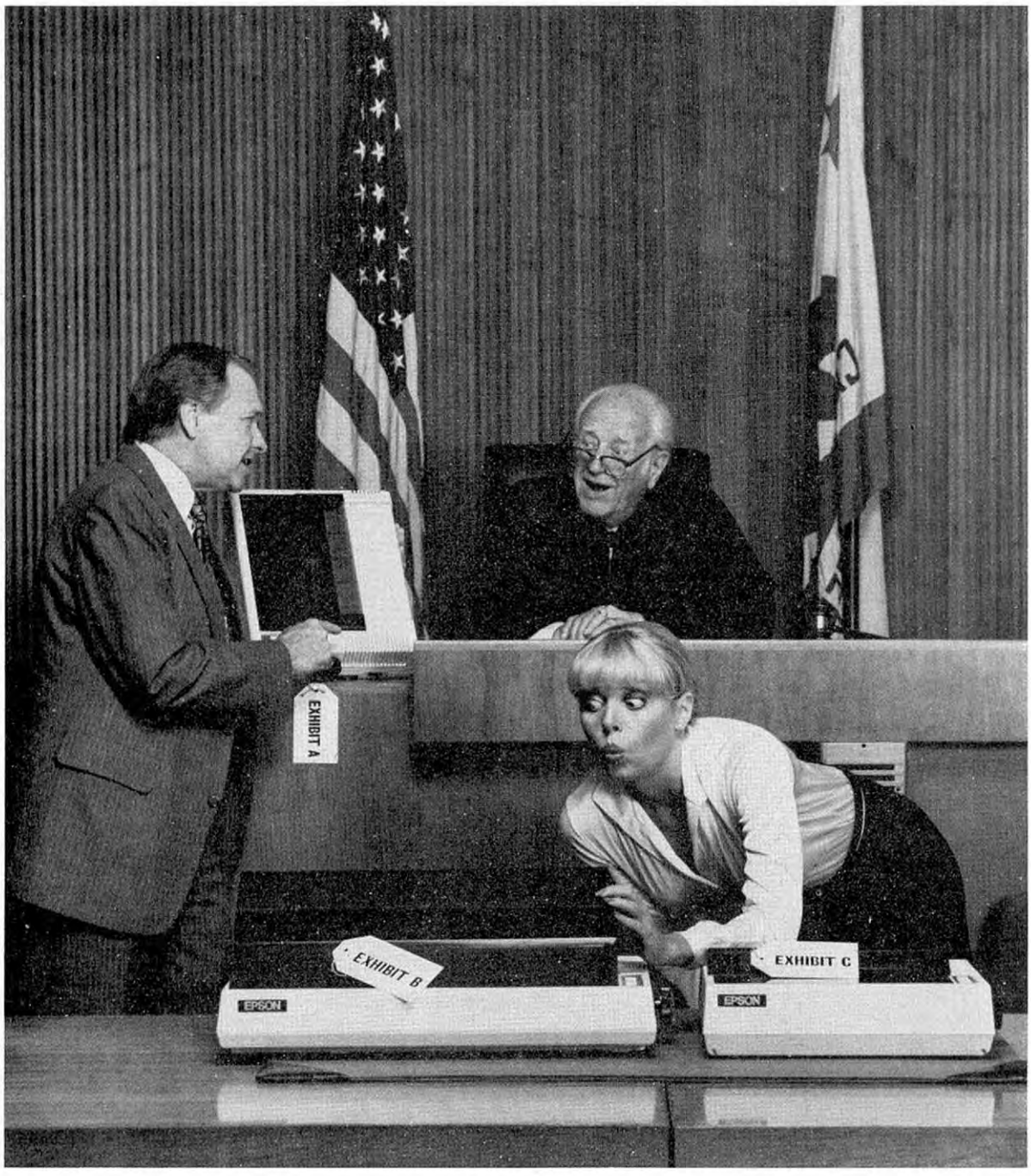

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Twenty graphics programs and a disk directory for your CC.

The Colorful Computer—Part III

Franklyn D. Miller
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We begin this final installment with programs for those without Extended Color Basic. Program Listing 1 (Printing) relies on the use of strings for very rapid graphics and changing patterns of color.

Program Listing 2 (Random POKE) gives rapidly changing patters of a different type using POKE for quick graphics. Line 30 prevents printing blank screens, since every 16th character between 128 and 255 is all pixels off. There are eight such black character blocks. You only have 120 colored graphics characters.

In Program Listing 3 (Blocks), strings are again used to print patterns, but the strings are constructed in a different fashion. In this case blank spaces are desirable, eliminating the need for a line equivalent to line 30 above. Program Listing 4 (Blocks 1) is a variation on the same theme. Try other variations by changing the values of A, B, C, and D, and by using different random number generators. Even programs this simple produce intricate displays.

Most graphics commands and options of Extended Color Basic were explained and illustrated in the previous articles. This time around, we'll put the functions to use rather than discuss them.

The Programs

Ellipses (Program Listing 5) makes use of the HW option as well as C, the color option. In Program Listing 6 (Sunburst 2) full circles are used along with with Get and Put. Don't forget the G in line 70 and the PSET in line 100.

Program Listing 7 (Circle-Star) was prompted by the problem of drawing a star within a circle on the Model I. On the Color Computer this task is almost trivial.

The Key Box

Color Basic and Extended Color Basic
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Color Computer

```
10 REM LISTING 1 PRINTING
20 CLS0
30 FORT=1TO31:A$=A$+CHR$(RND(127)+128):NEXT
40 FORX=1TO14
50 PRINTA$;:NEXT
60 PRINTA$;
70 PRINTA$;
80 PRINTLEFT$(A$,15);
90 FORI=1TO1900:NEXT
100 GOTO20
110 REM MEM =137
```

Program Listing 1. Printing

```
10 REM LISTING 2 RANDOM POKE
20 CLS0
30 C=RND(128)+128:IFC/16=INT(C/16)THEN30
40 FORA=155TO1STEP-1:FORB=1024TO1535STEPA:POKEB,C:NEXTB:CLS0:NEX
TA:RUN
50 REM MEM = 103
```

Program Listing 2. Random POKE

```
10 REM LISTING 3 BLOCKS
20 CLEAR500
30 CLS0:A=160:B=128:C=171:D=128
40 A$="":B$="":C$="":D$=""
50 FORI=0TO15
60 A$=A$+CHR$(A)+CHR$(B):B$=B$+CHR$(B)+CHR$(C)
70 C$=C$+CHR$(C)+CHR$(D):D$=D$+CHR$(D)+CHR$(A):NEXT
80 CLS0:FORI=1TO3
90 PRINTA$;B$;C$;D$;
100 NEXT
110 PRINTA$;B$;C$;:PRINT@479,D$;
120 A=D:D=C:C=B:B=RND(113)+142
130 FORI=1TO500:NEXT:GOTO40
140 REM MEM = 288
```

Program Listing 3. Blocks 1

```
10 REM LISTING 4 BLOCKS 2
20 CLEAR500
30 A=150:B=128:C=155:D=128
40 A$="":B$="":C$="":D$="":FORI=0TO15
50 A$=A$+CHR$(A)+CHR$(B):B$=B$+CHR$(C)+CHR$(D):C$=C$+CHR$(A)+CHR
$(C):D$=D$+CHR$(B)+CHR$(D):NEXT
60 CLS0:FORI=1TO3
70 PRINTA$;B$;C$;D$;:NEXT
80 PRINTA$;B$;C$;:PRINT@479,D$;
90 A=D:D=C:C=B:B=RND(113)+142
100 FORI=1TO500:NEXT:GOTO40
110 REM MEM =272
```

Program Listing 4. Blocks 2

Blanket, in Program Listing 8, again uses the HW option of Circle with the C option. Try changing the Screen instruction to 1,0. You might also try varying values for HW to create other designs.

Program Listing 9 (Shapes) combines Circle, Line, Draw and Paint to form solid geometric figures in perspective. A good exercise in graphics programming would be to construct other figures, such as truncated cones and truncated pyramids, in various perspectives. A crystallographer might work up a file of standard crystal structures and add dots to them to indicate if, for example, a cube is face centered or body centered.

Program Listing 10 (Shell) was originally published in *80 Micro* and is rewritten here to take advantage of Extended Color Basic. It uses mathematical equations to form its interesting patterns. Program Listing 11 (Fan) is a somewhat similar program giving a completely different pattern. Program Listing 12 (Moire), also an *80 Micro* rerun, has been rewritten for the Color Computer, and again uses mathematical functions to create a moire design. In Program Listing 13 (Petal), again using the same functions, yet another interesting pattern is created. Try experimenting with sine and cosine to form other attractive displays. The Line instruction is particularly versatile and easy to use.

Letters (Listing 14) is one way to create alphanumerics in high-resolution graphics. In the interest of keeping the program short, only five letters of the alphabet are used.

I recently saw another method for doing this using PSET, but it is woefully slow. Each letter in the program forms in such a way as to allow concatenation on the screen. You might need to change letter sizes and spacing to suit your tv. C1$ provides a space between letters drawing blank spaces whenever it is used.

The string in line 140 could be concatenated with the string in line 130 to reduce memory and speed of execution. Incidentally, my programs are in extended format for legibility. You could use multiple statement lines to reduce memory and improve execution speed.

Line 110 provides wraparound in case the string entered is too long. The program does not, however, provide an error trap to prevent printing below the lower or above the upper screen boundaries. This program could be used as a subroutine in another program if sufficient alphanumerics were provided in data statements. The easiest way is to use a disk and the Merge command to add it to the main program. The various letters could be called by proper use of INKEY$.

Program Listing 15 (Arrow) is an example of the use of Get and Put to create simple animation. Two arrays are used: one to store the picture of the arrow and the second to store a blank square of equal dimensions. The arrow is then moved across the screen and erased after each move. The last few lines show where the arrow has been in reverse graphics by the use of the PRESET option. Other effects can be obtained by us-

```
10 REM LISTING 5 ELLIPSES
20 PMODE3,1:PCLS:SCREEN1,0
30 FORI=6TO60STEP6
40 C=RND(3)+5:IFR=C THEN40
50 CIRCLE(127,96),I,C,1.5
60 R=C
70 NEXT
80 FORI=6TO90STEP6
90 C=RND(3)+5:IFR=C THEN90
100 CIRCLE(127,96),I,C,.7
110 R=C
120 NEXT
130 GOTO130
140 REM MEM = 183
```

Program Listing 5. Ellipses

```
10 REM LISTING 6 SUNBURST 2
20 PMODE4,1:PCLS:SCREEN1,1
30 DIMV(15)
40 FORI=0TO12STEP3
50 CIRCLE(12,12),I
60 NEXT
70 GET(0,0)-(24,24),V,G
80 FORI=0TO182STEP24
90 FORJ=0TO236STEP24
100 PUT(J,I)-(J+24,I+24),V,PSET
110 NEXTJ,I
120 GOTO120
130 REM MEM = 175
```

Program Listing 6. Sunburst 2

```
10 REM LISTING 7 CIRCLE-STAR
20 PMODE3,1:PCLS:SCREEN1,0
30 CIRCLE(127,96),88
40 LINE(50,60)-(204,60),PSET
50 LINE(50,60)-(190,158),PSET
60 LINE(204,60)-(62,158),PSET
70 LINE(62,158)-(127,10),PSET
80 LINE(127,10)-(188,156),PSET
90 GOTO90
100 REM MEM = 179
```

Program Listing 7. Circle-Star

```
10 REM LISTING 8 BLANKET
20 PMODE3,1:PCLS:SCREEN1,1
30 FORY=10TO180STEP10
40 C=RND(3)+5:IFR=C THEN40
50 FORX=20TO230STEP10
60 CIRCLE(X,Y),20,C,.3
70 NEXTX:R=C:NEXTY
80 GOTO80
90 REM MEM = 155
```

Program Listing 8. Blanket

```
10 REM LISTING 9 SHAPES
20 PMODE4,1:PCLS:SCREEN1,1
30 CIRCLE(40,20),16,,14/32
40 LINE(24,20)-(24,80),PSET
50 LINE(56,20)-(56,80),PSET
60 CIRCLE(40,80),16,,7/17,0,.5
70 PAINT(40,36),5,5
80 LINE(124,20)-(82,80),PSET
90 LINE(124,20)-(146,72),PSET
100 LINE(82,80)-(120,90),PSET
110 LINE(124,20)-(120,90),PSET
120 LINE(120,90)-(146,72),PSET
130 PAINT(120,40),5,5
140 CIRCLE(208,50),40
150 CIRCLE(208,50),40,,.3,0,.5
160 CIRCLE(208,50),30,,1.3,.25,.75
170 LINE(40,140)-(160,180),PSET,B
180 DRAW"BM40,140E26R120G26
190 DRAW"BM185,115D40G26
200 PAINT(120,150),5,5
210 GOTO210
220 REM MEM =459
```

Program Listing 9. Shapes

```
10 REM LISTING 10 SHELL
20 PMODE4,1:PCLS:SCREEN1,0
30 R=.8:PI=3.14159:P1=PI/30:P2=2*PI/3
40 FORT=0TO3.24STEPP1
50 R=R*1.17557
60 X1=COS(T)*R+127:Y1=SIN(T)*R+96
70 A=T*P2
80 X2=COS(A)*R+127:Y2=SIN(A)*R+96
90 LINE(X1,Y1)-(X2,Y2),PSET
100 B=T+2*P2
110 X1=COS(B)*R+127:Y1=SIN(B)*R+96
120 LINE(X1,Y1)-(X2,Y2),PSET
130 X2=COS(T)*R+127:Y2=SIN(T)*R+96
140 LINE(X1,Y1)-(X2,Y2),PSET
150 NEXT
160 GOTO160
170 REM MEM =341
```

Program Listing 10. Shell

ing And, Or or Not.

Program Listing 16 (Boxes) uses the Draw command along with the Scale option to fill the screen with nested boxes. The actual colors you get will depend upon your television set and the degree of color fringing in your set. Cubes, in Program Listing 17, uses Draw with the S option to draw a set of nested cubes which takes on a secondary three-dimensional aspect of its own.

Program Listing 18 (Herringbone) is a slow program using PSET to draw a herringbone pattern. This is another method for creating fabric patterns.

Rockets (Program Listing 19) draws a series of rocket-like images in various solid colors without the use of Paint. Program Listing 20 (Patterns) is for VLR graphics to quickly draw ever-changing and colorful patterns. Line 40 is included to eliminate blank spaces.

Disk Treat

Program Listing 21 (Directory) is an extra for Color Disk owners. It is a Color Disk Basic program that was written in a hurry after much frustration in trying to outwit the computer's DIR command. A pause should have been used to halt scrolling as in the Model I DOS. Instead shift, @ is used.

Color Basic DOS has some nice features. For one, it is in ROM (very convenient because it is available at all times from a Basic program or from the command mode). This way the directory is available without jumping back and forth between DOS and Basic. But! There is no convenient way to list a portion of the directory, to screen or printer, short of using machine language or a special Basic program. To stop a displaying directory requires rapid digital manipulation of the shift, @ keys (and it doesn't always stop).

Directory does not record file extensions or number of granules allocated, but could be easily changed to do so. In general, DOS places programs in the directory in the same order as they were saved in, and entries are not shifted as frequently as with the Model I. The program could be dressed up by adding more explanations for the user and by eliminating some of the screen printing, but it does work and will give the reader some idea of how the disk directory is stored. The purpose of Directory is to provide an alphabetical listing of the disk directory on either the screen (with appropriate pauses) or output to the Line Printer VII. You may need to change parts of the program for other printers.

The disk directory is on track 17 (same as the Model I), and each of the 18 sectors can hold eight file names. Every sector can be accessed in any order by using the DSKI$

```
10 REM LISTING 11 FAN
20 PMODE4,1:PCLS:SCREEN1,1
30 A=388:B=103:C=90
40 AN=360/A
50 FORN=1TOA STEP4:T=N*AN
60 X=B*COS(T)+128
70 Y=C*SIN(T)+96
80 LINE(128,96)-(X,Y),PSET
90 NEXT
100 GOTO100
110 REM MEM = 155
```

Program Listing 11. Fan

```
10 REM LISTING12 MOIRE
20 PI=3.14159:P1=PI/160
30 PMODE3,1:PCLS:SCREEN1,1
40 COLOR6,5
50 FORT=0TOPI/2STEPP1
60 X1=FIX(COS(T)*60):Y1=SIN(T)*60
70 X2=FIX(COS(T)*255):Y2=SIN(T)*191
80 LINE(X1,Y1)-(X2,Y2),PSET
90 X1=255-X1:Y1=191-Y1
100 X2=255-X2:Y2=191-Y2
110 LINE(X1,Y1)-(X2,Y2),PSET
120 NEXT
130 GOTO130
140 REM MEM = 255
```

Program Listing 12. Moire

```
10 REM LISTING 13 PETAL
20 PMODE3,1:PCLS:SCREEN1,1
30 COLOR7,5
40 PI=3.14159:P1=2*PI:P2=PI/75:P3=PI/3
50 FORT=0TO P1 STEPP2
60 R=COS(2*T)*127
70 X1=COS(T)*R+127:Y1=SIN(T)*R+127
80 A=T+P4
90 R2=COS(2*A)*94
100 X2=COS(A)*R2+127:Y2=SIN(A)*R2+96
110 LINE(X1,Y1)-(X2,Y2),PSET
120 NEXT
130 GOTO130
140 REM MEM = 249
```

Program Listing 13. Petal

```
10 REM LISTING 14 LETTERS
20 C1$="BR18
30 FORI=1TO5
40 READA$(I)
50 NEXT
60 CLS:INPUT"ENTER A STRING USING A, B, C, D, E";A$
70 INPUT"ENTER THE X, Y CORRDINATES OF THE STARTING POINT OF THE
 STRING";X,Y
80 PMODE3,1:PCLS:SCREEN1,1
90 FORI=1TOLEN(A$)
100 K=ASC(MID$(A$,I,1))-64
110 IFX>255THENY=Y+12:X=0
120 X1=X
130 DRAW"BM"+STR$(X1)+","+STR$(Y)+A$(K)
140 DRAWC1$
150 X=X+12
160 NEXT
170 GOTO170
180 DATAR6D8BU3L5BD3U8
190 DATAR4F2D4G2L4U4R4BL4U4
200 DATAR6BD8L6U8
210 DATAR4F2D4G2L4U8
220 DATAR6BD8L6U4R4BL4U4
230 REM MEM = 431
```

Program Listing 14. Letters

Program Listing 15. Arrow

```
10 REM LISTING 15 ARROW
20 PMODE3,1:PCLS:SCREEN1,1
30 DRAW"BM0,10R20U5F7G7U5L20U4
40 PAINT(4,12),8,8
50 DIMV(16),V1(16)
60 GET(0,0)-(28,18),V,G
70 GET(29,0)-(57,18),V1,G
80 PCLS:J=0
90 FORI=0TO244STEP35
```

Listing 15 continues

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command which has the format DSKI$ A, B, C, A$, B$, where A is the drive number, B is the track number, C is the sector number, and A$ and B$ are sector sections. After execution of DSKI$, each of the strings A$ and B$ will contain 128 bytes of data in ASCII format.

Although 18 sectors are available, the first two do not contain any directory entries, hence the statement in line 40. Space is allocated on the disk in granules, with 68 available for program files. Consequently, since each sector may contain eight file names, it is not necessary to scan all 18 sectors because all files can be stored in nine sectors.

The counterpart of DSKI$ is DSKO$, which permits bypassing of the directory and placement of invisible files on a disk which need not be accessed sequentially, and which will not appear in the directory. Color DOS does not allow the use of passwords. Of course, a key to these files must be maintained, preferably off line. There is no provision for placing such files in the directory except by the use of DSKO$. Since this program is rather simple, only a brief explanation will be given.

Line 10 clears more than enough string space and dimensions just about enough string-array memory. The string array must be greater than 68 because of the limitations of DSKI$ in accessing sectors. Line 20 allows you to designate a drive number if you have more than one, otherwise you may as well set A to zero.

In line 30, L is a counter for the sorting routine. Lines 40 and 50 tell Basic to start with sector 3. Line 60 jumps out of the loop if A$ does not contain an entry, and line 100 does the same if B$ is empty. Since the directory entries are stored 32 bytes apart, line 70 scans only those portions of the string containing file names.

M is incremented by two in line 140, because there are two strings. The file names are stored in the C$ array in their order of appearance. The program then goes to a modified Shell-sort subroutine (published by CINTUG, a Cincinnati computer club) to sort the file names. This will sort 63 names in about 30 seconds. The program then returns and gives the user the option of screen printing or output to the printer.

This is a handy program for obtaining a permanent disk index. The printer output is in five-column format. You could rewrite the program placing many disks (within the limits of memory) in a single index. It is also possible to add to the list a filename extension, number of granules, disk number, and so on.

The number of programs on a disk varies widely. There are 2,304 bytes per granule. The very longest program in a 32K computer uses about 24 granules. Because one granule is allocated for each program, any program of less than 2,304 bytes would still require one granule, leaving much of the disk empty. But using 500 bytes in a granule does not necessarily mean the remaining space must go unused. It can be used for the judicious storage of data using the DSK0$ function. Remember that if you do this, all data will need to be stored in strings. Therefore, the files must be in ASCII. Also, it will be necessary to keep an independent file of where the information resides and in what form.

I hope these programs will help you enjoy your Color Computer—I have. Used properly, it is a very powerful computer.■

Listing 15 continued

```
100 PUT(I,J)-(I+28,J+18),V,PSET
110 PUT(I,J)-(I+28,J+18),V1,PSET
120 NEXT
130 J=J+20:IFJ>179THEN140ELSE90
140 FORI=1TO500:NEXT
150 PCLS:J=0
160 FORI=0TO244STEP35
170 PUT(I,J)-(I+28,J+18),V,PRESET
180 NEXT
190 J=J+20:IFJ>179THEN200ELSE160
200 GOTO200
210 REM MEM = 362
```

```
10 REM LISTING 16 BOXES
20 PMODE4,1:PCLS:SCREEN1,1:H=10:V=10
30 B$="BM"+STR$(H)+","+STR$(V)+"R4D4L4U4
40 FORX=1TO18STEP2
50 C$="S"+STR$(X)+B$
60 DRAWC$
70 NEXT
80 H=H+20:IFH>245THENH=10:GOTO90ELSE30
90 V=V+20:IFV>180THEN100ELSE30
100 FORI=1TO1000:NEXT
110 SCREEN1,0
120 GOTO120
130 REM MEM = 216
```

Program Listing 16. Boxes

```
10 REM LISTING 17 CUBES
20 A$="BM":B$="S":C$="R20D20L20U20E14R20G14BE14D20G14
30 PMODE3,1:PCLS:SCREEN1,0
40 J=127:K=90
50 FORS=2TO18STEP2:E$=STR$(S)
60 D$=A$+STR$(J)+","+STR$(K)
70 DRAWB$+E$+D$+C$
80 J=J-10
90 NEXT
100 FORI=90TO180STEP8
110 PAINT(127,I),2,4
120 NEXT
130 GOTO130
140 REM MEM = 230
```

Program Listing 17. Cubes

```
10 REM LISTING 18 HERRING BONE
20 FORP=0TO1
30 PMODE3,1:PCLS:SCREEN1,P:Y=0:K=0
40 R=RND(3)+5:S=RND(3)+5:IFR = S THEN40
50 FORX=0TO220STEP20:FORI=X TOX+10:PSET(I,Y+K,R):Y=Y+1:NEXT:Y=K:
NEXT
60 FORX=10TO230STEP20:FORI =X TOX+10:IFY+K+10>191THEN100
70 PSET(I,Y+10+K,S):Y=Y-1:NEXT:Y=K:NEXT
80 K=K+2:IFK>180THEN100
90 Y=K:GOTO40
100 NEXTP
110 GOTO110
120 REM MEM = 259
```

Program Listing 18. Herringbone

Program Listing 19. Rockets

```
10 REM LISTING 19 ROCKETS
20 FORL=1TO10
30 PMODE1,1:PCLS:SCREEN1,P
40 COLORRND(3)+1,5
50 J=0
60 FORI=128TO218
70 LINE(I,J)-(I,96),PSET
80 J=J+2
90 NEXT
```

Listing 19 continues

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Listing 19 continued

```
100 J=0:FORI=128TO32STEP-1
110 LINE(I,J)-(I,96),PSET
120 J=J+2
130 NEXT
140 I=100:FORJ=100TO190
150 LINE(I,J)-(I+50,J),PSET
160 NEXT
170 IFP=0THENP=1ELSEP=0
180 FORK=1TO500:NEXT
190 NEXTL
200 GOTO200
210 REM MEM = 270
```

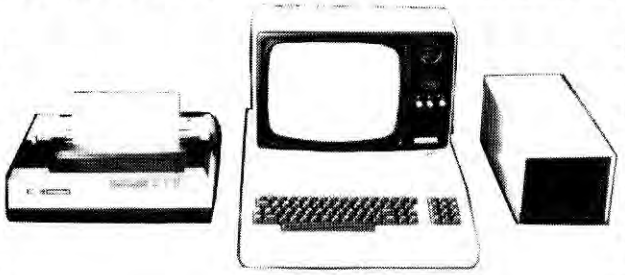
```
10 REM LISTING 20 PATTERNS
20 CLEAR50:CLS0
30 K=1:A=RND(2):P=240-A
40 M=RND(127)+128:IFM/16=INT(M/16)THEN40
50 Z$=CHR$(M)
60 Y$=STRING$(A,Z$)
70 FORI=1TOA*K:PRINT@P,Z$;:P=P+1:NEXT
80 K=K+1
90 FORI=1TOK:PRINT@P,Y$;:P=P-32:NEXT:P=P+31
100 FORI=1TOA*K:PRINT@P,Z$;:P=P-1:NEXT:P=P+33
110 K=K-1
120 FORI=1TOK:PRINT@P,Y$;:P=P+32:NEXT
130 K=K+2:IFK<13THEN40
140 FORJ=1TO1000:NEXT:CLS0
150 GOTO30
160 REM MEM = 307
```

Program Listing 20. Patterns

```
10 REM LISTING 21 DIRECTORY
20 CLEAR1000:DIMC$(80)
30 CLS:B=17:INPUT"ENTER THE DRIVE NUMBER";A
40 FORI=3TO12
50 DSKI$A,B,I,A$,B$
60 IFASC(A$)<48ORASC(A$)>91THEN150
70 FORJ=1TO97STEP32
80 C$(I+M-2)=MID$(A$,J,8)
90 PRINTC$(I+M-2),
100 C$(I+M-1)=MID$(B$,J,8)
110 IFASC(C$(I+M-2))=255ANDASC(C$(I+M-1))=255THEN160
120 PRINTC$(I+M-1),
130 M=M+2:L=L+2
140 NEXTJ:A$="":B$=""
150 NEXTI
160 L=L+3:GOSUB370
170 CLS:INPUT"ENTER (L)IST ON SCREEN OR (O)UTPUT TO PRINTER";D$
180 IFD$="L"GOSUB200ELSEGOSUB290
190 PRINT:INPUT"WANT ANOTHER DISK (Y/N)";Z$:IFLEFT$(Z$,1)="Y"THE
NRUNELSECLS:END
200 CLS
210 IFC$(I1)=""THENIFC$(I1+1)=""THEN240ELSEPRINTC$(I1+1),:GOTO24
0
220 IFASC(C$(I1))=255THEN280
230 PRINTC$(I1),C$(I1+1),
240 I1=I1+2:IFI1>80THEN280
250 Z=Z+1:IFINT(Z/13)=Z/13THEN270
260 GOTO210
270 INPUT"PRESS ENTER";N:CLS:GOTO210
280 RETURN
290 INPUT"HAS THE PRINTER BEEN TURNED ON";X
300 FORI=1TO73STEP5
310 FORK=0TO4:IFC$(I+K)=""THEN330
320 PRINT#-2,C$(I+K),
330 NEXTK
340 PRINT#-2,""
350 NEXT
360 GOTO190
370 G=L
380 G=INT(G/2):IFG>0THENG=(G OR1)ELSERETURN
390 FORS=1TOL-G:J1=S
400 IFC$(J1)>C$(J1+G)THENK$=C$(J1):C$(J1)=C$(J1+G):C$(J1+G)=K$:J
1=J1-G:IFJ1>0THEN400
410 NEXTS:GOTO380
420 REM MEM = 946
```

Program Listing 21. Directory

LNW80 COMPUTERS



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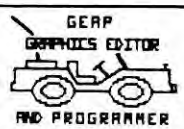

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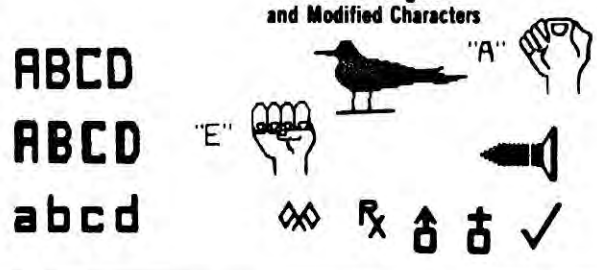

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Birthday Party

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This birthday party, for kids of all ages, consists of three programs: Scoreball, Dynamic Birthday Card and Cops 'N' Robbers.

Type in and Csave Scoreball Program Listing 1 as the first program on your tape. For the next program, Dynamic Birthday Card, record the Happy Birthday song or any other special message for your guest following Listing 1. Determine how many seconds it takes to play the message back. Next type in Program Listing 2. Adjust the timing loop in line 270 to give the required delay (for my 30-second message I used 15,000). Rewind to the beginning of the message and Csave the Birthday Card program. At the end, re-record the birthday message. Key in Cops 'N' Robbers (Program Listing 3), and Csave it immediately after the birthday message.

After each Csave, New out the old program. This prevents it from getting intertwined with later programs. Rewind the cassette to the beginning and press Play. Now you are ready for the party (unless you forgot the paper hats).

The Party Begins

To play ball, type Cload and Run. The program clears the screen, draws a table and displays a scoreboard. The scoreboard has your tally (the number of 3-pixel jumps your ball has traveled), how many times the ball has been hit, your bonus points (the number of times the ball hits the edge of the table) and the game number. The ball is pitched and travels across the screen. When the ball gets close to the edge press the space bar and it reverses direction—a hit. The closer the ball is to the edge, the higher your score. If you do not

The Key Box

Basic Level II
Model I
16K RAM

```
3 FOR Z=1 TO 3:B=0:C1=0
5 CLS:FOR X=0 TO 126:SET(X,6):NEXT
7 FOR Y=6 TO 46:SET(0,Y):SET(126,Y):NEXT
10 X=0:Y=0:C=3:ON ERROR GOTO 50:PRINTSTRING$(21,134);"  S C O R
E B A L L  ";STRING$(21,137):X$=INKEY$
20 Y=23:X=3:FOR P=0 TO 9:SET(0,23):SET(126,23):IF X=126 OR X=0 T
HEN B=B+1
30 SET(X,Y):FOR T=1 TO 5:NEXT:RESET(X,Y):X=X+C:PRINT@64,"TALLY:"
;C1,"BONUS:";B,"HIT";P,"GAME";Z;
40 C1=C1+1:IF INKEY$="" OR X>6 AND X<108 THEN 30 ELSE C=-C:NEXT
P:GOTO 60
50 CLS:PRINTCHR$(23);"YOU WENT THROUGH THE WALL...":PRINT"YOU LO
SE!   YOUR SCORE IS";C1+B*100:RESUME 70
60 CLS:PRINTCHR$(23);"YOU WIN!   YOUR SCORE IS";C1+B*100
70 PRINT"YOU HAVE";B;"BONUS POINT";:IF B<>1 THEN PRINT"S"
72 IF X<0 OR X>127 THEN 80
75 IF B<6 THEN PRINT"N.T.G.-NOT TOO GOOD" ELSE IF B>5 AND B<8 TH
EN PRINT"O.K."
77 IF B>7 THEN PRINT"TERRIFIC!":IF B=9 THEN PRINT"YOU ARE THE GR
EATEST!"
80 FOR T=1 TO 1500:NEXT T,Z
85 PRINT"SEND THAT BIRTHDAY CARD. "
86 PRINT"CLOAD AWA A A y!"
```

Program Listing 1

After three years of selling my Model I and Model III programs, I've earned back my development costs.

So I can lower the price.

Now I'm offering my Model I and Model III programs for $75 each.

They've been checked out by thousands of TRS-80* users, most of whom get in touch with me, Irwin Taranto. Thousands of phone calls later, these systems are completely developed, checked out, glitch-free.

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Company name _____

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hit in time, the ball goes past the edge and off the screen. The screen clears and displays YOU LOSE! It also displays your score and bonus points.

If you catch a hit ball at the opposite edge, a hole appears and you earn a bonus point. Each bonus point is multiplied by 100 and added to the final score. If you get ten hits without missing, the computer displays your score, bonus points and the message YOU WIN! The program plays three games and returns to ready. Next is the main event of any birthday party.

```
3 REMINDER *** PRESS THE "B" KEY TO BLOW OUT THE CANDLES ***
5 CLEAR 70
10 INPUT"WHO IS THIS PARTY FOR";N$
15 PRINT"NOW PULL OUT THE EARPHONE PLUG FROM THE CASSETTE"
20 PRINT"CALL ";N$;" IN,PLEASE.":FOR T=1 TO 2000:NEXT:CLS:FOR T=
1 TO 2000:NEXT T
50 PRINT CHR$(23);"**DYNAMIC BIRTHDAY CARD**":FOR T=1 TO 1000:NE
XT:CLS:GOTO 110
60 PRINT@208,CHR$(160);:PRINT@223,CHR$(160);:PRINT@238,CHR$(160)
;
70 PRINT@272,CHR$(141);:PRINT@287,CHR$(141);:PRINT@302,CHR$(141)
;:GOTO 124
80 PRINT@336,CHR$(191);:PRINT@351,CHR$(191);:PRINT@366,CHR$(191)
;
90 PRINT@400,CHR$(191);:PRINT@415,CHR$(191);:PRINT@430,CHR$(191)
;:FOR T=1 TO 1000:NEXT:GOTO 60
93 FOR PAP=456 TO 520 STEP 64:PRINT@PAP,STRING$(47,191);:NEXT PA
P
95 FOR PAP=581 TO 709 STEP 64:PRINT@PAP,STRING$(53,191);:NEXT PA
P
100 FOR PAP=771 TO 963 STEP 64:PRINT@PAP,STRING$(57,191);:NEXT P
AP:FOR T=1 TO 1000:NEXT:GOTO 80
105 STOP
110 SET(0,47):SET(1,47):SET(2,47):SET(3,47):SET(4,47):SET(5,47)
120 SET(120,47):SET(121,47):SET(122,47):SET(123,47):SET(124,47):
SET(125,47):SET(126,47):SET(127,47):GOTO 93
124 PRINT@0,"CLOSE YOUR EYES AND MAKE A WISH,";N$;"!"
126 PRINT@64,"NOW BLOW OUT THE CANDLES!"
130 IF INKEY$="B" THEN 200 ELSE ON RND(3) GOTO 160,180
140 IF POINT(93,11) THEN RESET(93,11):SET(92,11):RESET(92,12):SE
T(93,12):GOTO 130
150 RESET(92,11):SET(93,11):RESET(93,12):SET(92,12):GOTO 130
160 IF POINT(33,11) THEN RESET(33,11):SET(32,11):RESET(32,12):SE
T(33,12):GOTO 130
170 RESET(32,11):SET(33,11):RESET(33,12):SET(32,12):RESET(33,12)
:GOTO 130
180 IF POINT(63,11) THEN RESET(63,11):SET(62,11):RESET(62,12):SE
T(63,12):GOTO 130
190 RESET(62,11):SET(63,11):RESET(63,12):SET(62,12):GOTO 130
200 PRINT@208," ";:PRINT@223," ";:PRINT@238," "
220 PRINT@128,"HOORAY! HAPPY BIRTHDAY,";N$;"!"
230 FOR T=1 TO 1000:NEXT T:PRINT@336," ";:PRINT@351," ";:PRINT@3
66," "
240 PRINT@400," ";:PRINT@415," ";:PRINT@430," ";
250 FOR Y=21 TO 46:RESET(31,Y):NEXT Y
260 PRINT@0,"HAVE A SLICE!";CHR$(30):PRINT:PRINT
270 OUT 255,4:FOR X=1 TO 15000:NEXT:OUT 255,0
275 PRINT@0,"NOW HOW ABOUT A GAME OF COPS 'N' ROBBERS? JUST CLOA
D."
```

Program Listing 2

```
2 ON ERROR GOTO 130:CLS:PRINT"(*)(*)(*)(*)(*) C O P S   ' N '
R O B B E R S (*)(*)(*)(*)(*)":FOR F=1 TO 5:OUT 255,8:FOR T=1 TO
 200:NEXT T:OUT 255,0:FOR T=1 TO 200:NEXT T,F
3 FOR Z=1 TO 5
5 CLS:CX=1:CY=7:RX=31:RY=0
10 CP=(CY*64)+CX:RP=(RY*64)+RX
20 PRINT@CP,"C";:PRINT@ABS(RP),"R";:FOR M=1 TO 2
30 X$=INKEY$:IF X$<>"" THEN PRINT@CP," ";
40 IF X$="[" THEN CY=CY-1
50 IF X$=CHR$(10) THEN CY=CY+1
60 IF X$=CHR$(8) THEN CX=CX-1
70 IF X$=CHR$(9) THEN CX=CX+1
80 CP=(CY*64)+CX:PRINT@CP,"C";
90 IF CP=ABS(RP) THEN PRINT@CP,CHR$(143);:PRINT@0,"YOU CAUGHT ME
!":GOTO 165 ELSE NEXT M
100 PRINT@ABS(RP)," ";:RX=RX+SGN(RX-CX):RY=RY+SGN(RY-CY)
110 RP=(RY*64)+RX:IF ABS(RP)=CP THEN 90
120 GOTO 20
130 IF ERL=20 THEN PRINT@0,"HE GOT AWAY!"; ELSE 140
135 FOR T=1 TO 700:NEXT T:RESUME 170
140 PRINT@0,"YOU GOT LOST!":GOTO 135
165 FOR T=1 TO 700:NEXT T
170 NEXT Z
180 FOR T=1 TO 2000:NEXT:CLS
190 PRINT"SORRY THE PARTY'S OVER--IT'S BEEN LOTS OF FUN."
200 PRINT"GOOD BYE,EVERYBODY!"
```

Program Listing 3

Take a Byte

Cload and run the Dynamic Birthday Card program. The screen will ask "Who is this party for?" Type in the person's name and Enter. Pull out the earphone plug of the tape recorder and call in the guest. The program will clear the screen and display **DYNAMIC BIRTHDAY CARD** in 32 character mode. It next displays a cake in 64 character mode. After a short time delay, the computer draws three candles and lights them. The candles flicker as the guest reads the message on the screen. Tell the guest to blow out the candles. When he does, you secretly press the B key. Out go the candles and on comes the message: Hooray! Happy Birthday _____. After a short delay the computer resets a column of pixels from the cake to give the effect of a large slice being cut. Then it prints Have a slice! Using an Out statement, the computer turns on the recorder. The prerecorded message comes out of the speaker. When the recorder stops, leave the Play key down and replace the earphone plug for the next Cload.

More Fun and Games

The object of Cops 'N' Robbers is to move the cop (C) onto the robber (R). The cop is controlled with the arrow keys. There are two tricks: When you move, the robber will try to move in the other direction; and if you move onto position 1023 (the last position on the screen), the screen will scroll and fill with cops and robbers. If you catch the robber, the computer will display a graphic block (143) where he was caught and the message You caught me! If the robber runs off the bottom of the screen, it will display I got away! If you wander off the top or bottom of the screen, it will display You got lost! This program will play five games—and then the party is over. ■

Simon, a ten-year old computer whiz, enjoys playing the piano.

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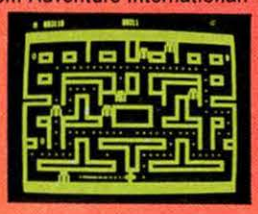

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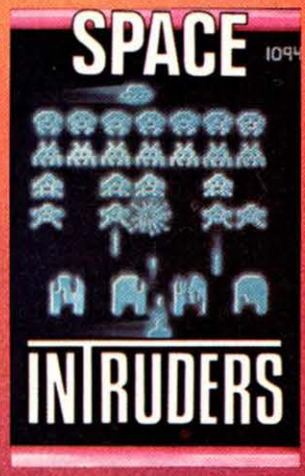

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For years I have been searching for the ultimate data-base program. My journey has exposed me to seasoned veterans like Versafile and Profile®. I have tried several of the "world's best" mailing-list and inventory-management packages, only to be bitterly disappointed after spending a dozen or more hours learning how to use them and entering data. Workhorses like Maxi Manager for the Model III and sophisticated CP/M programs like dBase II have not escaped my scrutiny.

I admit that I still have not found my Holy Grail. But I have come close. Computer Software Design's Data Ace is good, very good. It is also tough, perhaps too tough. Like the mountain climber who suffers frostbite and exhaustion, only to find the view at the top of the world a bit cloudy, I am beginning to think that my search for the ultimate data base may end up meaning more than reaching the summit.

Data Ace is a "relational systems language and operating system." Understanding relational data-base structure is important if you want to grasp the power that Data Ace offers. In the adjoining sidebar I've explained how relational bases work. For more details consult the referenced article and book.

The secret behind powerful data bases seems to be flexibility, exactly what Data Ace's relational format offers. Unlike the popular indexed sequential-access memory systems (ISAM), your applications are separate from the actual data storage. Once you know the kinds of information you are going to store, the rules of relational data-base structure dictate just how it is organized. When you go to use the data, programs are written to give you the desired results. The existing data can be easily reorganized to meet the needs of a new program. I'll take a closer look at writing programs for Data Ace later.

Data Ace is a completely integrated package. It features its own operating system (no need for TRSDOS or CP/M); data-management software; a query language allowing you to examine files directly; a structured programming language for manipulating data; a full-screen editor to write programs; and a catalog mode to store help files, programs, and procedures. A second disk contains a collection of utilities for tasks like back-up, data recovery, and data-base initialization. Since Data Ace is self-contained and provides no means for backing up the system disk, you must take care to prevent damage for the two copies provided, although Computer Software Design offers replacements for $30. In addition to the system disks and the utility disk you get a data disk for demonstration purposes.

Query Language

With the system disk in drive 0 and the demo disk in drive 1 you are ready to start

```
( PROCEDURE - LEADLIST      DATE 06/13/82  TIME HH.MM )
LIST CUSTOMERS WHERE ZIP = 45056 AND CRED.LIMIT >= 10000 AND YTD
.SALES < 1000 ( EXCLUDE CUS.NUM STREET )
```

Part A

```
CUS.NAME                CITY                STATE   ZIP PHONE#      YTD.SALES
CIRCLE SYSTEMS          OXFORD              OH    45056 5135552233          500

CRED.LIMIT
     15000


CUS.NAME                CITY                STATE   ZIP PHONE#      YTD.SALES
ENERGY EXCHANGE         OXFORD              OH    45056 5135551623            0

CRED.LIMIT
     10000
```

Part B

Fig. 1. Using the Data Interrogation Language (DIL), a procedure can be written that selects records for firms that have a 45056 zip code, credit limits equal to or greater than $10,000 and year to date sales less than $1000. Part A shows the procedure, part B shows the data for two firms that meet this criteria. The DIL procedure also directed Data Ace to delete the street address and customer numbers from the listing.

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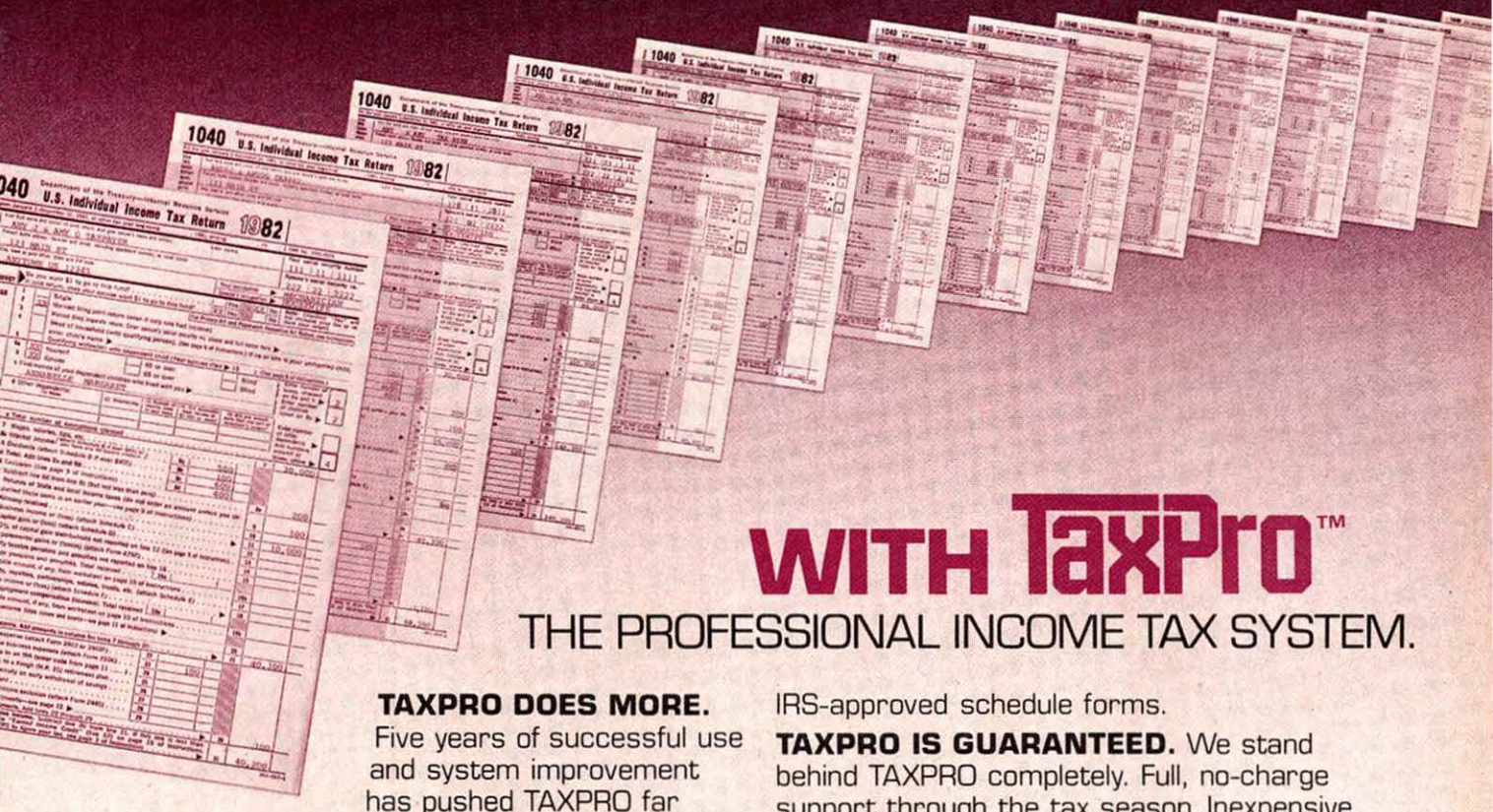

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learning. When booted up, the system automatically goes into the DIL or Data Interrogation Language. Via simple syntax you can examine records, either individually or in groups. (Don't know what a record is? Read the explanation of relational data bases.) For instance, my demo disk had a relation called Customers where there was one key field, a customer number. Other non-key fields in each record included the customer's name, address, phone number, year-to-date sales, and credit limit.

Using the DIL query language you can do something as simple as list the customer whose number is 1071, or something as complex as listing those customers whose zip code is 45056, have a credit limit greater than $10,000, and have purchased less than $1,000 this year. Your salesman can use this printed list on his next visit to the 45056 zip-code area, concentrating on those customers who can afford a lot but for some reason have not chosen to buy much this year. If your salesman works by telephone, you may want to get a printout that does not include the addresses. Figure 1 shows a DIL procedure that accomplishes this. As you can see, Data Ace's DIL mode is reasonably easy to use and very flexible.

Using the query language is straightforward since most of the commands are words like "where" and "sum" or the arithmetic symbols < and >. In addition to listing files you can add data, change files and delete files. When printing reports you can use the built-in column headings or define your own headings to give a custom look. The actual placement of the printed fields is still under the control of Data Ace. Single layer sorts, based on a key field, are available as is the capability to sum a group of numeric fields. If you are well versed in the structure of your data then you can make good use of the DIL Join command to select data from one relation, based on the value of data in another relation, and list data from two or more relations as if it all came from relation.

The power of Data Ace's DIL mode is substantial and can be taken advantage of with a minimum of training. If you need to do the same type of thing many times, you can store a string of DIL commands as a procedure using the catalog mode. By creating a library of procedures a user can have the advantages of speed and simplified access that relational bases offer, with a minimum of hassle.

The biggest drawback is the inability to customize reports that often call for complex manipulations of numbers, not to mention special printing. In this respect the DIL mode of Data Ace is inferior when compared to the overall power of many other data-base managers.

Structured Programming

If the DIL mode was all Data Ace offered I would have been very disappointed. However, Data Ace is vitalzed by its unique programming language, otherwise known as Data Manipulation Language (DML). Here you have total control. You can open up to 12 different relations at any one time, shuffling data back and forth, inputting data when necessary, and printing it out just the way you want it. There is, however, a price to pay for all of this power. DML is a derivative of Polyforth (the language Data Ace is written in). If you are a non-programmer, you are likely to be scared stiff. If you're just used to languages like Fortran and Basic, you have a lot of learning to do. Advertisements claim Data Ace's programming language offers the "...ease of Basic, the power of Pascal and the structure of C." So much for the advertisement. But you can learn how to use DML.

If you know something about Forth and are comfortable with stack and string manipulation, precision arithmetic, and relational data structures, then dive right in, using the 40-page introductory chapter on DML as a reference. The rest of us mortals will need to drag out volume two of the Data Ace user's guide. Here you'll find 100 plus pages devoted to detailed explanations of example programs. Spend a couple of evenings poring over these examples then sit down in front of your computer and give them a try. This approach is preferable to beating your head against the wall by starting out with your own application. Chris Horrocks, vice president of Computer Soft-

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Yours truly,



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Fig. 2. Data Ace allows text files and data files to be combined, giving a unique word processing capability.

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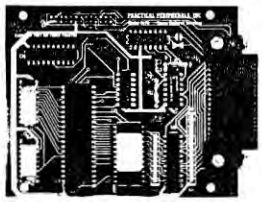

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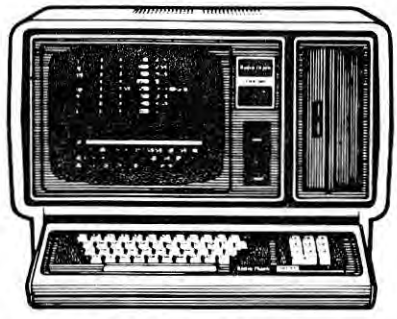

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ware Design, put it nicely, "When you start out using structured programming like Data Ace's DML there appears to be a high risk, but when you finish the job there is a visceral thrill." Horrocks went on to say, "Once you are familiar with this you won't want to touch anything else."

Catalog Mode

Data Ace's catalog mode allows the user to add programs and procedures (made up of DIL commands), and edit, list, or delete programs and procedures already on disk. A full-screen editor is available to assist you in writing and debugging programs and procedures. It offers more than 20 commands, and like other editors, is mastered through practice and patience.

The most recent release of Data Ace features word-processing capabilities. You can use the editor to write a letter or report that is stored as a text file. Then a DML program can access the text file, inserting names, addresses, and the like to give custom printouts. An example of this is shown in Fig. 2.

Data Ace has the distinction of allowing programs to be run with either a compiler or an interpreter. Source code for the interpreted programs is stored on the data disk and can be quickly altered in the catalog mode and rerun. Compiler operation is preferred for software that is debugged since it is stored on the system disk in a more compact form. The power and efficiency of Data Ace's Forth-like language is evident when you compile a routine. For example, a program that uses two or three relations, requires data input, and provides several different printouts can often have a compiled length of less than 2K. The compiled code for Data Ace is about 135K (said to be 900K of source code), leaving room for more than 400K of applications software on the system disk.

"Data Ace has the distinction of allowing programs to be run with either a compiler or an interpreter."

Data Definition

The importance of relational data structures is apparent through the fact that the system uses relations of its own to store programs, text, and procedures as well as keeping track of the various user-defined relations and their fields. At first glance a Data Ace relation may seem limited when compared to other data-base managers. You are allowed three key fields, with a total of no more than 27 bytes. The field total (key and non-key) is 25. The maximum length of a record is 256 bytes. This may seem restrictive until you break your data down into normalized form. Chances are you will end up with several smaller relations. If need be,

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you can violate one rule of normalization and have two relations that share the same key fields. The total number of records is limited only by your disk storage space.

Once you have defined a relation and started to enter data you are not locked in. You may, with some limitations, add and delete fields or change the field type. Data Ace has nine different field types, ranging from one-byte unsigned binary numbers to 255-character alphabetic strings. Your choice of fields affects the amount of disk space needed to store the data. If you find the data you so painstakingly entered is not the way you want it, just create a new relation that uses your existing records. It is worth mentioning again, one of Data Ace's strongest selling points is the fact that the storage and the application of the data are two separate and distinct functions.

Speed

What about speed? I am a cynic when it comes to benchmark tests for data-base managers. The room for error is great and the results often have little real-life value. Suffice it to say that Data Ace is fast. Speed is enhanced by storing an index in memory that shows the cylinder location for each record. That way it only takes one seek operation to locate a record on the disk.

"I am a cynic when it comes to benchmark tests for data-base managers. Suffice it to say that Data Ace is fast."

Efficiency is also increased by using notional relations, a relatively new addition to Data Ace. A notional relation has data that is identical to the original relation except that the order is different. This "alternate pathing" allows you to sort the data (also known as "inverting a field") by every field. When you update the original relation its notional is changed too.

Documentation and Utilities

All of the power and flexibility offered by Data Ace is useless if you can't learn the ropes. Computer Software Design supplies two manuals with each system. The first manual has nine chapters covering the fundamentals of using DIL, data definition (DDL), the catalog and editor, system utilities, and an introduction to programming with DML. After reading the two chapters on DIL and experimenting with the sample relations you'll soon be proficient.

The later chapters are not so easy to master. Unlike the monkey see, monkey do approach of giving examples that many manuals use, the Data Ace documentation concentrates on spelling out the functions individually. The information is all there but

Aunt Betilda's Flower Club

Your sweet Aunt Betilda (the one who bakes those fantastic cookies) has asked you to use your computer to help keep records for her flower club. Being a loyal (and hungry) nephew you agree. A simple job, right?

Don't reach for those cookies quite yet. Here is what Aunt Betilda wants you to keep track of: each member's name, how long they have been a member of the club, the different kinds of flowers they grow (including the number of colors and source for each type, assuming there is only one source for each type), and whether or not a member has paid his or her dues. All this information is recorded on file cards. You have to organize it in a data base so that when Auntie asks, "Which members have been in the club for less than three years, have two colors of tulips started from bulbs provided by Bea Phillips, and haven't paid their dues?" you can answer.

There are a number of ways to organize data, but this time you are going to try the relational method. Relational structures require that all the data be stored in the form of a two-dimension table. Unfortunately, the file cards you have aren't quite in a *normalized* form yet; Aunt Betilda is guilty of having *unnormalized* data (Fig. 1). When we fix this transgression the resulting 2-D tables of normalized data will be known as *relations*.

Rule number one: Each row in our relation must be different. Put another way, no two rows can be alike. If all but one column of two different rows are the same, that's okay, that one column makes the difference, it is the *key* to telling the two rows apart. Why not use the members' names as a *key*. After all, no two people have the same name.

Rule number two: Each column must contain a unique piece of data and the columns must be nonrepetitive. Hence it is not fair to list both the flower and number of colors in one column, nor can we have two or more columns giving the types of flowers. They need to be spread out, with one item per column. At this point you should tactfully explain to Aunt Betilda that you can only list up to four kinds of flowers for each member. (If you are really hungry you might go for five or six kinds, it is up to you. But remember, each kind will require a row.) The result after you have completed this step is shown in Fig. 2. At this point there are two keys that identify a row: the name and the flower type.

Our next rule is that the data in every column must be dependent on the key columns. This presents some problems. If we use the name as a key we

Continued on page 272

Name: Frieda Jones
Yrs. of membership 4
Dues paid: no

Flower type	# of colors	Source
Daisies	1	Betilda Smith
Tulips	3	Ben Phillips
Roses	2	Ellie Brown
Petunias	4	Esther Connors

Fig. 1. Unnormalized data looks like this. Normalization converts the information into a two-dimensional table that fits the rules of a relational data structure.

Name	Yrs.	Dues	Flower	Colors	Source
F. Jones	4	no	**Daisies**	1	B. Smith
F. Jones	4	no	**Tulips**	3	B. Phillips
F. Jones	4	no	**Roses**	2	E. Brown
F. Jones	4	no	**Petunias**	4	E. Connors
M. Williams	18	yes	**Marigolds**	17	F. Franklin
M. Williams	18	yes	**Petunias**	1	E. Connors

Fig. 2. The data has been organized into a table where each row is different and each column holds a unique piece of data. Note that there are two keys: the club member's name and the flower type. The key columns have been highlighted.

it may seem overwhelming and a bit terse. A comprehensive index would be a great addition. Volume two is a user programming guide devoted to example D, charts and program listings. The sample application, a cash-disbursement program for property management, is shown in both initial and revised versions.

The Data Ace offers two forms of back-up. Fast-copy allows you to duplicate the data disk, in identical form, on another data disk. Back-up also copies the data, but at the same time reorganizes it. Back-up is usually followed by Restore, which returns the reorganized data to the original disk. In addition to disk formatting and data-base initialization, the utilities disk contains a program that checks the integrity of your data files. This is recommended as a regular checkup rather than a last resort. A recent release of Data Ace has improved utilities, including the capability of expanding your data files as your disk capacity grows.

Applications

Okay, we have beaten Data Ace to death, but what can it do? Or perhaps a better question is what can it do better than other data-base managers? Does your company have an inventory-control system that relies on a timesharing system that is as expensive as it is unreliable? Data Ace offers an alternative to this kind of problem.

To tap its power you have to know something about data-base management and relational data structures in particular. A strong background in structured programming is helpful, although it isn't essential. There are some kinds of applications that could be solved through Data Ace but are more easily solved with canned programs; examples of these are general-ledger or checkbook packages.

Data Ace excels in situations where prepackaged software won't do. The manager who is faced with spiraling timesharing costs won't flinch at Data Ace's price since the development and debugging time is reduced from months, often required for truly custom software, to only weeks or days. The actual programming probably won't be done by the manager, but will be turned over to an in-house programmer or an outside service. Put another way, Data Ace is straightforward for the end user, once the data base is established and the programs and procedures are perfected by a skilled or semi-skilled programmer.

Perhaps Data Ace's most exciting prospects are still untapped. There are hundreds of businesses that must rely on custom programming or prepackaged software that works only in a mainframe or minicomputer environment. The relatively low price of Radio Shack hardware combined with

RELATION # 1

Name	Yrs.	Dues
F. Jones	4	no
M. Williams	18	yes

RELATION #2

Name	Flower	Colors	Source
F. Jones	Daisies	1	B. Smith
F. Jones	Tulips	3	B. Phillips
F. Jones	Roses	2	E. Brown
F. Jones	Petunias	4	E. Connors
M. Williams	Marigolds	17	F. Franklin
M. Williams	Petunias	1	E. Connors

Fig. 3. Each column in a relational data table must be dependent on the key column(s). When this occurs, there are two separate relations. The first is keyed on the club member's name while the second has a member's name and flower type as keys.

RELATION #1

Name	Yrs.	Dues
F. Jones	4	no
M. Williams	18	yes

RELATION #2

Name	Flower	Colors
F. Jones	Daisies	1
F. Jones	Tulips	3
F. Jones	Roses	2
F. Jones	Petunias	4
M. Williams	Marigolds	17
M. Williams	Petunias	1

RELATION #3

Flower	Source
Daisies	B. Smith
Tulips	B. Phillips
Roses	E. Brown
Petunias	E. Connors
Marigolds	F. Franklin

Fig. 4. The final stage of this data normalization ensures that the data in non-key columns depends directly on the data in key columns. To accomplish this a third relation is formed—one that has two fields, both of them keys, showing the flower type and the source.

continued from page 271

are okay, as long as we look at years of membership, dues paid, and types of flowers. The other two pieces of information, source and number of colors, are also dependent on the type of flower. Yet type of flower has no bearing on years of membership and dues. The solution is to establish more than one relation. Figure 3 shows the result; we have eliminated any partial dependence on a key. In the case of the number of colors per flower it depends on two things, who has them and what kind they are, so we use two keys: name and type.

The final rule is that the data in the non-key columns must depend directly on the key columns. Can you see the problem in Fig. 3? The source of flowers isn't dependent on who has the flowers. We need a separate relation, giving just the source and flower, with both acting as keys. This final step is carried out in Fig. 4. It may look like a lot more than we started with and seem like a lot more bother to normalize data but consider how easy it is to answer questions like, "Which members with three colors of tulips have paid their dues?"

Before grabbing a cookie and pouring a glass of milk, let's take a look at a few more terms. We usually refer to columns as *fields*. There are *key* fields and there are *non-key* fields. Each row (a group of two or more fields) is usually called a *record*. A group of records make up a *relation*. That about does it, enjoy the cookies. ■

For more information on relational data base structure see:

"Fundamentals of Relation Data Organization," Neely and Stewart, *Byte*, November 1981, page 48.

Computer Data Base Organization, James Martin, Prentice Hall, 1977.

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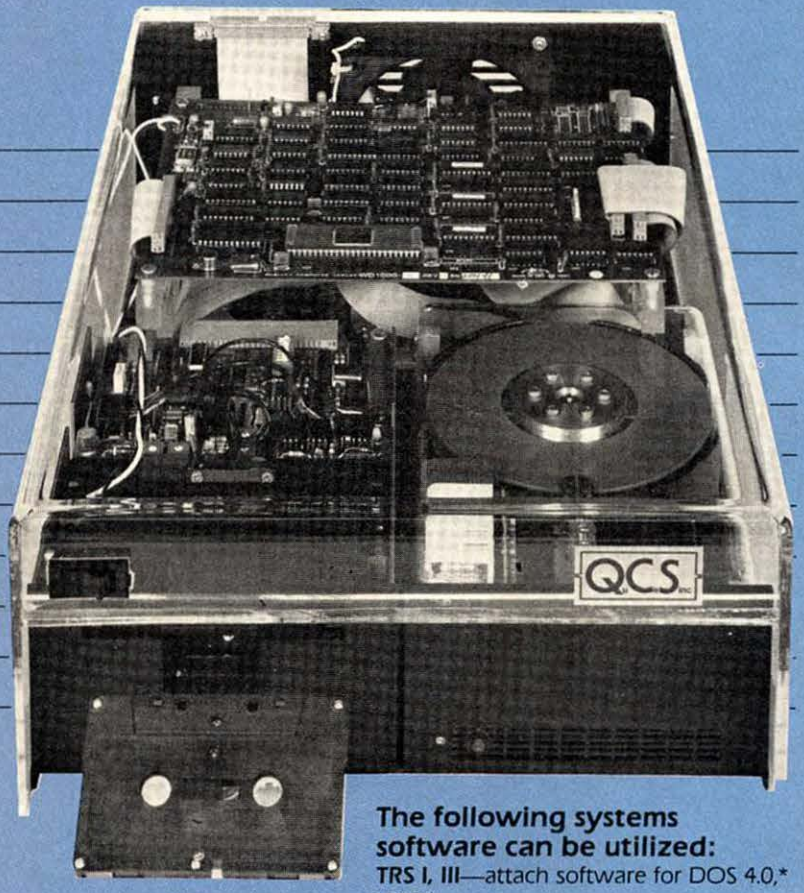

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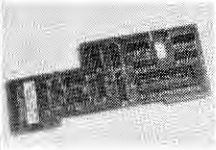

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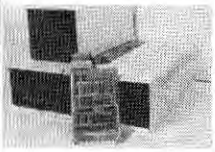

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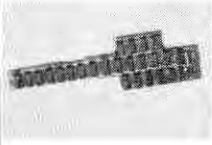

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Data Ace's quick development time results in a complete package that could be sold by OEMS to a small or mid-sized business. And if need be, the OEM can customize the Data Ace application for individual users. The price tag on such a system could easily exceed $10,000 and still be an attractive alternative. I can think of a half dozen specific packages that could be developed and marketed this way.

Apparently Computer Software Design has the same idea in mind. They offer a very attractive quantity discount for Data Ace. The first Model II package costs you $850. If you buy between five and ten systems the price drops to $340 each. As your out-of-pocket costs for each new package drop, your profit increases.

Model I and III

Data Ace's power is no longer limited to the Model II. This spring Computer Software Design released a version for the Models I and III. To run Data Ace on these machines you need Miller Microcomputer Systems' Forth. The total cost for a Model I/III package, including MMSForth is $345. I have no first-hand experience with Data Ace for the Model I/III, but am under the impression that it has the same features as the Model II version.

The development of Data Ace is an ongoing process. The version I first worked with (1.2) has been improved with addition of notional relations, word processing, and increased utility power. There is every indication that these kinds of improvements will continue, and perhaps Computer Software Design will offer update packages.

Data Ace for the Model 16 and a hard-disk version for the Model II were being developed in the spring of 1982. The hard-disk version will run under Radio Shack's operating system. With hard disks becoming prevalent on the Model III perhaps Computer Software Design will tackle this next. Hopefully they'll allow Data Ace to run under a recognized operating system, avoiding the claustrophobia I felt using a dedicated operating system.

The best way to learn about Data Ace is through their demonstration package. For $19.95 you get a one-disk system with sample relations and full DIL and DML capability. There are even 20 pages of documentation on the disk to get you started. This low price makes it easy for you to decide if Data Ace will fill your needs.

Conclusion

My experience with Data Ace has convinced me of its tremendous power and flexibility. It has taught me the virtues of relational data structure. I have also learned that a truly versatile data base is probably going to take a knowledge of programming to be mastered. Each new data manager I am exposed to leaves me a bit disappointed, so I'm not going to stop looking. But in the meantime, Data Ace will be part of my collection of survivors. ■

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SERIES

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Inside Scripsit—Part II

Craig A. Lindley
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In the first part of this series I pointed out many of Scripsit's design features and philosophies and outlined a general methodology for approaching program modification. In this part I will show you how to add features to the Scripsit word processing program, and on a more general level, how to modify any large program.

The First Step

Before modifying any program you must decide what features and functions you would like to add and exactly how they should work. The modification code that you will write is the instructions to your computer on how to carry out the functions you want to perform.

A tried and true method for completely specifying the exact functions you want is a process called "stepwise refinement." Take a blank sheet of paper and write the main idea for your modification near the top and draw a box around it. I call this the "black box." You proceed by breaking the black-box task into smaller tasks (boxes) until you cannot go any further (the tasks are non-divisible). At that point, you should have completely specified the problem and taken all the possible variables into consideration. This approach leads to a top down type of structure which makes the design, coding and maintenance of the program modifications much easier. I use this method in every computer program I write.

After I decided on the functions I wanted to add to the Scripsit program and designed them using the method stated above, the next problem to solve was how to execute these additional commands. After analyzing the functions to be added, I concluded that the two different types of commands would fit nicely into the existing two-level command structure on which Scripsit is based. I put commands that should not be executed accidentally such as Query the directory, Kill and New on the special command level. By placing them on this level, you must press the break key first before you can execute them. This reduces the chance of accident. I placed all the new cursor commands on the text-entry level so that they are available at all times.

Table 1 lists all of the added commands and how they are executed. I made numerous changes to the normal Scripsit command structure to accommodate the execution key combinations that I wanted.

The first set of commands I wanted to add to Scripsit are the ones now executed by the @, right-arrow and the @, left-arrow key combinations. These commands move the cursor to the start of the next word or end of the previous word respectively. The problem was that Scripsit used the @, right-arrow combination for the tab function and the @, left-arrow key combination didn't return a unique key code as did all the other control key combinations (the @, left-arrow combination returned the same key code as the left-arrow key). I solved the first problem by overlaying the tab-key code byte in the main command lookup table (79AAH) with a 14H or the @, T key code. This effectively changes the tab character from the @, right-arrow to the @, T key combination and opens up the @, right-arrow key combination for use with the function stated above.

The second problem was more difficult to remedy because the keyboard driver routine located at 6061H didn't provide a unique key code for the @, left-arrow combination. I patched the keyboard driver (at address 6156H) with the Keymod routine shown in Program Listing 1. This patch causes the @, left-arrow key combination to return a 7H code (the same as the @, G key combination which performs the same function), and therefore allows me to use the key as desired.

After freeing the key combinations needed for use by the patch program, I had to couple these key codes to the desired new function routines. I did not add these new command mnemonics to the existing command lookup tables. Instead, I generated new auxiliary lookup tables that are scanned when a command mnemonic match is not found in the main lookup tables. I needed two such auxiliary command lookup tables: one for the text entry-level command lookup and one for the special command lookup. Lines 610–810 of Listing 1 show these new command lookup tables and lines 4080–4190 show the routines that process these new tables.

I placed a branch in Scripsit after the nor-

The Key Box

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Scripsit

mal command lookup table is scanned for the command mnemonic. Ordinarily, if the command mnemonic is not found, Scripsit branches to the illegal command message output routine. I directed this branch to the routine that processes the auxiliary command lookup table. If the command mnemonic matches that found in the auxiliary table then it is executed. If it is not found, the error message routine is executed and the message is output.

New Functions

Anyone familiar with Scripsit's operation will recognize the command syntax and therefore realize how to use the added commands. In Table 1 a $ represents a space that is necessary for the command to be correctly interpreted and executed. Most commands are self-explanatory, but a few require discussion.

Enter the directory command and all other special commands after pressing break. I input the mnemonic Q (for Query) along with a qualifier or drive number to select the desired disk drive. If you enter just the mnemonic, you will see a directory of drive 0. If you specify a number between zero and three, you will see that drive's directory. If you enter any other number or letter, an illegal command message will be displayed. If the selected disk drive is nonexistent or not ready, you will be informed accordingly. This condition will not cause Scripsit to hang up. You will be returned to the text entry mode at the point in the text where you left off.

Execute the kill-file function by typing the complete word, Kill, or just the first letter, K, followed by a mandatory space and the filespec of the file you wish to kill. If the file is found, it will be deleted. If it is not found, you will be told so. This command and the directory command return you to the exact spot in the text where you left off.

The printer-pause function, which is invoked with the shift, P key combination, allows you to pause the line printer at the beginning of any print line. To use this function hold down the shift and P keys until the pause message appears on the display command line. The printer will then stop at the beginning of the next print line. The cursor will flash on the command line until you press any key, and at that time, printing will resume.

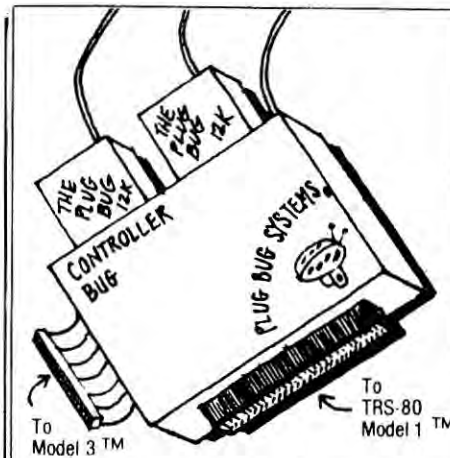
The underline feature in its present form will work for the Line Printer IV (Centronics 747) or any other printer that uses the codes 0FH to turn underlining on and 0EH to turn it off. If your printer uses some other single control character to turn the underlining function off and on, you can replace the 0EH and 0FH codes on lines 550 and 560 of the listing with these codes. If your printer uses multiple control codes to activate the underlining function, then modify the underlining routine (UNDRLN: lines 1120–1280) accordingly.

To initiate the underlining function, place the cursor immediately preceding where you want the underlining to begin and insert the shift, zero key combination at that point. This will place the underscore character at the cursor position. When the document is printed, underlining will begin at the first occurrence of the underscore character and continue until another underscore character is found in the text. All text between the underscore characters including spaces will be underlined. The underlining function will not terminate at the end of print line.

Num	How executed	Function
1	Break QD where D = drive = 0–3	Query disk directory of any disk drive. Indicates name, date, free space along with all non-system files.
2	Break K or KILL$filespec	Kills specified file, if found.
3	Break N or New	Reinitializes Scripsit completely. Destroys resident document. Like Basic New statement.
4	Break E or End	Returns to DOS instead of rebooting.
5	Break X = CC1,CC2. . .	Sends printer initialization codes to the line printer. CC1 and so on are decimal printer control codes from 1–31. You can send any number. They must be used before the document is printed. The message "Printer Initialized" will be output if all codes are in range.
6	<shift><P>	Pauses the line printer while printing. Hit any key to continue. Hitting clear while paused aborts printing.
7	@T	New tab function key. Replaced @→ which was needed for a new command.
8	WP$L or U*	Asterisks in filespec causes reentry. See text for explanation.
9	<shift>0	Placing the underscore character in the text causes underlining. See text for explanation.
10	Break S	When saving files to disk, a new or updated message will be output to indicate a new or updated file.
11	@H	Homes cursor to upper left corner of display screen.
12	@->	Moves cursor to beginning of next word or first alphanumeric character after space.
13	@<-	Moves cursor to end of last word or the first alphanumeric character before a space.
14	@up arrow	Scrolls window 13 lines towards beginning of text.
15	@down arrow	Scrolls window 13 lines towards end of text.
16	@F	Moves cursor 13 lines towards beginning of text.
17	@B	Moves cursor 13 lines towards end of text.

$ represents a mandatory space.

Table 1



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The Program

The complete patch program is shown in Listing 1. The program consists of two segments starting at locations 7AA5H and 7C62H respectively. This is one large program broken up this way to allow a large piece of the program (the one starting at 7AA5H) to be placed in the 381-byte memory area from 7AA5H to 7C28H that is unused by the Scripsit program. By breaking up the program in this manner, the approximately 1,380-byte patch program reduces the available text buffer space by only 980 bytes. This gives you many additional functions for less than 1K of memory.

The first segment of the program contains the underlining routine, program storage areas, auxiliary command lookup tables, disk I/O buffers, the Scripsit loading routine, and the program patch code. It also contains the code that checks and performs reentry to the Scripsit program. I chose the contents of this segment not to group certain functions together, rather to

Program Listing 1

```
                00100 ;*********************************************
                00110 ;*****      SCRIPSIT PATCH PROGRAM        *****
                00120 ;***              LISTING ONE             ***
                00130 ;***            OCTOBER 1981              ***
                00140 ;***             WRITTEN BY               ***
                00150 ;*****         CRAIG A. LINDLEY           *****
                00160 ;*********************************************
                00170 ;
                00180 ;SYSTEM EQUATES: * REFERS TO ADDRESSES WITHIN SCRIPSIT
                00190 ;
7CD1            00200 BUFFER  EQU     7CD1H   ;*DISK I/O BUFFER
6BE9            00210 CCMDL   EQU     6BE9H   ;*CLEAR CMD LINE ROUTINE
6708            00220 CHKPRM  EQU     6708H   ;*CHECK PARAMETER(S) ROUTINE
4428            00230 CLOSE   EQU     4428H   ;CLOSE DISK FILE OPSYS ROUTINE
58F0            00240 CMDSCH  EQU     58F0H   ;*COMMAND SEARCH ROUTINE
6C4C            00250 CONV    EQU     6C4CH   ;*ASCII DECIMAL TO HEX ROUTINE
54FB            00260 CURLFT  EQU     54FBH   ;*CURSOR LEFT ROUTINE
5518            00270 CURRHT  EQU     5518H   ;*CURSOR RIGHT ROUTINE
5E25            00280 DREAD   EQU     5E25H   ;*READ DISK RECORD
7697            00290 FENUM   EQU     7697H   ;*FIND END OF NUMERIC STR ROUTINE
6F76            00300 ILLCMD  EQU     6F76H   ;*ILLEGAL CMD OUTPUT ROUTINE
5FCC            00310 KEYIN   EQU     5FCCH   ;*WAIT FOR KEY INPUT
4430            00320 LOAD    EQU     4430H   ;LOAD CMD FILE OPSYS ROUTINE
4467            00330 LOUT    EQU     4467H   ;STRING OUT OPSYS ROUTINE
54B9            00340 MCURD   EQU     54B9H   ;*MOVE CURSOR DOWN ROUTINE
552D            00350 MCURUP  EQU     552DH   ;*MOVE CURSOR UP ROUTINE
5E1F            00360 OPEN    EQU     5E1FH   ;*OPEN DISK FILE
6BC8            00370 OPCMDL  EQU     6BC8H   ;*OUTPUT MSG ON CMD LINE
402D            00380 OPSYS   EQU     402DH   ;REENTRY OPSYS ROUTINE
441C            00390 PARSE   EQU     441CH   ;PARSE FILESPEC OPSYS ROUTINE
6F8B            00400 RECOV   EQU     6F8BH   ;*CMD RECOVERY ROUTINE
75C2            00410 SKIPBC  EQU     75C2H   ;*SKIP BLANK AND COMMA ROUTINE
5463            00420 WINDWN  EQU     5463H   ;*WINDOW DOWN ROUTINE
5411            00430 WINDUP  EQU     5411H   ;*WINDOW UP ROUTINE
                00440 ;
                00450 ;**********
                00460 ;THIS CODE IS PLACED IN SCRIPSIT'S UNUSED MEMORY AREA
                00470 ;**********
                00480 ;
7AA5            00490         ORG     07AA5H
                00500 ;
                00510 ;SYSTEM STORAGE AREA
                00520 ;
0002            00530 DIRPTR  DEFS    2               ;DIRECTORY DISPLAY PTR
7AA7 00         00540 UNDFLG  DEFB    0               ;UNDERLINE FLAG
7AA8 0E         00550 UNDOFF  DEFB    14              ;TURN UNDERLINE OFF
7AA9 0F         00560 UNDON   DEFB    15              ;TURN UNDERLINE ON
0002            00570 VDVR    DEFS    2               ;VIDEO DVR TEMP STORAGE
                00580 ;
                00590 ;ADDITION TO THE MAIN CMD LOOKUP TABLE
                00600 ;
7AAC 04         00610 CMDTB1  DEFB    4               ;NEW CMDS
7AAD 02         00620         DEFB    2               ;CURSOR BACKWARD ROUTINE
7AAE 08         00630         DEFB    8               ;HOME CURSOR
7AAF 1F         00640         DEFB    1FH             ;ADV TO START OF NEXT WRD
7AB0 07         00650         DEFB    7               ;BACKUP TO END OF LAST WRD
7AB1 5180       00660         DEFW    RSKP
7AB3 3680       00670         DEFW    FSKP
7AB5 566E       00680         DEFW    6E56H
7AB7 F87F       00690         DEFW    CURDWN
                00700 ;
                00710 ;ADDITION TO THE BREAK CMD LOOKUP TABLE
                00720 ;
7AB9 04         00730 CMDTB2  DEFB    4               ;NEW CMDS
7ABA 4B         00740         DEFB    'K'             ;KILL DISK FILE
7ABB 4E         00750         DEFB    'N'             ;RESTART SCRIPSIT
7ABC 58         00760         DEFB    'X'             ;EXECUTE PRINTER INIT
7ABD 51         00770         DEFB    'Q'             ;QUERY DISK
7ABE 4781       00780         DEFW    QUERY
7AC0 0281       00790         DEFW    PRTINT
7AC2 0052       00800         DEFW    5200H
7AC4 7E80       00810         DEFW    KILL
```

Program Listing 1 Continues

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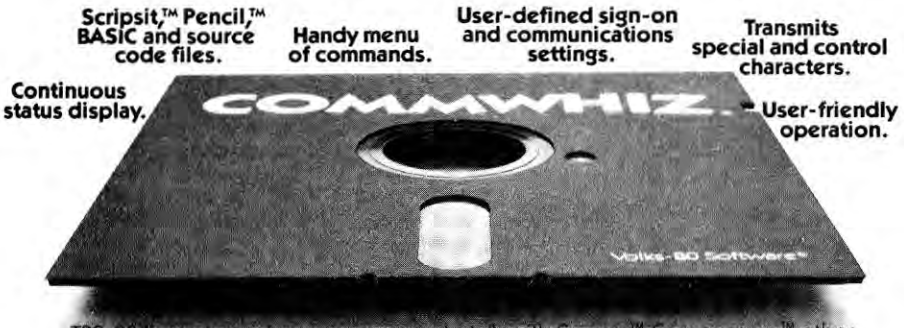

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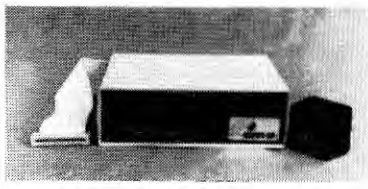

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Program Listing 1 Continued

```
                00820 ;
                00830 ;DISK DISK CONTROL BLOCK STORAGE (DCB)
                00840 ;
7AC6 53         00850 LCP       DEFM    'SCRIPSIT/LC'   ;FILESPECS
7AD1 03         00860           DEFB    3               ;FOR UPPER
7AD2 53         00870 UCP       DEFM    'SCRIPSIT/UC'   ;AND
7ADD 03         00880           DEFB    3               ;LOWER CASE
                00890 ;
0020            00900 KDCB      DEFS    32              ;KILL FILE DCB
                00910 ;
                00920 ;DCB FOR DIRECTORY READ
                00930 ;
7AFE 8020       00940 DIRDCB    DEFW    2080H           ;SHOW FILE OPEN
7B00 00         00950           DEFB    0
7B01 D17C       00960           DEFW    BUFFER          ;PHYSICAL BUFFER
7B03 00         00970           DEFB    0
7B04 0010       00980           DEFW    1000H           ;DEC OF FILE IN 1ST ENTRY
7B06 0000       00990           DEFW    0               ;LRL & EOF OFFSET TO 0
7B08 0000       01000           DEFW    0               ;INIT NRN TO 0
7B0A FFFF       01010           DEFW    0FFFFH          ;ENDING RECORD NUMBER
7B0C 001F       01020           DEFW    1F00H
7B0E 2000       01030           DEFW    20H
7B10 101F       01040           DEFW    1F10H
7B12 4000       01050           DEFW    40H
7B14 201F       01060           DEFW    1F20H
7B16 6000       01070           DEFW    60H
7B18 301F       01080           DEFW    1F30H
7B1A 8000       01090           DEFW    80H
7B1C 401F       01100           DEFW    1F40H
                01110 ;
                01120 ;POWER OF TENS LOOKUP TABLE
                01130 ;
7B1E F0D8       01140 TENTBL    DEFW    -10000
7B20 18FC       01150           DEFW    -1000
7B22 9CFF       01160           DEFW    -100
7B24 F6FF       01170           DEFW    -10
7B26 FFFF       01180           DEFW    -1
                01190 ;
                01200 ;UNDERLINE ON/OFF ROUTINE
                01210 ;
7B28 E5         01220 UNDRLN    PUSH    HL              ;SAVE REG
7B29 FE40       01230           CP      40H             ;@ ?
7B2B 2015       01240           JR      NZ,UN2          ;IF NOT THEN
7B2D 21A77A     01250           LD      HL,UNDFLG       ;GET UNDERLINE FLAG
7B30 CB46       01260           BIT     0,(HL)          ;IS FUNCTION ON ?
7B32 2008       01270           JR      Z,UN1           ;IF NOT THEN
7B34 CB86       01280           RES     0,(HL)          ;IF ON - TURN OFF
7B36 21A87A     01290           LD      HL,UNDOFF       ;PT AT UNDERLINE OFF CODE
7B39 7E         01300           LD      A,(HL)          ;GET FUNCTION CHAR
7B3A 1806       01310           JR      UN2
7B3C CBC6       01320 UN1       SET     0,(HL)          ;IF OFF - TURN ON
7B3E 21A97A     01330           LD      HL,UNDON        ;PT AT UNDERLINE ON CODE
7B41 7E         01340           LD      A,(HL)          ;GET FUNCTION CHAR
7B42 32E837     01350 UN2       LD      (37E8H),A       ;OUTPUT NORMAL CHAR TO
                01360                                   ;THE LINE PRINTER
7B45 E1         01370           POP     HL              ;RESTORE REG
7B46 C3745F     01380           JP      5F74H           ;BACK TO SCRIPSIT
                01390 ;
                01400 ;**********
                01410 ;START OF THE MAIN PROGRAM
                01420 ;**********
                01430 ;
7B49 211A43     01440 START     LD      HL,431AH        ;3RD POS CMD INPUT BUF
7B4C 3E0D       01450           LD      A,13            ;CR ?
7B4E BE         01460           CP      (HL)
7B4F CA2D40     01470           JP      Z,OPSYS         ;IF YES ERROR
7B52 D7         01480           RST     10H             ;FIND 1ST NON BLANK CHAR
7B53 E5         01490           PUSH    HL              ;SAVE CHAR POS
7B54 FE55       01500           CP      'U'             ;SELECT UPPER CASE ?
7B56 2005       01510           JR      NZ,ST1          ;IF NOT THEN
7B58 11D27A     01520           LD      DE,UCP          ;LOAD UPPER CASE PROGRAM
7B5B 1803       01530           JR      ST2
7B5D 11C67A     01540 ST1       LD      DE,LCP          ;LOAD LOWER CASE PROGRAM
7B60 CD3044     01550 ST2       CALL    LOAD            ;LOAD FILE
7B63 C22D40     01560           JP      NZ,OPSYS        ;IF ERROR THEN
7B66 CD2844     01570           CALL    CLOSE           ;CLOSE DISK FILE
7B69 F3         01580           DI                      ;INTERRUPTS OFF
                01590 ;
                01600 ;**********
                01610 ;PERFORM SCRIPSIT PATCHING HERE
                01620 ;**********
                01630 ;
                01640 ;INSERTION POINT #1 - PATCH FOR MODEL III OPERATION
                01650 ;         CALL    MODIII
                01660 ;
                01670 ;CHANGE LOCATION OF TXTBUF TO MAKE ROOM FOR PATCHES
                01680 ;
7B6A 214283     01690           LD      HL,TXTBUF
7B6D 227752     01700           LD      (5277H),HL
7B70 221654     01710           LD      (5416H),HL
7B73 223255     01720           LD      (5532H),HL
7B76 229359     01730           LD      (5993H),HL
7B79 22CB59     01740           LD      (59CBH),HL
7B7C 22B65D     01750           LD      (5DB6H),HL
7B7F 221663     01760           LD      (6316H),HL
7B82 225263     01770           LD      (6352H),HL
7B85 22DF66     01780           LD      (66DFH),HL
7B88 22B469     01790           LD      (69B4H),HL
7B8B 22256E     01800           LD      (6E25H),HL
7B8E 221A74     01810           LD      (741AH),HL
7B91 222874     01820           LD      (7428H),HL
                01830 ;
```

Program Listing 1 Continues

fill the unused memory area as completely as possible.

The second segment of the patch program contains the new video output messages and all routines that provide all the new functions. This second segment starts at the text buffer location of the original Scripsit program. For this reason, I moved the text buffer location to immediately after the end of this segment. The text buffer is shown in the listing as TXTBUF. The start of the text buffer is now at 8342H instead of the normal 7F62H.

Program Operation

Assemble the program shown in Listing 1 with the name WP/CMD. The program will work for either a 32K or 48K machine. The assembled program, along with a copy of Scripsit (either upper or lowercase) must be resident (but not necessarily on the same disk) in your system when you want to use your modified word processor. Now, instead of typing either Scripsit/UC or Scripsit/LC to execute Scripsit, type either WP L or WP U. This loads either the upper or lowercase version of Scripsit that you requested, makes the necessary patches, and then enters the word processor program. The default is the lowercase version of Scripsit so WP X loads the lowercase version unless X = U specifically. You must specify something. Typing just WP returns you to the operating system.

If you leave Scripsit with the End command and return to DOS, and while in DOS do not modify memory above 7C21H, you can reenter Scripsit with the text buffer still intact. This means that you can load and execute a small Basic program without disturbing your Scripsit document. To reenter Scripsit, just type an asterisk after the case specification in the file name as follows: WP U* or WP L*.

This program will check to see if reentry is possible, and if it is, moves you to the beginning of the file with all of the text still intact. If the program determines that memory above 7C21H has been disturbed, it will reinitialize Scripsit accordingly. If, after reentry, your document seems to be partially missing, the chances are good that important pointers in Scripsit have been disturbed. Under these conditions, use the New command to start your editing over. This will delete the text in the text buffer and reinitialize all of Scripsit's pointers. You will have to reload your document file to continue editing, but it is better to start over than risk a system crash somewhere down the line.

Model III Operation

You can operate the Model I Scripsit patch program on a Model III with a parallel printer by adding the code in Program Listing 2 to that of Listing 1. There are only three areas of the Scripsit program that need to be modified for Model III operation: final character output to the line printer, the polling of the shift keys, and the tape I/O routines. By incorporating the code in Listing 2 into the patch program, Scripsit

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can automatically be configured for use with the Model III computer at runtime.

Because the Model III uses a port to output characters to the line printer instead of a memory-mapped location as does the Model I, no printed output is available from the stock Model I Scripsit program when you run it on the Model III. To fix this problem, replace every occurrence of the instruction to send a character to the memory-mapped location 37E8H for printed output with a call to a routine that contains the output port instruction.

Replace LD (37E8H),A with OUT (0F8H),A. This occurs five times in the unmodified Scripsit program and two additional times in the patch program. All seven of these occurrences must be changed. The first portion of the code shown in Listing 2 performs these patches.

The shift keys are handled differently on a Model III than on a Model I. This difference makes one of them incompatible with the Model I Scripsit program. By replacing the code that polls the shift keys in the Scripsit program with the Shift routine shown in Listing 2, both shift keys on the Model III can be made to work just as they do on the Model I machine.

The tape routines contained in the Model I Scripsit program are not compatible with the Model III computer. For this reason, they will be replaced with calls to the Model III ROM to make the tape I/O work. If you use only disk I/O, you needn't worry about this fix. The patches for fixing the tape I/O are shown in the last portion of Listing 2.

Installing these Model III patches into Program Listing 1 is a simple task. First, add the code of Listing 2 at the end of Listing 1, immediately before the TXTBUF label (insertion point 2). Second, make a call to this code as shown at insertion point 1 in Listing 1. This will patch both the patch program and the Scripsit program and then return to the initialization portion of the patch program. Third, run the Convert program on both the patch program and the Scripsit program. You should now be able to execute your enhanced Scripsit program on your Model III computer as explained in the preceding section.

After the patch program executes Scripsit, proceed as usual with your word processing. All the commands are exactly the same except those previously noted in this article. With the additional features now available through this patch program, your word processing should be easier than ever.

The structure of the patch program makes adding more new commands simple. Just use the information presented in the first article, decide exactly what the new commands should do, investigate the portions of Scripsit that will be involved with these modifications, assemble the changes into the code of Listing 1, and then test and debug the result. ■

Craig Lindley is self-employed with Clockwork Software. He enjoys playing the guitar and backpacking.

Program Listing 1 Continued

```
                01840 ;INSERT LONG JUMP CODE FOR PATCH INSERTION INTO SCRIPSIT
                01850 ;
7B94 3EC3       01860           LD      A,0C3H          ;LONG JMP CODE
7B96 325561     01870           LD      (6155H),A       ;PATCH KEYBOARD ROUTINE
7B99 329E7A     01880           LD      (7A9EH),A       ;UNDERLINE ROUTINE
7B9C 32AF5F     01890           LD      (5FAFH),A       ;VIDEO UNDERSCORE
7B9F 32A273     01900           LD      (73A2H),A       ;PRINTER PAUSE
7BA2 32165E     01910           LD      (5E16H),A       ;NEW/UPDATED FILE MSG
                01920 ;
                01930 ;STORE PATCH ROUTINE ADDRESSES IN SCRIPSIT
                01940 ;
7BA5 216C80     01950           LD      HL,KEYMOD
7BA8 225661     01960           LD      (6156H),HL
7BAB 21287B     01970           LD      HL,UNDRLN
7BAE 229F7A     01980           LD      (7A9FH),HL
7BB1 21F480     01990           LD      HL,UNDERL
7BB4 22B05F     02000           LD      (5FB0H),HL
7BB7 21C780     02010           LD      HL,LPWAIT
7BBA 22A373     02020           LD      (73A3H),HL
7BBD 21E080     02030           LD      HL,NEWOLD       ;NEW OLD FILE ROUTINE
7BC0 22175E     02040           LD      (5E17H),HL
7BC3 21B080     02050           LD      HL,LKUP1        ;PATCH MAIN CMD TBL
7BC6 22F852     02060           LD      (52F8H),HL
7BC9 21BC80     02070           LD      HL,LKUP2        ;PATCH BRK CMD TBL
7BCC 226664     02080           LD      (6466H),HL
7BCF 21B982     02090           LD      HL,RETURN       ;PATCH END ROUTINE
7BD2 229565     02100           LD      (6595H),HL
7BD5 212580     02110           LD      HL,UPWSRL       ;UP WINDOW SCROLL ROUTINE
7BD8 22D979     02120           LD      (79D9H),HL
7BDB 210680     02130           LD      HL,DWSRL        ;DOWN WIND SCROLL ROUTINE
7BDE 22D779     02140           LD      (79D7H),HL
7BE1 211780     02150           LD      HL,CURUP        ;CURSOR UP ROUTINE
7BE4 22BF79     02160           LD      (79BFH),HL
                02170 ;
                02180 ;PATCH SCRIPSIT CMD TABLE TO ACCEPT @T FOR TAB INSTEAD
                02190 ;OF THE USUAL @ -> COMBINATION.
                02200 ;
7BE7 3E14       02210           LD      A,14H           ;@T PATCH
7BE9 32AA79     02220           LD      (79AAH),A
                02230 ;
                02240 ;OVERLAY SCRIPSIT SIGN ON MSG WITH A NEW ONE
                02250 ;
7BEC 21627F     02260           LD      HL,MSG1         ;PT AT NEW SIGN ON MSG
7BEF 11F757     02270           LD      DE,57F7H
7BF2 013300     02280           LD      BC,51
7BF5 EDB0       02290           LDIR                    ;MOVE INTO PLACE
                02300 ;
                02310 ;THIS ROUTINE CHECKS TO SEE IF REENTRY INTO SCRIPSIT IS
                02320 ;POSSIBLE. IF IT IS THEN CONTROL IS RETURNED TO SCRIPSIT
                02330 ;WITH THE TEXT BUFFER INTACT. IF TEXT BUFFER IS DAMAGED
                02340 ;SCRIPSIT WILL AUTOMATICALLY REINITIALIZE.
                02350 ;
7BF7 E1         02360           POP     HL              ;RESTORE CMD BUF PTR
7BF8 23         02370           INC     HL
7BF9 E5         02380           PUSH    HL
7BFA DDE1       02390           POP     IX
7BFC 3E2A       02400           LD      A,'*'           ;RESTART CHAR
7BFE BE         02410           CP      (HL)            ;RESTART ?
7BFF 2007       02420           JR      NZ,ST3          ;IF NOT THEN INITIALIZE
7C01 3A217C     02430           LD      A,(TSTBYT)      ;LOAD TEST BYTE
7C04 FE5A       02440           CP      5AH             ;IS IT OK ?
7C06 2808       02450           JR      Z,ST4           ;IF SO RESTART
7C08 3E5A       02460 ST3       LD      A,5AH           ;ELSE REINITIALIZE
7C0A 32217C     02470           LD      (TSTBYT),A      ;STORE TEST BYTE
7C0D C33F52     02480           JP      523FH
                02490 ;
7C10 F3         02500 ST4       DI
7C11 31FC41     02510           LD      SP,41FCH
7C14 21C052     02520           LD      HL,52C0H        ;COPY INTERNAL CONDITION
7C17 E5         02530           PUSH    HL              ;ON STACK
7C18 3E8B       02540           LD      A,8BH           ;BEG OF FILE CODE
7C1A DD360020   02550           LD      (IX),20H        ;CLEAR CMD BUF
7C1E C3DD52     02560           JP      52DDH           ;JUMP INSIDE SCRIPSIT
                02570 ;
7C21            02580 TSTBYT    EQU     $               ;REENTRY TEST BYTE
                02590 ;
                02600 ;**********
                02610 ;END OF CODE PLACED IN SCRIPSIT'S UNUSED MEMORY AREA
                02620 ;**********
                02630 ;
                02640 ;
                02650 ;**********
                02660 ;CODE FOR NEW SCRIPSIT FUNCTIONS - INTO OLD TEXT BUF AREA
                02670 ;**********
                02680 ;
7F62            02690           ORG     07F62H  ;PATCHES IN OLD TXTBUF AREA
                02700 ;
                02710 ;SYSTEM MESSAGES
                02720 ;
7F62 2A         02730 MSG1      DEFM    '** SCRIPSIT PATCH PROGRAM **
7F82 42         02740           DEFM    'BY CRAIG A. LINDLEY'
                02750 ;
7F95 13         02760 MSG2      DEFB    19
7F96 50         02770           DEFM    'PRINTER INITIALIZED'
                02780 ;
7FA9 09         02790 MSG3      DEFB    9
7FAA 4E         02800           DEFM    'NEW FILE!'
                02810 ;
7FB3 0D         02820 MSG4      DEFB    13
7FB4 46         02830           DEFM    'FILE UPDATED!'
                02840 ;
```

Program Listing 1 Continues

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Program Listing 1 Continued

```
7FC1 46       02850 MSG5    DEFM    'FREE GRANS - DIRECTORY - DRIVE X'
7FE1 20       02860         DEFM    ' - FILENAME - DATEXXXX'
7FF7 0D       02870         DEFB    13
              02880 ;
              02890 ;**********
              02900 ;ADDED SCRIPSIT FUNCTION ROUTINES
              02910 ;**********
              02920 ;
              02930 ;THIS COMMAND MOVES THE CURSOR DOWNWARD THROUGH THE FILE
              02940 ;
7FF8 3E0D     02950 CURDWN  LD      A,13            ;13 LINES
7FFA F5       02960 CURD1   PUSH    AF              ;SAVE COUNT
7FFB CDB954   02970         CALL    MCURD           ;MOVE CURSOR DOWN ROUTINE
7FFE CDF382   02980         CALL    FIXPTR          ;FINISH PTR UPDATE
8001 F1       02990         POP     AF
8002 3D       03000         DEC     A
8003 20F5     03010         JR      NZ,CURD1        ;LOOP FOR ALL 13
8005 C9       03020         RET
              03030 ;
              03040 ;THIS COMMAND CAUSE THE SCREEN TO SCROLL DOWNWARD THROUGH
              03050 ;THE FILE USING THE WINDOW FUNCTION.
              03060 ;
8006 3E0D     03070 DWSRL   LD      A,13            ;13 LINES
8008 F5       03080 DWNW1   PUSH    AF              ;SAVE COUNT
8009 CD6354   03090         CALL    WINDWN          ;WINDOW DOWN ROUTINE
800C FD710E   03100         LD      (IY+0EH),C      ;HOUSE KEEPING
800F CDF382   03110         CALL    FIXPTR          ;FINISH PTR UPDATE
8012 F1       03120         POP     AF              ;GET COUNT
8013 3D       03130         DEC     A
8014 20F2     03140         JR      NZ,DWNW1        ;LOOP FOR ALL 13
8016 C9       03150         RET
              03160 ;
              03170 ;THIS ROUTINE MOVES THE CURSOR UPWARD THROUGH THE FILE.
              03180 ;
8017 3E0D     03190 CURUP   LD      A,13            ;13 LINES
8019 F5       03200 CURU1   PUSH    AF              ;SAVE COUNT
801A CD2D55   03210         CALL    MCURUP          ;MOVE CURSOR UP ROUTINE
801D CDF382   03220         CALL    FIXPTR          ;FINISH PTR UPDATE
8020 F1       03230         POP     AF
8021 3D       03240         DEC     A
8022 20F5     03250         JR      NZ,CURU1        ;LOOP FOR ALL 13
8024 C9       03260         RET
              03270 ;
              03280 ;THIS ROUTINE CAUSES THE SCREEN TO SCROLL UPWARD THROUGH
              03290 ;THE FILE USING THE WINDOW FUNCTION
              03300 ;
8025 3E0D     03310 UPWSRL  LD      A,13            ;13 LINES
8027 F5       03320 UPWS1   PUSH    AF              ;SAVE COUNT
8028 CD1154   03330         CALL    WINDUP          ;WINDOW UP ROUTINE
802B FD710E   03340         LD      (IY+0EH),C      ;HOUSE KEEPING
802E CDF382   03350         CALL    FIXPTR          ;FINISH PTR UPDATE
8031 F1       03360         POP     AF              ;GET COUNT
8032 3D       03370         DEC     A
8033 20F2     03380         JR      NZ,UPWS1        ;LOOP FOR ALL 13
8035 C9       03390         RET
              03400 ;
              03410 ;THIS ROUTINE SKIPS THE CURSOR FORWARD TO THE START OF
              03420 ;THE NEXT WORD EVERYTIME THE @ -> KEYS ARE PRESSED.
              03430 ;
8036 1A       03440 FSKP    LD      A,(DE)          ;GET TXTBUF CHAR
8037 FE20     03450         CP      20H             ;LOOP UNTIL SP CODE FOUND
8039 2809     03460         JR      Z,W1
803B CD1855   03470         CALL    CURRHT          ;MOVE CURSOR RIGHT
803E CDF382   03480         CALL    FIXPTR          ;FINISH PTR UPDATE
8041 C8       03490         RET     Z               ;IF EOF THEN
8042 18F2     03500         JR      FSKP
8044 CD1855   03510 W1        CALL    CURRHT          ;LOOP UNTIL NON SP FOUND
8047 CDF382   03520         CALL    FIXPTR          ;FINISH PTR UPDATE
804A C8       03530         RET     Z               ;IF EOF THEN
804B 1A       03540         LD      A,(DE)
804C FE20     03550         CP      20H
804E C0       03560         RET     NZ
804F 18F3     03570         JR      W1
              03580 ;
              03590 ;THIS ROUTINE SKIPS THE CURSOR BACK TO THE END OF THE
              03600 ;PREVIOUS WORD EVERY TIME THE @ <- KEYS ARE PRESSED.
              03610 ;
8051 1A       03620 RSKP    LD      A,(DE)          ;GET TXTBUF CHAR
8052 FE20     03630         CP      20H             ;LOOP UNTIL SP CODE FOUND
8054 2809     03640         JR      Z,W2
8056 CDFB54   03650         CALL    CURLFT          ;MOVE CURSOR LEFT
8059 CDF382   03660         CALL    FIXPTR          ;FINISH PTR UPDATE
805C D8       03670         RET     C               ;IF BEG OF FILE THEN
805D 18F2     03680         JR      RSKP
805F CDFB54   03690 W2        CALL    CURLFT          ;LOOP UNTIL NON SP FOUND
8062 CDF382   03700         CALL    FIXPTR          ;FINISH PTR UPDATE
8065 D8       03710         RET     C               ;IF BEG OF FILE THEN
8066 1A       03720         LD      A,(DE)
8067 FE20     03730         CP      20H
8069 C0       03740         RET     NZ
806A 18F3     03750         JR      W2
              03760 ;
              03770 ;THIS ROUTINE PATCHES THE KEY INPUT ROUTINE TO PROVIDE
              03780 ;UNIQUE CODES FOR THE @ -> (1FH) AND THE @ <- (07H)
              03790 ;KEY COMBINATIONS.
              03800 ;
806C FE9D     03810 KEYMOD  CP      9DH             ;` -> ?
806E 2005     03820         JR      NZ,KEY2         ;IF NOT THEN
8070 3E1F     03830         LD      A,1FH           ;NEW CODE
8072 C37961   03840 KEY1    JP      6179H
8075 FE9E     03850 KEY2    CP      9EH             ;@ <- ?
```

Program Listing 1 Continues

Program Listing 1 Continued

```
8077 C25D61    03860          JP      NZ,615DH
807A 3E07      03870          LD      A,7             ;NEW CODE
807C 18F4      03880          JR      KEY1
               03890 ;
               03900 ;THIS ROUTINE IS USED TO KILL A DISK FILE WHILE IN
               03910 ;SCRIPSIT.
               03920 ;
807E D5        03930 KILL     PUSH    DE              ;SAVE PTR
807F FD361220  03940          LD      (IY+12H),20H    ;SEARCH PARMS
8083 FD361320  03950          LD      (IY+13H),20H
8087 CD0867    03960          CALL    CHKPRM          ;FIND PARMS
808A 382D      03970          JR      C,CMDILL        ;IF NOT FOUND THEN
808C EB        03980          EX      DE,HL
808D CDC275    03990          CALL    SKIPBC          ;SKIP BLANKS AND COMMAS
8090 EB        04000          EX      DE,HL           ;"HL"-> FILENAME IF ANY
8091 D5        04010          PUSH    DE
8092 7E        04020          LD      A,(HL)          ;1ST CHAR OF BUFFER
8093 CDFF53    04030          CALL    53FFH           ;CR ?
8096 2821      04040          JR      Z,CMDILL
8098 11DE7A    04050          LD      DE,KDCB         ;DCB FOR FILE KILL
809B CD1C44    04060          CALL    PARSE           ;PARSE CMD, MOVE TO DCB
809E 0600      04070          LD      B,0             ;LRL=256
80A0 21D17C    04080          LD      HL,BUFFER       ;DISK I/O BUFFER
80A3 CD1F5E    04090          CALL    OPEN            ;OPEN FILE
80A6 CD2C44    04100          CALL    442CH           ;KILL FILE
80A9 C22F5E    04110          JP      NZ,5E2FH        ;IF ERROR THEN
80AC D1        04120          POP     DE              ;RESTORE PTR
80AD C38B6F    04130          JP      RECOV
               04140 ;
               04150 ;THIS ROUTINE EXTENDS THE SCOPE OF AVAILABLE CMDS FOR
               04160 ;THE MAIN SCRIPSIT CMD LOOKUP ROUTINE.
               04170 ;
80B0 3A3E7C    04180 LKUP1    LD      A,(7C3EH)       ;RESTORE CMD CHAR
80B3 21AC7A    04190          LD      HL,CMDTB1       ;NEW CMD LOOK UP TBL
80B6 CDF058    04200          CALL    CMDSCH          ;SEARCH FOR CMD
80B9 C3766F    04210 CMDILL   JP      ILLCMD          ;ILL CMD IF NOT FOUND
               04220 ;
               04230 ;THIS ROUTINE EXTENDS THE SCOPE OF AVAILABLE CMDS FOR
               04240 ;THE SCRIPSIT BREAK CMD LOOKUP ROUTINE.
               04250 ;
80BC 3A3A7C    04260 LKUP2    LD      A,(7C3AH)       ;RESTORE CMD CHAR
80BF 21B97A    04270          LD      HL,CMDTB2       ;NEW CMD TBL
80C2 CDF058    04280          CALL    CMDSCH          ;SEARCH FOR CMD
80C5 18F2      04290          JR      CMDILL          ;IF NOT FOUND THEN
               04300 ;
               04310 ;THIS ROUTINE IS USED TO PROVIDE A PAUSE FOR THE PRINTER
               04320 ;DURING THE OUTPUT OF A PRINTED DOCUMENT. IT IS EXECUTED
               04330 ;BY THE <SHIFT> P KEY COMBINATION.
               04340 ;
80C7 CD7771    04350 LPWAIT   CALL    7177H           ;PRINT LINE
80CA E5        04360          PUSH    HL
80CB C5        04370          PUSH    BC
80CC D5        04380          PUSH    DE
80CD CD6160    04390          CALL    6061H           ;SCAN KEYS
80D0 D1        04400          POP     DE
80D1 C1        04410          POP     BC
80D2 E1        04420          POP     HL
80D3 B7        04430          OR      A               ;TEST FOR 0
80D4 2807      04440          JR      Z,LP1           ;IF NO KEY THEN
80D6 FE50      04450          CP      'P'             ;LP WAIT ?
80D8 2003      04460          JR      NZ,LP1          ;IF NOT PAUSE CHAR
80DA CDD282    04470          CALL    CPWAIT          ;WAIT FOR KEY
80DD C3A573    04480 LP1      JP      73A5H           ;RETURN TO ROUTINE
               04490 ;
               04500 ;THIS ROUTINE DISPLAYS A NEW/UPDATED MSG WHEN WRITING
               04510 ;A FILE TO DISK.
               04520 ;
80E0 C22F5E    04530 NEWOLD   JP      NZ,5E2FH        ;IF DISK ERROR THEN
80E3 3005      04540          JR      NC,NEW1         ;IF OLD FILE THEN
80E5 21A97F    04550          LD      HL,MSG3         ;NEW FILE MSG
80E8 1803      04560          JR      NEW2
80EA 21B37F    04570 NEW1     LD      HL,MSG4         ;UPDATED MSG
80ED CDE96B    04580 NEW2     CALL    CCMDL           ;CLEAR CMD LINE
80F0 CDC86B    04590          CALL    OPCMDL          ;OUTPUT MSG ON CMD LINE
80F3 C9        04600          RET
               04610 ;
               04620 ;THIS ROUTINE CHECKS EACH VIDEO OUTPUT CHAR TO SEE IF
               04630 ;IT IS AN @ CHAR. IF IT IS THE VIDEO IS SENT AN
               04640 ;UNDERSCORE CHAR INSTEAD.
               04650 ;
80F4 FE40      04660 UNDERL   CP      40H             ;@ CHAR ?
80F6 2004      04670          JR      NZ,VU1          ;IF NOT THEN
80F8 2B        04680          DEC     HL              ;BACK UP CURSOR
80F9 365F      04690          LD      (HL),5FH        ;REPLACE CHAR
80FB 23        04700          INC     HL
80FC FD3406    04710 VU1      INC     (IY+6)
80FF C3B25F    04720          JP      5FB2H
               04730 ;
               04740 ;THIS ROUTINE OUTPUTS A SERIES OF CONTROL CODES TO THE
               04750 ;LINE PRINTER FOR INITIALIZATION. tHESE CODES MUST BE
               04760 ;IN THE RANGE 1-31 DECIMAL.
               04770 ;
8102 D5        04780 PRTINT   PUSH    DE              ;SAVE REGS
8103 C5        04790          PUSH    BC
8104 FD36123D  04800          LD      (IY+12H),3DH    ;PARMS TO CHK
8108 FD36133D  04810          LD      (IY+13H),3DH
810C CD0867    04820          CALL    CHKPRM          ;CHECK FOR =
810F 382E      04830          JR      C,EXIT          ;IF NOT FOUND ABORT
8111 EB        04840          EX      DE,HL           ;"DE" -> NUM POS
8112 1A        04850          LD      A,(DE)          ;GET BYTE
8113 FE1E      04860          CP      1EH             ;CR ?
8115 2828      04870          JR      Z,EXIT          ;IF YES ABORT
```

Program Listing 1 Continues

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Program Listing 1 Continued

```
8117 21957F   04880          LD      HL,MSG2         ;LP MSG
811A CDC86B   04890          CALL    OPCMDL          ;OUTPUT ON CMD LINE
811D CDC275   04900 PRTCMD   CALL    SKIPBC          ;SKIP BLANKS AND COMMAS
8120 1A       04910          LD      A,(DE)          ;GET NEXT CHAR
8121 FE1E     04920          CP      1EH             ;DONE WITH LIST ?
8123 281A     04930          JR      Z,EXIT          ;IF YES THEN
8125 EB       04940          EX      DE,HL
8126 B7       04950          OR      A               ;CLEAR FLAGS
8127 E5       04960          PUSH    HL              ;SAVE POS OF NUM START
8128 CD4C6C   04970          CALL    CONV            ;CONVERT ASCII DEC TO HEX
812B 7C       04980          LD      A,H             ;MSW OF CONVERTED NUMBER
812C B7       04990          OR      A               ;A ZERO ?
812D C2766F   05000          JP      NZ,ILLCMD       ;IF NOT TOO BIG
8130 7D       05010          LD      A,L             ;LSW OF CONVERTED NUMBER
8131 FE20     05020          CP      20H             ;NUM LESS THAN 32 ?
8133 D2766F   05030          JP      NC,ILLCMD       ;IF NOT THEN ERROR
8136 32E837   05040 PRTC1    LD      (37E8H),A       ;ELSE OUTPUT TO PRINTER
8139 D1       05050          POP     DE              ;RESTORE NUM START
813A CD9776   05060          CALL    FENUM           ;FIND END OF NUMBER
813D 18DE     05070          JR      PRTCMD          ;PROCESS ALL OF LIST
813F C1       05080 EXIT     POP     BC              ;RESTORE REGS
8140 D1       05090          POP     DE
8141 C9       05100          RET
              05110 ;
              05120 ;THIS ROUTINE PROVIDES A DIRECTORY OF ANY DISK WHILE
              05130 ;IN SCRIPSIT. THE CURSOR IS RETURNED TO THE EXACT PLACE
              05140 ;WHERE THE EDITING LEFT OFF.
              05150 ;
8142 3E08     05160 NODRV    LD      A,8
8144 C32F5E   05170 DIRERR   JP      5E2FH           ;REPORT ERROR
              05180 ;
8147 D5       05190 QUERY    PUSH    DE
8148 11D37D   05200          LD      DE,7DD3H        ;POINT AT BRK BUF
814B 1A       05210          LD      A,(DE)          ;GET CHAR AFTER Q
814C FE1E     05220          CP      1EH             ;CR ?
814E 2004     05230          JR      NZ,Q1           ;IF NOT THEN
8150 3E30     05240          LD      A,'0'           ;LOAD DRIVE 0 CODE
8152 18DE     05250          JR      Q2
8154 CDC275   05260 Q1       CALL    SKIPBC          ;SKIP BLANKS AND COMMAS
8157 1A       05270          LD      A,(DE)          ;GET CHAR
8158 FE30     05280          CP      '0'             ;RANGE CHECK CHAR
815A DA766F   05290          JP      C,ILLCMD
815D FE34     05300          CP      '4'
815F D2766F   05310          JP      NC,ILLCMD
              05320 ;
8162 32E07F   05330 Q2       LD      (MSG5+31),A     ;PUT DRIVE # IN DIR MSG
8165 D630     05340          SUB     30H             ;CVRT TO BINARY
8167 32047B   05350          LD      (DIRDCB+6),A    ;STUFF DRIVE -> DCB
816A 07       05360          RLCA
816B 07       05370          RLCA
816C 07       05380          RLCA
816D F6C7     05390          OR      0C7H
816F 327481   05400          LD      (SETDRV+1),A
8172 AF       05410          XOR     A
8173 CBC7     05420 SETDRV   SET     0,A
8175 32B482   05430          LD      (SELDRV+1),A
8178 CDB382   05440          CALL    SELDRV
817B 010000   05450          LD      BC,0
817E CD6000   05460          CALL    60H             ;WAIT FOR RESTORE
8181 CDA182   05470          CALL    RESTOR          ;SEEK TRK 0
8184 3AEC37   05480 TSTBSY   LD      A,(37ECH)
8187 CB47     05490          BIT     0,A             ;DRIVE BUSY ?
8189 20F9     05500          JR      NZ,TSTBSY
818B CB7F     05510          BIT     7,A             ;DRV NOT RDY ?
818D 20B3     05520          JR      NZ,NODRV
818F CB57     05530          BIT     2,A             ;NO TRK 0 ?
8191 28AF     05540          JR      Z,NODRV
8193 01CD00   05550          LD      BC,205          ;TEST FOR DISK IN DRIVE
8196 0B       05560 TST1     DEC     BC              ;INDEX OFF FIRST
8197 78       05570          LD      A,B
8198 B1       05580          OR      C               ;TIME RUN OUT ?
8199 28A7     05590          JR      Z,NODRV
819B 3AEC37   05600          LD      A,(37ECH)
819E CB4F     05610          BIT     1,A
81A0 20F4     05620          JR      NZ,TST1
81A2 019D19   05630          LD      BC,6557         ;DISK TURNING ?
81A5 0B       05640 TST2     DEC     BC              ;MUST SEE INDEX BEFORE
81A6 78       05650          LD      A,B             ;LOOP TIMES OUT
81A7 B1       05660          OR      C
81A8 2898     05670          JR      Z,NODRV
81AA 3AEC37   05680          LD      A,(37ECH)
81AD CB4F     05690          BIT     1,A             ;INDE  ?
81AF 28F4     05700          JR      Z,TST2
81B1 CDBF82   05710          CALL    CLRSCN          ;CLEAR SCREEN
              05720 ;
81B4 110000   05730          LD      DE,0            ;READ BOOT TRK
81B7 ED53087B 05740          LD      (DIRDCB+10),DE  ;INFO INTO DCB
81BB 21D17C   05750          LD      HL,BUFFER       ;DISK I/O BUF
81BE E5       05760          PUSH    HL
81BF CD4182   05770          CALL    RDSCTR
81C2 11AA00   05780          LD      DE,170          ;DIR GAT SECTOR
81C5 D5       05790          PUSH    DE
81C6 E5       05800          PUSH    HL              ;SAVE BUF ADDR
81C7 ED53087B 05810          LD      (DIRDCB+10),DE
81CB CD4182   05820          CALL    RDSCTR          ;GET GAT SECTOR
81CE E1       05830          POP     HL
81CF AF       05840          XOR     A
81D0 4F       05850          LD      C,A             ;ZERO GAT COUNTER
81D1 0660     05860          LD      B,96            ;96 TRKS TOTAL ALL DRIVES
81D3 7E       05870 GATLP1   LD      A,(HL)          ;GET GRAN STATUS
81D4 2F       05880          CPL                     ;COMPLIMENT FOR FREE
```

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```
81D5 1F       05890          RRA                    ;SET CARRY IF 1 OR 3
81D6 89       05900          ADC     A,C            ;INC C BY 1 OR 2
81D7 4F       05910          LD      C,A
81D8 23       05920          INC     HL             ;GET TO NEXT TRACK STATUS
81D9 10F8     05930          DJNZ    GATLP1         ;loop until thru
              05940 ;
81DB 2A1E40   05950          LD      HL,(401EH)     ;GET VIDEO DVR ADDR
81DE 22AA7A   05960          LD      (VDVR),HL
81E1 215E5E   05970          LD      HL,5E5EH       ;REPLACEMENT DVR
81E4 221E40   05980          LD      (401EH),HL
81E7 69       05990          LD      L,C
81E8 2600     06000          LD      H,0
81EA CD0383   06010          CALL    WRLNO          ;WRITE # OF FREE GRANS
81ED 21A17D   06020          LD      HL,BUFFER+0D0H
81F0 11E47F   06030          LD      DE,MSG5+35     ;INSERT FILENAME & DATE
81F3 010800   06040          LD      BC,8
81F6 C5       06050          PUSH    BC
81F7 EDB0     06060          LDIR                   ;MOVE IN DISKNAME
81F9 13       06070          INC     DE
81FA 13       06080          INC     DE
81FB 13       06090          INC     DE
81FC C1       06100          POP     BC             ;MOVE IN DATE
81FD EDB0     06110          LDIR
81FF 21C17F   06120          LD      HL,MSG5
8202 CD6744   06130          CALL    LOUT           ;OUTPUT DIRECTORY HEADER
8205 CD2783   06140          CALL    WRRET
8208 CD2783   06150          CALL    WRRET
820B D1       06160          POP     DE             ;RECOVER SECTOR #
820C 13       06170          INC     DE             ;POINT TO SECTOR 2
820D 13       06180          INC     DE
820E ED53A57A 06190          LD      (DIRPTR),DE
8212 ED53087B 06200          LD      (DIRDCB+10),DE
8216 E1       06210          POP     HL             ;RECOVER BUFFER PTR
8217 0608     06220          LD      B,8
8219 160B     06230          LD      D,11           ;INIT FOR 12 DISPLY LINES
821B C5       06240 SCTRLP   PUSH    BC
821C D5       06250          PUSH    DE             ;SAVE SCREEN COUNTER
821D CD4182   06260          CALL    RDSCTR         ;GET NEXT SECTOR
8220 ED5BA57A 06270          LD      DE,(DIRPTR)
8224 13       06280          INC     DE
8225 ED53A57A 06290          LD      (DIRPTR),DE
8229 ED53087B 06300          LD      (DIRDCB+10),DE ;INC NRN BY ONE
822D D1       06310          POP     DE
822E CD4782   06320          CALL    PRTDIR         ;OUTPUT ANY VISIBLE DEC'S
8231 C1       06330          POP     BC
8232 10E7     06340          DJNZ    SCTRLP
8234 CDD282   06350          CALL    CPWAIT         ;OUTPUT WAIT MSG
8237 2AAA7A   06360          LD      HL,(VDVR)      ;RECOVER VIDEO DVR
823A 221E40   06370          LD      (401EH),HL
823D D1       06380          POP     DE
823E C38B6F   06390          JP      RECOV
              06400 ;
8241 11FE7A   06410 RDSCTR   LD      DE,DIRDCB
8244 C33644   06420          JP      4436H          ;READ DISK SECTOR
              06430 ;
8247 E5       06440 PRTDIR   PUSH    HL             ;SAVE PTR TO BUFFER
8248 0608     06450          LD      B,8            ;INIT FOR 8 DECS/SECTOR
824A C5       06460 PRTLP1   PUSH    BC             ;SAVE COUNTER
824B E5       06470          PUSH    HL             ;SAVE BUF PTR
824C 7E       06480          LD      A,(HL)         ;BYPASS DEC IF SPARE
824D 07       06490          RLCA
824E 3844     06500          JR      C,ENDLP
8250 07       06510          RLCA
8251 3841     06520          JR      C,ENDLP
8253 07       06530          RLCA
8254 07       06540          RLCA
8255 303D     06550          JR      NC,ENDLP
8257 7D       06560          LD      A,L            ;PT TO FILENAME
8258 C605     06570          ADD     A,5
825A 3001     06580          JR      NC,PRT1        ;IF NO CARRY
825C 23       06590          INC     HL             ;ELSE BUMP PTR
825D 6F       06600 PRT1     LD      L,A
825E 0E08     06610          LD      C,8            ;INIT FOR 8 BYTES
8260 7E       06620 PRTLP2   LD      A,(HL)
8261 FE20     06630          CP      ' '
8263 C4FD82   06640          CALL    NZ,WRCHR
8266 23       06650          INC     HL
8267 0D       06660          DEC     C
8268 20F6     06670          JR      NZ,PRTLP2
826A 0E03     06680          LD      C.3            ;INIT FOR EXT
826C 7E       06690          LD      A,(HL)
826D FE20     06700          CP      ' '            ;BYPASS IF NO EXT
826F 280F     06710          JR      Z,PRTLP4
8271 3E2F     06720          LD      A,'/'          ;WRITE A "/"
8273 CDFD82   06730          CALL    WRCHR
8276 7E       06740 PRTLP3   LD      A,(HL)         ;REGET CHAR
8277 FE20     06750          CP      ' '
8279 C4FD82   06760          CALL    NZ,WRCHR       ;WRITE IT IF NON-BLANK
827C 23       06770          INC     HL
827D 0D       06780          DEC     C
827E 20F6     06790          JR      NZ,PRTLP3
8280 15       06800 PRTLP4   DEC     D              ;DEC LINES/SCREEN
8281 200E     06810          JR      NZ,DORET
8283 CDD282   06820          CALL    CPWAIT         ;OUTPUT WAIT MSG
8286 CDBF82   06830          CALL    CLRSCN         ;CLEAR SCREEN
8289 21CE7F   06840          LD      HL,MSG5+13
828C CD6744   06850          CALL    LOUT           ;DISPLAY
828F 160D     06860          LD      D,13           ;REINIT TO 12
8291 CD2783   06870 DORET    CALL    WRRET
8294 E1       06880 ENDLP    POP     HL
8295 7D       06890          LD      A,L            ;PT TO NEXT DEC
8296 C620     06900          ADD     A,32
```

Program Listing 1 Continues

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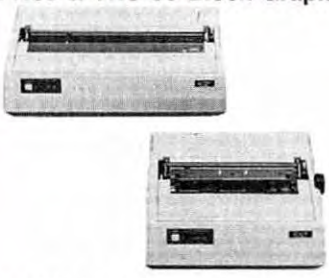

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the name of the disk
the name of a program
the name of a business file
any extension such as a date, CMD ↙310

Other special features include easy updating. Where some software houses have protected their disks to make them unreadable, File Force will let you assign a disk name and enter those program names. It will also create a master printout of all business files and records on your disks for safe keeping and better management of your resources.

System Requirements: TRS-80 Model I, 48K, One Disk Drive, TRS-DOS Version 2.3. $19.95. Please add $2 for handling and postage. $5 overseas. For your convenience you may phone in VISA or M/C orders.

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Program Listing 1 Continued

```
8298 3001     06910          JR      NC,END1          ;IF NOT CARRY
829A 24       06920          INC     H                ;IF CARRY
829B 6F       06930 END1     LD      L,A
829C C1       06940          POP     BC
829D 10AB     06950          DJNZ    PRTLP1
829F E1       06960          POP     HL
82A0 C9       06970          RET
              06980 ;
82A1 CDB382   06990 RESTOR   CALL    SELDRV
82A4 3E03     07000          LD      A,3
82A6 32EC37   07010          LD      (37ECH),A        ;RESTORE
82A9 CDB382   07020 RES1     CALL    SELDRV           ;SELECT DRIVE
82AC 3AEC37   07030          LD      A,(37ECH)
82AF 0F       07040          RRCA
82B0 D0       07050          RET     NC
82B1 18F6     07060          JR      RES1
              07070 ;
82B3 3E00     07080 SELDRV   LD      A,0
82B5 32E137   07090          LD      (37E1H),A
82B8 C9       07100          RET
              07110 ;
              07120 ;THIS ROUTINE MAKES SCRIPSIT EXIT TO DOS INSTEAD OF
              07130 ;REBOOTING EACH TIME.
              07140 ;
82B9 CDBF82   07150 RETURN   CALL    CLRSCN           ;CLEAR SCREEN
82BC C32D40   07160          JP      OPSYS            ;BACK TO DOS NOT REBOOT
              07170 ;
              07180 ;THESE ARE MISC SUBROUTINES USED IN THE SCRIPSIT MODS.
              07190 ;
              07200 ;CLEAR SCREEN ROUTINE
              07210 ;
82BF E5       07220 CLRSCN   PUSH    HL
82C0 3E20     07230          LD      A,20H            ;SPACE CODE
82C2 21003C   07240          LD      HL,3C00H         ;1ST DISPLAY ADDR
82C5 222040   07250          LD      (4020H),HL       ;INITIALIZE CURSOR
82C8 CB74     07260 CLR1     BIT     6,H              ;ALL SCREEN CLEARED ?
82CA 2004     07270          JR      NZ,CLR2          ;IF YES THEN
82CC 77       07280          LD      (HL),A
82CD 23       07290          INC     HL
82CE 18F8     07300          JR      CLR1
82D0 E1       07310 CLR2     POP     HL
82D1 C9       07320          RET
              07330 ;
              07340 ;WAIT FOR KEY PRESS ROUTINE
              07350 ;
82D2 E5       07360 CPWAIT   PUSH    HL
82D3 C5       07370          PUSH    BC
82D4 21803F   07380          LD      HL,3F80H
82D7 0640     07390          LD      B,40H
82D9 368C     07400 CP1      LD      (HL),8CH
82DB 23       07410          INC     HL
82DC 10FB     07420          DJNZ    CP1
82DE 218A6A   07430          LD      HL,6A8AH         ;WAIT MSG
82E1 CDC86B   07440          CALL    OPCMDL           ;DISPLAY ON CMD LINE
82E4 010080   07450          LD      BC,8000H         ;SELECT DELAY LENGTH
82E7 CD6000   07460          CALL    60H
82EA CDD25F   07470          CALL    5FD2H            ;GET KEY
82ED CDE96B   07480          CALL    CCMDL            ;CLEAR CMD LINE
82F0 C1       07490          POP     BC
82F1 E1       07500          POP     HL
82F2 C9       07510          RET
              07520 ;
              07530 ;THIS ROUTINE UPDATES THE CURRENT FILE POSITION AND
              07540 ;PLACES THE EOF CHAR (00) IN THE TEXT BUFFER. IT IS
              07550 ;USED AFTER EACH OF THE COMMANDS THAT ARE REPEATED
              07560 ;THAT DON'T USE THE NORMAL REPEAT MODE.
              07570 ;
82F3 ED53437C 07580 FIXPTR   LD      (7C43H),DE       ;UPDATE FILE PTR
82F7 2A2B7C   07590          LD      HL,(7C2BH)       ;PT AT EOF
82FA 3600     07600          LD      (HL),0           ;STORE EOF CHAR
82FC C9       07610          RET
              07620 ;
              07630 ;WRITES CHAR IN "A" ON SCREEN AT CURRENT CURSOR POSITION
              07640 ;
82FD D5       07650 WRCHR    PUSH    DE
82FE CD3300   07660          CALL    33H
8301 D1       07670          POP     DE
8302 C9       07680          RET
              07690 ;
              07700 ;CONVERTS # IN "HL" TO ASCII DECIMAL AND STORES IT
              07710 ;ON THE DISPLAY.
              07720 ;
8303 E5       07730 WRLNO    PUSH    HL
8304 D5       07740          PUSH    DE
8305 C5       07750          PUSH    BC
8306 111E7B   07760          LD      DE,TENTBL        ;PT AT TENS TABLE
8309 1A       07770 WN1      LD      A,(DE)           ;LOAD INTO "BC"
830A 4F       07780          LD      C,A
830B 13       07790          INC     DE
830C 1A       07800          LD      A,(DE)
830D 47       07810          LD      B,A
830E 13       07820          INC     DE               ;NEXT TBL VALUE
830F D5       07830          PUSH    DE               ;SAVE PTR
8310 3E2F     07840          LD      A,02FH           ;INIT FOR ASCII DIGIT
8312 3C       07850 WN2      INC     A                ;DIGIT + 1
8313 54       07860          LD      D,H              ;MOVE #
8314 5D       07870          LD      E,L
8315 09       07880          ADD     HL,BC            ;ADD NEG POWER OF TEN
8316 38FA     07890          JR      C,WN2            ;OVERFLOW UNTIL CORRECT
8318 EB       07900          EX      DE,HL            ;# TO "HL"
8319 D1       07910          POP     DE               ;GET TBL PTR
```

Program Listing 1 Continues

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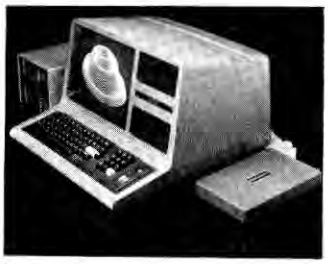

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All of the BASIC language components described in the Radio Shack manuals are implemented, with the following exceptions:

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From the January 1981 issue of the CSRA Computer Club newsletter:

There was some amusement at the November meeting when the Radio Shack representatives stated that the software in the ROM cartridges could not be copied. This month's 68 Micro Journal reported they had disassembled the programs on ROM by covering some of the connector pins with tape. They promise details next month. Never tell a hobbyist something can't be done! This magazine seems to be the only source so far of technical informations on the TRS-80 color computer™. Devoted to SS-50 6800 and 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in future issues.

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Program Listing 1 Continued

```
831A CDFD82   07920          CALL    WRCHR           ;OUTPUT DIGIT
831D 0C       07930          INC     C               ;END OF TBL ?
831E 20E9     07940          JR      NZ,WN1
8320 C1       07950          POP     BC
8321 D1       07960          POP     DE
8322 E1       07970          POP     HL
8323 3E20     07980          LD      A,20H
8325 18D6     07990          JR      WRCHR
              08000 ;
              08010 ;LIKE LFCR EXCEPT THAT IT DOESN'T ERASE NEXT LINE
              08020 ;
8327 E5       08030 WRRET    PUSH    HL              ;SAVE REG
8328 D5       08040          PUSH    DE
8329 C5       08050          PUSH    BC
832A 0E40     08060          LD      C,40H           ;LINE # INC
832C 2A2040   08070          LD      HL,(4020H)      ;GET CURSOR POS
832F 7D       08080 LF1      LD      A,L             ;LSW
8330 B9       08090          CP      C               ;GREATER THAN "C" ?
8331 3807     08100          JR      C,LF2           ;IF YES THEN
8333 3E40     08110          LD      A,40H           ;INC
8335 81       08120          ADD     A,C             ;ADD LINE # INC
8336 4F       08130          LD      C,A             ;BACK INTO "C"
8337 30F6     08140          JR      NC,LF1          ;TRY AGAIN
8339 24       08150          INC     H               ;CARRY INC MSW
833A 69       08160 LF2      LD      L,C             ;REPLACE LSW
833B 222040   08170          LD      (4020H),HL      ;NEW CURSOR POSITION
833E C1       08180          POP     BC              ;RESTORE REGS
833F D1       08190          POP     DE
8340 E1       08200          POP     HL
8341 C9       08210          RET
              08220 ;
              08230 ;INSERTION POINT #2 - ADD LISTING TWO CODE HERE
              08240 ;FOR MODEL III OPERATION
              08250 ;
8342          08260 TXTBUF   EQU     $               ;START OF NEW TXTBUF
              08270 ;
              08280 ;
7B49          08290          END     START
00000 TOTAL ERRORS
```

Program Listing 2

```
00100 ;*********************************************
00110 ;*****      SCRIPSIT PATCH PROGRAM        *****
00120 ;***            LISTING TWO               ***
00130 ;***           OCTOBER 1981               ***
00140 ;***     CHANGES TO RUN ON MODEL III      ***
00150 ;***           WRITTEN BY                 ***
00160 ;*****       CRAIG A. LINDLEY            *****
00170 ;*********************************************
00180 ;
00190 ;THIS ROUTINE SHOULD BE PLACED RIGHT BEFORE THE START
00200 ;OF THE MODIFIED TEXT BUFFER (TXTBUF) AS SHOWN IN
00210 ;LISTING ONE. A CALL TO THIS ROUTINE SHOULD BE PLACED
00220 ;IN THE INITIALIZATION PORTION OF THE PATCH PROGRAM.
00230 ;SEE TEXT FOR DETAILS.
00240 ;
00250 ;**********
00260 ;ADDED SUBROUTINES TO MAKE SCRIPSIT COMPATABLE
00270 ;**********
00280 ;
00290 ;THIS SENDS THE CHAR TO BE PRINTED TO THE PRINTER
00300 ;OUTPUT PORT INSTEAD OF THE MODEL I MEMORY MAPPED
00310 ;LOCATION. EVERY  LD  (37E8H),A  WILL BE REPLACED
00320 ;BY A CALL TO THIS ROUTINE.
00330 ;
00340 CHROUT  OUT     (0F8H),A        ;OUTPUT CHARACTER
00350         RET
00360 ;
00370 ;THIS MAKES THE RIGHT SHIFT KEY WORK ON THE MODEL III.
00380 ;
00390 SHIFT   LD      A,(3880H)       ;GET SHIFT STATUS
00400         OR      A               ;IS IT 0 ?
00410         RET     Z               ;IF YES THEN
00420         LD      A,1             ;ELSE RETURN A 1
00430         RET
00440 ;
00450 ;*********************************************
00460 ;PATCHES TO MODEL I SCRIPSIT TO RUN ON THE MODEL III.
00470 ;*********************************************
00480 ;
00490 ;**********
00500 ;THIS PATCH PLACES CALLS TO CHROUT AS STATED ABOVE.
00510 ;**********
00520 ;
00530 MODIII  LD      A,0CDH          ;SUB CALL CODE
00540         LD      (UN2),A         ;PATCH PATCH PROGRAM
00550         LD      (PRTC1),A       ;  "     "     "
00560         LD      (5244H),A       ;PATCH SCRIPSIT
00570         LD      (665EH),A
00580         LD      (6722H),A
00590         LD      (7A97H),A
00600         LD      (7A9EH),A
00610         LD      (60CDH),A       ;CALL FOR SHIFT ROUTINE
00620         LD      (60F9H),A
00630 ;
```

Program Listing 2 Continues

Program Listing 2 Continued

```
00640 ;NOW PLACE ADDRESS OF CHROUT AFTER SUB CALL CODE
00650 ;
00660           LD      HL,CHROUT       ;NEW PRINT SUBROUTINE
00670           LD      (UN2+1),HL      ;PATCH PATCH PROGRAM
00680           LD      (PRTC1+1),HL    ;   "     "     "
00690           LD      (5245H),HL      ;PATCH SCRIPSIT
00700           LD      (665FH),HL
00710           LD      (6723H),HL
00720           LD      (7A98H),HL
00730           LD      (7A9FH),HL
00740 ;
00750 ;**********
00760 ;PATCH SHIFT POLLING TO ALLOW BOTH KEYS TO WORK
00770 ;**********
00780 ;
00790           LD      HL,SHIFT        ;NEW POLLING ROUTINE
00800           LD      (60CEH),HL
00810           LD      (60FAH),HL
00820 ;
00830 ;**********
00840 ;THE FOLLOWING PATCHES ALLOW THE TAPE FUNCTIONS TO WORK
00850 ;ON THE MODEL III MACHINE.
00860 ;**********
00870 ;
00880           LD      A,0C3H          ;LONG JUMP CODE
00890           LD      (63CBH),A
00900           LD      (63DAH),A
00910           LD      (63AFH),A
00920           LD      (6381H),A
00930           LD      (63F9H),A
00940 ;
00950 ;NOW PLACES ADDRESSES OF APPROPRIATE TAPE ROUTINES AFTER
00960 ;THE LONG JUMPS JUST INSTALLED.
00970 ;
00980           LD      HL,287H         ;WRITE LEADER AND SYNC
00990           LD      (63CCH),HL
01000           LD      HL,296H         ;FIND LEADER AND SYNC
01010           LD      (63DBH),HL
01020           LD      HL,264H         ;WRITE BYTE TO TAPE
01030           LD      (63B0H),HL
01040           LD      HL,235H         ;READ BYTE FROM TAPE
01050           LD      (6382H),HL
01060           LD      HL,1F8H         ;CASSETTE OFF
01070           LD      (63FAH),HL
01080 ;
01090           RET                     ;RETURN TO PATCH PROGRAM
01100 ;
01110 ;
```


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DBM 5
A Data Base For All Seasons
The File Clerk
for the
TRS-80® Models I & III

VERSION 5.5
SPECIFICATIONS:

- A multi-feature file manager
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- Up to 20 user defined fields
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- Computed Fields
- 140-page MANUAL

DMB5 provides three data management features:

A) A comprehensive file manager for defining your records, data entry or edit, and general record retrieval.
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AMS1.0
Apartment Management System

Efficient Property Management
General Ledger Compatibility

PRODUCT BRIEF:

Written by a CAP for his own property management company, this menu driven system provides a practical, proven method for efficiently managing rental property.

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1. LATE RENTS. Lists tenants, apt. #, amount of rent due, date rent was due, number of days late, payments on account.
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3. SCHEDULE OF RENTS. Lists tenants' names (up to 4 per apt.), type of unit, amount of rent and other charges, and the last month rent was paid.
4. SECURITY DEPOSITS held by apartment.
5. LEASE EXPIRATIONS of all units in order of expiration.
6. RENT INCREASES lists date of last increase plus current information.
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8. MAILING LABELS for all tenants.

This apartment management system is a complete package designed to promote ease of management. The reports listed can be run at any time so there is no delay on checking tenants or obtaining any other information desired.

Requires Model III and 132 column printer. Maintains up to 300 UNITS per diskette.

PRICES

#AMS-III	$395
Manual Only	$ 30

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A SCREEN FORMATER FOR DBM5

- Full CURSOR control
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- **Includes DBM5** fast **(KSAM)** master key
- **View** is a compiled **basic** program
- **Basic** source code is included

TRS-80 is a Tm of Radio Shack, Tandy Corp.
NEWDOS80 is a Tm of Apparat, Inc.
TRS232 is a Tm of Small System Software Co.

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AT LAST! A serial input/output interface designed for connection to the TRS80 Model I **with** or **without** an expansion interface.

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- Integral Power Supply included!
- May be daisy chained with other MPR 232s

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Assembled and Tested	$129.00(MOD I)
PC Board Only	$29.00(MOD I)
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MODELS I & III

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SUPPORT EQUIPMENT:
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SIMPLEX MODE	STANDARD MODE
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(Without Clock Speedup Mods)

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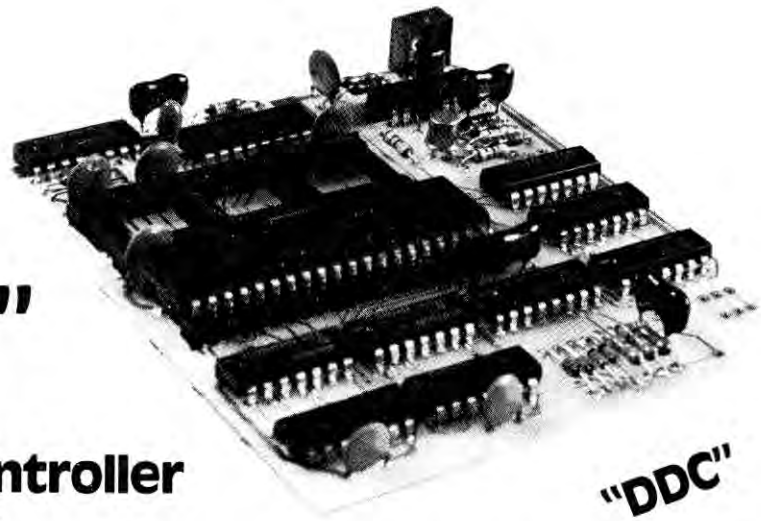
Aerocomp's Proven Best-By Test! The "DDC"

Double Density Controller



★ Technical Superiority

At last! A double density controller for Model I with HIGHER PROB[illegible]ILITY OF DATA RECOVERY THAN WITH ANY OTHER DOUBLE DENSITY CONTROLLER ON THE MARKET TODAY! The "DDC" f[illegible]rocomp. No need to worry about the problems that keep cropping up on existing products. AEROCOMP'S ne[illegible] design phase lock loop data separator has a wider capture window than the digital types currentl[illegible] allows high resolution data centering. The finest resolution available with digital circuitry is 1[illegible] "DDC" analog circuit allows infinately variable tuning. Attack and settling times are opti[illegible]
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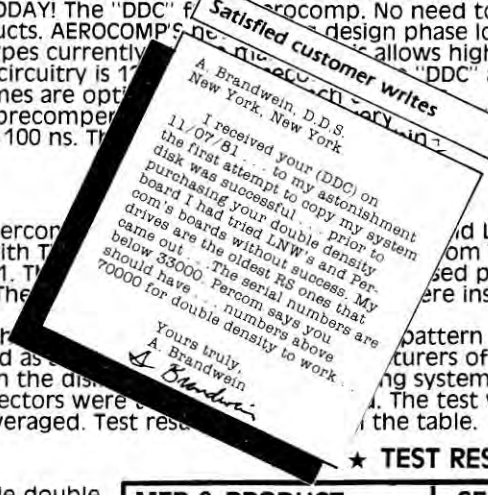
The bottom line is state of the art reliability!

★ Test Proven

Tests were conducted on AEROCOMP'S "DDC", Percon[illegible]d LNW's "LNDoubler"** using a Radio Shack TRS80*** Model I, Level 2, 48 K with T[illegible]om TFD100 * disk drive (Siemens Model 82). Diskette was Memorex 3401. T[illegible]sed piece of media to determine performance under adverse conditions. The[illegible]re installed sequentially in the expansion interface.
The test consisted of formatting 40 tracks on th[illegible]pattern on all tracks. The 6DB6 pattern was chosen because it is recommended as [illegible]turers of drives and diskettes. An attempt was then made to read each sector on the di[illegible]ng system was Newdos/80, Version 1.0, with Double Zap, Version 2.0. Unreadable sectors were [illegible]. The test was run ten times with each double density controller and the data averaged. Test res[illegible] the table.


Satisfied customer writes

A. Brandwein, D.D.S.
New York, New York

I received your (DDC) on 11/07/81 . . . to my astonishment the first attempt to copy my system disk was successful . . . prior to purchasing your double density board I had tried LNW's and Percom's boards without success. My drives are the oldest RS ones that came out . . . The serial numbers are below 33000. Percom says you should have . . . numbers above 70000 for double density to work . . .

Yours truly,
A. Brandwein

★ Features

TRS80 Model I owners who are ready for reliable double density operation will get (1) 80% more storage per diskette, (2) single and double density data separation with far fewer disk I/O errors, (3) single density compatibility and (4) simple plug-in installation. Compatible with all existing double density software.

★ Value

$139.95 for the BEST double density controller on the market.

$179.95 for "DDC" complete with DOSPLUS 3.3D
$229.95 for "DDC" complete with LDOS

★ TEST RESULTS ★

MFR & PRODUCT	SECTORS LOCKED OUT (AVG)
AEROCOMP "DDC"	0
PERCOM "DOUBLER II"	18
PERCOM "DOUBLER A"	250
LNW "LNDOUBLER"	202

Note: test results available upon written request. All tests conducted prior to 8-25-81

Aerocomp's 14 day money back guarantee applies to hardware only.
Specials will be prorated. Shipping $2.00 in Cont. US. See opposite page for details.

Data Separators

The advances that make the "DDC" great are incorporated in the new AEROCOMP Single Den[illegible] and Double Density Data Separator ("DDS").

★ Has your original manufacturer left you holding the bag?

If you already own a Percom "Doubler A", "Doubler II" or LNW "LNDoubler", the AEROCOMP "DDS" will make it right. Look at the test results:

MFR. & PRODUCT	SECTORS LOCKED OUT	
	WITHOUT "DDS"	WITH "DDS"
PERCOM "DOUBLER II"	18	1
PERCOM "DOUBLER A"	250	0
LNW "LNDOUBLER"	202	0

Note: Same test procedures as "DDC".
* Trademark of Percom Data Co.
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★ "DDS" $49.95

(Use 1791 chip from your DD Controller)

★ "DDS" with disk controller chip included $79.95

★ Disk controller chip $34.95

(Shipping $2.00 Cont. US - see opposite page for details)

Plugs directly into your existing Double Density Controller.

Happy DDS customer writes . . .

I don't often write letters such as this, but I feel I should in this case . . . I am suprised and pleased with your DDS. It is not often a product is better than one expects . . . This (these) test (s) used a Percom Doubler "A". (Test without DDS installed showed many errors). (With DDS) not one error!!! After ten (10) tests of formatting and verifing and zeroing NOT ONE FAILURE OR LOCK OUT. Great!!!

Phil Gnadt
Kansas City, Kansas

See opposite page ▸▸▸▸▸▸

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40 & 80 TRACK
as low as $259.95

NEW LOW PRICES
Thanks to you our sales volume has allowed us to cut costs and we're passing the savings along. We offer the best disk drive value in the market place. Reliability, features and cost tough to beat. We deliver...and we stand behind our products. AEROCOMP is the only manufacturer to offer FREE TRIAL! Buy Aerocomp drives today. You deserve the best.

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All above drives are complete with silver enclosure, power supply and external drive cable connection. 115 VAC, 50/60 Hz. 230 VAC, 50/60 Hz available on special order.

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- ★ 40-Track "FLIPPY" Bare Drive $279.95
- ★ 80-Track "FLIPPY" Bare Drive $369.95

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DOSPLUS 3.3 or NEWDOS / 80,2.0 available with any package.

Add $5.00 per drive for shipping & handling (Cont. US).

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100% TESTED
AEROCOMP Disk Drives are completely assembled at the factory and ready to plug in when you receive them. Each drive is 100% bench tested prior to shipment. We even enclose a copy of the test checklist, signed by the test technician, with every drive. AEROCOMP MEANS RELIABILITY!!

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All the features of MX80 plus Friction Feed. Shipping & cables as above.

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*With Purchase of Printer

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LOAD 80

You will too when you use this data encryption-decryption program.

I Have a Secret

James T. Demberger
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St. Petersburg, FL 33709

Are you interested in cryptograms, hidden word puzzles, or in cryptography? You can find a solution to most cryptograms if a pattern exists and you test all possible characters in all positions of the pattern. Gilbert S. Vernam's algorithm for data encryption does not create any pattern and, as a result, you cannot decrypt the data unless you know the correct cipher key. For additional information regarding the Vernam algorithm see *The Codebreakers* by David Kahn and an article in *Kilobaud Microcomputing*, November 1980.

```
1000 CLEAR MEM/2: F1$ = "ABCDEFGHI": F2$ = "CIPHERKEY": F3$ = "": F4$ = ""
1010 0% = 90 '0% IS -/+ TO PRODUCE ASCII CODE IN RANGE 32 TO 90
1020 LPRINT" ": LPRINT" ": FOR I% = 1TO9
1030 F3$ = F3$ + CHR$(ASC(MID$(F1$,I%,1)) + ASC(MID$(F2$, I%, 1)) - 0%)
1040 F4$ = F4$ + CHR$(ASC(MID$(F3$, I%, 1)) - ASC(MID$(F2$, I%,1)) + 0%)
1050 LPRINT ASC(MID$(F1$, I%,1)); " + ";
1060 LPRINT ASC(MID$(F2$, I%,1)); " - "; 0%; " = ";
1070 LPRINT ASC(MID$(F3$, I%,1)); " - ";
1080 LPRINT ASC(MID$(F2$, I%,1)); " + "; 0%; " = ";
1090 LPRINT ASC(MID$(F4$, I%,1))
1100 NEXT I%: LPRINT" "
1110 LPRINT F1$ + " + " + F2$ + " = " + F3$
1120 LPRINT F3$ + " - " + F2$ + " = " + F4$
1130 LPRINT" ": END

RUN

65 + 67 - 90 = 42 - 67 + 90 = 65
66 + 89 - 90 = 65 - 89 + 90 = 66
67 + 80 - 90 = 57 - 80 + 90 = 67
68 + 72 - 90 = 50 - 72 + 90 = 68
69 + 69 - 90 = 48 - 69 + 90 = 69
70 + 82 - 90 = 62 - 82 + 90 = 70
71 + 75 - 90 = 56 - 75 + 90 = 71
72 + 69 - 90 = 51 - 69 + 90 = 72
73 + 89 - 90 = 72 - 89 + 90 = 73

ABCDEFGHI + CIPHERKEY = *A920>83H
*A920>83H - CIPHERKEY = ABCDEFGHI
```

Figure 1

Vernam's Algorithm

The Vernam algorithm, when used with a computer to encrypt or decrypt data, proceeds as follows:

- The data to be encrypted is considered one long string of bytes (a string of characters);
- The computer generates a cipher key that is a string of bytes (a string of random characters);
- The computer Exclusive-Ors (XORs) each byte of the data string with the corresponding byte of the cipher key to produce an encrypt data string;
- To recover the original data string the computer XORs each byte of the encrypt data string with the corresponding byte of the cipher key.

Level II Basic does not have a logical operation that uses the logical XOR instruction of the Z80 microprocessor. I needed a Level II Basic operation that would substitute for the logical XOR operation; I did not want to write an encryption/decryption program in Level II Basic that would require Assembly language code. The XOR to encrypt a byte flips bits into a new pattern; the XOR to decrypt a byte flips the bits back to the original bit pattern.

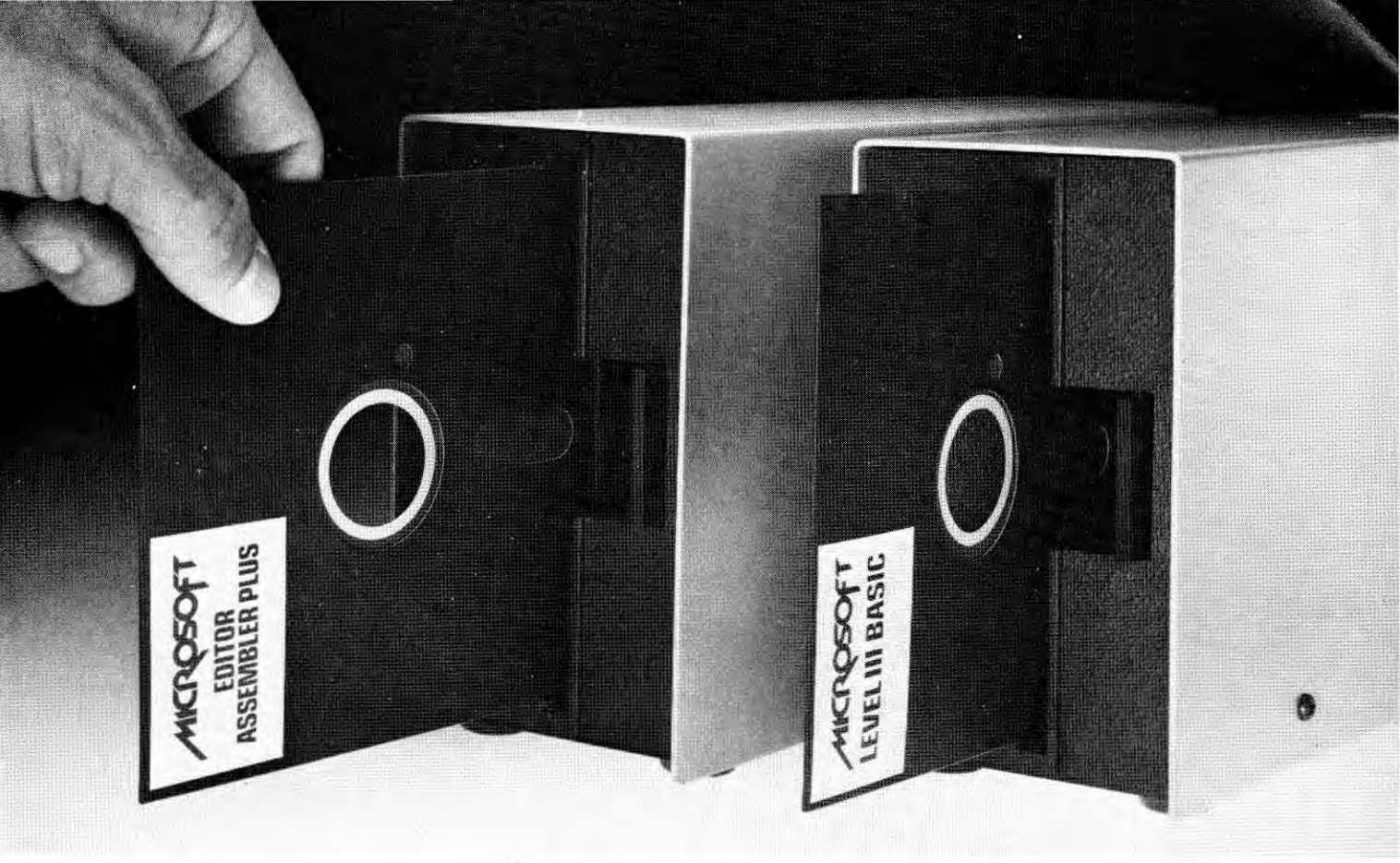
An add instruction followed by a subtract instruction produces the same result when only the right byte of an integer field is considered. Figure 1 contains a short program that illustrates byte-by-byte character string addition and subtraction. This is not logically or literally the same as encryption/decryption resulting from the logical XOR instruction, but the substitution works.

The Cipher Key

The length of the cipher key and the number of different characters in the key determine the key's randomness. If you recycle a short key when encrypting a string of data, you may create a pattern that will reveal the key length and characters used in

The Key Box

Level II Disk Basic
Model I or III
48K RAM
TRSDOS 1.3 or NEWDOS80
1 or more disk drives



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- Bidirectional printing
- Full UPPER/lower case ASCII *plus* TRS-80 graphics or DSE scientifics character sets in 9 × 7 dot matrix format (9 × 9 available as option — requires print head change)
- Motor control — turns off the motor when the printer is not in use
- 2048 character buffer
- Software selectable features
  - transfer protocol (XON/XOFF or none)
  - character densities (10, 12, 15, 16.5 cpi *plus* double width in each size)
  - self-test
  - forms, length, control

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```
1000 CLEAR MEM/2: K1$ = "IN": K2$ = "THE" K3 = "YARD"
1010 L1% = LEN &K1$): L2% = LEN(K2$): L3% = LEN(K3$)
1020 M1% = 1: M2% = 1: M3%1: LPRINT" ": LPRINT" ": FOR I% = 1 TO 24
1030 LPRINT MID$(K1$,M1%,1); MID$(K2$,M2%,1) MID$(K3$,M3%,1);
1040 IF M1% = L1% THEN M1% = 1 ELSE M1• = M1% + 1
1050 IF M2% = L2% THEN M2% = 1 ELSE M2% = M2% + 1
1060 IF M3% = L3% THEN M3% = 1 ELSE M3% = M3% + 1
1070 IF (M1% + M2% + M3%) = 3 THEN LPRINT" "
1080 NEXT I%: LPRINT" ": LPRINT" "
1090 LPRINT"                Fig. 2": END


RUN

ITYNHAIERNTDIHYNEAITRNHDIEYNTAIHRNED
ITYNHAIERNTDIHYNEAITRNHDIEYNTAIHRNED
```

Figure 2

the key.

You can use three key words to generate a long random string of characters for the cipher key. The first letter of the first key word, followed by the first letters from the second and third key words, become the first three characters of the cipher key. The second letters from each key word generate the next three characters of the cipher key. When you reach the end of any key word, use the first character of that particular key word for the next character. Figure 2 contains a program using the key words "IN," "THE" and "YARD" that generate a 36 character cipher key. Assuming that only uppercase letters are used, this method has at most only 26 different characters or ASCII decimal codes for each position of the cipher key.

Program Listing 1 uses one letter or space from each of the three key words to generate one character or ASCII decimal code for each position of the cipher key. The ASCII decimal codes can have 79 different values even though only uppercase letters or spaces are used in the key words.

I wrote the encryption/decryption program in Listing 1 to study the result of encryption/decryption using different cipher keys, to develop cipher key generation and encryption/decryption subroutines that I can use in other programs, and to verify with a disk processing program that the subroutines perform as intended. The program's disk file processing section processes a random file of 20 records, each record including an integer record number and a 62 byte string. You can easily change the program to increase the number of records or to increase or decrease string length.

The cipher key word input subroutine accepts uppercase letters A through Z and spaces for the key words. Each key word can have up to 26 letters or spaces. The subroutine computes and displays the length of the cipher key generated by the three key words. Use key words that contain a good mix of all letters. If the same letters are used repeatedly in all three key words, the cipher key will not be very random. If all three key words use only the letter Z, the encrypted string will be the same as the input string.

Key words with lengths equal to three different prime numbers generate a very long cipher key compared to the length of a cipher key generated by key words with lengths equal to the next higher even numbers. Key word lengths of 3, 5 and 7 generate a 105 byte cipher key while lengths of 4, 6 and 8 generate a cipher only 24 bytes long. The longest cipher key generated with key word lengths of 26 or less occurs when the lengths are 23, 25 and 26. With no letter repeated in any one key word, the cipher key will run for 14,950 bytes before the same sequence of more than 23 bytes is repeated.

The encryption/decryption subroutine accepts strings with a length of up to 256 bytes. Setting variable ED$ to E encrypts the string; setting ED$ to D decrypts the string. The subroutine encrypts all characters

with ASCII decimal codes 32–127 except ASCII decimal code 96, the lowercase @ sign. The subroutine substitutes lowercase @ for space (ASCII decimal code 32) on encryption; consequently, the subroutine decrypts any real uppercase @ as a space. The uppercase @ is used as a substitute for a space to prevent a pattern of low decimal values in the encrypted strings. The subroutine does not encrypt control codes with ASCII decimal codes 0–31; if these codes are in the input string, the subroutine passes them to the output string. The subroutine encrypts all graphic and space compression codes (ASCII decimal codes higher than 127) as uppercase @ signs (ASCII decimal 64). You may encrypt integer, single and double precision variables after you convert them to strings with the STR$ function.

Encrypted characters or codes can have any decimal value from 33 to 205. Encryption does not produce any control codes that will interfere with printing or displaying the encrypted string or with writing or reading the string to and from a disk file. The last two lines of the subroutine display the decimal codes for output strings; systems without the lowercase modification display the lowercase ASCII codes as if they were uppercase.

Only one character of the cipher key is in memory at any one time. This character is a decimal value equal to 270 minus the ASCII decimal codes for one letter from each of the three key words. The cipher key value 0–78 is added to the ASCII decimal code of a character on encryption and subtracted from the decimal code value of a character for decryption. The key word input subroutine stores the ASCII decimal codes for each letter or space in the three key words in arrays N1%, N2% and N3% so they won't have to be repeatedly recomputed in the encryption/decryption subroutine. A blinking symbol in the upper right corner of the display assures the user that the program has not hung up or died.

The user and test records entry subroutine accepts up to 10

```
118 141 151 169 137 146 158
118 180 164 151 147 169 127
131 160 141 151 146 108  94
138 109 133 147 122 140 113
118 114 132 141 109 150  85
```

Figure 3

records for encryption/decryption. The subroutine prompts the user for generating three types of test records and for repeating the previous record to save time keying test data. Variable N% is a loop index and a switch for prompt messages in this subroutine. In addition, the encryption/decryption subroutine uses N% to reset key word character pointers M1%, M2% and M3% to the first character of each key word for each group of strings. In general, you should not reset the character pointers at regular intervals (after each record or string) to avoid a pattern of characters in encrypted data. This subroutine has optional code to compute the character rate per second for encryption/decryption.

The file processing sections create or initialize a disk file, add records to a file and print records from a file. File initialization creates file header and trailer records. The header record gives the number of the last user or data record in the file; additions to the file start with the next record. The trailer record marks the end of the file for the print routine. The key word character pointers are reset when the first encrypted record in the file or the first record of any additions to the file is processed. For additions to the file, the program resets the pointers when it encounters a flag in the last record preceding the file addition. This flag (K4%) is the first two letters from each of the key words. It is written into the leftmost six bytes of the last encrypted record of the original file and the last record of any additions to the file when the rightmost six characters of an input string are ENDEND. When the encryption/decryption subroutine finds the flag, the pointers are reset so the cipher key stays in step with the encrypted strings.

The timer code in the program indicates an encryption or decryption speed of approximately

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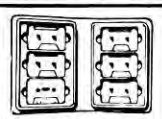
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seven characters per second. Speed may not be much of a problem since, in many cases, you need to encrypt only certain fields in a file. In a payroll file you need to encrypt only the dollar fields to provide salary information security.

I assigned all variables in the program as integer (%) or string ($) so if you merge the subroutines into other programs, the variable names and attributes will not conflict with variable names or with DEFINT or DEFSTR statements. You can change the number of records in the file and the length of the encrypted string making up the body of the record by assigning other values to the variables NR% and SL% at line 2830. You can change the values of NR% and SL% without making any other changes to the program. Keyboard input at line 3070 drops to the next line of the display after 62 characters are entered as a warning that too many characters have been entered for a 62 byte string.

There is little probability that the encrypted character strings produced by the subroutine can be decrypted unless the key words used to generate the cipher key are known. This assumption is made with qualification—the keywords should contain a good mix of most of the letters of the alphabet and the cipher key length should be as long as or longer than the total length of the encrypted strings. Figure 3 is a list of 35 numbers representing the encrypted ASCII decimal codes for a 35 character message. If anyone decrypts the message in Fig. 3, I will admit there is a serious flaw in the encryption/decryption subroutine logic.

If you think you have decrypted the message, send it to me together with a stamped, self-addressed envelope for a reply. ■

Mr. Demberger is a retired Army officer and retired IBM systems engineer who has been working in the data processing field since 1949, and with small computers since 1965.

Program Listing

```
1000 '  PROGRAM NAME "CRYPTO"
1010 '  LANGUAGE: TRS/80 LEVEL II DISK BASIC
1020 '  AUTHOR  : JAMES T. DEMBERGER
1030 '
1040 '   VARIABLE USAGE
1050 '
1060 '  CR$             COPYRIGHT STRING
1070 '  D$              DATE
1080 '  ED$             ENCRYPT/DECRYPT SWITCH
1090 '  F0$,F1$F2$      RECORD FIELDS
1100 '  I%              LOOP INDEX, COUNTER
1110 '  IN%             SUBRECORDS PER SECTOR
1120 '  IR%             RECORD NUMBER
1130 '  IS%             SUBRECORD NUMBER
1140 '  J%              LOOP INDEX, COUNTER
1150 '  K1$,K2$,K3$     USER'S KEY WORDS
1160 '  K4$             POINTER RESET FLAG
1170 '  L1%,L2%,L3%     LENGTH OF K1,K2,K3
1180 '  M%              LOOP INDEX, COUNTER
1190 '  M1%,M2%,M3%     ARRAY POINTER TO N1,N2,N3
1200 '  N%              SUBSCRIPT FOR RN ARRAY
1210 '  N1%,N2%,N3%      ASCII ARRAY FOR KEY WORD LETTERS
1220 '  NE%             LAST RECORD SWITCH
1230 '  NF%             FILE NAME
1240 '  NK%             VALUE OF NTH CHARACTER OF ENCRYPTION KEY
1250 '  NR%             NUMBER OF RECORDS
1260 '  NS%             RESET SWITCH FOR EN/DECRYPT (FILE PROCESSI
NG)
1270 '  RI$             INPUT RECORD TO EN/DECRYPT SUBROUTINE
1280 '  RN$             USER/TEST RECORDS TO BE EN/DECRYPT
1290 '  RO$             OUTPUT RECORD FROM EN/DECRYPT SUBROUTINE
1300 '  RS$             OPTION SWITCH
1310 '  SL%             STRING LENGTH IN DISK RECORD
1320 '  TC%             TOTAL CHARACTERS EN/DECRYPT
1330 '  TS%             HAVE TIMER SWITCH
1340 '  T0%-T5%         MINUTES/SECONDS COUNTERS
1350 '
1360 CLEAR MEM/2: DIM RN$(10): DIM CR$(3)
1370 CR$(1)="COPYRIGHT 1981 BY JAMES T. DEMBERGER"
1380 CR$(2)="7280 60TH AVE NO, ST PETERSBURG, FL 33709"
1390 CR$(3)="PHONE 813-546-1182": ONERRORGOTO 3570
1400 K1$=STRING$(26," "): K2$=STRING$(26," "): K3$=STRING$(26,"
")
1410 RI$=STRING$(255," "): RO$=STRING$(255," ")
1420 DIM N1%(26), N2%(26), N3%(26): CLS: PRINTTAB(18)"CRYPTO PRO
GRAM"
1430 PRINTTAB(9) CR$(1): PRINTTAB(7) CR$(2): PRINTTAB(16) CR$(3)

1440 '
1450 '   DRIVER MENU
1460 '
1470 IF K4$="" THEN GOSUB 1640
1480 GOSUB 2680
```

Program continues

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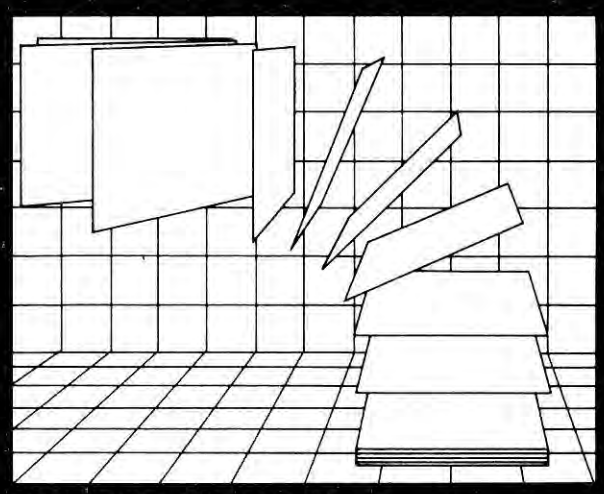
Program continued

```
1490 PRINT:PRINT"      TEST OPTIONS"
1500 PRINT"EN/DECRYPT USER RECORDS - ENTER R"
1510 PRINT"EN/DECRYPT TEST RECORDS - ENTER T"
1520 PRINT"CHANGE CYPHER KEY       - ENTER K"
1530 PRINT"PROCESS DISK FILE       - ENTER F"
1540 PRINT"            END PROGRAM - ENTER E": PRINT"   ENTER OP
TION"
1550 RS$=INKEY$: IF RS$=""THEN 1550 ELSE PRINT"OPTION "; RS$: PR
INT
1560 IF RS$="R" OR RS$="T" THEN GOSUB 2220: GOTO 1490
1570 IF RS$="K" THEN GOSUB 1640: GOTO 1490
1580 IF RS$="F" THEN 2740 ELSE IF RS$="E" THEN 1600
1590 PRINT"NOT R T K F OR E": GOTO 1490
1600 CLS: PRINT"END OF PROGRAN": END
1610 '   END DRIVER MENU
1620 '
1630 '   KEY WORD INPUT SUBROUTINE
1640 PRINT: PRINT"    CYPHER KEY INPUT": PRINT
1650 PRINT"ENTER THREE KEY WORDS/LINES FOR THE CYPHER KEY"
1660 PRINT"USE ONLY UPPERCASE CHARACTERS A THRU Z OR SPACE"
1670 FOR I%=1TO3: IF I%=1 THEN RI$=K1$: GOTO 1690
1680 IF I%=2 THEN RI$=K2$ ELSE IF I%=3 THEN RI$=K3$
1690 PRINTUSING"OLD KEY WORD/LINE # ";I%;: PRINT RI$: RS$=""
1700 PRINTUSING"NEW KEY WORD/LINE # ";I%;: LINEINPUT RI$
1710 PRINTUSING" WORD/LINE LENGTH ##"; LEN(RI$)
1720 FOR J%=1TOLEN(RI$)
1730 IF MID$(RI$,J%,1)=" " THEN MID$(RI$,J%,1)="@": GOTO 1770
1740 IF MID$(RI$,J%,1)<"A" THEN 1760
1750 IF MID$(RI$,J%,1)>"Z" THEN 1760 ELSE 1770
1760 PRINT"MUST BE UPPERCASE CHARACTERS A-Z OR SPACE": GOTO 1700
1770 IF J%>26 THEN PRINT"<1 OR >26 CHARACTERS, RE-";": GOTO 1490
1780 IF I%=1 THEN K1$=RI$: N1%(J%)=90-ASC(MID$(RI$,J%,1)): GOTO
1810
1790 IF I%=2 THEN K2$=RI$: N2%(J%)=90-ASC(MID$(RI$,J%,1)): GOTO
1810
1800 IF I%=3 THEN K3$=RI$: N3%(J%)=90-ASC(MID$(RI$,J%,1))
1810 NEXT: NEXT
1820 K4$=LEFT$(K1$,2)+LEFT$(K2$,2)+LEFT$(K3$,2)
1830 L1%=LEN(K1$): L2%=LEN(K2$): L3%=LEN(K3$)
1840 I%=26: IF L1%<I% THEN I%=L1%
1850 IF L2%<I% THEN I%=L2% ELSE IF L3%<I% THEN I%=L3%
1860 J%=I%
1870 IF INT(I%/L1%)=I%/L1% THEN 1880 ELSE 1900
1880 IF INT(I%/L2%)=I%/L2% THEN 1890 ELSE 1900
1890 IF INT(I%/L3%)=I%/L3% THEN 1910 ELSE 1900
1900 I%=I%+J%: GOTO 1870
1910 PRINTUSING"GENERATED CYPHER KEY LENGTH IS ##### BYTES"; I%
1920 PRINT: RETURN
1930 '   END KEY WORD INPUT SUBROUTINE
1940 '
1950 '   ENCRYPT/DECRYPT SUBROUTINE
1960 IF LEN(RI$)<1 THEN PRINT"NO DATA": STOP
1970 IF ED$="E" THEN PRINT"EN";: GOTO 2000
1980 IF ED$="D" THEN PRINT"DE";: GOTO 2000
1990 PRINT"EN/DECRYPT SWITCH NOT E OR D": STOP
2000 PRINT"CRYPT TEXT"
2010 RO$="": IF N%=1 OR NS%=1 THEN M1%=1: M2%=1: M3%=1: NS%=0
2020 FOR J%=1TOLEN(RI$)
2030 IF POINT(127,2) THEN RESET(127,2): SET(127,1): GOTO 2050
2040 RESET(127,1): SET(127,2)
2050 I%=ASC(MID$(RI$,J%,1)): IF I%<32 THEN 2090
2060 IF ED$="E" THEN IF I%=32 THEN I%=96 ELSE IF I%>127 THEN I%=
64
2070 NKM%=N1%(M1%)+N2%(M2%)+N3%(M3%)
2080 IF ED$="E" THEN I%=I%+NK% ELSE I%=I%-NK%: IF I%=96 THEN I%=
32
2090 RO$=RO$+CHR$(I%)
2100 IF M1%=L1% THEN M1%=1 ELSE M1%=M1%+1
2110 IF M2%=L2% THEN M2%=1 ELSE M2%=M2%+1
2120 IF M3%=L3% THEN M3%=1 ELSE M3%=M3%+1
2130 NEXT: IF ED$="E" THEN 2150 ELSE IF LEFT$(RO$,6)<>K4$ THEN 2
150
2140 RO$=RIGHT$(RO$,(LEN(RO$)-6)): M1%=1: M2%=1: M3%=1
2150 PRINT RO$
2160 'RETURN   'CHANGE TO REM TO ACTIVATE CODE PRINT
2170 FOR J%=1TOLEN(RO$): PRINTUSING"### ";ASC(MID$(RO$,J%,1));
2180 NEXT: PRINT: RETURN
2190 '   END ENCRYPT/DECRYPT SUBROUTINE
2200 '
2210 '   USER & TEST RECORDS ENTRY SUBROUTINE
2220 INPUT"NUMBER OF RECORDS TO ENCRYPT - 10 OR LESS ";N%
2230 IF N%<1 OR N%>10 THEN 2220 ELSE IF RS$="R" THEN 2280
2240 PRINT"FOR CHARACTERS WITH ASCII CODES:"
2250 PRINTTAB(13)"32 TO 127 ENTER <TESTP>"
2260 PRINTTAB(14)"0 TO 127 ENTER <TESTA>"
2270 PRINT"    FOR 100 LETTER <X> ENTER <CHARX>"
2280 FORN%=1TONR%
2290 PRINTUSING"REC NO ## ENTER TEXT"; N%;
2300 IF N%=1 THEN PRINT: GOTO 2320
2310 PRINT" - TO DUPLICATE PREVIOUS RECORD ENTER <,./>"
2320 LINEINPUT RN$(N%): IF RN$(N%)="" THEN 2290
2330 IF N%=1 THEN 2350
2340 IF RN$(N%)=",./" THEN J%=N%-1: RN$(N%)=RN$(J%): GOTO 2420
2350 IF LEFT$(RN$(N%),4)="CHAR" THEN 2360 ELSE 2370
2360 RN$(N%) = STRING$(100,(MID$(RN$(N%),5,1))): GOTO 2420
2370 IF LEFT$(RN$(N%),5)="TESTA" THEN 2380 ELSE 2400
2380 RN$(N%)="": FOR J%=0TO127
2390 RN$(N%)=RN$(N%)+CHR$(J%): NEXT: GOTO 2420
2400 IF LEFT$(RN$(N%),5)="TESTP" THEN 2410 ELSE 2430
2410 RN$(N%)="": FOR J%=32TO127: RN$(N%)=RN$(N%)+CHR$(J%): NEXT
2420 PRINT RN$(N%)
2430 NEXT
2440 IF TS%=1 THEN GOSUB 2590
2450 ED$="E": FORN%=1TONR%: PRINTUSING"REC NO ## "; N%;
2460 IF TS%=1 THEN TC%=TC%+LEN(RN$(N%))
2470 RI$=RN$(N%): GOSUB 1960: RN$(N%)=RO$: NEXT
2480 IF TS%=1 THEN GOSUB 2590: GOSUB 2590
2490 ED$="D": FORN%=1TONR%: PRINTUSING"REC NO ## "; N%;
2500 IF TS%=1 THEN TC%=TC%+LEN(RN$(N%))
2510 RI$=RN$(N%): GOSUB 1960: NEXT
2520 IF TS%=1 THEN GOSUB 2590
2530 RETURN
2540 '   TIMER SUBROUTINE
2550 'DELETE GOTO LINES IN NEXT THREE LINES TO REMOVE TIMER CODE
2560 ON TS% GOTO 1320,1330,1340,1480,2440,2460,2480,2500
2570 ON TS% GOTO 2520,2540,2550,2560,2570,2580,2590,2600,2610
```

Program continues

Program continued

```
2580 ON TS% GOTO 2620,2630,2640,2650,2660,2670,2680,2690,2700
2590 IF T0%=1 THEN 2610 ELSE T0%=1
2600 T1%=VAL(MID$(TIME$,13,2)): T2%=VAL(MID$(TIME$,16,2)): RETUR
N
2610 T0%=0: T3%=VAL(MID$(TIME$,13,2)): T4%=VAL(MID$(TIME$,16,2))
2620 IF T2%<=T4% THEN 2630 ELSE T4%=T4%+60: T3%=T3%-1
2630 IF T1%<=T3% THEN 2640 ELSE T3%=T3%+60
2640 T5%=T4%-T2%: T5%=T5%+60*(T3%-T1%)
2650 PRINTUSING"TOTAL CHAR #####  SECONDS ####  "; TC%;T5%;
2660 IF T5%=0 THEN TC%=0: PRINT: RETURN
2670 PRINTUSING"CHAR/SEC ##.#"; TC%/T5%: TC%=0: RETURN
2680 INPUT"TIME EN/DECRYPTION?  ENTER 1 FOR YES "; TS%
2690 PRINT: IF TS%=1 THEN RETURN ELSE TS%=0: RETURN
2700 '   END TIMER SUBROUTINE
2710 '   END USER & TEST RECORDS SUBROUTINE
2720 '
2730 '   FILE PROCESSING MENU
2740 PRINT: PRINT "    FILE PROCESSING": IF D$="" THEN 2750 ELSE
2770
2750 PRINT: LINEINPUT"ENTER DATE (MM/DD/YY) "; D$
2760 IF LEN(D$)<>8 THEN PRINT"RE-";: GOTO 2750
2770 PRINT: PRINT"ADD RECORDS TO FILE - ENTER A"
2780 PRINT"PRINT RECORDS        - ENTER P"
2790 INPUT"RETURN TO MAIN MENU - ENTER M"; RS$: IF RS$="M" THEN
1490
2800 IF RS$="A" OR RS$="P" THEN 2810 ELSE PRINT"NOT A P M": GOTO
 2770
2810 PRINT: LINEINPUT"ENTER FILE NAME OR <ENTER) "; NF$
2820 IF NF$="" THEN 1490
2830 OPEN "R",1,NF$: M%=1: NE%=0: NR%=20: SL%=62
2840 IF SL%+2>256 THEN STOP ELSE IN%=INT(256/(SL%+2))
2850 IR%=INT((M%-1)/IN%)+1: IS%=M%-IN%*(IR%-1)
2860 FIELD 1, ((IS%-1)*(SL%+2)) AS F0$, 2 AS F1$, SL% AS F2$
2870 GET 1,1: PRINT"FILE HEADER (RECORD 1) ="
2880 PRINTUSING"### "; CVI(F1$);: PRINT F2$: CLOSE: PRINT
2890 IF LEFT$(F2$,8)="CRYPFILE" THEN 2930
2900 PRINT"FILE DOES NOT EXIST - ENTER C TO CREATE"
2910 LINEINPUT"                 ENTER R TO REENTER NAME "; F1$
2920 IF F1$="C" THEN 3450 ELSE 2810
2930 IF RS$="A" THEN SR%=CVI(F1$)+1: GOTO 3000
2940 INPUT"ENTER STARTING RECORD NUMBER "; SR%
2950 IF SR%>0 AND SR%<=NR% THEN 3300
2960 PRINTUSING"<1 OR>##, RE-"; NR%: GOTO 2940
2970 '   END FILE PROCESSING MENU
2980 '
2990 '   ADD RECORDS ROUTINE
3000 PRINT: PRINT"    ADD RECORD ROUTINE"
3010 PRINT"ADD THE WORD ENDEND TO LAST RECORD TO BE ADDED"
3020 PRINT"    THE WORD ENDEND TERMINATES ADD ROUTINE"
3030 NS%=1: N%=0: OPEN "R",1,NF$
3040 FOR M%=SR%TONR%: IR%=INT((M%-1)/IN%)+1: IS%=M%-IN%*(IR%-1)
3050 FIELD 1, ((IS%-1)*(SL%+2)) AS F0$, 2 AS F1$, SL% AS F2$
3060 GET 1,IR%
3070 PRINT: PRINTUSING"ENTER REC ##"; M%: LINEINPUT"
 "; RI$
3080 'LINEINPUT ABOVE IS QUOTE, DOWN ARROW, SPACE, SPACE, QUOTE
3090 IF LEFT$(RI$,6)=K4$ THEN PRINT"USED K4 FLAG - REENTER": GOT
O 3070
3100 IF LEN(RI$)>0 AND LEN(RI$)<=SL% THEN 3120
3110 PRINTUSING"LENGTH < 1 OR >###"; SL%: GOTO 3070
3120 IF RIGHT$(RI$,1)=" " THEN RI$=LEFT$(RI$,(LEN(RI$)-1)): GOTO
 3120
3130 IF RIGHT$(RI$,6)<>"ENDEND" THEN 3150
3140 NE%=1: RI$=LEFT$(RI$,(LEN(RI$)-6)): RI$=K4$+RI$: GOTO 3160
3150 IF RIGHT$(RI$,1)=" " THEN RI$=LEFT$(RI$,(LEN(RI$)-1)): GOTO
 3150
3160 ED$="E": GOSUB 1960: LSET F2$=RO$: LSET F1$=MKI$(M%)
3170 PUT 1,IR%: IF NE%=1 THEN 3180 ELSE NEXT M%
3180 RI$=STR$(M%): RI$=MID$(RI$,2,4): J%=M%: M%=M%+1
3190 RO$="CRYPFILE NAME "+NF$+" UPDATED "+D$+" LAST RECORD "+RI$
3200 IR%=INT((M%-1)/IN%)+1: IS%=M%-IN%*(IR%-1): PRINTJ%;M%;IR%;I
S%
3210 FIELD 1, ((IS%-1)*(SL%+2)) AS F0$, 2 AS F1$, SL% AS F2$
3220 GET 1,IR%: LSET F2$=RO$: LSET F1$=MKI$(M%)
3230 PUT 1,IR%: M%=1: IR%=INT((M%-1)/IN%)+1: IS%=M%-IN%*(IR%-1)
3240 FIELD 1, ((IS%-1)*(SL%+2)) AS F0$, 2 AS F1$, SL% AS F2$
3250 GET 1, IR%: LSET F2$=RO$: LSET F1$=MKI$(J%)
3260 PUT 1, IR%: CLOSE: PRINT"END ADD RECORDS": PRINT: GOTO 2740
3270 '   END ADD RECORDS ROUTINE
3280 '
3290 '   PRINT ROUTINE
3300 PRINT: PRINT"    PRINT ROUTINE": PRINT: NS%=1: N%=0
3310 OPEN "R",1,NF$
3320 FOR M%=SR%TONR%: IR%=INT((M%-1)/IN%)+1: IS%=M%-IN%*(IR%-1)
3330 FIELD 1, ((IS%-1)*(SL%+2)) AS F0$, 2 AS F1$, SL% AS F2$
3340 GET 1,IR%: IF M%>1 AND LEFT$(F2$,8)="CRYPFILE" THEN 3410
3350 IF M%=1 THEN PRINT"FILE HEADER (RECORD 1) =" ELSE GOTO 3370
3360 PRINTUSING"### "; CVI(F1$);: PRINT F2$: NEXT M%
3370 ED$="D": RI$=F2$: PRINTUSING"REC ### "; M%;
3380 IF RIGHT$(RI$,1)=" " THEN RI$=LEFT$(RI$,(LEN(RI$)-1)): GOTO
 3380
3390 GOSUB 1960    'RO$ PRINTED BY ENCRYPT/DECRYPT SUBROUTINE
3400 NEXT M%
3410 CLOSE: PRINT: PRINT"    END PRINT ROUTINE": GOTO 2740
3420 '   END PRINT ROUTINE
3430 '
3440 '   CREATE FILE ROUTINE
3450 OPEN "R",1,NF$
3460 FOR M%=1TONR%: IR%=INT((M%-1)/IN%)+1: IS%=M%-IN%*(IR%-1)
3470 FIELD 1, ((IS%-1)*(SL%+2)) AS F0$, 2 AS F1$, SL% AS F2$
3480 IF M%>2 THEN 3520 ELSE RO$=STRING$(10,32)
3490 LSET RO$=NF$: J%=1: RI$=STR$(J%): RI$=MID$(RI$,2,4)
3500 RO$="CRYPFILE NAME "+RO$+" UPDATED "+D$+" LAST RECORD "+RI$
3510 LSET F2$=RO$: LSET F1$=MKI$(J%): GOTO 3530
3520 RO$=STRING$(SL%,CHR$(32)): LSET F1$=MKI$(M%): LSET F2$=RO$
3530 PUT 1, IR%: NEXT M%: CLOSE: PRINT NF$+" FILE CREATED": GOTO
 2740
3540 '   END PRINT ROUTINE
3550 '
3560 '   ERROR TRAP
3570 CLOSE: PRINT"ERROR ";ERR/2+1;" AT LINE ";ERL
3580 PRINT"WANT TO CONTINUE OR TO ABORT? C/A "
3590 RS$=INKEY$: IF RS$="" THEN 3590
3600 IF RS$="C" THEN RESUME 1490 ELSE RESUME 1600
3610 '
3620 '   LAST LINE CRYPTO PROGRAM
```

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Eight-bit printer driver for the Color Computer.

LP VII Patch for the CC

Roger L. Degler
814 W. Keating Ave.
Mesa, AZ 85202

The Radio Shack Color Computer is simple to use, interface to, and expand. Despite the TRS-80C's simplicity (in terms of design, construction, and ease of use), it is an amazingly powerful machine. However, TRS-80C is not perfect.

I am dissatisfied with the line printer driver routine contained in the Color Basic ROM. The link between the printer and the computer is serial RS-232. For some reason, Radio Shack and Microsoft decided that seven data bits, rather than eight, are adequate. For most printers it probably is.

But Radio Shack introduced the low-cost (less than $400) Line Printer VII as a mate to the Color Computer. It requires the eighth bit for its graphics mode. This dot-matrix printer can print upper and lowercase ASCII characters and dot-controlled graphics. It connects easily to the TRS-80C via an inexpensive four-wire cable and works well for the alphanumeric characters.

However, to use the dot-controlled graphics mode you must send eight data bits with the most significant bit set. If the computer sends only seven bits, how can you send the eighth bit? Radio Shack claims it is easy. Simply go to your local Radio Shack store or Computer Center and get a copy of a program catalog number 700-2013. (Take your own tape to the store and Radio Shack will copy it to your tape at no charge.) That would be fine if the stores could get the program themselves.

After waiting three months for the local Computer Center to receive their copy I gave up and wrote one myself (see Program Listing 1).

How the Program Works

In the Color Basic ROM, at address $A282, is a subroutine I call OUTCH for Output Character. This subroutine outputs the character which is in the A register to whichever output device you have specified (the screen, line printer, or the cassette recorder). This subroutine starts with a JSR $0167 instruction. This is a call to a RAM trap at address $0167. When you turn on or reset the computer this address contains an RTS instruction ($39). If the RTS instruction is still intact the effect of the trap is nil. Control returns to OUTCH and processing continues normally. If, however, a JMP instruction is present in the trap (addresses $0167-$0169), you can divert control from the ROM subroutine into a RAM resident routine to do whatever you like.

Program Listing 1 is divided into two sections—Start and Here. The Start section saves the current contents of the RAM trap and installs a JMP instruction that transfers control to the Here section every time OUTCH is called. The Start section should be executed only once after loading the program into memory.

The Here section takes control each time OUTCH is called. It determines if the output device is to be the printer, and if so, it makes sure the character is output with eight data bits rather than seven. If the output device is not the line printer, then

"I am dissatisfied with the line printer driver routine contained in the Color Basic ROM."

The Key Box

Color Computer
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the instruction which was originally in the trap location is executed. In Color Basic this will be an RTS instruction which returns control to OUTCH. In Extended Color Basic this will be a JMP instruction to a routine at address $8273. In either case, if the output device is not the line printer, then control returns to wherever the original trap would have sent it.

When Here determines that the line printer is the output device, the logic starting at label A@ gets the ROM-resident line-printer driver to output the full eight data bits and then JMPs into the middle of the ROM driver so that it will carry out this task. The comment, "out 1 stop bit," in Listing 1 is not an error. It should be a start bit, but the order in which the ROM driver works is: output one stop bit, output one start bit, output seven (or eight) data bits, and output one stop bit. The first step seems out of place, but it works.

The program is position independent. You can load it into any available memory and execute it there at label Start. The program sets up the trap so that control is transferred to Here no matter where Here is.

You may load the program into your computer with POKE statements and then save it to cassette using Extended Color

```
0001 0600                       NAM   PRTDRV

                        ********************************
                        *                              *
                        * PATCH TO ALLOW 8-BIT SERIAL  *
                        * TO THE LINE PRINTER SO THAT  *
                        * GRAPHICS MAY BE PRINTED.     *
                        *                              *
                        * ** POSITION INDEPENDENT **   *
                        *                              *
                        *                              *
                        * AUG. 15, 1981   12:30 AM     *
                        * ROGER L. DEGLER              *
                        *                              *
                        ********************************

0002 0600                       ORG   $0000

0003 0000               TRAP    EQU   $0167       'OUTCH' TRAP

                        *
                        * INITIAL START-UP
                        *

0004 0000 8E0167        START   LDX   #TRAP        SAVE OLD TRAP
0005 0003 A684                  LDA   0,X
0006 0005 A78D001B              STA   EXIT,PCR
0007 0009 EC01                  LDD   1,X
0008 000B ED8D0016              STD   EXIT+1,PCR

0009 000F 867E                  LDA   #$7E        SET NEW TRAP
0010 0011 A784                  STA   0,X
0011 0013 308D0004              LEAX  HERE,PCR
0012 0017 BF0168                STX   TRAP+1

0013 001A 39                    RTS           RETURN TO CMND LOOP


                        *
                        * VECTOR TO HERE FOR EVERY
                        * CALL TO 'OUTCH'
                        *

0014 001B 3404          HERE    PSHS  B           SAVE B
0015 001D D66F                  LDB   <$006F      TST FOR PRTR
0016 001F 5C                    INCB
0017 0020 3504                  PULS  B
0018 0022 2B03                  BMI   A@          BR IF YES
0019 0024 000000        EXIT    BSZ   3           NO -- OLD TRAP
                        *
0020 0027 3262          A@      LEAS  2,S         BUMP RTRN ADR
0021 0029 3417                  PSHS  CC,A,B,X    SAVE REGS
0022 002B 1A50                  ORCC  #$50        DISABLE INTRPTS
0023 002D BDA2FB                JSR   $A2FB       OUT 1 STOP BIT
0024 0030 C609                  LDB   #9          B=BIT CTR
0025 0032 3404                  PSHS  B           SAVE CTR ON STK
0026 0034 5F                    CLRB              CLR C-BIT




0027 0035 7EA2CC                JMP   $A2CC       BACK TO ROM

0028 0038                       END   START
```

Program Listing 1

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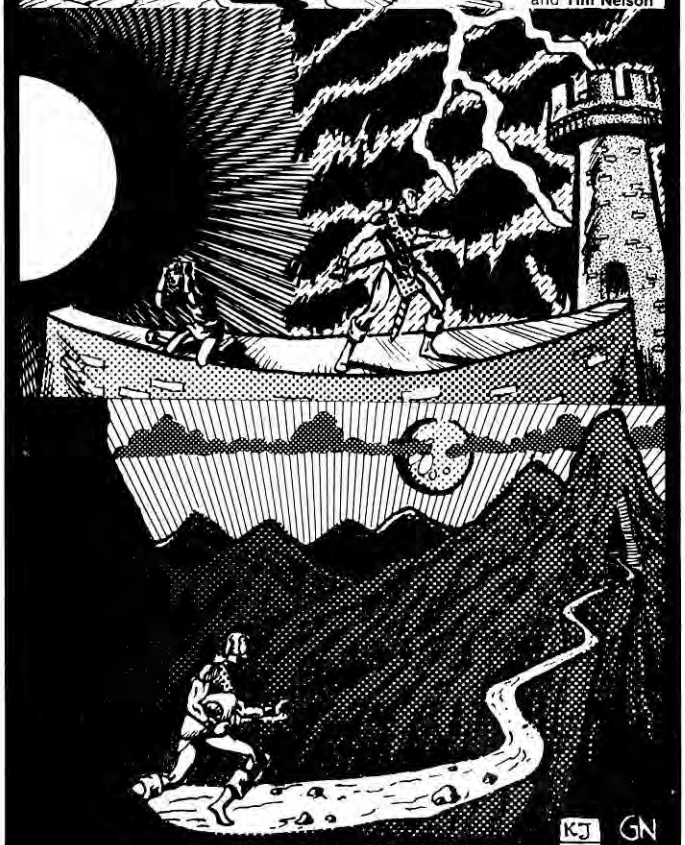

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Basic's CSAVEM command. A much simpler method is to use a monitor program such as CBug from The Micro Works.

The program listing starts at address $0000. Since the program is position independent, do not load the program at that address. Rather, depending upon how much RAM you have in your system, select an address high out of the way of your Basic program. You can protect this top end of memory from being overwritten by Basic via the Clear command.

The Line Printer VII has a three-position slide switch on its back for selecting the desired interface. The three choices are seven-bit serial, eight-bit serial, and Centronics-compatible parallel. The normal selection for use with a TRS-80C is seven-bit serial. With the switch in the eight-bit serial position, and without this program, the printer accepts data from the computer, but never prints it because the computer is sending seven-bit data followed by two stop bits. This appears to the printer as eight-bit data followed by one stop bit with the eighth data bit always high. This makes it impossible for the printer to recognize any of the control codes necessary to begin the print cycle.

Each time you turn on your computer you must load this program via the CLOADM command and execute it via the EXEC command. You can then put the switch into the eight-bit serial position and all will be well. All normal alphanumeric characters will print normally, and you may use the dot-controlled graphics mode at will. You must refer to the user's manual for your printer to see what control codes to send to achieve the desired results.

Program Listings 2-4 are short programs demonstrating that the new eight-bit program in Listing 1 works correctly.■

Mr. Degler is president of Micro Technical Products Inc.

```
10 PRT=-2                          'Printer device #.
20 PRINT #PRT,CHR$(18);            'Select graphics mode.
30 FOR CC=0 TO 127                 'CC = Column Counter.
40 MD=CC-INT(CC/12)*12             'Calculate modulo 12.
50 IF MD>6 THEN MD=12-MD
60 CHAR=1                          'Calculate correct bit pattern.
70 IF MD=0 THEN 90
80 FOR I=1 TO MD: CHAR=CHAR*2: NEXT
90 CHAR=CHAR+128                   'Set MSB.
100 PRINT #PRT,CHR$(CHAR);         'Output character to printer.
110 NEXT CC                        'Advance to next column.
120 PRINT #PRT,CHR$(30)            'Select character mode.
130 END
```

Program Listing 2

```
10 PRT=-2                          'Printer device #.
20 '
30 LB$=CHR$(128+64)                'Low Bar string.
40 MB$=CHR$(128+8)                 'Middle Bar string.
50 HB$=CHR$(128+1)                 'High Bar string.
60 LV$=CHR$(128+8+16+32+64)        'Low Vertical string.
70 HV$=CHR$(128+1+2+4+8)           'High Vertical string.
80 CY$=LV$+MB$+MB$+HV$+HB$+HB$+HV$+MB$+MB$+LV$+LB$+LB$ 'CYcle st
ring.
90 '
100 PRINT #PRT,CHR$(18);           'Select graphics mode.
110 FOR CC=1 TO 20                 'CC = Cycle Counter
120 PRINT #PRT,CY$;
130 NEXT CC
140 PRINT #PRT,CHR$(30)            'Select character mode.
150 END
```

Program Listing 3

```
10 PRT=-2                  'Printer device #
20 PRINT #PRT,CHR$(18);    'Select graphics mode.
30 FOR I=128 TO 255
40 PRINT #PRT,CHR$(I);     'Output graphics character with MSB set.
50 NEXT I
60 PRINT #PRT,CHR$(30)     'Select character mode.
70 END
```

Program Listing 4

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On the leading edge of data-base technology.

Profile III+

Wynne Keller
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There is a considerable difference between the listed price for the Radio Shack version of Profile III+ and The small Computer Company version. The reason for the price difference is volume sales; Radio Shack offers a lower price due to their huge market. I asked the president of The small Computer Company why anyone would want to buy the program from him instead of Radio Shack. His reply was service; his company helps clients with any installation and initialization problems, and if any software bugs develop, registered owners can expect solutions within hours or, at most, days.

Profile III+ comes on two disks: the creation disk, which initializes the data base, and a run-time disk. If the creation disk is damaged it can usually be restored from a back up, but the back-up disk itself is unusable. The creation disk is vital initially, but not in everyday use. If it does have to be replaced, timing is not likely to be crucial, since you can still run the program while obtaining the new copy. Run-time disks are not protected.

Capacity

The maximum number of characters per record is 1,020; up to 255 of these can be in the key segment. The key segment includes all the fields for sorting or searching. All other fields go to different segments. Total capacity depends on the number of drives available, but if each record were 255 characters, about 250 records would fit on drive 0. This drive also holds the run-time programs, and about 600 on drive 1.

In practice, segments must be carefully allotted to the various drives to fill the drives uniformly. If any one drive fills, the empty space in the rest becomes unusable. Plan carefully to ensure that the smallest segment goes on drive 0. Total four-drive capacity with 255-character records is about 2,000. For some applications, this may not be enough.

Unfortunately, the program is only compatible with TRSDOS, and cannot be used on hard-disk drives. It would be nice if a future version of Profile III+ were compatible with DOSPLUS or LDOS so it could be used on hard-disk drives.

Sort is in memory, and the capacity depends on the length of the field chosen. On a three-character field, about 6,000 records can be sorted. On a 50-character field, about 850 records is the limit. If you want a two-field sort, capacity is reduced because the number of characters in the first field of the sort is added to the second, and all must fit in memory. If the records don't fit, select a portion to sort at one time. Although this is annoying, what the sort lacks in capacity it gains in speed.

Profile III+ allows math formulas using add, subtract, multiply, or divide. Up to 16 formulas can be written, using up to 20 fields per formula. The math fields let you calculate taxes, commissions, totals, subtotals, and so on. Used properly formula fields are very powerful.

They cannot do everything, however, and it might be helpful to point out a limitation: A typical business problem is inventory control. You cannot write a formula that takes the total on hand at the beginning of the year, and subtracts from it another field that is to be daily sales of the item. A field cannot add or subtract something from itself and store the result back in the original field. The only practical solution is to write a program to accept daily sales data and access the Profile III+ files to automatically alter the field containing total on hand.

Initialization

Setting up any data base is difficult for a novice. Standard data-base terms, such as file, field, record, sector, key, and Boolean logic, must be understood completely to use the program. The manual assumes the reader is a business user who is approaching data-base software for the first time. Worksheets are provided to help the user determine what fields are needed, and includes typical field lengths. However, nothing but experience will teach you exactly how to initialize the program for greatest utility.

The manual, although explicit in some areas, is vague in others. It does, however, include a helpful glossary.

Profile III+ has a useful field type called associated fields. This is the first data base I've encountered with this type of field, and it is very powerful. Suppose you were indexing a library and had a book that belonged under two topics, perhaps history and humor. If you don't have associated fields, the only way to give the book two category listings is to enter it twice into the data base. This involves needless duplication of the author's name and book title, just to have another record putting the book in a second category.

The solution is associated fields. Create two (or more) associated fields for the category; type history into one, and humor into the other. Profile III+ searches or sorts by each associated field. The book will show up in a category list twice: once for humor, once for history, but you only had to type the information once. Associated fields must all be the same length, and must be in the same segment of the record (probably the key segment).

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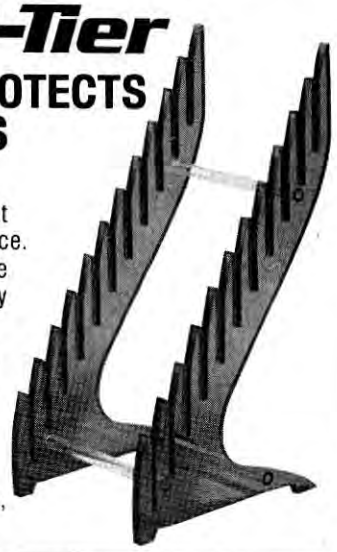

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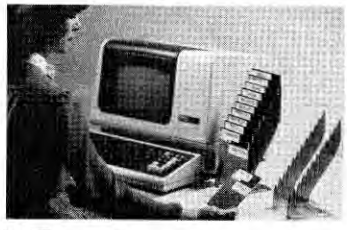

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Profile III + sorts more than one field at a time, but the fields to be sorted must be in the proper order, and you cannot change the order later. So, if you plan to sort mailing lists by zip codes and names within each zip code, initialize the zip-code field first, and then the last-name field, followed by the first-name field. This works well, except if you later want the list in some other order, it cannot be done. In some applications this can be a problem.

Initialization is more complicated if the file is to occupy more than one drive. The key segment must include all fields to search or sort later. Other segments contain less vital information, which can go on another drive. The manual assumes that if you assign segments to another drive, you have at least three because the instructions state to assign the first segment to drive 1, and the second to drive 2 (the creation disk is on drive 0).

If you have two drives, you'll want to use drive 0 also, and swap the creation disk out so a segment goes on drive 0. It's easy to put the wrong disk in, or the right disk at the wrong moment, and have initialization fail. The manual needs better step-by-step directions for initializing with a two-drive system, stating exactly when to swap disks, as well as when to use the run-time disk, and when a formatted disk.

Add / Update / Inquire

As you begin using the program, the most striking features are speed and flexibility. Program sections load rapidly, and all programs are in machine code for greatest possible operation speed. You can design as many as five different screens for adding and viewing records. Screens can be protected with passwords, and portions of screens can be protected from data entry or changes. The different screens can be accessed by various personnel allowing access to only portions of the data. It is also possible to force some fields to fill before the user can consider the entry complete.

Designing screens is easy. You specify the field number, and indicate the type of data to enter with various characters. Among the format choices are alphanumeric, numeric, dollar and cents decimal, protected, month/day/year, year/month/day, and must-fill versions of all of these. The cursor can move anywhere on the screen, and a counter tells you the cursor's location. Any type of user instructions can be included on the screen, and the entry prompt doesn't have to be the field name. During viewing of records, you can switch from one screen to another quite easily. For adding records it is best to work with only one screen at a time.

Add, update, and search are all available from the same master program, so there's no delay. As in all random-access data bases, there's a brief delay after each entry while the record writes to the disk. The program appears forgiving of user errors. The break key doesn't cause lost records. Break is under program control, and pressing it twice moves you from one section to another.

Adding records includes the ability to duplicate a previous entry in each field with a single key. Enter and the arrow keys control cursor movement. If you try to record the screen before all the must-fill fields have received data, the screen flashes the fields that still need data. For speed in adding records, set up the screen so that all must-fill fields are first. When the record is complete, the clear key records it.

Searching can be on any key segment field. You can also build an index file that allows more rapid searches on the indexed field. Records can be accessed directly by record number, scanned one at a time using the arrow keys, or searched via any key field. Once you find the record, you can look at adjacent records, or press enter to continue the search and see if any other records meet the search criterion. Changes can be made on any record displayed. The search can find records even if the uppercase/lowercase configuration of the letters does not match the original entry.

There is a wild-card search in which you can specify a particular position for the match, and not care if the rest of the positions match. This is useful for coded inventories; a letter or number in a certain position can mean something special, and all records with a match in that position can be found.

A potentially serious flaw in the program is the search on numeric fields. Numeric entries are right justified after they are typed. If the field is 10 characters long and you type five, the five characters move over when you press enter. This looks fine, until you try to search that field. If the search data is only five digits, the record is not found! Type five blank spaces ahead of the number for a match to occur. This can cause serious usage problems, especially if the person using the program is not the one who set it up and doesn't know the field's length.

Extended selection is available for reports or labels, allowing searches on up to 16 fields, if you have that many key fields. Specify the option before making the menu choice for printouts. In extended and regular (two field) selection, enter each field to search, and the Boolean relationship (equals, greater than, less than, and so on). The records can match if they meet the selection criteria in every field (and relationship) or if they meet the criteria in any field (or relationship), or you can mix and/or relationships as needed. This is complicated to describe but not that difficult to use, and is similar to most data bases, except that using default values makes simple one-field selections easier. In the extended selection mode, associated fields lose their associated status, and each must be entered in-

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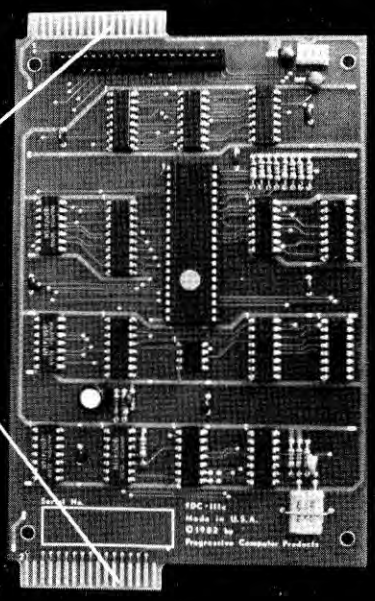

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to the search separately, if you want to search all fields.

Reports / Labels

Sorting is part of the report or label options. The whole file can be sorted, or a selection of records. If the field to sort is very large, it may be necessary to select only a portion of the records at a time. It is also possible to sort less than the entire field (perhaps just the first three characters) if an exact sort isn't needed. This feature increases sort speed and capacity.

Report and label formats are designed by the user in much the same way as screens. A report can have only two lines per record, and if both lines are used, a space is automatically inserted between records. Labels may have eight lines, and any field can be pushed left to meet the end of the previous field, so no undesirable long gaps are left between fields such as last name, first name. It is possible to use labels up to six across, an important feature for heavy business use.

All reports and labels can be designed for 80 or 132-character printers, but, unfortunately, you cannot software select the 132-character mode in a printer that uses 8½-inch paper. It would be helpful for the user to have the option of entering the 132-character control code his printer uses. The only way around this problem is to load Basic from some other disk before loading Profile III+ and send your 132-character control code to the printer.

Designing report formats is easier with Profile III+ than any other data base I've tested. Profile III+ allows you to visualize the report on screen. A grid across the top of the screen marks print positions up to 132 characters. One part of the screen is for column headings, and the part directly below is for the field number to go with the heading. Up to five different report formats are allowed per file.

Special Features

Profile III+ has features designed to simplify use or increase flexibility. Perhaps the most important of these are the connections to Super Scripsit (not regular Scripsit) and VisiCalc. It was not possible to test these interfaces, but according to the manual, it is possible to design form letters with Super Scripsit and print them with names and addresses and other information from Profile III+. The VisiCalc interface allows you to specify whether each field is a label or a value. You then select the records you want and save them to disk in a manner compatible with VisiCalc.

You can also customize menus. A user menu automatically bypasses several questions that must normally be answered, and is useful to employees who know little about computers. After customization, the appropriate file name, program, and format are loaded by pressing one menu selection. With a user menu, it took 15 seconds from the moment the add-records selection was made until the initial phase for adding records was on screen. While this didn't save a lot of time (it took 18 seconds with the regular menu), it was easier and removed possibilities for error. User menus can be further customized to include selection and sort criteria if you regularly use the same parameters to print your reports.

Mass operations are very powerful. These include mass recalculate, delete, printout, and purge. Mass recalculate allows you to change an amount in a formula, then recalculate the records that use that formula. Mass purge first makes printouts, then deletes. Mass delete removes records without making a printout first. The printouts in mass operations are screen prints, one per page.

The sophistication of data-base software continues to improve. This program has more features than the best I have previously reviewed, and also offers greater speed and less aggravation. The convenience, of course, has a higher price tag. But convenience is not all you're buying. There are some new features not previously available in Model I or III data-base software. These include associated fields, user-created menus, VisiCalc interface, user-created input screens, and different protection levels at various parts of the program.

The small Computer Company's Profile III+ sells for $300. Their address is: The small Computer Company, 230 West 41st St., Suite 1203, NY, NY 10036. Radio Shack's Profile III+, catalog #26-1592, sells for $199. ■

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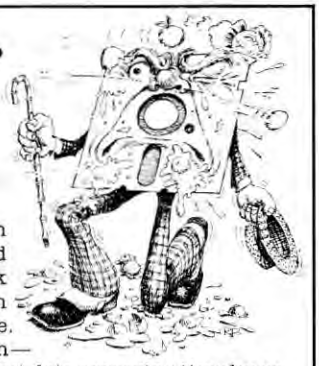

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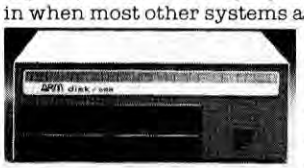

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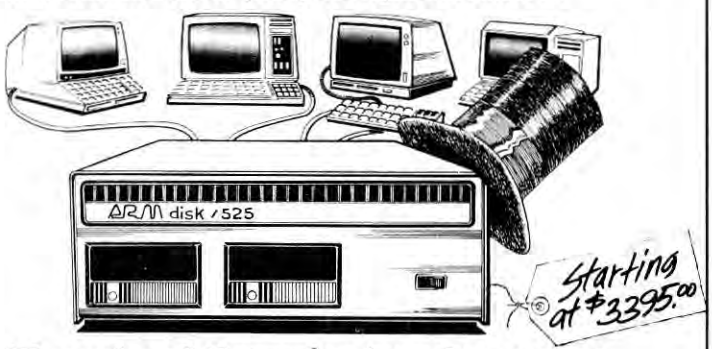

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Can you get all your frogs across the busy highway, avoiding heavy traffic, so they aren't squashed? So far, so good. ***Now,*** get them across the river by jumping on floating logs and hopping on swimming turtles. You score each time a frog crosses the river safely. Joystick compatible.

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SPACE ROCKS

By Steven Kearns from Acorn
Gigantic antimatter rocks appear on the Tactical Display Screen of your spacecraft. You blast away with lasers and they just explode into smaller chunks. To score in this fast arcade game with sound, you must destroy the rocks. To stay in the game at all, you must avoid them!

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By Jeff Zinn from Big Five
This new arcade game from Big Five continues their tradition of bringing you the most exciting action in innovative space games. Your fighting spacecraft must run the gauntlet of the attacking alien's weaponry in order to accomplish your defense mission. You'll use all your skill and dexterity just to survive! Joystick Compatible.

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ARMORED PATROL

By Westmoreland & Gilman from Adventure
As commander of a lumbering T-36 tank you have the firepower to destroy the enemy—if you can find them. They may be hiding behind the houses scattered about, the bleak terrain and your only view is thru the drivers port (your screen). Impressive animation in this arcade game.

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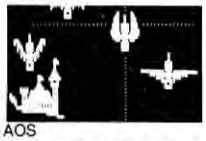
VOYAGE OF THE VALKYRIE



By Leo Christopherson from AOS
Combine the animation and music techniques pioneered by Christopherson with the challenge of his first fast-moving arcade game and you have VOYAGE OF THE VALKYRIE! You speed through a magical maze guarded by ferocious birds that swoop down to attack if you don't get them first. To list all the play and options of this exciting game would take the 16 pages of instruction included.

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METEOR MISSION 2

By Hogue & Konyu from Big-Five
Six astronauts are stranded on a desolate planet. You must undock from your command module and maneuver your rescue shuttle through the asteroid field to save them. You can only save one at a time, and each landing burns away parts of your landing sites. Order this realtime action game now or live with the astronauts' pitiful screams forever. Joystick Compatible.

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CATERPILLAR

From Soft Sector Marketing
This is the fast-action arcade game you've been waiting to play at home! You must hit mushrooms and caterpillars—segment by segment—moths and tumble bugs. The challenges: they are all moving; when hit they split into additional segments or metamorphose into different shapes; when you destroy a caterpillar, the new one that replaces it is a segment ***longer*** than the original!

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DEFENSE COMMAND

By Hogue & Konyu from Big Five
You are the lone defender of 10 Krotnium fuel cells essential for the survival of the planet. Aliens swoop down from above to steal the fuel; it's your job to destroy them. You can still save the cells after a raid, but you must shoot the alien and simultaneously move under the cell to catch it. If things look bad you can set off one of your 4 antimatter bombs and destroy all enemies on the screen! Arcade fun with action and sound. Joystick Compatible.

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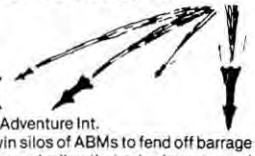

By Philip Oliver from Adventure Int.
You must use your twin silos of ABMs to fend off barrage after barrage of enemy missiles that rain down toward your cities. As your skill increases so does the difficulty and speed of this machine language arcade game. Watch the skies and may your aim be true! MISSILE ATTACK has sound and fast-moving graphics galore.

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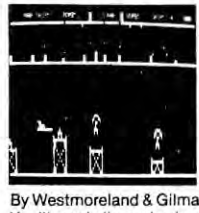

ELIMINATOR

By Westmoreland & Gilman from A.I.
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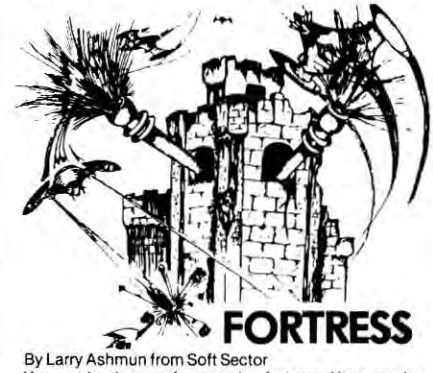

FORTRESS

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By Carl Miller from Acorn
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ALIEN ARMADA

By Waldron Hodsdon from Liberty
Hmmm. Looks like another "Space Invaders" type game. Nice neat racks of aliens poised over your defensive base...but WATCH OUT! Here they come, swooping down with their bombs and Kamakazi-like dives. There are individual attackers plus group flights—all intent on destroying your three bases before you destroy them. ALIEN ARMADA allows up to two players and has three levels of difficulty from beginner to expert.

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Does practice make perfect?

Production Learning Curve

J. R. Jeffrey
8 Hope Road
Eatontown, NJ 07724

How much will the 123rd widget off your production line cost? How much should you pay the XYZ Corporation for the 300 items they will produce for you? How do you determine the average cost of items coming off your assembly line for amortization purposes?

You may answer all these questions completely or in part by using the production learning-curve program presented here.

The theoretical beginnings of the learning curve arose in studies and practice as far back as the 1920s. During the 1920s engineers and program managers recognized that people engaged in manufacturing processes could work faster as time passed. They found that this reduction in labor hours per item appeared to be a constant function and could be plotted on logarithmic paper. The resulting plot was a linear depiction of the labor-hour reduction arising from the learning involved in production.

Researchers have shown that the labor-hour reduction resulting from the learning process is a function that causes a set percentage decline in costs per labor hours as the number of units produced is doubled.

The Key Box

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Disk Basic

Learning rate = 85 Number of items = 125 Cost of first item = 1,000,000.00

*****These computations assume that the unit cost decreases by a constant percentage at each doubling of the quantity produced.

unit numb	unit cost	cumulative average	total cost
1	1,000,000.00	1,000,000.00	1,000,000.00
2	850,000.02	925,000.01	1,850,000.02
3	772,914.83	874,304.95	2,622,914.85
4	722,500.03	836,353.72	3,345,414.88
5	685,671.09	806,217.19	4,031,085.97
6	656,977.65	781,343.94	4,688,063.62
7	633,656.50	760,245.73	5,321,720.12
8	614,125.01	741,980.64	5,935,845.14
9	597,397.39	725,915.84	6,533,242.52
10	582,820.48	711,606.30	7,116,063.00
11	569,940.63	698,727.60	7,686,003.63
12	558,431.03	687,036.22	8,244,434.65
13	548,048.56	676,344.86	8,792,483.21
14	538,608.01	666,506.52	9,331,091,23
15	529,965.34	657,403.77	9,861,056.57
16	522,006.33	648,941.43	10,383,062.90
17	514,638.78	641,041.28	10,897,701.68
18	507,787.82	633,638.31	11,405,489.50
19	501,391.23	626,677.93	11,906,880.74
20	495,397.33	620,113.90	12,402,278.07
21	489,762.51	613,906.69	12,892,040.58
22	484,449.51	608,022.28	13,376,490.09
23	479,426.62	602,431.16	13,855,916.71
24	474,666.30	597,107.63	14,330,583.01
25	470,144.81	592,029.11	14,800,727.81

Fig. 1. Unit cost learning curve—complete schedule

Learning rate = 85 Number of items = 125 Cost of first item = 1,000,000.00

*****These computations assume that the unit cost decreases by a constant percentage at each doubling of the quantity produced.

unit numb	unit cost	cumulative average	total cost
125	322,364.72	416,132.57	52,016,571.16

Fig. 2. Unit cost learning curve—single unit

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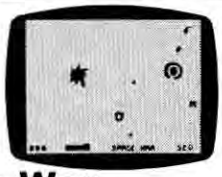

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Exciting racetrack game for 1 to 4 players. Each player gets $100 to bet. There are 4 horses in each of 12 races; odds are posted at the bottom of the screen for each. The outcome of the race ***cannot*** be predicted. At the end of the race, the computer awards wins or losses. No joystick required; one player must enter information at the keyboard. Extended BASIC required.
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Cocobug

Debugging Monitor for TRS-80 Color Computers

By Allen Gelder From Allen Gelder Software
COCOBUG is a compact monitor program. "With COCOBUG you may examine RAM and ROM in hexadecimal, ASC II or mixed hex and ASC II form. In addition, the powerful MC6809E CPU is made available in a pair of 6809 Programming Models that depict the CPU features at entry and exit (via a restorable Breakpoint) of your machine code string. Byte entry and Breakpointing, plus the ability to direct real-time program flow, are made easy and natural through a line-entry of addresses, bytes and certain control characters."
Tape, $19.95 4K Color BASIC, 16K Extended Color BASIC.

Co-Resident Editor/ Assembler (CO-RES9)

From Cer-Comp
CO-RES9 is a M6809 processor machine language program for the color computer. You can enter the text of your article, letters, or a chapter of your newest book; then go back and revise. The tape contains two copies of a demonstration program that you can use to familiarize yourself with the Editor and Assembler entry format.
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Cosmic Super Bowl

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An excellent simulation of the popular handheld football games, but with a ***cosmic*** flavor. You must maneuver your player through a field of defenders. 5 action skill levels. Extended BASIC not required.
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By Fred Scerbo
From Illustrated Memory Banks
Test your reflexes in this arcade-type space game. Your fighter craft is armed with automatic laser cannons and rechargeable shields to blast the enemy pirate saucers which pop in and out of hyperspace. Comets can destroy you and end game unless you hit them ***dead center.*** 3 levels of difficulty; challenging. Extended BASIC, joysticks required.
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6809 Assembly Language Programming

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This comprehensive book covers 6809 assembly language programming in detail. The entire instruction set is presented and fully explained. The book contains many fully debugged, practical programming examples with solutions in both object code and source code. Discussion of assembler conventions, I/O devices, and interfacing methods is also included. If you've never before programmed in assembly language, this book will teach you how. If you're an experienced programmer, you'll find this book an invaluable reference to the 6809 instruction set and programming techniques.
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Cosmic Invaders

From Spectral Associates
Fast-action invaders-type game, complete with 16 skill levels, dynamite sound and 4-color hi-res graphics. Use the special mobile defense shield to help you dodge the invaders' bombs. With Mystery Invader who zooms in and out of hyperspace. Extended BASIC not required.
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Starbase Attack

By Fred Scerbo
From Illustrated Memory Banks
You are the lone defender of 3 starbase cities on the far edge of our galaxy in this exciting simulation. Your cities are under attack by either alien warheads or bombarding asteroids. You only have a limited time to evacuate your population. You must ward off attack while launching your escape vehicles and your own ship. Extended BASIC, one joystick required.
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By Commander from Interpro
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The curve that describes this observation is Y = A*x**B, where Y equals the unit or average cost of the item, A equals the cost of the first unit (FUC), and x equals the number of units in the run.

B is a function related to the percent slope of the logarithmic cost line. A 50 percent learning rate gives a 45-degree slope to the logarithmic line. Slopes of 80–90 percent are common for production of electronic equipment. B equals LOG(S)/LOG(2), where S is the learning rate (R) expressed as a decimal (for example, R equals 90 percent gives S equals 0.9). I used an equivalent expression in the program to decrease the rounding error.

The above equation defines two curves. The first is the unit log-linear learning curve, which results when the cost of each unit declines at a constant percentage (learning rate) as the number of units produced is doubled. The second curve is the cumulative-average log-linear learning curve, which results when the average unit cost decreases at a constant percentage as the number of units produced is doubled.

Although the cumulative and unit curves have the same basic defining equation, the results of its use are different. Y = A*x**B in the unit curve gives the cost of the last unit of the production run in either monetary or labor units. For the cumulative average curve the equation Y = A*x**B gives the cumulative average value of the cost of the units in that production run in either monetary or labor units.

Learning rate = 85 Number of items = 25 Cost of first item = 1,000,000.00

*****These computations assume that the cumulative average cost follows a log-linear curve.

unit numb	unit cost	cumulative average	total cost
1	1,000,000.00	1,000,000.00	1,000,000.00
2	700,000.05	850,000.02	1,700,000.05
3	618,744.43	772,914.83	2,318,744.48
4	571,255.62	722,500.03	2,890,000.10
5	538,355.35	685,671.09	3,428,355.46
6	513,510.47	656,977.65	3,941,865.92
7	493,729.59	633,656.50	4,435,595.51
8	477,404.59	614,125.01	4,913,000.11
9	463,576.38	597,397.39	5,376,576.48
10	451,628.27	582,820.48	5,828,204.75
11	441,142.14	569,940.63	6,269,346.89
12	431,825.46	558,431.03	6,701,172.35
13	423,458.87	548,048.56	7,124,631.23
14	415,880.98	538,608.01	7,540,512.20
15	408,967.91	529,965.34	7,949,480.12
16	402,621.21	522,006.33	8,352,101.33
17	396,757.96	514,638.78	8,748,859.29
18	391,321.54	507,787.82	9,140,180.83
19	386,252.58	501,391.23	9,526,433.41
20	381,513.18	495,397.33	9,907,946.59
21	377,066.22	489,762.51	10,285,012.81
22	372,876.32	484,449.51	10,657,889.13
23	368,923.19	479,426.62	11,026,812.31
24	365,178.82	474,666.30	11,391,991.14
25	361,629.07	470,144.81	11,753,620.21

Fig. 3. Cumulative average learning curve—complete schedule

Learning rate = 85 Number of items = 125 Cost of first item = 1,000,000.00

*****These computations assume that the cumulative average cost follows a log-linear curve.

unit numb	unit cost	cumulative average	total cost
125	247,013.72	322,364.72	40,295,589.72

Fig. 4. Cumulative average learning curve—single unit

Program Listing

```
10 REM *****Production learning curve program
20 REM *****Written by J.R. Jeffrey
30 REM *****            8 Hope Road
40 REM *****            Eatontown, NJ 07724
50 REM *****            December 20, 1981
60 REM *****Based on the Boeing curve and the book:
70 REM *****Planning Production Costs by E.B. Cochran
80 '*****Headliner 90-100 *****
90 CLS:PRINT@320,CHR$(23)TAB(9)"Log-linear":PRINTTAB(11)"Learnin
g":PRINTTAB(13)"Curves"
100 PRINT@896,"";:GOSUB1310
200 '*****Function and variable definition*****
210 DEFDBL B,C,U,N,R,T
220 DEFSTR Q,P
230 DEFINT A,K
240 DEF FN C(C1,N,B)=C1*N[B 'Change if disks not available
250 PU="###,###,###.##" 'Edit string for unit & cum costs
260 PT="###,###,###,###.##" 'Edit string for total cost
300 '*****Instructions and data entry 310-470*****
310 CLS:PRINT"This program will compute values for log-linear le
arning or     production experience curves. Are your production
```

Listing continues

> *"During the 1920s engineers and program managers recognized that people engaged in manufacturing processes could work faster as time passed."*

In practice, learning curves are applied to estimate the cost of producing a given number of prime-mission equipment items within an equipment category. The estimate may be expressed in terms of monetary units (dollars or other currency) or labor units (man-hours, man-months or some other such measure). The estimate is composed of contractor (producer) quantity related recurring costs and includes administrative costs and fees or profit associated with production of the end items. It normally will not include any contractor non-recurring or non-quantity related costs (for example, project management, test and evaluation; training; in-house government production costs; government furnished equipment (GFE); data; special test equipment; or initial spares and repair parts).

The Program

You may use either the unit or cumulative average curve. To use the program you must know or assume certain things:

- The curve the production costs follow (is it unit or cumulative average?);
- The slope or learning rate;
- The cost of the first unit; and
- The number of units in the production run.

Figures 1-4 show example runs using a TRS-80 with a disk drive and Epson MX-80

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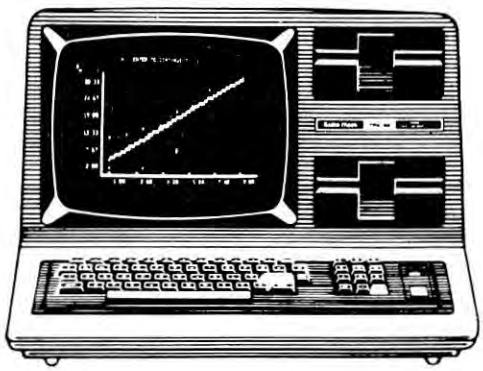
TRS-80 MODEL III



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printer. Figure 1 is a complete schedule for a production run of 25 items on an 85-percent unit-cost learning curve with a FUC of $1,000,000. Figure 2 is a computation for a single unit (the 125th) on the same 85-percent curve with an FUC of $1,000,000. Figures 3 and 4 provide similar computations for the cumulative-average learning curve using the same starting inputs.

There is a rounding error in the computations amounting to about two cents per million dollars. Item 2 in Figs. 1 and 3 confirm this. The figures that read 850,000.02 in both examples should read exactly 850,000. This also very neatly shows the difference between the two curves; the cumulative average in the cumulative curve equals the unit cost in the unit curve. Be sure you know which curve you are using or you could introduce a very large unintentional error into your computations.

A single-value computation on the unit-cost learning curve is an approximation that begins to show errors in the fifth significant figure for a million-dollar FUC and unit numbers greater than 10. I used the approximation to get a faster single-value response since a full run of the unit curve would have been necessary otherwise. No approximation is required for the cumulative curve because of the simpler mathematics involved.

Neither disk nor printer are necessary to run the program. The Program Listing shows you where to change the program so disks aren't needed. The program is already constructed to allow you to go around the printer output by putting all the output on the screen.

You could further develop the program by determining first-unit costs when all values for a single lot in the production run are known or by handling multiple lot computations. ■

Listing continued

```
costs decreas-ing at a constant rate for each unit or for the cu
mulative      average of all units produced?"
320 PRINT:PRINT:PRINTTAB(10)"<1> Each unit":PRINTTAB(10)"<2> Cum
ulative average"
330 PRINT:PRINT:INPUT"Answer with 1 or 2";A1
340 IF A1 <1 OR A1>2 PRINT"YOU MADE AN ERROR":GOTO330
350 CLS:INPUT"Input cost of first production unit";C1
360 PRINT:PRINT:INPUT"Enter the learning rate (generally called
the slope)";R
370 IF R<50 OR R>100 PRINT"YOUR ANSWER MUST BE BETWEEN 50 AND 10
0":GOTO360
380 B=LOG(100/R)/(-0.6931471824645996) 'Alternative form used to
 reduce rounding error FROM .08 TO .02 CENTS PER MILLION $
390 CLS:PRINT"Do you want to compute for a particular unit, e.g.
, unit #556 ordo you want a complete schedule from the first uni
t to a        particular unit?"
400 PRINT:PRINT:PRINTTAB(10)"<1> Particular unit":PRINTTAB(10)"<
2> Complete schedule"
410 PRINT:PRINT:INPUT"Answer with 1 or 2";A2
420 IF A2<1 OR A2>2 PRINT"YOU MADE AN ERROR":GOTO410
430 PRINT:PRINT:INPUT"What is the number of the particular unit
or last unit if a      complete schedule";N
435 N1=N
 'Save N to allow normal use in computations
440 CLS:PRINT"Do you want your answer printed on your MX-80 prin
ter?":PRINT:PRINT
450 PRINTTAB(10)"<1> On printer and screen":PRINTTAB(10)"<2> Jus
t the screen"
460 PRINT:PRINT:INPUT"Answer with 1 or 2";A3
470 IF A3<1 OR A3>2 PRINT"YOU MADE AN ERROR":GOTO460
500 '*****Compute single values*****
510 IF A2=2 GOSUB600  :GOTO1400   'GOSUB to compute complete sch
edule
520 ON A1 GOSUB840  ,810  :ON A1 GOSUB920  ,900  :GOSUB940  :GOS
UB970  :GOSUB1310  'Compute single value to screen
530 IF A3=1 THEN GOSUB1320 ELSE GOTO1400
540 IF Q="Y" THEN LPRINTCHR$(18):Q="":ON A1 GOSUB1120 ,1110 :GOS
UB1130 :ON A1 GOSUB1150 ,1140 :GOSUB1160 :GOSUB1190 :ON A1 GOSUB
1150 ,1140 :LPRINTCHR$(18):LPRINTCHR$(140):GOSUB1400
550 IF Q="N" THEN GOTO1400
560 PRINT"YOU MADE AN ERROR!":GOTO530
600 '*****Compute complete curve schedule*****
610 N=0  'N save earlier to allow normal use in computations
620 IF A3=1 THEN GOSUB1320 ELSE GOTO 660
630 IF Q="Y" THEN LPRINTCHR$(18): Q="":ON A1 GOSUB 1120 ,1110 :G
OSUB1130 :ON A1 GOSUB 1150 ,1140 :GOSUB1160 :GOTO660
640 IF Q="N" THEN Q="":GOTO660
650 PRINT"YOU MADE AN ERROR!":GOTO620
660 ON A1 GOSUB 920  ,900  :GOSUB940
670 ' To allow continuous printing on both screen & printer remo
ve FOR...NEXT and following INPUT stmt.
680 FOR K=1 TO 12
690 N=N+1
700 IF A3=1:IF PEEK(16425)>=61 THEN POKE16425,0:LPRINTCHR$(140):
GOSUB1130 :ON A1 GOSUB 1150 ,1140 :GOSUB1160
```

Listing continues

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"**OMNITERM** has my vote as the top TRS-80 terminal program available today" Kilobaud Microcomputing, June 1981, pages 16-19.

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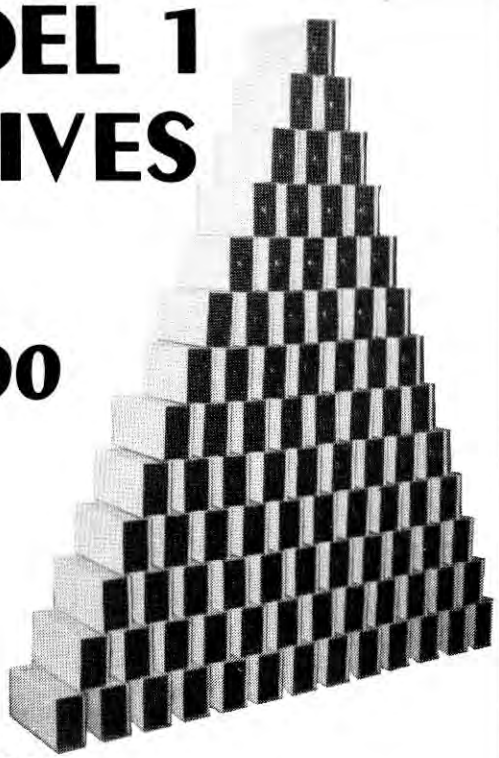

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Listing continued

```
710 ON A1 GOSUB860  ,810  :GOSUB970  'line to screen
720 IF A3=1 THEN GOSUB1190
730 IF N>=N1 AND A3=1 LPRINTCHR$(18):LPRINTCHR$(140):RETURN
740 IF N>=N1 THEN RETURN
750 NEXT
760 GOSUB1310
770 GOTO660
800 '*****Computational routines*****
805 '*****Change 810, 820, 840, 860 if disks not available*****
810 CN=FN C(C1,N,B):IF N=1 THEN CM=0:TM=0:GOTO830
820 CM=FN C(C1,N-1,B):TM=(N-1)*CM
830 TN=N*CN:UC=TN-TM: RETURN
835 '*****840 is an estimate of the curve for point values*****
840 UC=FN C(C1,N,B):TN=(C1/(1+B))*(((N+0.5)[(1+B))+1+B-((1.5)[(1
+B))):CN=TN/N
850 RETURN
860 UC=FN C(C1,N,B):TN=TN+UC:CN=TN/N
870 RETURN
900 '*****Screen print routine*****
910 CLS:PRINT"*****These computations assume that the cumulative
 average cost follows a log-linear curve.":PRINT:RETURN
920 CLS:PRINT"***These costs assume that the unit cost decreases
 by a constantpercentage at each doubling of the quantity produc
ed.":PRINT:RETURN
930 PRINT:PRINT"*****The cumulative average and total costs are
estimates       differing from unit costs sums. They become more
 accurate       as N increases.":PRINT:RETURN
940 PRINT"unit";TAB(22)"unit";TAB(32)"cumulative";TAB(57)"total"

950 PRINT"numb";TAB(22)"cost";TAB(34)" average";TAB(57)" cost":P
RINT
960 RETURN
970 PRINTN;TAB(12)USING PU;UC;
980 PRINTTAB(28)USING PU;CN;
990 PRINTTAB(44)USING PT;TN
1000 RETURN
1100 '***** Printer output routines*****
1110 LPRINTCHR$(14)"CUMULATIVE AVERAGE LEARNING CURVE":LPRINTCHR
$(15):RETURN
1120 LPRINTCHR$(14)"UNIT COST LEARNING CURVE":LPRINTCHR$(15):RET
URN
1130 LPRINT"Learning rate = ";R;" Number of items = ";N1;"Cost
of first item = ";USING PU;C1:RETURN
1140 LPRINT:LPRINT"*****These computations assume that the cumul
ative average cost":LPRINT"follows a log-linear curve.":RETURN
1150 LPRINT:LPRINT"*****These computations assume that the unit
cost decreases by":LPRINT"a constant percentage at each doubling
 of the quantity produced.":RETURN
1160 LPRINT:LPRINT"unit";TAB(22)"unit";TAB(32)"cumulative";TAB(5
7)"total
1170 LPRINT"numb";TAB(22)"cost";TAB(34)" average";TAB(57)" cost"
:LPRINT
1180 RETURN
1190 LPRINTN;TAB(12)USING PU;UC;
1200 LPRINTTAB(28)USING PU;CN;
1210 LPRINTTAB(44)USING PT;TN
1220 RETURN
1300 '*****Interogatives*****
1310 INPUT"Press <ENTER> to continue.";Q:RETURN
1320 Q="":POKE16425,0:CLS:INPUT"*****IS YOUR PRINTER READY? PAPE
R AT TOP OF PAGE! ANSWER Y OR N. N MEANS  YOU HAVE NO PRINTER OR
 YOU DO NOT WANT TO USE THE ONE YOU HAVE.";Q:RETURN
1400 Q="":INPUT"*****Do you want to run more values? Answer Y or
 N.";Q  'Program termination or repeat
1410 IF Q="Y" CLEAR:GOTO200
1420 IF Q="N" STOP
1430 PRINT"YOU MADE AN ERROR!":GOTO1400
1500 '
1510 '
1600 '*****THE MAIN VARIABLES ARE*****
1610 '  A1  Operator response - Type of curve
1620 '  A2  operator response - schedule LEN
1630 '  A3  Operator response - Print option
1640 '  B   Curve slope function
1650 '  C   DEF FN for learning curve
1660 '  C1  Cost of first unit (fuc)
1670 '  CM  Cost of (N-1)st unit
1680 '  CN  Cost of Nth unit
1690 '  K   Loop counter
1700 '  N   Number of units to be considered
1710 '  N1  Used to save N
1720 '  PT  Edit string for total cost
1730 '  PU  Edit string for unit/cum cost
1740 '  Q   Operator response - YES/NO
1750 '  R   Learning rate
1760 '  TM  Total (N-1)st unit
1770 '  TN  Total Nth unit
1780 '  UC  Unit cost
```

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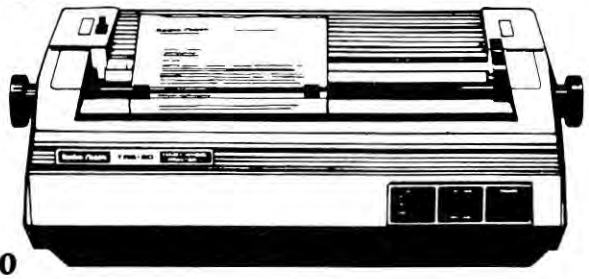

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Savings and loans offer all-saver securities in answer to the money funds. The attraction of these securities is their tax-exempt feature. All interest earned on these 12-month deposits are exempted from taxes up to $1,000 for a depositor who files individually, or up to $2,000 for a couple filing jointly.

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Program Listing

```
10 CLEAR500
30 GOSUB 2440
40 PRINT@327,"Compute Tax Exempt Yield."
50 ' ** TAXABLE YIELD PROGRAM **
60 ' ** COPYWRITE TED BYRNE 08/30/81 **
70 CLS:PRINTCHR$(23):PRINT@384,"Hello. Please Type in your first
 name and ";
80 PRINT"Press  'Enter'.";
90  INPUT NME$
100 ' ** MENU INSTRUCTIONS **
110 CLS:PRINT@132,"Welcome to 'Tax Yield' - Here's my menu "NME$
:GOTO130
120 CLS:PRINT@148," ** MENU **
130 PRINT@268,"1. Compute Taxable Yield."
140 PRINT@332,"2. Compute Tax Exempt Yield."
150 PRINT@396,"3. Develope A Taxable Yield Table."
160 PRINT@460,"4. Compute Maximum 'All Saver' Investment."
170 PRINT@524,"5. Quit."
180 PRINT@660,"Type number of selection (1-5)";
190 FOR OVER =0 TO 127
200   SET(OVER,0)
210   SET(OVER,47)
220 NEXT OVER
230 FOR UNDER =0 TO 47
240   SET(0,UNDER)
250   SET(127,UNDER)
260 NEXT UNDER
270 N$=INKEY$:IFN$="" GOTO 270
280 IF VAL(N$)<1 OR VAL(N$)>5 GOTO 300
290 ON VAL(N$) GOTO 310  ,780  ,1180 , 1640 ,2260
300 PRINT@844, "OOPS! I asked for a number from 1 to 5.":FOR X=1
 TO 500: NEXT X:CLS:GOTO120
```

Listing continues

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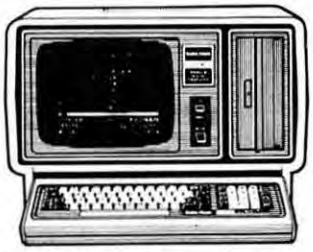

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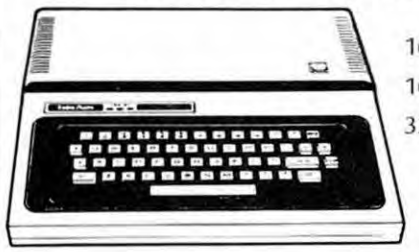

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✓ 220

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Listing continued

```
310 CLS

320 ' **  TAXABLE YIELD **

330 '** INSTRUCTIONS **
340 CLS:PRINT@74,"PART I. COMPUTING TAXABLE YIELD."
350 PRINT@256,"Do you want an explanation of 'Taxable YIeld' (Y
or N)?"
360 T$=INKEY$:IFT$=""GOTO 360
370 IF T$ = "Y" GOTO 390
380 IF T$= "N" GOTO 550       ELSE 350
390 CLS:PRINT@64,"This is a program "NME$", designed to tell
400 PRINT"you the amount you would have to earn to equal a
410 PRINT"tax exempt yield, or the taxable interest rate
420 PRINT"which is equivalent to that you will receive on a
430 PRINT"security which pays a known amount of tax deductible
440 PRINT"interest.
450 PRINT"   To operate the program you will have to know the
460 PRINT"rate of interest paid on the tax exempt security and
470 PRINT"the marginal tax rate of the holder of the security."
480 T= 800: FOR X= 1 TO T: NEXT X
490 PRINT"    FOR EXAMPLE: If your marginal tax rate is 50%, and

500 PRINT"a tax exempt bond has a yield of 10% , then this pro-
510 PRINT"gram will compute that you would need to make at least

520 PRINT"20%  to do as well with a taxable security."
530 PRINT"         PRESS THE 'SPACE BAR' TO GO ON"
540 IF INKEY$=" " GOTO 550  ELSE 540
550 CLS:FORG=1 TO 63:PRINT@G+63,"*";:NEXT G

560 ' ** COMPUTING TAXABLE YIELD **

570 ' **Instructions**

580 PRINT@192,"I am going to request data from you now "NME$"."
590 PRINT"FIRST please type the marginal tax rate in % and press
 'ENTER'."
```

Listing continues

higher tax brackets, the all saver makes sense.

My bank is trying to provide responsible information to customers. We've set up a personal banking center with a telephone hot line, and we've given the staff the best data on the customers' needs so we can advise them on the all savers depending upon their needs.

The Program Listing is a result of that project. It allows you to compare the advantages of the all-saver rates to those of taxable securities for any known marginal tax rate (parts I and II). Since the rates on all savers can change from month to month, part III allows you to construct a comparison range for different rates on all savers at different marginal tax rates. You set a range by choosing the basis point spread anticipated in the coming period.

Part IV allows you to instantly generate the maximum deposit a saver should make into this account if parts I–III have shown it beneficial. You can specify a range of basis points around a known rate to allow some speculation about various liquidity needs for various returns on all-saver accounts.

The program is user-friendly with abundant use of instructions, INKEY$, and personalizing features. The program is written for a TRS-80 Model III with TRSDOS 1.3.

One last point: Part IV is constructed using simple interest; the modifications for various types of compounding can be made to line 2070 according to your needs.■

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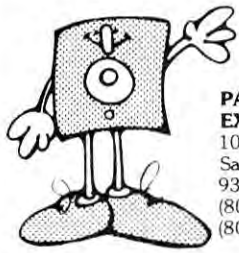

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Listing continued

```
600 PRINT"   (For Example, if marginal tax rate is 25%, type 25)
 ";
610 INPUTM$:M=VAL(M$)
620 PRINT:PRINT"Thank you "NME$". Now in percent, type in  the r
eturn or
630 INPUT"yield on the tax exempt in % and press 'ENTER'.";R$:R=
VAL(R$)
640 Rl=R*.01:Ml=M*.01:I=Rl/(1-Ml) '** HERE'S THE FORMULA **

650 PRINT
660 PRINT"","","THEN YOU WOULD"
670 PRINT"","","NEED AT LEAST"
680 PRINT"IF MARGINAL","AND YIELD ON","THIS RATE ON"
690 PRINT"TAX RATE IS..","TAX EXEMPT IS..","A TAXABLE SECURITY";

700 PRINT:FOR G= 1 TO 63:PRINT"*";:NEXT G
710 PRINT@960,USING"##.##%";M;
720 PRINT@980,USING"##.##%";R;
730 PRINT@998,USING"##.##%";I*100
740 PRINT;:PRINT"Do you want to compute more 'Taxable Yields' "N
ME$ "(Y or N)?";
750 T$=INKEY$:IFT$="" GOTO 750
760 IF T$="Y" GOTO 550
770  IF T$="N" GOTO 120  ELSE 740

780 ' ** COMPUTE TAX EXEMPT YIELD **

790 ' **Instructions **

800 CLS:PRINT@74,"PART II. CALCULATION OF TAX EXEMPT YIELD ."
810 PRINT@256,"Do you want an explanation of tax exempt yield
820 PRINT"calculations (Y or N)?";
830 T$=INKEY$:IF T$=""GOTO 830
840 IFT$="Y"GOTO 860
850 IFT$="N"GOTO  980
860 CLS:PRINT"This is a program "NME$", which will compute
870 PRINT"the interest you would have to recieve on a tax
880 PRINT"exempt security to be equal to that received on
890 PRINT"a taxable security.":FORX=1 TO 500:NEXT X
900 PRINT:PRINT"    FOR EXAMPLE, If you can get 18% on a
910 PRINT"taxable security, and you're in the 30% marginal
920 PRINT"tax bracket, then a tax exempt security would have
930 PRINT"to pay at least 13%.
931 PRINT:PRINT
940 PRINT"    PRESS 'SPACE BAR' TO CONTINUE"
950 ' ** COMPUTATION **
960 N$=INKEY$:IF N$="" GOTO 960
970 IF N$=" " GOTO 980  ELSE 970
980 CLS:PRINT@192,"Type in the marginal tax rate and press 'ENTE
R' "NME$". ";:INPUTM$:M=VAL(M$)
990 PRINT@322,"Good "NME$", now type in  the interest the taxabl
e security
1000 PRINT@386,"is paying and press 'ENTER'. ";:INPUT I$:I=VAL(I
$)
1010 Il=I*.01:Ml=M*.01:R=Il*(1-Ml) '** The Formula **
1020 PRINT@512,"You need a tax exempt rate of ";
1030 PRINTUSING"##.##%";R*100;
1040 PRINT" to enjoy the same"
1050 PRINT@576,"after tax income as you would on the taxable sec
urity
1060 PRINT@640,"paying ";
1070 PRINTUSING"##.##%";I;
1080 PRINT" when the marginal tax rate is ";
1090 PRINTUSING"##.##%";M;
1100 PRINT"."
1110 PRINT:PRINT"Wanna' compute some more of these (Y or N)?";
1120 T$=INKEY$:IFT$="" GOTO1120
1130 IFT$="Y" GOTO 980
1140 IFT$="N" GOTO 120  ELSE 1110
1150 IFT$="Y" GOTO 980  :IFT$="N" GOTO 120  ELSE 1120
1160 ' ** TAXABLE YIELD TABLE **

1170 ' ** Instructions **

1180 CLS:PRINT@10,"PART III. COMPILING A TAXABLE YIELD TABLE."
1190 PRINT:PRINT"This component of the program will allow you to
 compute
1200 PRINT"the amount someone would have to receive on a taxable

1210 PRINT"security to match the rate received on a tax exempt
1220 PRINT"security."
1230 PRINT:PRINT"What's special here "NME$", is that a chart wil
```

Listing continues

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Listing continued

```
l be
1240 PRINT"constructed for you. Thus if you know an approximate

1250 PRINT"rate for the tax exempt, you'll be able to compute it
's
1260 PRINT"advantages over a range of near values."
1270 PRINT:PRINT:PRINT"  PUSH THE 'SPACE BAR' TO CONTINUE"
1280 IF INKEY$= " " GOTO 1310 ELSE 1280

1290 ' ** Intake Data For Calculations **

1310 CLS:INPUT"Type in the probable rate on the tax exempt secur
ity and press  'ENTER'. ";Y$:Y=VAL(Y$)
1320 PRINT:INPUT"Type in the number of basis points by which the
 range should be constructed and press 'ENTER'.";B$:B=VAL(B$)
1330 B1=(B*.01):Y1=Y-4*B1
1340 CLS:PRINT"TABLE 1: REPRESENTATIVE "
1350 PRINT"TAXABLE EQUIVALENT YIELDS ON TAX EXEMPTS AROUND "Y"%"

1360 PRINT"If Tax"
1370 PRINT"Exempt","   And The Marginal Tax Rate Is...."
1380 PRINT"Offers"
1390 PRINT@268,"20%":PRINT@276,"25%":PRINT@284,"30%":PRINT@292,"
35%":PRINT@300,"40%":PRINT@308,"45%":PRINT@316,"50%"
1400 FORX=1 TO64:PRINT"-";:NEXT X
1410 '** BODY OF TABLE AND CALCULATIONS **
1420 ' **COMPUTING COLLUMNS **

1430 FOR C= 1 TO 9
1440   PRINT USING "##.##"; Y1;
1450 ' ** COMPUTING ROWS **
1460 M1 =0
1470     FOR X=1 TO 7
1480     R=Y1*.01:M=(.20+M1):I=(R/(1-M))*100
1490      P=11+C2:PRINT TAB(P) ; USING "##.##"; I;
1500    M1= M1 + .05
1510 C2=C2+8
1520  NEXTX
1530 C2=0:P=0
1540 Y1=Y1+B1
1550 NEXT C
1560 PRINT@646,"*";
1570 PRINT@960,"-------Do You Want To Run Another Table "NME$" (
Y or N)-----";
1580 FOR UNDER=8 TO44
1590   SET(18,UNDER)
1600 NEXT UNDER
1610 T$=INKEY$:IF T$=""GOTO 1610
1620 IF T$="Y" GOTO 1310
1630 IF T$ = "N" GOTO 120     ELSE 1570

1640 ' ** PARTIV -- MAXIMUM INVESTMENT TABLE **
1492'        **  INSTRUCTIONS **
1650 CLS:PRINT"PART IV : COMPUTING MAXIMUM SAVING IN 'ALL SAVER
ACCOUNTS"
1660 PRINT@192,"Will you need instructions "NME$"(Y or N)?"
1670 T$=INKEY$:IF T$=""THEN 1670
1680 IFT$="Y" GOTO 1700
1690 IFT$="N" GOTO 1910 ELSE 1670
1700 CLS:PRINT"    Tax changes in 1981 have allowed the sale of
'All Saver
1710 PRINT"Accounts' so that individuals could shield some of th
e interest
1720 PRINT"on their savings from taxes.":PRINT
1730 PRINT"     As the law is currently written, an individual c
an earn
1740 PRINT"$1,000, or a couple could earn $2,000 in interest fro
m such
1750 PRINT"an 'All Saver Account' without paying federal taxes o
n
1760 PRINT"this interest "NME$"."
1770 PRINT@842,"PRESS THE 'SPACE BAR' TO CONTINUE"
1780 N$=INKEY$:IFN$=""GOTO1780
1790 IFN$=" "GOTO 1800 ELSE 1780
1800 CLS:PRINT:PRINT"     But, an account paying 10% will earn t
hat $1,000 on
1810 PRINT"a deposit of $10,000, while an account paying 20% wil
l need
1820 PRINT"a deposit of only $5,000 to earn the legal maximum in
terest.
1830 PRINT"As you can imagine then, how much you should put into
```

Listing continues

Listing continued

```
1840 PRINT"an 'All Saver Account' depends upon the rate it pays.

1850 PRINT:PRINT"     This is a program designed to compute the
maximum
1860 PRINT"useful deposit for an individual or a couple who file
 taxes
1870 PRINT"jointly."
1880 PRINT:PRINT"PRESS THE 'SPACE BAR TO CONTINUE."
1890 N$=INKEY$:IFN$=""THEN1890
1900 IF N$=" "THEN 1910 ELSE 1890
1910 CLS:PRINT"Type in the anticipated percentage return on the
"
1920  INPUT"'All Saver' account and press 'ENTER' ." ;I1$:I=VAL(
I1$)
1930 '** THE FORMULA **

1940 PRINT"Type in the number of basis points the range should b
e
1950 INPUT"constructed over and press 'ENTER'. ";R$:R=VAL(R$)
1960 R1=R*.01:I1=I-4*R1
1970 CLS:PRINT"TABLE 2:MAXIMUM DEPOSITS IF'ALL SAVER'IS RANGED A
ROUND "I"%"
1980 ' ** FORMAT THE TABLE **

1990 PRINT"If'All Saver'","    And You File Your Taxes
2000 PRINT"Tax Exempt"
2010 PRINTTAB(0);"Offers";:PRINTTAB(25);"Singly";:PRINTTAB(48);"
Jointly"
2020 ' ** BODY OF TABLE CALCULATIONS **
2030 PRINT
2040 FOR C=1 TO 9
2050  PRINTUSING"  ##.##"; I1,
2060    I2=I1*.01
2070     DI=1000*(1/I2):DJ=2000*(1/I2)
2080    PRINTTAB(24 );USING"$$#,####";DI,
2090    PRINTTAB(48);USING"$$#,####";DJ
2100  I1=I1+R1
2110 NEXTC
2120 PRINT@585,"*";
2130 FOR OVER =0 TO 127
2140   SET(OVER,13)
2150 NEXT OVER
2160 FOR UNDER = 6  TO 47
2170   SET(28,UNDER)
2180 NEXT UNDER
2190 FOR UNDER =8 TO 47
2200 SET(85,UNDER)
2210 NEXT UNDER
2220 PRINT@896,"------Do you want to run another table "NME$" (Y
 or N)-------- ";
2230 T$=INKEY$:IFT$=""GOTO2230
2240.IFT$="Y" GOTO 1910
2250 IFT$="N" GOTO 120          ELSE 2230
2260 ' ** END OF PROGRAM **
2270 GOSUB 2350
2280 CLS:PRINT@64," ":FORX=1 TO 5 :PRINT"BYRNE-SOFT  ";:NEXTX
2290 PRINT@384,"I hope I was helpful "NME$". Remember now
2300 PRINT"....Please .. PLEASE .... Remove diskette(s) before
2310 PRINT"turning me off."
2320 PRINT:PRINT@665,"THANK YOU."
2330 PRINT@832," ":FORX=1 TO 5 :PRINT"BYRNE-SOFT  ";:NEXTX
2331 END
2350 CLS
2360 CLS:FORI=1 TO2
2370 FORB=26TO1 STEP-1
2380 FORC=1TO3
2390 A=A+.25
2400 PRINTTAB(28+SIN(A)*B);"BYRNE-SOFT"
2410 FOR Z=1TO10
2420 NEXT Z
2430 NEXTC,B
2440 CLS:PRINT@64,STRING$(64,147)
2450 PRINT@338,"Taxable Yield Computations"
2460 PRINT@540,"By"
2470 PRINT@724,"BYRNE - SOFT c. 1981"
2480 PRINT@960,STRING$ (63,178)
2490 T=925
2500 FOR I= 1 TO T : NEXT
2510 PRINT@836,"Prepared In South Hadley Ma. - All Rights Reserv
ed - TRB";
2520 FOR X= 1 TO T: NEXT
2530 RETURN
```


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Adding the finishing touches.

Homebrew Data Base Management—Part III

Karl Townsend
103 Knollwood Drive
Lansdale, PA 19446

Most programs we write for our own use have very few features that make the human/computer interface work more effectively. I wrote this data base program for my own use and I know what to enter when it produces those enigmatic question marks. I know it is processing data even though there is no indication of activity, but you might think the program had died if you were unfamiliar with it.

This is too real a picture of some homebrewed (and commercial) software. Often, when we get the program to finally do the job we want, we stop all programming and documentation. This is fine so long as the program is fresh in our minds but what do we do when we want to run it or to fix a bug months later? Our only guides are missing or incomplete screen prompts, a few REM statements and some cryptic notes for documentation.

I am not going to discuss documentation as this program is fairly well documented through these articles. I left out the REM statements to conserve memory space, but with adequate documentation this will not be a problem. Instead I will look at the area of interfacing to the program. This is what I call "civilizing" a program.

At the conclusion of Part II of this series, we had finished the basic program. It still has a number of rough edges and it lacks those humanizing touches that can make the difference between drudgery or a pleasurable experience when you operate it. We can clean up and smooth the program's operation in the following areas:

- The sorted report and the raw file print need improved formatting.
- Field names are needed.
- Screen indications are needed to let the operator know what is happening during the more time-consuming operations.
- Record counts on file save and load are needed.

Print Format

If we set up the report format as fixed length fields we will not be able to use the data base for general applications as originally planned. Instead, we must make provisions to enter the format specifications to agree with the field definitions when a new file is set up for the first time. Since we will be inputting the field names as well as the format, we can achieve both functions in the New subroutine. We will also include a page change function for multiple page reports.

Program Listing 1 may look a little daunting on first inspection since it involves line changes and additions through several of the program's functions. However, it can easily be resolved into small, understandable segments. Some new entries will overwrite and substitute for some current program statements.

Line 13130 begins a continuation of the New routine. This prompt requests you to enter the name and width of each field that you are going to use. (Width is the maximum number of characters in a field.) The For...Next loop in lines 13140-13170 handles input. Notice that the loop cycles the same number of times as the number of fields you decided to use. The names are stored in the data array zero record position and the width information is stored in the chaining array zero record position. Little

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```
10 'DBIII/L01
3030 FL = 0
3040 POKE 16425,1
3050 GOSUB 15000
3120 LPRINT GO;
3160 LPRINTTAB(PR(J)) DA(GO,J);
3170 IF PR(J+1) = 5 THEN LPRINT
3200 LPRINT: LPRINT
3205 IF PEEK(16425) > 56 THEN GOSUB 15000
3230 LPRINT CHR$(12);
13130 PRINT "ENTER FIELD NAME, FIELD WIDTH."
13140 FOR I = 1 TO FC
13150 PRINT "FIELD ";I;
13160 INPUT DA(0,I), KY(0,I)
13170 NEXT I
13180 RETURN
15000 IF FL = 1 THEN LPRINTCHR$(12): GOTO 15060 ELSE FL = 1
15010 PR(1) = 5
15020 FOR J = 2 TO FC
15030 IF PR(J-1) + KY(0,J) => 80 THEN PR(J) = 5 ELSE PR(J) = PR(
J-1) + KY(0,J-1)
15040 NEXT J
15050 TT = (80 - LEN(TI$) - 5)/2
15060 LPRINT TAB(TT) TI$
15070 LPRINT
15080 FOR J = 1 TO FC
15090 LPRINT TAB(PR(J)) DA(0,J);
15095 IF PR(J+1) = 5 THEN LPRINT
15100 NEXT J
15110 LPRINT: LPRINT
15120 RETURN
```

Program Listing 1. Formatting and headings

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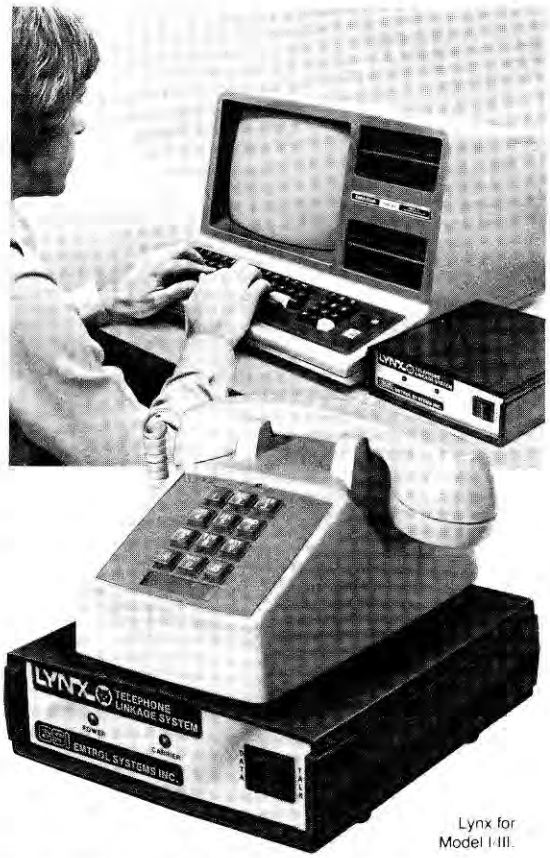

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by little, we utilize the full capacity of the arrays. Once the program stores the names and field sizes, it returns to the menu.

To take care of the formatting and page control, we will enter a new subroutine starting at line 15000. This calculates the field print positions, provides top-of-page form control and prints the title and field headings on each page of the report. Note that this subroutine assumes an 80-column printer. If your printer has other limits, adjust lines 15030 and 15050.

```
10 'DBIII/L02
1080 CLS:PRINT @ 1, "RECORD MERGE"
1085 PRINT @ 65, "INSERTING RECORD # ";
1086 PRINT @ 91, "AT POSITION ";
1087 PRINT @ 110, "AT FIELD ";
1095 PRINT @ 83,I;
1105 PRINT @ 120,J;
1135 PRINT @ 103, GO;
6200 GOTO 1080
```

Program Listing 2. Sort action indicators

```
10 'DBIII/L03
6000 CLS: PRINT "STARTING PURGE ROUTINE"
6025 PRINT @ 65, "PURGING RECORD NO. ";
6026 PRINT @ 94, "CHECKING RECORD NO. ";
6035 PRINT @ 115, I-1
6043 PRINT @ 85, I
6046 PRINT @ 85,RC: GOTO 6045
```

Program Listing 3. Purge action indicators

```
10 'DBIII/L04
8005 CLS: PRINT @ 64,"WRITING RECORD NUMBER - ";
8025 PRINT @ 90, I
8045 PRINT "FILE - ";TI$, RC;" RECORDS SAVED"
9005 CLS: PRINT @ 64, "READING RECORD NUMBER - ";
9025 PRINT @ 90, I
9045 PRINT "FILE - ";TI$, RC;" RECORDS READ IN"
11007 CLS: PRINT @ 64, "WRITING RECORD NUMBER - ";
11033 PRINT @ 90, I
11065 PRINT "FILE - ";TI$, RC;" RECORDS SAVED"
12015 CLS: PRINT @ 64, "READING RECORD NUMBER - ";
12035 PRINT @ 90, I
12065 PRINT "FILE - ";TI$, RC;" RECORDS READ IN"
```

Program Listing 4. Save and load action indicators

Line 15000 contains the instruction that causes the printer to go to the top of the page. It has a control flag so it will not act until the program is ready for the second printed page. The program assumes the printer to be mechanically positioned at the top of the page for the first page of printing. The flag FL is zero as the result of line 3030 when the print selection was first made. The first time through this routine, FL is zero and blocks a top-of-form instruction; FL is changed to one at this time. The second time through, when ready to begin page two, it will trigger a page change.

Lines 15010–15040 compute the print position for each field in the record. The first field will be tabbed five spaces in to allow room for the record number. The next field will be tabbed five spaces plus the width of the first field. The next will be five spaces plus the width of field 1 plus the width of field 2 and so on. This continues up to the printer column limitation, where the next field will print tab five spaces right on the next line. This avoids splitting a field over two lines.

The field print tab calculation takes place only when the heading for the first page is printed. The same flag (FL) that prevented the top of page instruction on the first page will cause a jump around the format computation for succeeding pages. Array PR holds the print positions to be used as each page is printed.

Line 15050 computes the location of the center of the page to print the title.

Actual printing of the heading starts at line 15060 where the title is printed using TT as a centering tab. The printer then skips a line (line 15070) and prints the field names spaced according to the position information contained in the PR array. Line 15095 provides for moving to the next line when the first has been completed if the total character count of all the field widths exceeds the printer's character capacity. An-

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other line is skipped and the program returns to the print routine.

To accommodate the new formatted print function, we must make some changes to the print routine itself. Line 3030 sets the flag (FL) to zero for the first pass through the heading routine to indicate first page. Line 3040 POKEs a one into the computer's internal line counter to tell it the printer is waiting at the top of a page and to count lines for page changing. Line 3050 provides the GOSUB that sends the program to the heading/formatting subroutine.

Add or change the following lines in the print subroutine to allow the formatting to take place. Line 3120 prints the record number at the beginning of each record. Line 3160 tabs the print data to the proper field location and prints the data. Line 3170 provides the wrap-around for a record longer than a single print line. Line 3200 satisfies the open semicolon on printing the last field in a record and then skips a line. Line 3205 looks at the internal line counter to see if it is time to start a new page. If so it transfers the program to the formatting/heading function. Line 3230 advances to top of form on completion of the final print statement.

When you have entered all the lines in Program Listing 1 and saved the program, run some tests. Generate a small file and exercise the New format input and the Print function. Make sure you allow enough characters in each field to hold your longest input plus a few extra for a separator between fields. You can easily generate a layout with some 80-column crosshatched paper worksheets. This enables you to plan what the print is to look like.

Program Listing 5. The complete data base program

```
10 'DBIII/V23  KARL L. TOWNSEND  NOVEMBER 1981
100 CLEAR 2000
110 DEFSTRD: DEFINT A-C,E-Z
120 DIM DA(50,5), KY(50,5)
130 FOR I = 1 TO 50
140 KY(I,0) = 1
150 NEXT I
500 PRINT "MENU"
510 PRINT "ADD     -<1>          PURGE          -<6>          SAVE-D    -
<11>"
520 PRINT "FILE P  -<2>          SELECT         -<7>          LOAD-D    -
<12>"
530 PRINT "PRINT   -<3>          SAVE-T         -<8>          NEW       -
<13>"
540 PRINT "EDIT    -<4>          LOAD-T         -<9>          RESTORE   -
<14>"
550 PRINT "DELETE  -<5>          LOOK           -<10>         STOP      -
<15>"
560 INPUT ME
570 ON ME GOSUB 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000,9
000, 10000, 11000, 12000, 13000, 14000
580 IF ME = 15 THEN GOTO 20000 ELSE GOTO 500
1000 INPUT"HOW MANY NEW RECORDS TO INPUT?";NC
1010 FOR I = RC+1 TO RC+NC
1020 PRINT "ENTER RECORD # ";I
1030 FOR J = 1 TO FC
1040 PRINT DA(0,J);
1050 INPUT DA(I,J)
1060 NEXT J
1070 NEXT I
1080 CLS:PRINT @ 1, "RECORD MERGE"
1085 PRINT @ 65, "INSERTING RECORD # ";
1086 PRINT @ 91, "AT POSITION ";
1087 PRINT @ 110, "AT FIELD ";
1090 FOR I = RC+1 TO RC+NC
1095 PRINT @ 83,I;
1100 FOR J = 1 TO FC
1105 PRINT @ 120,J;
1110 GO = 1
1120 FM = 1
1130 FOR K = 1 TO RC
1135 PRINT @ 103, GO;
1140 IF DA(I,J) =< DA(GO,J) THEN KY(I,J) = GO:
      KY(FM,J) = I:
      K = RC:
      GOTO 1180
1150 IF KY(GO,J) = 0 THEN KY(I,J) = 0:
      KY(GO,J) = I:
      K = RC:
      GOTO 1180
1160 FM = GO
1170 GO = KY(GO,J)
1180 NEXT K
1190 NEXT J
1200 RC = RC + 1
1210 NEXT I
1215 PRINT
1220 RETURN
2000 PRINT"START RAW FILE PRINT"
2010 LPRINT TI$: LPRINT
2020 FOR I = 0 TO RC
2030 LPRINT I,
2040 FOR J = 0 TO FC
2050 LPRINT DA(I,J),
2060 NEXT J
2070 LPRINT
2080 NEXT I
2090 RETURN
3000 PRINT "WHICH FIELD SHOULD THE PRINT FOLLOW? FIELD 1 - ";FC
3020 INPUT PC
```

Listing 5 Continues

Raw File Print

Although the raw file print is intended only to be used as a rough work listing as we are utilizing the data base program, we may as well use the same format in this location. Enter the two lines below and try the file print function.

```
2050  LPRINT TAB(PR(J)) DAZ(I,J);
2055  IF PR(J + 1) = 5 THEN LPRINT
```

Line 2050 serves the same tab and print function as in the standard print routine and line 2055 prevents a split field. This change should make your work listing much more readable.

Add Headings

As long as we now have field names, why not use them for our prompts when adding new records? As the program presently works, the input prompt asks for your input by field number. It is rather easy to forget what the input is for field 3, but if the prompt were to ask "City?," for example, input will be much easier and more accurate.

Enter line 1040 as shown:

```
1040  PRINT DA(0,J);
```

Enter some new records. This makes a real difference in record entry, doesn't it?

Sort Indicators

You will find when you have finished adding a group of new records to a file containing a dozen or more records, the computer will appear to go dead while it merges the additions. It would be nice to have some indication on the screen during this process that the program is running as it should.

Program Listing 2 contains a group of PRINT @ statements that we will insert into the sort routine. Line 1080 starts by clearing the screen. As each record is brought into the insert routine, the "Inserting Record #"

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Listing 5 Continued

```
3030 FL = 0
3040 POKE 16425,1
3050 GOSUB 15000
3060 GO = 1
3080 FOR I = 2 TO RC
3100 GO = KY(GO,PC)
3110 IF DA(GO,0) = "D" THEN GOTO 3220
3115 IF KY(GO,0) = 0 THEN GOTO 3220
3120 LPRINT GO;
3140 FOR J = 1 TO FC
3160 LPRINTTAB(PR(J)) DA(GO,J);
3170 IF PR(J+1) = 5 THEN LPRINT
3180 NEXT J
3200 LPRINT: LPRINT
3205 IF PEEK(16425) > 56 THEN GOSUB 15000
3220 NEXT I
3230 LPRINT CHR$(12);
3240 RETURN
4000 NC = 0
4020 INPUT "EDIT WHICH RECORD?";RN
4040 IF RN = -1 THEN GOTO 1080
4042 NC = NC + 1
4044 FOR I = 1 TO FC
4046 DA(RC+NC,I) = DA(RN,I)
4048 NEXT I
4050 DA(RN,0) = "D"
4060 INPUT "WHICH FIELD?";CN
4080 IF CN = -1 THEN GOTO 4020
4100 PRINT DA(RN,CN)
4120 INPUT DA(RC+NC,CN)
4170 GOTO 4060
5000 INPUT "ENTER RECORD NUMBER TO BE DELETED.";SN
5010 IF SN = -1 THEN RETURN
5020 DA(SN,0) = "D"
5030 GOTO 5000
6000 CLS: PRINT "STARTING PURGE ROUTINE"
6010 PC = 0
6020 SD = 0
6025 PRINT @ 65, "PURGING RECORD NO. ";
6026 PRINT @ 94, "CHECKING RECORD NO. ";
6030 FOR I = 2 TO RC
6035 PRINT @ 115, I-1
6040 IF DA(I,0) <> "D" THEN GOTO 6110 ELSE PC = PC + 1
6043 PRINT @ 85, I
6045 IF DA(RC,0) = "D" THEN RC = RC - 1 ELSE GOTO 6050
6046 PRINT @ 85,RC: GOTO 6045
6050 FOR J = 1 TO FC
6060 FOR K = 0 TO 2
6070 A2 = PEEK(VARPTR(DA(RC,J))+K)
6080 POKE(VARPTR(DA(I,J))+K),A2
6090 NEXT K
6093 NEXT J
6095 DA(I,0) = ""
6100 RC = RC - 1
6110 SD = SD + 1
6120 NEXT I
6130 FOR I = 1 TO RC
6140 FOR J = 1 TO FC
6150 KY(I,J) = 0
6160 NEXT J
6170 NEXT I
6180 RC = 1
6190 NC = SD - PC
6200 GOTO 1080
7000 FOR I = 1 TO RC
7001 KY(I,0) = 0
7002 NEXT I
7010 INPUT "ENTER FIELD TO BE SEARCHED.";SF
7020 INPUT "ENTER LIST TO BE FOUND.";C$
7030 CC = LEN(C$)
7040 FOR I = 2 TO RC
7050 FOR J = 1 TO LEN(DA(I,SF))-CC+1
7060 IF C$ <> MID$(DA(I,SF),J,CC) THEN GOTO 7090
7070 IF OC <> 2 THEN KY(I,0) = 1
7080 GOTO 7110
7090 NEXT J
7100 IF OC = 2 THEN KY(I,0) = 0
7110 NEXT I
7120 INPUT "<1> END    <2> AND    <3> OR";OC
7130 IF OC = 1 THEN RETURN ELSE GOTO 7010
8000 INPUT "MOUNT TAPE AND SET FOR RECORD - <ENTER>";X$
8005 CLS: PRINT @ 64,"WRITING RECORD NUMBER - ";
8010 PRINT#-1,TI$,RC,FC
8020 FOR I = 0 TO RC
8025 PRINT @ 90, I
8030 PRINT#-1, KY(I,0), KY(I,1), KY(I,2), KY(I,3), KY(I,4), KY(I
,5), DA(I,0), DA(I,1), DA(I,2), DA(I,3), DA(I,4), DA(I,5)
```

Listing 5 Continues

message shows the array position of that record. The "At Position" message shows the search through the file for the insertion point for the particular field shown following the "At Field" notation. On running, the position and field will change quite rapidly while the record number indication steps rather sedately through each record. With this display, you know the program is running and where it is in the current sort procedure.

Purge Indicators

The purge routine may also result in a static screen for long periods when the program is purging a large file. Program Listing 3 contains a group of Print @ statements that we will insert in the Purge subroutine. Like the sort screen display, this starts by clearing the screen. It then shows progress through the file as the records are checked for a delete flag and are purged. Key in this listing and try it: It demonstrates both the purge display and the sort display as the file is re-sorted.

Save/Load Indicators

A final area where we will add some screen activity is during loading and saving the data records. Since we have provided both tape and disk input and output, we will have some line insertions at four different locations within the program. Enter the lines shown in Program Listing 4.

Lines 8005, 8025 and 8045 indicate as each record is saved to tape cassette while the equivalent is done for disk in lines 11007, 11033 and 11065.

Line 9005, 9025 and 9045 signal tape files being loaded back into memory, while lines 12015, 12035, and 12065 do the same for disk loads. You can omit the disk related lines if you do not have disk capability.

Conclusion

We have built a data base program (Program Listing 5) incorporating such techniques as an insertion sort, chaining, and menu selection. I hope that some of what I have presented in this series will assist you in adapting these ideas to your own programming efforts. The data base itself started as a bare skeleton which I have fleshed out and dressed up a little bit. It is, however, far from a complete program doing all things for all people. You might explore other areas including adapting for numeric data handling, selected field printing, selected sorting fields, and so on. The possibilities of extending the program are almost unlimited. ■

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```
8040 NEXT I
8045 PRINT "FILE - ";TI$, RC;" RECORDS SAVED"
8050 RETURN
9000 INPUT "MOUNT TAPE AND SET FOR PLAY - <ENTER>";X$
9005 CLS: PRINT @ 64, "READING RECORD NUMBER - ";
9010 INPUT#-1,TI$,RC,FC
9020 FOR I = 0 TO RC
9025 PRINT @ 90, I
9030 INPUT#-1, KY(I,0), KY(I,1), KY(I,2), KY(I,3), KY(I,4), KY(I
,5), DA(I,0), DA(I,1), DA(I,2), DA(I,3), DA(I,4), DA(I,5)
9040 NEXT I
9045 PRINT "FILE - ";TI$, RC;" RECORDS READ IN"
9050 RETURN
10000 INPUT "ENTER STARTING RECORD NUMBER.";SN
10010 FOR I = 1 TO FC
10020 PRINT DA(SN,I),
10030 NEXT I
10040 PRINT
10050 INPUT "NEXT?";NN$
10060 IF NN$ = "N" THEN SN = SN + 1: GOTO 10010
10070 IF NN$ = "B" THEN SN = SN - 1: GOTO 10010
10080 IF NN$ = "-1" THEN RETURN
10090 GOTO 10050
11000 PRINT "CURRENT FILE IS ";CF$
11005 INPUT "SAVE FILE NAMED - ";CF$
11007 CLS: PRINT @ 64, "WRITING RECORD NUMBER - ";
11010 OPEN "O",1,CF$
11020 PRINT#1, TI$;",", RC; FC
11030 FOR I = 0 TO RC
11033 PRINT @ 90, I
11035 IF DA(I,0) = "" THEN DA(I,0) = "0"
11040 PRINT#1, KY(I,0); KY(I,1); KY(I,2); KY(I,3); KY(I,4); KY(I
,5); DA(I,0);","; DA(I,1);","; DA(I,2);","; DA(I,3);","; DA(I,4)
;","; DA(I,5)
11050 NEXT I
11060 CLOSE 1
11065 PRINT "FILE - ";TI$, RC;" RECORDS SAVED"
11070 RETURN
12000 INPUT "ENTER FILE NAME TO BE LOADED.";CF$
12010 OPEN "I",1,CF$
12015 CLS: PRINT @ 64, "READING RECORD NUMBER - ";
12020 INPUT#1, TI$, RC, FC
12030 FOR I = 0 TO RC
12035 PRINT @ 90, I
12040 INPUT#1, KY(I,0), KY(I,1), KY(I,2), KY(I,3), KY(I,4), KY(I
,5), DA(I,0), DA(I,1), DA(I,2), DA(I,3), DA(I,4), DA(I,5)
12050 NEXT I
12060 CLOSE 1
12065 PRINT "FILE - ";TI$, RC;" RECORDS READ IN"
12070 RETURN
13000 PRINT "PREPARE FOR NEW FILE"
13010 FOR I = 0 TO 50
13020 FOR J = 0 TO 5
13030 DA(I,J) = ""
13040 IF J <> 0 THEN KY(I,J) = 0 ELSE KY(I,J) = 1
13050 NEXT J
13060 NEXT I
13070 RC = 1
13110 INPUT "ENTER FILE TITLE.";TI$
13120 INPUT "HOW MANY FIELDS PER RECORD? 1-5";FC
13130 PRINT "ENTER FIELD NAME, FIELD WIDTH."
13140 FOR I = 1 TO FC
13150 PRINT "FIELD ";I;
13160 INPUT DA(0,I), KY(0,I)
13170 NEXT I
13180 RETURN
14000 FOR I = 1 TO RC
14010 KY(I,0) = 1
14020 NEXT I
14030 RETURN
15000 IF FL = 1 THEN LPRINTCHR$(12): GOTO 15060 ELSE FL = 1
15010 PR(1) = 5
15020 FOR J = 2 TO FC
15030 IF PR(J-1) + KY(0,J) => 80 THEN PR(J) = 5 ELSE PR(J) = PR(
J-1) + KY(0,J-1)
15040 NEXT J
15050 TT = (80 - LEN(TI$) - 5)/2
15060 LPRINT TAB(TT) TI$
15070 LPRINT
15080 FOR J = 1 TO FC
15090 LPRINT TAB(PR(J)) DA(0,J);
15095 IF PR(J+1) = 5 THEN LPRINT
15100 NEXT J
15110 LPRINT: LPRINT
15120 RETURN
20000 END
```

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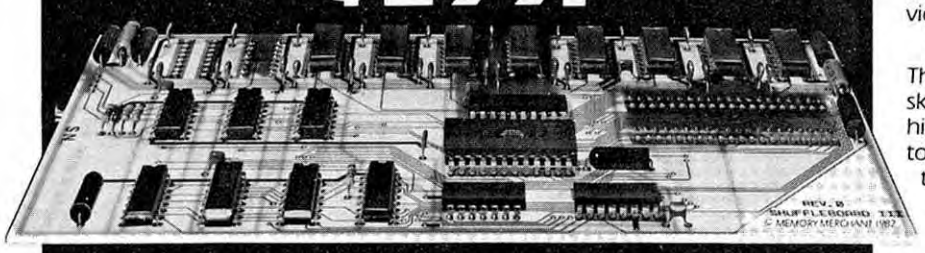

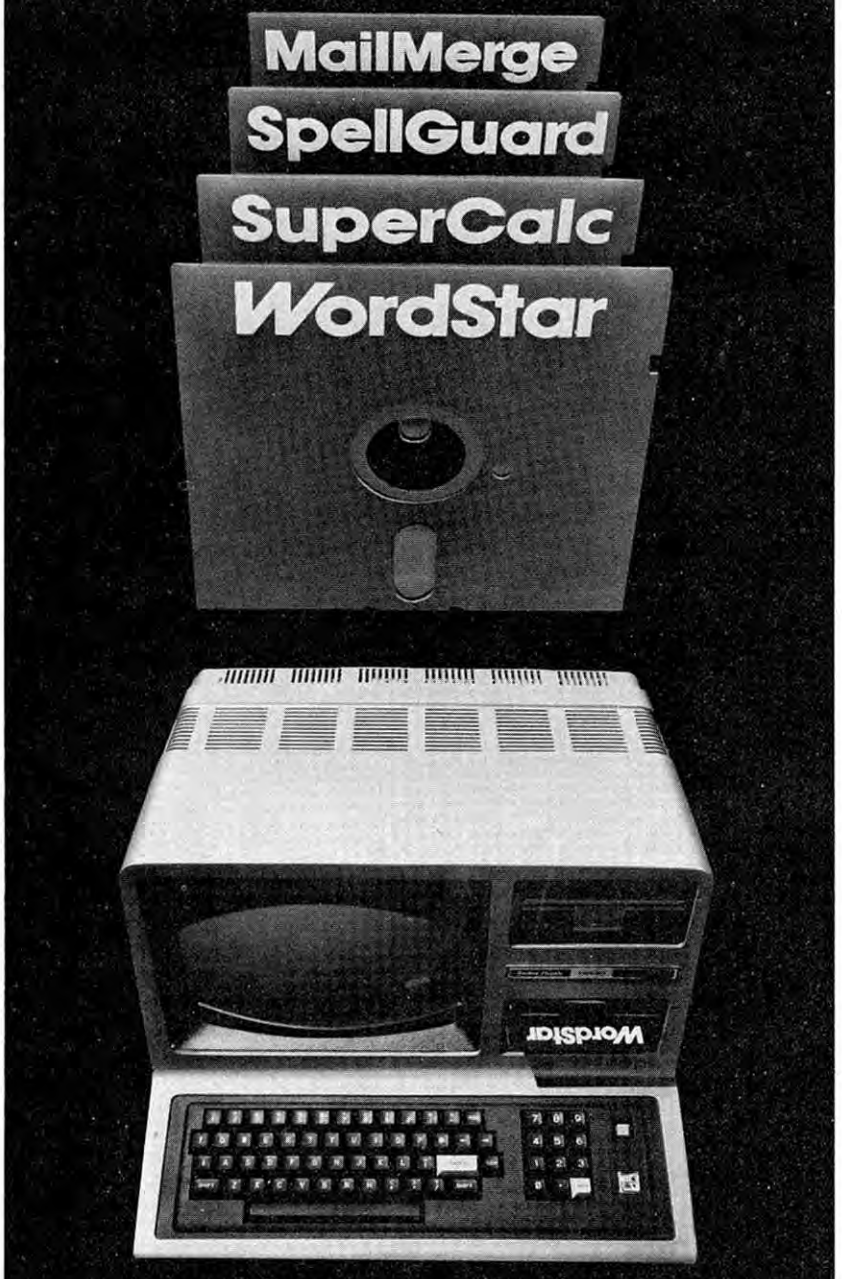

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If you run a small business, Invoice will help you to get the bills out and keep track of them at the same time. Program Listing 1 is disk oriented (other versions appear at the end of this article). If you use your computer for business purposes, a disk system makes the system hum instead of plod. I recommend NEWDOS80 2.0 for business applications. I used a few of NEWDOS' tremendous extras in this program.

Invoice has four principle functions. First, data is input to identify the customer and related billing information. Second, the work done and parts used are entered. (You can delete either the labor billing if you are strictly a merchandiser, or the parts billing if you provide only professional services.) Third, the collected data is written to a disk file. Fourth, the data is recovered from disk and printed.

Any number of data sets may be entered over any time span; each is added to the

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Program Listing 1. Invoice

```
10 CLEAR 2000 : DEFSTR N,A,D,P,M : DEFINT Q,B
20 DIM PN(30),PD(30),PP(30),Q(30) : G$="#####.##" : G1$=STRING$(
8,"*")
30 CLS : PRINT "            INVOICE  1.5
MENU
----"
40 PRINT : PRINT "1 - ENTER CUSTOMER
2 - ENTER BILLING
3 - ENTER PARTS BILLING
4 - STORE DATA / START NEXT INVOICE
5 - PRINT INVOICES
6 -
7 -
8 - HELP
9 - QUIT"
50 PRINT : IF K1=1 THEN PRINT "CUSTOMER INFO IN BUFFER  ";
60 IF K2=1 THEN PRINT "LABOR INFO IN BUFFER  ";
70 IF K3=1 THEN PRINT "PARTS INFO IN
BUFFER"
80 PRINT : X=980 : GOSUB 9300 : ON X GOTO 100,200,270,400,700,30
,30,30,9998
100 IF K1=1 THEN CLS : PRINT "INVOICE DATA FROM LAST ENTRY HAS N
OT BEEN STORED -

HIT @ TO IGNORE & CONTINUE ENTRY
HIT ANY OTHER KEY TO RETURN TO MENU" : X=330 : GOSUB 9350 : IF X
$<>"@" THEN 30
110 CLS : PRINT "CUSTOMER NAME
ACCOUNT NUMBER
CUSTOMER PO#
ADDRESS:
        STREET

       ADDITIONAL
        CITY
        STATE
        ZIP CODE
        TAX EXEMPT (Y/N)"
120 PRINT @ 0, "CUSTOMER NAME";:INPUT N : PRINT "ACCOUNT NUMBER"
;: INPUT NA : PRINT "CUSTOMER PO#"; : INPUT NPO : PRINT "ADDRESS
:" : PRINT "
      STREET"; : INPUT A1 : PRINT "        ADDITIO
NAL"; : INPUT A4 : PRINT "        CITY"; : INPUT A2
130 PRINT "        STATE"; : INPUT A3 : PRINT "        ZIP CODE"
; : INPUT A5
140 PRINT "        TAX EXEMPT (Y/N)"; : INPUT X$ : IF X$="Y" THE
N K5=1 ELSE IF X$="N" THEN K5=0 ELSE GOTO 140
150 PRINT : PRINT "IS ALL DATA CORRECT (Y/N) ? "; : GOSUB 9400 :
 GOSUB 9350 : IF X$="Y" THEN K1=1 : GOTO 30 ELSE IF X$="N" THEN
110 ELSE GOTO 150
```

Listing 1 continues

disk file as it is entered. A momentary power outage or operator mistake wipes out only one data set, not everything that has been entered. The print routine prints invoices on standard printer paper, not pre-printed invoice forms. For the smaller business, this eliminates hassle and expense. With a relatively small amount of work, the program can be adapted to pre-printed forms. After the file is printed, it is transferred to another disk file and the first file is killed. This leaves the print file empty and ready to receive new data, and retains the already printed data for record, bookkeeping and rebilling use.

How It Works

Looking at Program Listing 1, lines 10 and 20 clear string space, define string and integer variables and dimension the arrays. Lines 30 and 40 print the menu to the screen. Items 6 and 7 of the menu are blank and may be deleted or filled with your own routines. Item 8, Help, exists so you can write your own text file, listing hints and instructions that your operators may need.

Quit, item 9, provides a simple way out of the program. If this program is used as a subprogram in a business system, replace the End command in line 9998 with 9999. Line 9999 directs the computer to run the mother program (9999 RUN "business/BAS:0").

Lines 50-70 check for unstored data in the data buffers, and if found note the fact

Listing 1 continued

```
160  CLS : K1=1 : GOTO30
200 IF K2=1 THEN CLS : PRINT "PREVIOUS DATA IN BUFFER HAS NOT BE
EN STORED -

HIT @ TO IGNORE & CONTINUE
HIT ANY OTHER KEY TO RETURN TO MENU" : X=330 : GOSUB 9350 : IF X
$<>"@" THEN CLS : GOTO 30
210 CLS : IL=1 : PRINT "IF THIS IS A PARTS SALE ONLY, HIT 'P'
ELSE HIT ANY KEY"; : GOSUB 9400 : GOSUB 9350 : IF X$="P" THEN D(
1)="@" : K2=1 : GOTO 270 ELSE CLS
220 CLS : PRINT "LABOR BILLING:          ";IL;"
-------------

DATE
HOURS
RATE/HR
DESCRIPTION"
230 PRINT @ 192, "DATE"; : INPUT D(IL) : PRINT "HOURS"; : INPUT
T(IL) : PRINT "RATE/HR"; : INPUT R(IL) : PRINT "DESCRIPTION?"; :
 LINEINPUT M(IL)
240 PRINT "IS ALL DATA CORRECT (Y/N) ?"; : GOSUB 9400 : GOSUB 93
50 : IF X$="Y" THEN 250 ELSE IF X$="N" THEN 220 ELSE 240
250 PRINT : PRINT "IS THERE ANOTHER LABOR ENTRY TO BE MADE (Y/N)
 ? "; : GOSUB 9400 : GOSUB 9350 : IF X$="Y" THEN IL=IL+1 : GOTO
220 ELSE IF X$="N" THEN 260 ELSE 250
260 K2=1 : CLS : PRINT "ARE THERE PARTS ENTRIES TO BE MADE (Y/N)
 ?"; : GOSUB 9400 : GOSUB 9350 : IF X$="Y" THEN 270 ELSE IF X$="
N" THEN Q(1)=0 : K3=1 : GOTO 30 ELSE GOTO 260
270 IF K3=1 THEN CLS : PRINT "PREVIOUS DATA IN BUFFER HAS NOT BE
EN STORED -

HIT @ TO IGNORE & CONTINUE
HIT ANY OTHER KEY TO RETURN TO MENU" : X=330 : GOSUB 9350 : IF X
$<>"@" THEN CLS : GOTO 30
280 IP=1 : CLS : GOSUB 390
290 PRINT @ 896, IP; STRING$(50," ") : PRINT "QUANTITY
PART NUMBER
DESCRIPTION
PRICE/EACH" : GOSUB 390
300 PRINT @ 704, "QUANTITY"; : INPUT Q(IP) : PRINT "PART NUMBER?
```

Listing 1 continues

CONVERT YOUR TRS-80 MODEL-I OR III INTO A

DEVELOPMENT SYSTEM

Now you can develop Z-80 based, stand-alone devices such as games, robots, instruments and peripheral controllers, by using your TRS-80 as a development system. The DEVELOPMATE plugs into the expansion connector of your TRS-80 and adds **PROM PROGRAMMING** and **IN-CIRCUIT-EMULATION** capabilities to your system (with or without expansion interface).

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at the bottom of the menu. Line 80 calls a subroutine that prints an input prompt at screen location X, obtains the input by the INKEY$ function and routes the computer to the appropriate program line for the selected function.

Lines 100–150 are a module for inputting the customer billing information. At the beginning of each input module, the program checks for data already in the buffer (lines 100, 200 and 270). (The existence of this data has also been displayed at the bottom of the menu.) You may ignore and overwrite this data. The module lists all information that is going to be requested (line 110), and then asks for each item by moving the cursor. Information not needed or available may be marked blank by hitting the enter key in response to the cursor. Incidentally, NEWDOS80 offers a blinking cursor option that goes well here.

After requesting the customer name, the program asks for an account number. This permits setting up an account-number file that supplies the rest of the address information automatically. Should you use such a scheme, inputting the customer name also allows you to check the validity of the account number entered. (The name must match the account number.)

"If you run a small business Invoice will help you get the bills out."

You are next asked the tax status of the customer. If the customer is exempt from sales tax, enter a Y to this query. The program will set a flag causing the invoice to be printed with "tax exempt" at the sales tax entry. After securing the customer information, the program prompts for correctness and returns to the menu.

Labor and Parts

Lines 200–390 input data for labor and parts billing. The format is similar to that for the customer input module. It is possible to enter labor data, exit to menu, and then enter the parts data. If a particular invoice is for a parts sale only, use menu 2 (enter billing) rather than item 3 (enter parts billing) and answer the "parts sale only?" query with Y. Storing an invoice on disk without passing through the labor submodule will very likely cause a disk error when you attempt to recover the information for printing.

After entering all data, menu item 4 (store data/start next invoice) causes the record to be written to the disk file by the module starting at line 400. First, the INVNUMBR file is read for the number of the last invoice written. This number is then incremented and restored in INVNUMBR and retained as

Listing 1 continued

```
  "; : LINEINPUT PN(IP) : PRINT "DESCRIPTION? "; : LINEINPUT PD(I
P) : PRINT "PRICE/EACH"; : INPUT PP(IP)
310 PRINT @ 0, "HIT 'N' IF DATA IS NOT CORRECT
HIT SPACE BAR TO ENTER MORE PARTS
HIT ENTER IF NO MORE PARTS "; : GOSUB 9400 : GOSUB 9350 : IF X$=
"N" THEN 290 ELSE IF X$=" " THEN IP=IP+1 : GOTO 290 ELSE IF ASC(
X$)=13 THEN CLS : K3=1 : GOTO 30
320 GOTO 310
390 PRINT @ 0, "PARTS USED:
------------------------
" : RETURN
400 CLS : PRINT "STORING DATA"
410 IF K1=0 THEN PRINT "
DATA INCOMPLETE - NO CUSTOMER INFO " : K4=1
420 IF K2=0 THEN PRINT "
DATA INCOMPLETE - NO LABOR INFO " : K4=1
430 IF K3=0 THEN PRINT "
DATA INCOMPLETE - NO PARTS INFO " : K4=1
440 IF K4=1 THEN PRINT : PRINT "HIT @ TO CONTINUE
HIT ANY OTHER KEY FOR MENU " : X=916 : GOSUB 9350 : IF X$<>"@" T
HEN K4=0 : GOTO 30 ELSE K4=0
450 OPEN "R",1,"INVNUMBR","MU"
460 GET 1,,,B; : PRINT B : B=B+1 : PRINT B
470 PUT 1,!0,,B;
480 CLOSE
490 OPEN "R",1,"PRINTFIL:0","MU"
500 X=LOC(1)% : PRINT X
510 PUT 1,!X,,B,N,NA,NP,A1,A2,A3,A4,A5,IL,IP,K5;
520 FOR I=1 TO IL
530 PUT 1,,,D(I),R(I),M(I),T(I);
540 NEXT I
550 FOR I=1 TO IP
560 PUT 1,,,Q(I),PN(I),PD(I),PP(I);
570 NEXT I
580 CLOSE
590 CMD "F=KEEP",G$,G1$
600 GOTO 30
700 CLS : PRINT "***** PRINTING INVOICES *****" : PRINT : PRINT
"HOW MANY COPIES ? "; : GOSUB 9400 : GOSUB 9300 : K9=X : PRINT
710 PRINT : PRINT : PRINT "HIT ANY KEY WHEN PRINTER IS READY & P
APER IS AT TOP OF FORM " : X=410 : GOSUB 9350 : PRINT
720 POKE 16425,1
730 OPEN "I",1,"PRINTFIL:0","MU"
740 IF EOF(1) THEN CLOSE : GOTO 1440
750 GET 1,,,B,N,NA,NP,A1,A2,A3,A4,A5,IL,IP,K5;
760 I=1
770 GET 1,,,D,R,M,T;
780 T(I)=T : D(I)=D : R(I)=R : M(I)=M : IF I=IL THEN 790 ELSE I=
I+1 : GOTO 770
790 I=1
800 GET 1,,,Q,PN,PD,PP;
810 Q(I)=Q : PN(I)=PN : PD(I)=PD : PP(I)=PP
820 IF I=IP THEN 840 ELSE I=I+1 : GOTO 800
840 CLS:PRINT"PRINTING INVOICE"
850 FOR I9=1 TO K9
860 FOR I=0 TO 3 : LPRINT : NEXT I
870 LPRINT CHR$(31);CHR$(16);"35";"J.L. HACKMAN"
880 LPRINT CHR$(16);"35";"P.O.BOX 194"
890 LPRINT CHR$(16);"35";"MOUNT PLEASANT, MI"
900 LPRINT CHR$(16);"35";"48858"
910 LPRINT : LPRINT CHR$(16);"35";"TEL. 517-773-9004"
920 LPRINT :LPRINT "INVOICE #";B
930 LPRINT LEFT$(TIME$,8)
940 LPRINT :LPRINT: LPRINT CHR$(30);N
950 LPRINT A1
960 IF A4="" THEN 970 ELSE LPRINT A4
970 LPRINT A2;", ";A3
980 LPRINT A5
990 LPRINT:LPRINT:LPRINT "GENTLEMEN:"
1000 LPRINT:LPRINT
1010 IF NPO="" THEN 1020 ELSE LPRINT "REFERENCE YOUR PURCHASE OR
DER #";NPO
1020 LPRINT "THE FOLLOWING SERVICES HAVE BEEN RENDERED TO YOU."
1030 LPRINT:LPRINT "DATE      DESCRIPTION
1040 LPRINT "LABOR  TIME (HOURS)","LABOR RATE","TOTAL"
1050 LPRINT"-------------------------------------------------
------------"
1060 LPRINT
1070 FOR I3=1 TO IL
1080 IF D(I3)="@" THEN LPRINT "          PARTS SALE ONLY":GOSUB9
500: GOTO 1130
1090 LPRINT D(I3);"  ";M(I3)
1100 LPRINT T(I3),, : LPRINT USING G$;R(I3),: L(I3)=T(I3)*R(I3)
: LPRINT USING G$;L(I3)
1110 GOSUB 9500 : LPRINT
```

Listing 1 Continues

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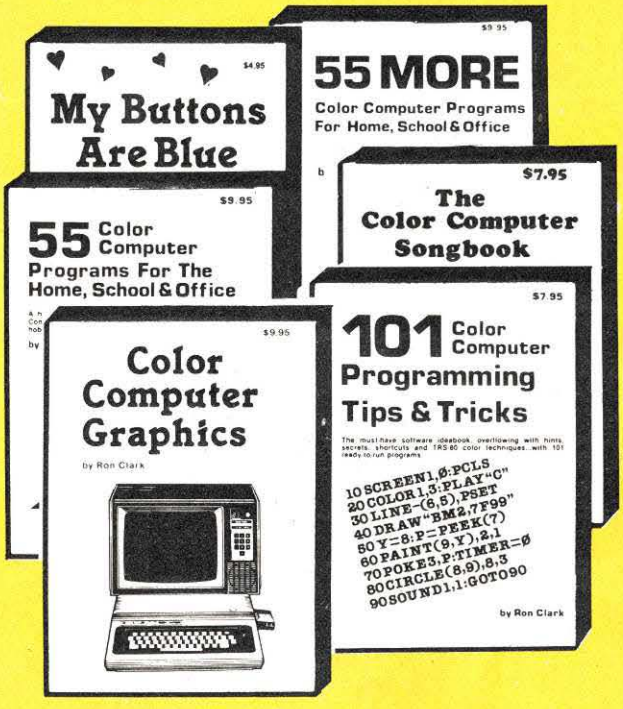

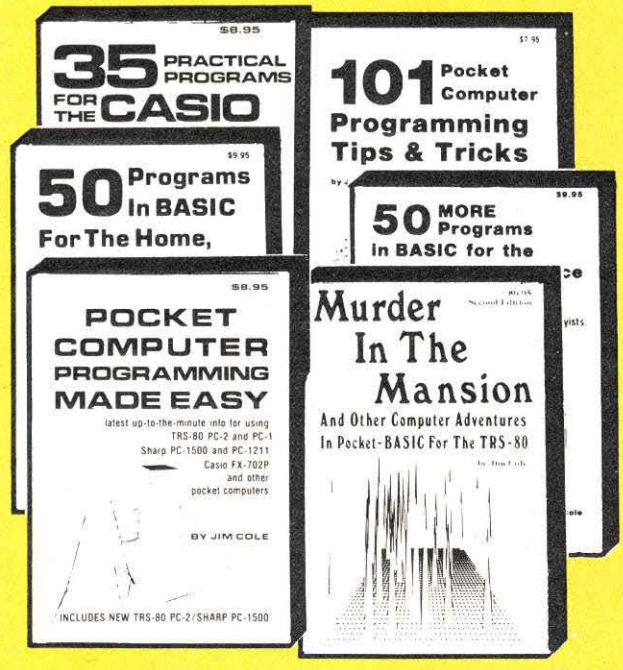

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variable B to identify the invoice and its disk record. The entire record is then written into the PRINTFIL file. The NEWDOS80 command F = KEEP is used in line 590 to clear all variables and arrays except G$ and G1$, and the program returns to menu. The entry process of modules 1, 2, and 4 is repeated for each of the invoices to be written, with each record being added to PRINTFIL in sequence.

Printing Invoices

After all the data is in, the invoices may be printed by menu item 5 (print invoices). The program is designed so power failures will not wipe out records already written. Also, invoicing data may be entered all day or in several sessions, while the time-consuming printing can be done at night, during lunch hour, or at times when the computer is not needed for other functions.

Line 700 starts the print module by asking the number of copies to be printed. If multi-part paper is used, only one print cycle is necessary. However, if you are using one-part paper, this function allows you to make file copies of invoices automatically.

Line 720 resets the line counter of the printer driver. It may be necessary to add POKE 16424,XX to this line (XX is the number of lines per page plus one for your printer/paper combination). I have found it necessary to POKE this location with a 66 instead of the default value of 67 when using

"The job's not done until the paperwork is finished."

certain printers in order to have succeeding invoices printed in proper registration.

Lines 730-820 read each record from PRINTFIL and load the data into variables and arrays. If you don't need the disk-file storage mode of this program, you can go directly from the menu after loading data to line 840 and print it. Alternatively, the disk-writing routine in the store-data module and the read routine in this module may be replaced with cassette I/O routines, if you are not yet ready to take the disk plunge.

Line 840 starts the print process, while lines 870-910 contain the return address information. Your name should be placed in line 1400.

The CHR$(16),"35", sets the positioning for printing. If your printer does not recognize CHR$(31) as setting the double-width mode, or if your printer allows some other print style you deem desirable for printing your letterhead, modify line 870 accordingly. In line 930, LEFT$(TIME$,8) extracts the system date from NEWDOS80 and uses it as the invoice date. The CHR$(30) in 940 returns the printer to the

Listing 1 continued

```
1120 NEXT I3
1130 LPRINT:L=0
1140 FOR I5=1TOIL:L=L+L(I5):NEXT I5: LPRINT "SUBTOTAL FOR LABOR
     $"; : LPRINT USING G$;L
1150 LPRINT
1160 LPRINT : GOSUB 9500 : IF IP<1 THEN 1330
1170 IF D(1)<>"0" THEN LPRINT "DURING THE ABOVE LABORS, THE FOLL
OWING PARTS WERE USED:" ELSE C=0 : CT=0 : GOTO 1310
1180 LPRINT : GOSUB 9500
1190 LPRINT "QUAN.","PART NUMBER","DESCRIPTION" : LPRINT "PRICE
PER ITEM",,,"EXTENDED PRICE"
1200 LPRINT "-----------------------------------------------------
-------------"
1210 LPRINT : GOSUB 9500
1220 FOR I4=1 TO IP
1230 LPRINT Q(I4),PN(I4),PD(I4) : LPRINT PP(I4),,, : LPRINT USIN
G G$;Q(I4)*VAL(PP(I4))
1240 GOSUB 9500 : LPRINT
1250 NEXT I4
1260 LPRINT : GOSUB 9500 : C=0
1270 FOR I6=1 TO IP
1280 C=C+(Q(I6)*VAL(PP(I6))):NEXTI6
1290 LPRINT "SUBTOTAL FOR PARTS        $"; : LPRINT USING G$;C
1300 CT=INT(C*40)/1000:LPRINT "SALES TAX                    $"; : I
F K5=1 THEN LPRINT "TAX EXEMPT" : CT=0 ELSE LPRINT USING G$;CT
1310 LPRINT "LABOR                     $"; : LPRINT USING G$;L
1320 CC=C+CT+L
1330 LPRINT "                              ----------"
1340 LPRINT:LPRINT "TOTAL DUE                  $"; : LPRINT USING
 G$;CC
1350 IF PEEK(16425)>50 THEN LPRINT CHR$(11) : LPRINT : LPRINT :
LPRINT : LPRINT
1360 LPRINT:LPRINT
1370 LPRINT "PLEASE BRING ANY ERRORS OR DISSATISFACTION TO MY AT
TENTION IMMEDIATELY."
1380 LPRINT "THANK YOU FOR YOUR BUSINESS."
1390 LPRINT:LPRINT
1400 LPRINT "SINCERELY YOURS,":LPRINT:LPRINT:LPRINT"JOHN HACKMAN
"
1410 LPRINT CHR$(11)
1420 NEXT I9
1430 GOTO 740
1440 CLS : PRINT "DONE PRINTING - OK TO MOVE INVOICES TO 'PENDIN
G' FILE (Y/N) ?"
1450 X=148 : GOSUB 9350 : IF X$="Y" THEN 1480 ELSE IF X$="N" THE
N 1460 ELSE 1440
1460 PRINT : PRINT "ENTER CHOICE -
1 - REPRINT INVOICES
2 - RETURN TO MAIN MENU
3 - MOVE INVOICES TO 'PENDING' FILE"
1470 GOSUB 9400 : X=X+84 : GOSUB 9300 : ON X GOTO 700,30,1480,14
60
1480 OPEN "I",1,"PRINTFIL","MU"
1490 OPEN "R",2,"PENDING","MU"
1500 X=LOC(2)% : PUT 2,!X
1510 IF EOF(1) THEN CLOSE : KILL "PRINTFIL:0" : GOTO 30
1520 GET 1,,,B,N,NA,NP,A1,A2,A3,A4,A5,IL,IP,K5; : DI$=LEFT$(TIME
$,8)
1530 PUT 2,,,B,DI$,G1$,N,NA,NP,A1,A2,A3,A4,A5,IL,IP,K5;
1540 I=1
1550 GET 1,,,D,R,M,T;
1560 PUT 2,,,D,R,M,T; : IF I=IL THEN 1570 ELSE I=I+1 : GOTO 1550
1570 I=1
1580 GET 1,,,Q,PN,PD,PP; : PUT 2,,,Q,PN,PD,PP; : IF I=IP THEN 15
90 ELSE I=I+1 : GOTO 1580
1590 GOTO 1510
9300 GOSUB 9350 : X=VAL(X$): RETURN
9350 PRINT@X," ? ";:FOR I9=0TO50:X$=INKEY$:IFX$=""THEN NEXT I9 E
LSE RETURN
9360 PRINT@X-2,STRING$(7,CHR$(143));:FOR I9=0TO50:X$=INKEY$:IFX$
=""THEN NEXT I9 ELSE RETURN
9370 GOTO 9350
9400 X=(PEEK(16417)*256)+PEEK(16416)-15356 : RETURN
9450 X=X+15360 : X1=INT(X/256) : X2=X-X1*256 : POKE 16417,X1 : P
OKE 16416,X2 : RETURN
9500 IF PEEK(16425)>59 THEN LPRINT CHR$(11) : LPRINT : LPRINT :
LPRINT : LPRINT : RETURN ELSE RETURN
9998 CLS : IF K1>0 OR K2>0 OR K3>0 THEN PRINT "UNSTORED DATA STI
LL IN BUFFER

HIT SPACE TO RETURN TO MENU
HIT '@' TO QUIT ANYHOW "; : GOSUB 9400 : GOSUB 9350 : IF X$=" "
THEN 30 ELSE IF X$="@" THEN END ELSE 9998
```


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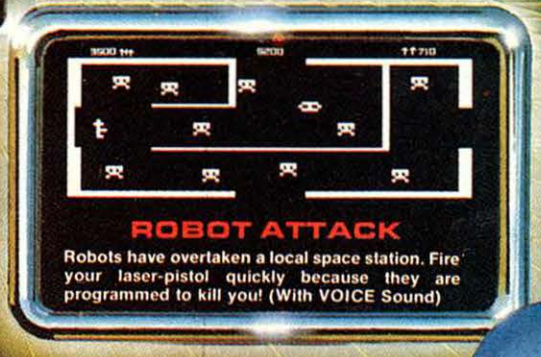

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normal-character mode.

During the rest of the print routine, you will notice occasional GOSUB 9500s. This subroutine checks to see if the printing is approaching the end of the page and, if so, advances the printer to the next page with the proper top margin and resumes printing.

At the conclusion of each invoice, the program loops back to read the file for the next invoice. If an end-of-file marker is encountered and detected by line 740, the file is closed and the program drops to line 1440. Here, the normal routine is to kill PRINTFIL after transferring all of its records to the pending file. However, line 1440 provides means for interrupting this procedure. For instance, if invoice printing was done while no one was in attendance and your printer chose this time to eat all the paper in sight, 1440 permits another run.

Transferring records to the pending file and killing PRINTFIL clears PRINTFIL for new data. This is necessary since the data writes to PRINTFIL are sequential and would therefore just add and add. Moving the printed data to the pending file leaves us with a computer-usable record of billing sent out. The form of the file is such that other programs can access it, mark "paid" those records for which payment has been received, print reports of unpaid bills and rebill overdues, and abstract data for use in general ledger, sales reports, inventory maintenance and customer histories and

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```
2000 CLS : DEFINT B : INPUT "ENTER FIRST INVOICE NUMBER -1";B
2010 OPEN "R",1,"INVNUMBR","MU"
2020 PUT 1,!0,,B;
2030 CLOSE
2040 END
```

Program Listing 2

Program Listing 3

```
25 CLS : INPUT "DATE";DI$ : INPUT "STARTING INVOICE NUMBER";B
40 PRINT : PRINT "1 - ENTER CUSTOMER
2 - ENTER BILLING
3 - ENTER PARTS BILLING
4 - STORE DATA / START NEXT INVOICE
5 - PRINT INVOICES
6 -
7 -
8 - HELP
9 - QUIT"
80 PRINT : X=980 : GOSUB 9300 : ON X GOTO 100,200,270,400,700,30
,30,30,9998
230 PRINT @ 192, "DATE"; : INPUT D(IL) : PRINT "HOURS"; : INPUT
T(IL) : PRINT "RATE/HR"; : INPUT R(IL) : PRINT "DESCRIPTION?"; :
 INPUT M(IL)
240 PRINT "IS ALL DATA CORRECT (Y/N) ?"; : GOSUB 9400 : GOSUB 93
50 : IF X$="Y" THEN 250 ELSE IF X$="N" THEN 220 ELSE 240
300 PRINT @ 704, "QUANTITY"; : INPUT Q(IP) : PRINT "PART NUMBER?
 "; : INPUT PN(IP) : PRINT "DESCRIPTION? "; : INPUT PD(IP) : PRI
NT "PRICE/EACH"; : INPUT PP(IP)
400 CLS : PRINT "STORING DATA" : PRINT
410 IF K1=0 THEN PRINT "NO CUSTOMER INFO" : K4=1
420 IF K2=0 THEN PRINT "NO LABOR INFO" : K4=1
430 IF K3=0 THEN PRINT "NO PARTS INFO" : K4=1
440 IF K4=1 THEN PRINT : PRINT "HIT '@' TO CONTINUE
HIT ANY OTHER KEY TO RETURN TO MENU"; : GOSUB 9400 : GOSUB 9350
: IF X$="@" THEN 450 ELSE 30
450 CLS : PRINT "HIT ANY KEY WHEN CASSETTE IS READY AND IN RECOR
D MODE"; : GOSUB 9400 : GOSUB 9350
460 PRINT #-1,B,DI$,N,NA,NP,A1,A2,A3,A4,A5,IL,IP,K5
470 FOR I=1 TO IL
480 PRINT #-1,D(I),R(I),M(I),T(I)
490 NEXT I
500 FOR I=1 TO IP
510 PRINT #-1,Q(I),PN(I),PD(I),PP(I)
520 NEXT I
530 K1=K2=K3=K4=0 : B=B+1
540 GOTO 30
550 '
730 CLS : PRINT "READY CASSETTE IN PLAY MODE"
740 INPUT #-1,B,DI$,N,NA,NP,A1,A2,A3,A4,A5,IL,IP,K5
750 CLS : IF DI$="@" AND N="@" THEN GOTO 30 ELSE PRINT "LOADING
DATA"
760 FOR I=1 TO IL
770 INPUT #-1,D(I),R(I),M(I),T(I)
780 NEXT I
790 FOR I=1 TO IP
800 INPUT #-1,Q(I),PN(I),PD(I),PP(I)
810 NEXT I
820 '
930 LPRINT DI$
1430 GOTO 730
2000 CLS : PRINT "CLOSING CASSETTE FILE" : PRINT : PRINT "HIT AN
Y KEY WHEN CASSETTE IS READY IN RECORD MODE"; : GOSUB 9400 : GOS
UB 9350
2010 PRINT #-1,0,"@","@","@","@","@","@","@","@","@",0,0,0
2020 GOTO 30
```

Program Listing 4

```
10 CLEAR 2000 : DEFSTR N,A,D,P,M : DEFINT Q,B
20 DIM PN(30),PD(30),PP(30),Q(30) : G$="#####.##" : G1$=STRING$(
8,"*")
25 CLS : INPUT "DATE";DI$ : INPUT "STARTING INVOICE NUMBER";B
30 CLS : PRINT "            INVOICE  1.5
MENU
----"
40 PRINT : PRINT "1 - ENTER CUSTOMER
```

Listing 4 continues

profiles.

In line 1530 the first part of each record is put into the pending file. You will notice that something extra is added to the data—items DI$ (billing date) and G1$ (defined in line 20 as eight asterisks). G1$ can be used as a paid/not-paid marker for each record. When an invoice is paid, G1$ can be updated to contain the date of the payment. The presence of asterisks in this field therefore tells us the bill has not yet been paid. The paid date in completed records allows computing the time each customer takes to pay his bills.

Lines 9300-9450 are handy subroutines used for display formatting and data input. Lines 9350-9370 place a flashing marker at location X on the screen and obtain X$ by the INKEY$ function. Line 9300 calls this subroutine and converts X$ to its numerical value, returning it as X. Subroutine 9400 returns the current cursor position on the screen plus four. (The plus four positions the marker from 9350 without overlapping existing text on the screen.) Line 9450 permits setting the cursor position anywhere on the screen by specifying X in the same values as PRINT@ uses.

Initial Setup

Before running the main program for the first time, enter and run Program Listing 2. This creates the invoice-number file the main program expects to find when it runs, and allows you to set the starting invoice number you want. Also, it may be used to re-

Listing 4 continues

```
2 - ENTER BILLING
3 - ENTER PARTS BILLING
4 - STORE DATA / START NEXT INVOICE
5 - PRINT INVOICES
6 -
7 -
8 - HELP
9 - QUIT"
50 PRINT : IF K1=1 THEN PRINT "CUSTOMER INFO IN BUFFER  ";
60 IF K2=1 THEN PRINT "LABOR INFO IN BUFFER  ";
70 IF K3=1 THEN PRINT "PARTS INFO IN
BUFFER"
80 PRINT : X=980 : GOSUB 9300 : ON X GOTO 100,200,270,400,700,30
,30,30,9998
100 IF K1=1 THEN CLS : PRINT "INVOICE DATA FROM LAST ENTRY HAS N
OT BEEN STORED -
HIT @ TO IGNORE & CONTINUE ENTRY
HIT ANY OTHER KEY TO RETURN TO MENU" : X=330 : GOSUB 9350 : IF X
$<>"@" THEN 30
110 CLS : PRINT "CUSTOMER NAME
ACCOUNT NUMBER
CUSTOMER PO#
ADDRESS:
        STREET
       ADDITIONAL
        CITY
        STATE
        ZIP CODE
        TAX EXEMPT (Y/N)"
120 PRINT @ 0, "CUSTOMER NAME";:INPUT N : PRINT "ACCOUNT NUMBER"
;: INPUT NA : PRINT "CUSTOMER PO#"; : INPUT NPO : PRINT "ADDRESS
:" : PRINT "
      STREET"; : INPUT A1 : PRINT "        ADDITIO
NAL"; : INPUT A4 : PRINT "        CITY"; : INPUT A2
130 PRINT "        STATE"; : INPUT A3 : PRINT "        ZIP CODE"
; : INPUT A5
140 PRINT "        TAX EXEMPT (Y/N)"; : INPUT X$ : IF X$="Y" THE
N K5=1 ELSE IF X$="N" THEN K5=0 ELSE GOTO 140
150 PRINT : PRINT "IS ALL DATA CORRECT (Y/N) ? "; : GOSUB 9400 :
 GOSUB 9350 : IF X$="Y" THEN K1=1 : GOTO 30 ELSE IF X$="N" THEN
110 ELSE GOTO 150
```

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set the invoice-number file if your number system is not simple sequential. Caution—the variable type holding the invoice number in the main program is integer, therefore the invoice numbers cannot exceed 32767. If you wish to start your invoice numbers with the year (e.g., 82001) you must define variable B in line 10 as single or double precision. If your invoice numbering scheme is more complicated, you may wish to make B a string variable and build an automatic updating function using RIGHT$, VAL, and so on.

Other Options

The program may be modified to meet your system configuration and needs. If cassette, rather than disk, storage is desired, use the code in Program Listing 3. After the data for each invoice is entered store it using menu function 4. At the end of an input session, or any time thereafter, the casette file may be printed using menu function 5. The operation is similar to that under disk, except for the time and inconvenience involved in handling cassettes, and no new permanent record file is written after printing—you just save the cassette file you just printed. Also you must put in the starting invoice number and the date at the beginning of each input session.

To print invoices directly, without the use of data files, substitute the programming shown in Listing 4. If a disk system is never going to be used, delete lines 400-600, 730-820 and 1440-1590. The program will now request data that otherwise would have been supplied by the DOS and the disk files.

If you use a DOS other than NEWDOS80 2.0, the file I/O sections must be modified to conform to your DOS requirements. My system runs in double density with a Percom Doubler. Addition of the Doubler has substantially reduced the number of disk errors (to zero) while making a nice improvement in the amount of storage area (141 grans per disk). Obviously, NEWDOS or something similar is needed, since Model I TRSDOS can't handle 40 tracks. Tossing in the system control features of NEWDOS (expanded Auto function, control of the break key, ability to restrict disks to Run only, and so on) make a program like Invoice something you can turn over to clerical operators without major problems. However, if you *must* use TRSDOS, then you will have to make changes in the file-handling sections.

Many of the filespecs call for a specific drive. If you are using a single-drive system or want your data files on some other drive, check the filespecs in Listing 1 and make the appropriate changes.

The Bottom Line

This program has improved my business operations measurably. I get my billing out faster and more accurately. I have good records of what went out, was paid or is still pending. And I show my customers a glimpse of what a small computer can do in their business as well as mine.■

Listing 4 continued

```
160  CLS : K1=1 : GOTO30
200 IF K2=1 THEN CLS : PRINT "PREVIOUS DATA IN BUFFER HAS NOT BE
EN STORED -
HIT @ TO IGNORE & CONTINUE
HIT ANY OTHER KEY TO RETURN TO MENU" : X=330 : GOSUB 9350 : IF X
$<>"@" THEN CLS : GOTO 30
210 CLS : IL=1 : PRINT "IF THIS IS A PARTS SALE ONLY, HIT 'P'
ELSE HIT ANY KEY"; : GOSUB 9400 : GOSUB 9350 : IF X$="P" THEN D(
1)="@" : K2=1 : GOTO 270 ELSE CLS
220 CLS : PRINT "LABOR BILLING:          ";IL;"
-------------
DATE
HOURS
RATE/HR
DESCRIPTION"
230 PRINT @ 192, "DATE"; : INPUT D(IL) : PRINT "HOURS"; : INPUT
T(IL) : PRINT "RATE/HR"; : INPUT R(IL) : PRINT "DESCRIPTION?"; :
 INPUT M(IL)
240 PRINT "IS ALL DATA CORRECT (Y/N) ?"; : GOSUB 9400 : GOSUB 93
50 : IF X$="Y" THEN 250 ELSE IF X$="N" THEN 220 ELSE 240
250 PRINT : PRINT "IS THERE ANOTHER LABOR ENTRY TO BE MADE (Y/N)
 ? "; : GOSUB 9400 : GOSUB 9350 : IF X$="Y" THEN IL=IL+1 : GOTO
220 ELSE IF X$="N" THEN 260 ELSE 250
260 K2=1 : CLS : PRINT "ARE THERE PARTS ENTRIES TO BE MADE (Y/N)
 ?"; : GOSUB 9400 : GOSUB 9350 : IF X$="Y" THEN 270 ELSE IF X$="
N" THEN Q(1)=0 : K3=1 : GOTO 30 ELSE GOTO 260
270 IF K3=1 THEN CLS : PRINT "PREVIOUS DATA IN BUFFER HAS NOT BE
EN STORED -
HIT @ TO IGNORE & CONTINUE
HIT ANY OTHER KEY TO RETURN TO MENU" : X=330 : GOSUB 9350 : IF X
$<>"@" THEN CLS : GOTO 30
280 IP=1 : CLS : GOSUB 390
290 PRINT @ 896, IP; STRING$(50," ") : PRINT "QUANTITY
PART NUMBER
DESCRIPTION
PRICE/EACH" : GOSUB 390
300 PRINT @ 704, "QUANTITY"; : INPUT Q(IP) : PRINT "PART NUMBER?
 "; : INPUT PN(IP) : PRINT "DESCRIPTION? "; : INPUT PD(IP) : PRI
NT "PRICE/EACH"; : INPUT PP(IP)
310 PRINT @ 0, "HIT 'N' IF DATA IS NOT CORRECT
HIT SPACE BAR TO ENTER MORE PARTS
HIT ENTER IF NO MORE PARTS "; : GOSUB 9400 : GOSUB 9350 : IF X$=
"N" THEN 290 ELSE IF X$=" " THEN IP=IP+1 : GOTO 290 ELSE IF ASC(
X$)=13 THEN CLS : K3=1 : GOTO 30
320 GOTO 310
390 PRINT @ 0, "PARTS USED:
------------------------
" : RETURN
400 CLS : PRINT "STORING DATA" : PRINT
410 IF K1=0 THEN PRINT "NO CUSTOMER INFO" : K4=1
420 IF K2=0 THEN PRINT "NO LABOR INFO" : K4=1
430 IF K3=0 THEN PRINT "NO PARTS INFO" : K4=1
440 IF K4=1 THEN PRINT : PRINT "HIT '@' TO CONTINUE
HIT ANY OTHER KEY TO RETURN TO MENU"; : GOSUB 9400 : GOSUB 9350
: IF X$="@" THEN 450 ELSE 30
450 CLS : PRINT "HIT ANY KEY WHEN CASSETTE IS READY AND IN RECOR
D MODE"; : GOSUB 9400 : GOSUB 9350
460 PRINT #-1,B,DI$,N,NA,NP,A1,A2,A3,A4,A5,IL,IP,K5
470 FOR I=1 TO IL
480 PRINT #-1,D(I),R(I),M(I),T(I)
490 NEXT I
500 FOR I=1 TO IP
510 PRINT #-1,Q(I),PN(I),PD(I),PP(I)
520 NEXT I
530 K1=K2=K3=K4=0 : B=B+1
540 GOTO 30
550 '
700 CLS : PRINT "***** PRINTING INVOICES *****" : PRINT : PRINT
"HOW MANY COPIES ? "; : GOSUB 9400 : GOSUB 9300 : K9=X : PRINT
710 PRINT : PRINT : PRINT "HIT ANY KEY WHEN PRINTER IS READY & P
APER IS AT TOP OF FORM " : X=410 : GOSUB 9350 : PRINT
720 POKE 16425,1
730 CLS : PRINT "READY CASSETTE IN PLAY MODE"
740 INPUT #-1,B,DI$,N,NA,NP,A1,A2,A3,A4,A5,IL,IP,K5
750 CLS : PRINT "LOADING DATA"
760 FOR I=1 TO IL
770 INPUT #-1,D(I),R(I),M(I),T(I)
780 NEXT I
790 FOR I=1 TO IP
800 INPUT #-1,Q(I),PN(I),PD(I),PP(I)
810 NEXT I
820 '
840 CLS:PRINT"PRINTING INVOICE"
850 FOR I9=1 TO K9
860 FOR I=0 TO 3 : LPRINT : NEXT I
870 LPRINT CHR$(31);CHR$(16);"35";"J.L. HACKMAN"
```

Listing 4 continues

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Listing 4 Continued

```
880 LPRINT CHR$(16);"35";"P.O.BOX 194"
890 LPRINT CHR$(16);"35";"MOUNT PLEASANT, MI"
900 LPRINT CHR$(16);"35";"48858"
910 LPRINT : LPRINT CHR$(16);"35";"TEL. 517-773-9004"
920 LPRINT :LPRINT "INVOICE #";B
930 LPRINT DI$
940 LPRINT :LPRINT: LPRINT CHR$(30);N
950 LPRINT A1
960 IF A4="" THEN 970 ELSE LPRINT A4
970 LPRINT A2;", ";A3
980 LPRINT A5
990 LPRINT:LPRINT:LPRINT "GENTLEMEN:"
1000 LPRINT:LPRINT
1010 IF NPO="" THEN 1020 ELSE LPRINT "REFERENCE YOUR PURCHASE OR
DER #";NPO
1020 LPRINT "THE FOLLOWING SERVICES HAVE BEEN RENDERED TO YOU."
1030 LPRINT:LPRINT "DATE      DESCRIPTION
1040 LPRINT "LABOR  TIME (HOURS)","LABOR RATE","TOTAL"
1050 LPRINT"-------------------------------------------------------
------------"
1060 LPRINT
1070 FOR I3=1 TO IL
1080 IF D(I3)="@" THEN LPRINT "          PARTS SALE ONLY":GOSUB9
500: GOTO 1130
1090 LPRINT D(I3);"  ";M(I3)
1100 LPRINT T(I3),, : LPRINT USING G$;R(I3),: L(I3)=T(I3)*R(I3)
: LPRINT USING G$;L(I3)
1110 GOSUB 9500 : LPRINT
1120 NEXT I3
1130 LPRINT:L=0
1140 FOR I5=1TOIL:L=L+L(I5):NEXT I5: LPRINT "SUBTOTAL FOR LABOR
     $"; : LPRINT USING G$;L
1150 LPRINT
1160 LPRINT : GOSUB 9500 : IF IP<1 THEN 1330
1170 IF D(1)<>"0" THEN LPRINT "DURING THE ABOVE LABORS, THE FOLL
OWING PARTS WERE USED:" ELSE C=0 : CT=0 : GOTO 1310
1180 LPRINT : GOSUB 9500
1190 LPRINT "QUAN.","PART NUMBER","DESCRIPTION" : LPRINT "PRICE
PER ITEM",,,"EXTENDED PRICE"
1200 LPRINT "-------------------------------------------------------
-------------"
1210 LPRINT : GOSUB 9500
1220 FOR I4=1 TO IP
1230 LPRINT Q(I4),PN(I4),PD(I4) : LPRINT PP(I4),,, : LPRINT USIN
G G$;Q(I4)*VAL(PP(I4))
1240 GOSUB 9500 : LPRINT
1250 NEXT I4
1260 LPRINT : GOSUB 9500 : C=0
1270 FOR I6=1 TO IP
1280 C=C+(Q(I6)*VAL(PP(I6))):NEXTI6
1290 LPRINT "SUBTOTAL FOR PARTS          $"; : LPRINT USING G$;C
1300 CT=INT(C*40)/1000:LPRINT "SALES TAX                    $"; : I
F K5=1 THEN LPRINT "TAX EXEMPT" : CT=0 ELSE LPRINT USING G$;CT
1310 LPRINT "LABOR                       $"; : LPRINT USING G$;L
1320 CC=C+CT+L
1330 LPRINT "                          ----------"
1340 LPRINT:LPRINT "TOTAL DUE                  $"; : LPRINT USING
 G$;CC
1350 IF PEEK(16425)>50 THEN LPRINT CHR$(11) : LPRINT : LPRINT :
LPRINT : LPRINT
1360 LPRINT:LPRINT
1370 LPRINT "PLEASE BRING ANY ERRORS OR DISSATISFACTION TO MY AT
TENTION IMMEDIATELY."
1380 LPRINT "THANK YOU FOR YOUR BUSINESS."
1390 LPRINT:LPRINT
1400 LPRINT "SINCERELY YOURS,":LPRINT:LPRINT:LPRINT"JOHN HACKMAN
"
1410 LPRINT CHR$(11)
1420 NEXT I9
1430 GOTO 730
9300 GOSUB 9350 : X=VAL(X$): RETURN
9350 PRINT@X," ? ";:FOR I9=0TO50:X$=INKEY$:IFX$=""THEN NEXT I9 E
LSE RETURN
9360 PRINT@X-2,STRING$(7,CHR$(143));:FOR I9=0TO50:X$=INKEY$:IFX$
=""THEN NEXT I9 ELSE RETURN
9370 GOTO 9350
9400 X=(PEEK(16417)*256)+PEEK(16416)-15356 : RETURN
9450 X=X+15360 : X1=INT(X/256) : X2=X-X1*256 : POKE 16417,X1 : P
OKE 16416,X2 : RETURN
9500 IF PEEK(16425)>59 THEN LPRINT CHR$(11) : LPRINT : LPRINT :
LPRINT : LPRINT : RETURN ELSE RETURN
9998 CLS : IF K1>0 OR K2>0 OR K3>0 THEN PRINT "UNSTORED DATA STI
LL IN BUFFER
HIT SPACE TO RETURN TO MENU
HIT '@' TO QUIT ANYHOW "; : GOSUB 9400 : GOSUB 9350 : IF X$=" "
THEN 30 ELSE IF X$="@" THEN END ELSE 9998
```

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1 Motorola Inc., Phoenix, AZ. **Seminar on 8-bit MPUs** Holiday Inn East, Wichita, KS.

1-3 Philadelphia Area Computer Society, Philadelphia, PA. **Philadelphia Area Computer Show** Philadelphia Center Hotel.

8-9 Tidewater Radio Conventions Inc., Portsmouth, VA. **Computer Show and Electronic Flea Market** Pavillion, Virginia Beach, VA.

8-11 Northeast Expositions Inc., Chestnut Hill, MA. **Electronica: Personal Electronics and Home Entertainment Products** Hynes Auditorium, Boston, MA.

12-13 The Yankee Group, Boston, MA. **The Home Talks Back: Seminar on Electronic Products, Electronically Delivered** New York City.

19-20 The Yankee Group, Boston, MA. **The Home Talks Back: Seminar on Electronic Products, Electronically Delivered** Palo Alto, CA.

19 Motorola Inc., Phoenix, AZ. **Seminar on 8-bit MPUs** Holiday Inn, Ft. Washington, PA.

20 Motorola Inc., Phoenix, AZ. **Seminar on 8-bit MPUs** Stratford Inn, Stratford, CT.

21 Motorola Inc., Phoenix, AZ. **Seminar on 8-bit MPUs** Sheraton Smithtown Inn, Smithtown, NY.

22 Motorola Inc., Phoenix, AZ. **Seminar on 8-bit MPUs** Sheraton-Lexington Motor Inn, Lexington, MA.

24-26 Texas Association for Educational Data Systems, Austin, TX. **18th Annual Convention** Villa Capri Hotel, Austin, TX.

25-26 University of Oregon, Eugene, OR. **First Annual Pacific Northwest Computer Graphics Conference** Eugene Conference Center/Hilton Hotel Complex.

25-27 Association for Computing Machinery, New York, NY. **Annual Convention** Dallas Hilton Hotel.

28-31 National Computer Shows, Chestnut Hill, MA. **The Gulf Coast Computer Show and Applefest** Houston Civic Center.

28-31 National Computer Shows, Chestnut Hill, MA. **Third Annual Mid-Atlantic Computer Show and Office Equipment Exposition** Washington, DC, Armory.

30-2 The George Washington University, Office of Continuing Medical Education, Washington, DC. **Symposium on Computer Applications in Medical Care** Sheraton Washington Hotel, Washington, DC.

November

1-3 Online Inc., Weston, CT. **Online '82: Conference for Users of Data Bases** Atlanta Hilton.

7-9 New York State Association for Educational Data Systems, Ardsley, NY. **17th Annual Conference of the NYSAEDS** Americana Hotel, Albany, NY.

8-12 Virginia Polytechnic Institute and State University, Blacksburg, VA. **Workshop on Personal Microcomputer Interfacing and Scientific Instrumentation Automation** Virginia Tech Campus.

9-10 Saginaw Valley Chapter of Data Processing Management Association, University Park, MI. **Ninth Great Lakes Computer Expo '82** Civic Center, Saginaw, MI.

11-14 National Computer Shows, Chestnut Hill, MA. **The Fourth Annual Northeast Computer Show and Office Equipment Exposition** Hynes Auditorium, Boston, MA.

15-17 Virginia Polytechnic Institute and State University, Blacksburg, VA. **Workshop on Microcomputer Interfacing, Design, and Programming Using the Z80/8085/8080** Virginia Tech Campus.

18-21 National Computer Shows, Chestnut Hill, MA. **Applefest** San Francisco Civic Center and Brooks Hall.

December

9-12 National Computer Shows, Chestnut Hill, MA. **The Second Annual Southeast Computer Show and Office Equipment Exposition** Atlanta Civic Center.

Coming Next Month

November's *80 Micro* takes you into the world of contemporary science and medicine. Can we expect to find micros there? You bet!

We can thank scientists working at the University of Iowa back in 1939, for the first computer. Computers have come a long way since then, as Tom Hager relates. One of the many scientific uses of microcomputers, measuring the temperature inside a running shoe, is detailed by James Larsen of Nike, Inc. Color Computer enthusiasts will learn how to use their machine for stargazing in an article by John Fowler.

The use of micros in medicine is evolving rapidly as reported by Technical Editor Michael Vose. They are even using TRS-80s at the local hospital, as Wynne Keller has discovered.

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by Dennis Kitsz

LNW-80 kit a worthwhile endeavor

It took a lot of headscratching, hours of telephone orders, a few trips to Radio Shack, 40 long hours of close work, and another dozen hours of troubleshooting. The question: Was it worth the work to save 700 bucks? The answer: You bet it was...at least for me.

What I've built is the machine I'm using to write this month's column—an LNW-80, built from a kit. Actually, LNW Research is hedging a little, calling these things semi-kits, since the units are nothing like a classic Heathkit (the standard of comparison) in either the ease of construction, the completeness of documentation, instructions, or parts.

I selected the full-blown semi-kit: printed circuit boards for the CPU section and an expansion interface ($90 and $85 with gold edge connectors), keyboard with numeric pad ($100), metal case ($85), three hard-to-find parts kits ($140—more on that later), and a Level II ROM set ($120). The semi-kit total, with shipping, was about $640. To that total I had to add the expense of a bucketful of my own parts and quite a few purchases, including capacitors, resistors, integrated circuits (48K of memory, too), regulators, diodes, transistors, sockets, and miscellaneous whatsises like fuse cases and wire clamps—the kind of stuff I always thought I had in my oversized junkbox, but when it came down to needing it, the cupboard was bare. This investment came to about $250 more, making the total kit cost about $900. This is at least $700 below an assembled LNW-80 ($1,600), or about the same as a TRS-80 Model III purchased at discount.

Before jumping in with the construction, you might want to know what this LNW computer is. The manufacturer calls it a Model I/III-compatible microcomputer with added features. But the LNW-80 is both more and less than that. Model I/III users will find it very familiar, while first-time computer users will appreciate the wide range of features that TRS-80 owners have known for some time. But I'll hold off listing these capabilities until I describe the assembly and operation of the computer. For the moment, consider that this machine contains just about every feature Model I owners have hoped for or modified their units to contain, and many of those the Model III should have had. In addition, high-resolution graphics (384 by 192) and color are standard.

In the next two columns, I'll cover assembly and operation, plus some fixes, to the LNW-80. In addition to running through the assembly of the machine, I will also present a few quick and easy modifications that will facilitate using some of the LNW's special features.

Before I begin, readers, please take note: I'm going to sound harsh in some of my criticisms of LNW Research, their documentation and support, and some aspects of the computer itself. Nevertheless, I purchased the LNW because I had the opportunity to use one and became convinced that it is a very good computer. Notwithstanding the amount of grief involved in the assembly of the machine, my views about its quality have not changed.

Opening the Box

The first surprise is how heavy the delivered box is—$11.17 worth of UPS up here to New England. Although most of the weight turns out to be the heavy metal case, that heftiness gave me a reassuring feeling about the whole system. I'm always a sucker for appearances, but this hunch was a good one. The case is 1/16-inch solid steel, painted cream white, and packed in plenty of scratch protection. A few bags of screws dropped out, and underneath was a pair of printed circuit boards.

All the integrated circuits—the so-called hard-to-find parts kit—were thrown ignominiously into a plastic bag, with the static-sensitive ones bundled into little aluminum foil globs. The five-pound transformer had fortunately been packed well and prevented from crushing the other parts. The keyboard is complete and also well packed; the connector survived un-

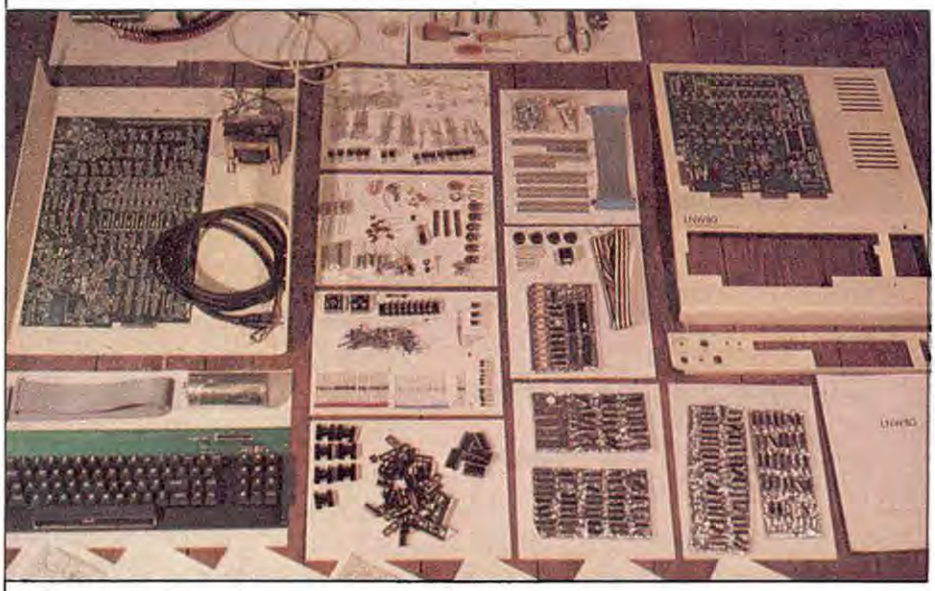


Photo 1. All the parts assembled for a complete LNW-80 kit. Clockwise from back: necessary tools; case top and expansion PC board; case back; manuals; foil trays of integrated circuits; sockets and heat sinks; keyboard, cable, and power-supply capacitors; main PC board, cord, transformer, in case bottom; at center are remaining small parts and hardware; at very bottom (just visible) are schematic sheets.

bent. A hefty sheaf of documentation rose out of the packing material. Another chunk of case fit into the bottom of the box. Photo 1 shows the complete parts in the semi-kit, together with all the extra parts purchased to complete the computer. The next photos are close-ups of the carefully manufactured printed circuit boards. Just a few of the hundreds of extra parts purchased for the kit are shown in Photo 3.

Long ago I learned the lesson that it's important to read an entire construction manual before attempting to build a kit, so I held myself back from tearing into the pile of parts with my soldering iron ablaze, and sat down in a comfortable chair with some Dewars and the LNW manual. I was soon confronted with one of the biggest documentation cop-outs I have ever read: "The purchaser of the LNW-80 is assumed to have a certain degree of ability in assembling electronic equipment. Therefore, a detailed step-by-step assembly manual containing topics, such as how to install a resistor, transistor, or IC, will not be discussed. What the assembly instructions will include are general and specific construction hints that we felt would be useful in making your LNW-80 board as easy and simple to build as possible."

Okay, says I, that's on the inside edge of reasonable. However, LNW's definition of construction hints is to tell you only how to wire parts of the machine that otherwise defy logical construction. The entire assembly *and* testing section for this $900 project is just 10 pages of dot-matrix printing, vague descriptions, and a few sketches. Compared with the detailed, clear, and carefully written documentation of the Archbold speed-up kit for the Model I, this assembly book is an inexcusable jumble: no photos, messy sketches, and dot-matrix printing. There is not a single valuable troubleshooting hint in the manual. Here's an example: "Turn system on and measure the following voltages...(voltage chart)...Turn power off and solder all power-supply jumpers indicated below...(jumper chart)... reaply (sic) power and measure all supply voltages as you first did. After all voltages are present, you can install all components that you are to use."

What if it doesn't come up with the right voltages? Where do you look? How do you start? Don't look for help in Section 8 (Circuit Description). This is so cursory (10 pages including an expansion bus pinout and abbreviated memory map) as to be useless. My 12-volt supply didn't work; here's what I found in their description: "CR15 rectifies the AC signal which is then filtered by C121. Q4 regulates the voltage to +12 volts. If the voltage at JP9 exceeds 13 volts, CR11 will begin to conduct. While the gate of Q6 remains unchanged, the anode will begin to rise above the gate voltage. This will cause Q6 to begin conducting and result in turning SCR2 on. F2 will then open. The +12 volts are used for both the LNW-80 and the Expansion Board." My fuse was intact, yet there was no

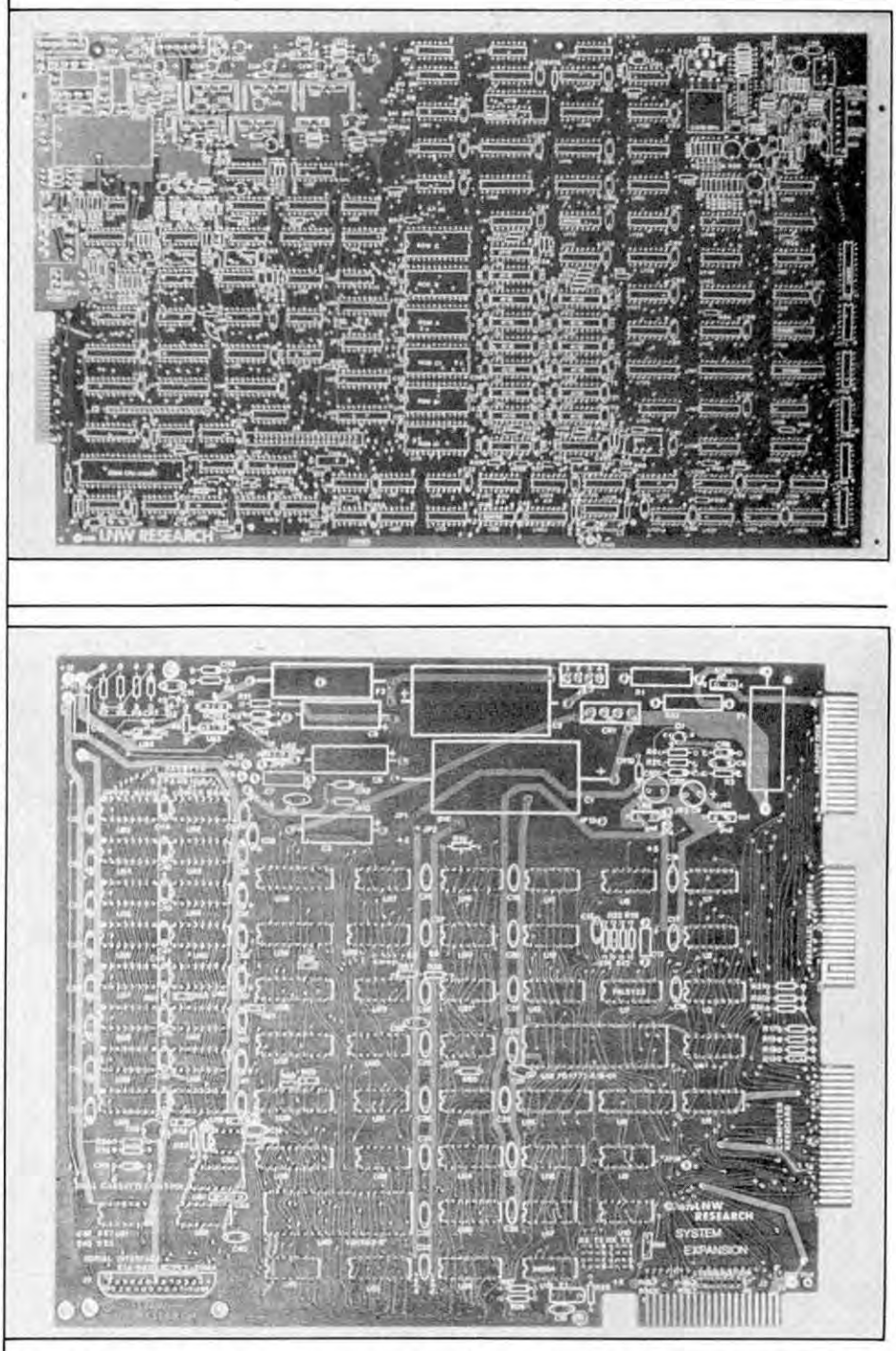
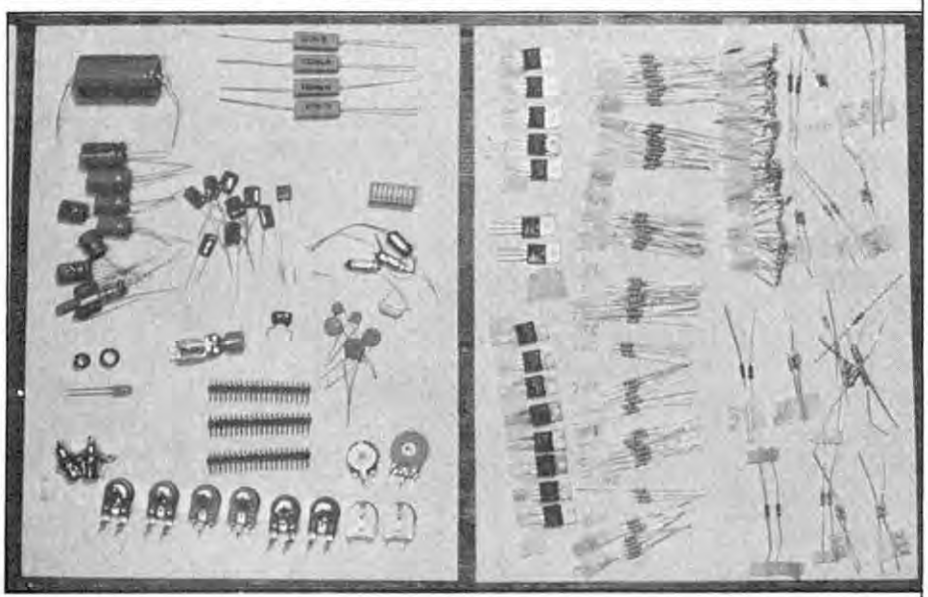


Photo 2. LNW-80 blank printed circuit boards. (a) Main CPU and high-resolution board; (b) expansion interface with gold edge connectors. The boards are setting on the case bottom and top, respectively.

+12 volts. Yeah, I found it, but not because I knew what the gobbledygook above was supposed to mean.

Okay, time to back up and summarize the manual's problems:

- It is incomplete in the description of the computer, assembly instructions, and technical data about the machine's operation and circuitry.
- It doesn't match the LNW-80 since the computer has been changed but the documentation hasn't. The errata don't cover all the changes.
- It specifies parts that physically do not fit on the printed circuit board—especially the variable resistors and capacitors.
- It's unclear and not particularly literate (I've been misunderstood before when I said that about other publications. I don't mean literary; I merely mean knowing how to spell, punctuate, and produce a reasonably complete sentence.)
- It is disorganized; even the errata appear in several places. There is no logical flow for the builder, no clear breakdown for repairs, and no specifications or tolerances.
- LNW releases itself from responsibility by implication; that is, LNW Research continues to ship a manual labeled "preliminary" even though it is dated March 1981 (and the expansion board documentation dated October 1979).



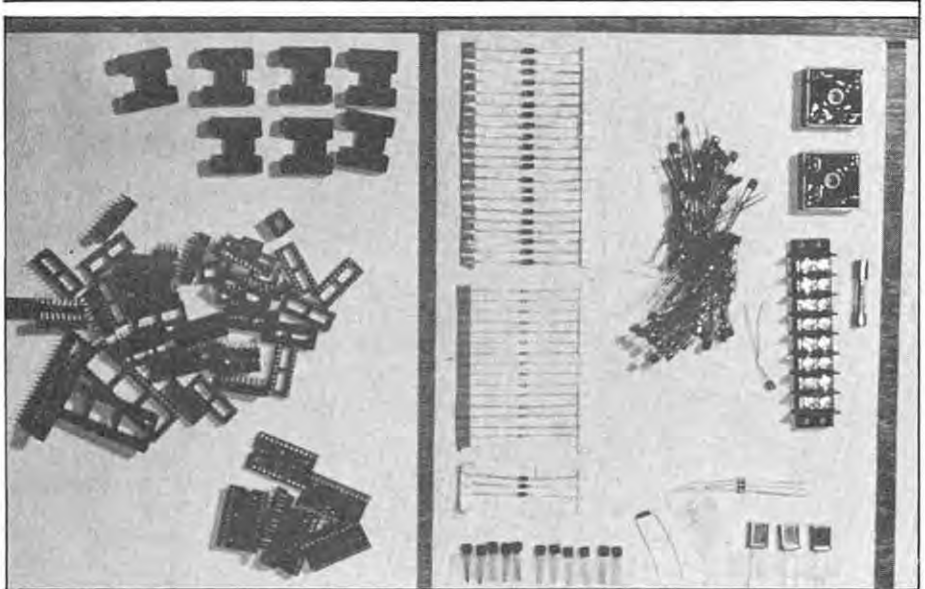


Photo 3. Just a few of the extra parts that must be purchased before the kit can be built. (a) Hundreds of resistors, capacitors, voltage regulators, switches, variable resistors, LED, etc.; (b) bridge rectifiers, bypass capacitors, diodes, sockets, heat sinks.

The LNW manual makes several assumptions that, two years after the Model I's demise, no longer make sense (if they ever did). The first and most problematic is that the user must already know how to operate a TRS-80. There is no Basic manual, no instructions for operation, no specifications for the language, not even a list of command words or errors. The first-time user of this machine will be lost. Beyond that, all the notions common to TRS-80 users are assumed—precision, speed of operation, even how to enter a program. And what of the confusion that results when a user releases the shift or caps lock and still sees uppercase letters? Although the keyboard implies it, there is no lowercase driver in the Basic! To use the LNW-80, then, it becomes imperative to have the background, manuals, and instruction books for Radio Shack's TRS-80. This is an economical cop-out for LNW (even if they did intend to be a software copycat of the Model I), yet it is a serious disservice to the LNW-80 buyer.

There's one more problem, and this one's a little more far-reaching. You simply cannot build this kit unless you have both good tools and test equipment, and that means more than a pocket voltmeter. It means you will probably need a temperature-controlled soldering unit (or at least an often-cleaned, low-wattage iron with several tips), a good multimeter (preferably a digital one), and an oscilloscope. I was scrupulous about assembling this LNW-80 (and it's far from the first computer I've put together) and it still would not function correctly when it was finished. The scope was essential.

Neither the advertisements nor the manuals suggest that this is a tough project. It is. And if you think that you can get started assembling the computer when it arrives, you're wrong; LNW Research sells only a hard-to-find parts kit, not the whole works. Although the kit does include some esoteric parts, it seems to be mostly a random collection of what was out of stock in southern California when LNW made up its list. Be prepared to search for a high-speed CPU, odd regulators and zener diodes, plus a host of obscure capacitors—tantalums, variables, high-capacitance

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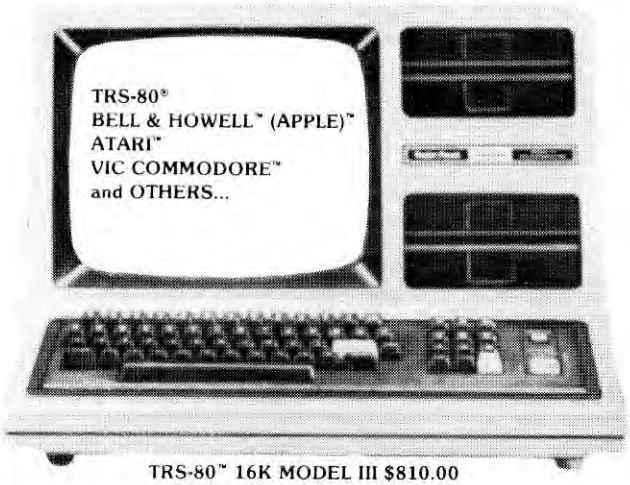

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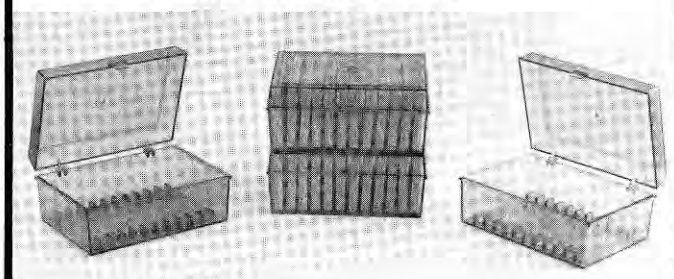

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types, and odd sizes. In fact, it took more than a dozen telephone calls to round up the parts that I didn't already own—although more than half of those "hard to find" parts I *did* have. Still curiously missing was an RGB ROM (for high-resolution color graphics), although assembled LNW-80s are being shipped with this ROM; instead, an NTSC ROM was included. Calls to LNW for information about the RGB ROM were fruitless.

Total time from receipt of LNW-80 kit to final rounding up of all remaining parts: 18 days.

First Steps

Once all the parts were at hand, I was more than ready. I commandeered an entire room of the house. Cats out.

I gave the boards another visual inspection, since the last thing I wanted to troubleshoot was a bashed trace on the board. I looked carefully, with a bright light and a magnifying glass, but the blearies got to me and I gave up. Bad move; more later on the problems caused by that single incomplete trace.

The 0.1 mF bypass capacitors went in first, since they were the smallest (and prettiest) parts. I got a good quantity price on tiny Blue Max capacitors, since nearly 200 are used in the full system (Photo 4). Then the resistors went in—a real pain. These things are numbered counterclockwise from the middle-left side of the board. . . mostly. Finding the last 20 or so was improbable madness, since they are scattered out of order around the board. Some resistor numbers are left over because they are not used, contributing to the confusion (Photo 5). Finally, I inserted the remaining capacitors, which were also scattered about. Total time for resistors and capacitors: four hours.

After that 18-day wait, though, the energy level was high. I forced myself to take a break, then jumped into installing the sockets. Okay folks, that's—no kidding—1,848 solder points. That's two hours of continuous soldering, not counting the sneezing fits from solder

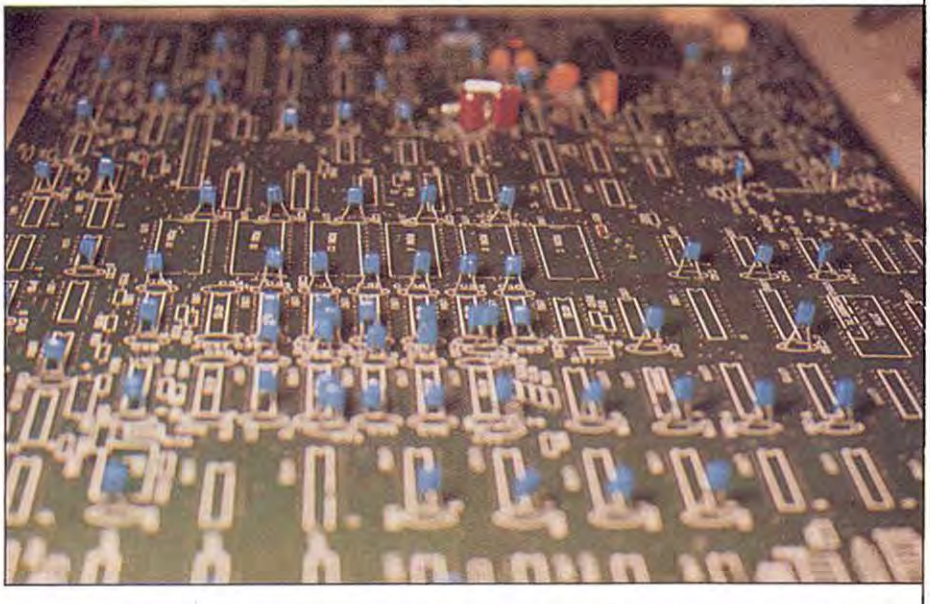

Photo 4. Installation of the capacitors. High-quality Blue Max miniature PC capacitors are used, although any 0.1 mF disks are adequate.

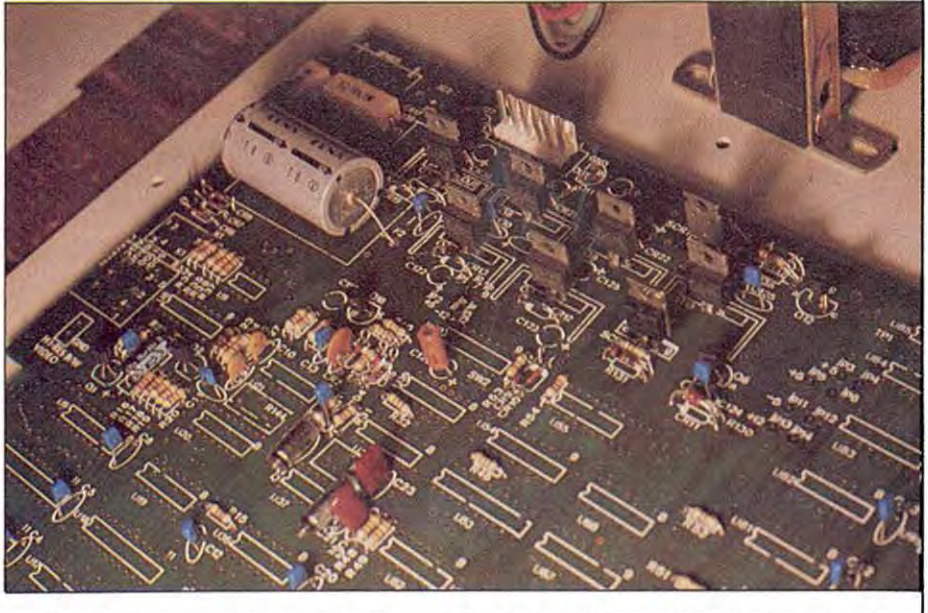

Photo 5. Resistors, regulators, capacitors, and connectors installed. Sockets will go in next.

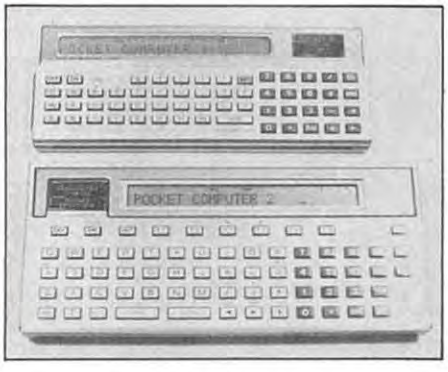

Photo 6. Pocket Computers 1 and 2 compared.

PC-2 has a more legible display, but does not quite fit into the pocket.

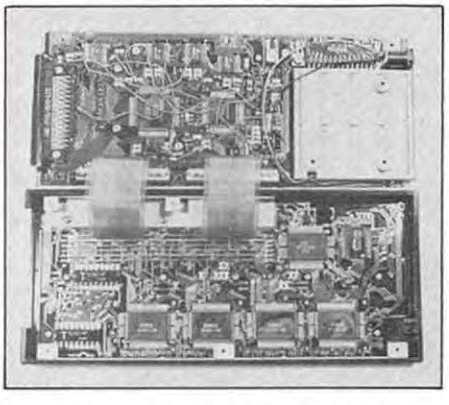

Photo 7. PC-2 opened and separated. Visible are (top left) expansion connector; (top center) proprietary LH5801 CPU; (top right) battery compartment; (center) flexible interconnection cables; (bottom) memory chips.

flux smoke. But nevertheless, so far, so good. I put in miscellaneous parts such as crystals, voltage regulators, small connectors, and a DIP switch for selecting Level II or other ROMs.

The miniature glass diodes can be difficult to install because they are very small and their glass bodies break. So you might take the advice of an author years ago in *Popular Electronics* (I've long forgotten who; if you recall, let me know). Lay the diodes against the point of a pencil and bend each lead around the pencil. It forms a kind of spring to protect the diode from snapping when installing it, plus gives the added bonus of providing a natural heat-sink during soldering (see Fig. 1).

After hours of little stuff, I decided to put some large hardware together. Ironically, this is the best documentation in the manual. The case assembly, transformer and keyboard installation, back panel, and various sockets and receptacles (darn! gotta buy a power cord, too!) fit perfectly in place. An automotive hose clamp made an excellent holder for the big capacitor, and for safety I purchased heavy bridge rectifiers and bolted them to the case. I slipped the PC boards in place just to admire my handiwork and went to bed.

Next time: Completing the assembly, testing, the disappointing LNW keyboard bounce, the RFI question, comparisons with Models I/III, the success of the 4 MHz speed, questions of weight and heat, screen deglitching, thoughts about reliability, easier dealings with high-resolution graphics, and a schematic map to keep you from tearing them up in frustration.

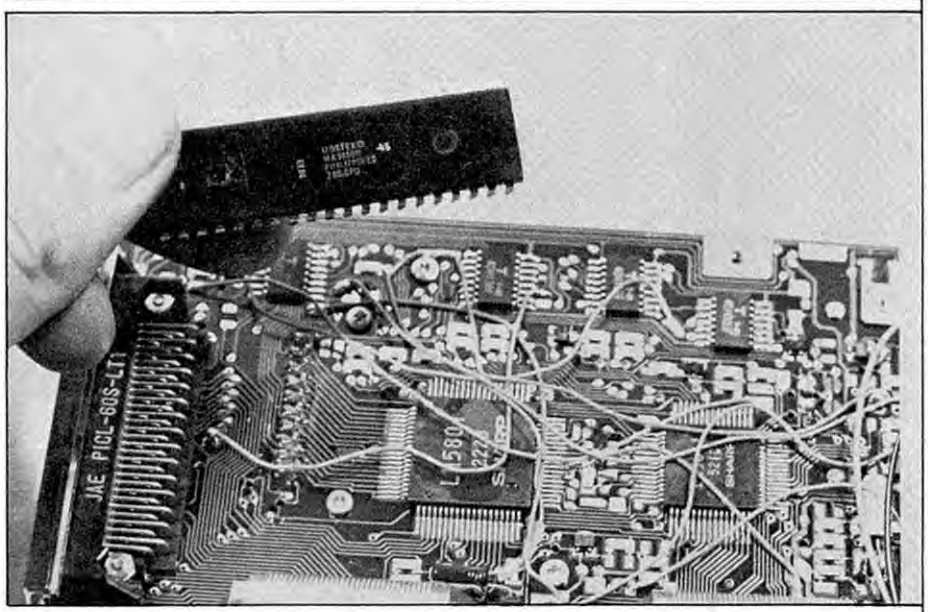

Photo 8. 40-pin Z80 CPU as used in the Model I compared with compact 72-pin LH5801 proprietary CPU made by Sharp Electronics for the PC-2. It is the same CPU Sharp uses in its Model 500 Pocket Computer.

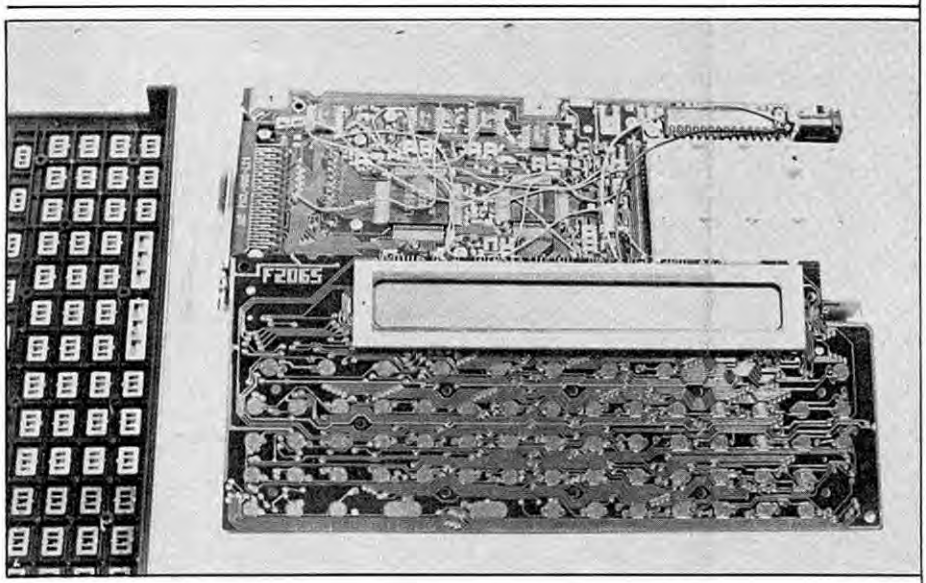

Photo 9. The PC-2 keyboard disassembled. Liquid crystal display unit is attached to the board. Rubber pop contacts connect gold-plated keyboard points in high-quality calculator style. Don't take this keyboard apart unless you have memorized where the keys go; all the keytops (at left) fell out when I separated the keyboard and case.

Inside the PC-2

Since this month is a potpourri of other computers, I have prepared a quick photo tour through the Radio Shack Pocket Computer 2. This is an astounding unit, by contrast with its PC-1 predecessor, and in comparison with any microcomputer of the recent past. It is surprisingly fast. FOR X = 1 TO 200: NEXT X executes in an elephantine 37.5 seconds on the PC-1, 0.7 seconds on the Model I, and 3 seconds on the PC-2—putting the PC-2 in league with the full-size micros. (Imagine what images "full-size micro" might have conjured up a few years ago!) This new pocket unit is bigger (it won't fit in any of my overall pockets), and contains a host of interesting features, including extra Basic commands for internal status, printer size and color, displayable and printable high-resolution graphics, and so on.

Since the PC-2's printer draws letters and graphics with ball-point pen cartridges, its "printed" output is very legible. Its graphs and other work can be printed in black (one of the four available colors in the rotating print head),

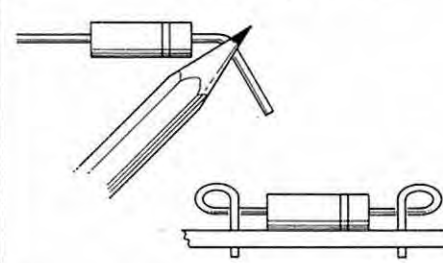

Fig. 1. Safe installation of small glass diodes. (a) Bend the leads around a pencil lead; (b) insert the finished diode easily on the board, providing both stress protection and heat-sinking.

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pasted up, and reproduced directly in reports or scientific articles. The older PC-1 is still a good deal at the lower price (and it does fit in my overalls), but the PC-2 is the one to save your pennies for. Photos 6–12 give a rundown of the machine's packed innards.

Exatron Memory Expansion

Hey, Model I owners! With Radio Shack's Expansion Interface on its way out, there are only a few choices left. Two of these are complete expansion interfaces patterned on the Radio Shack concept: One is the familiar LNW expansion board (build it yourself or buy an expensive assembled piece), the other is the excellent, but poorly advertised, Micromint assembled expansion interface. (I've seen pretty advertisements for a Lobo expansion box, but never having heard from a Lobo user nor seen an actual unit in operation, I'll leave this one out.)

If you don't plan to go with a disk system, if you already have a printer cable, use a Stringy Floppy, have invested in other pieces such as a standalone modem, or are generally satisfied with your Model I keyboard, (except for its 16K memory limitation) then there is an excellent new product from Exatron (181 Commercial Street, Sunnyvale, CA 94086). It is the MM-800 Internal Memory-expansion Board, consisting of eight 64K memory chips, plus several interesting options. The cost is $199.50 complete, but that's a good price for an assembled and tested unit with the convenience of this one. If you don't believe that, you can obtain the PC board for $19.50, the 64K dynamic memories for $79.50 per set, and the additional set of spare parts for $19.50, including the gold standoff pins. You'll save $80, but you will do at least $80 worth of work fitting the pins in straight and precisely lining up the other parts.

The completed board (Photo 13) is simple to install. The documentation, though an improvement from Exatron's usual, is still weak, typewritten, and with sketchy diagrams. All the necessaries are there, but the expansion board's several options are clouded by a sudden jump from "simple talk" to "tech talk" after the basic installation is complete. In fact, without digging, the manual hardly tells you what the board does!

So here is what the Exatron 64K keyboard memory expansion board provides:

- 48K memory with the Basic ROM, just as a standard expansion interface would provide. This mode is standard at power-on.
- 64K memory with the Basic ROM, keyboard, and screen switched out. Machine-language subroutines can access the screen and keyboard when needed, or they can be used via...
- Memory-mapped I/O, separately selected and thus usable with either 48K or 64K options.
- High-speed CPU operation (50 percent or 100 percent).
- Spare latched ports for use in modifying the keyboard to control additional internal or external devices.

Installation is a two-hour job (see Photos 14–16)—the first hour spent deciphering the documentation and wishing for better drawings or actual photographs. It turned out to be far easier than the plodding documentation suggested. There was no debugging involved, and even though I thought I would break either the board or the

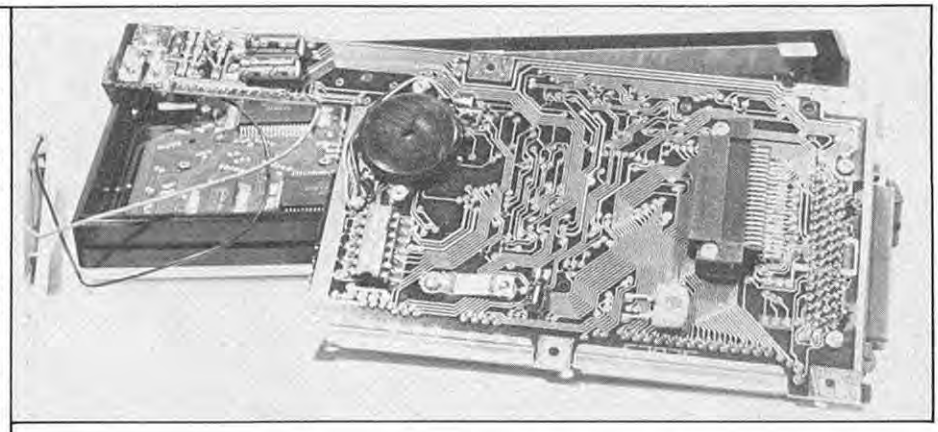

Photo 10. Bottom of the PC-2. Connector is for memory expansion and protrudes through the case bottom; beeper is at left, all-reset button at bottom center.

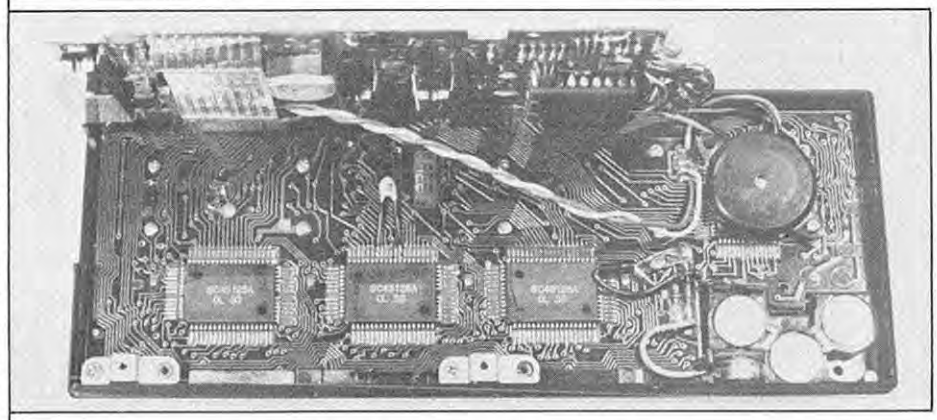

Photo 11. Quick comparison with PC-1 innards shows the same style integrated circuits, beeper, and compact board arrangement. Main physical difference is the stiff and breakable interconnect cable which only allowed the two boards to be separated a little. They have been stretched nearly to the breaking point for this photo.

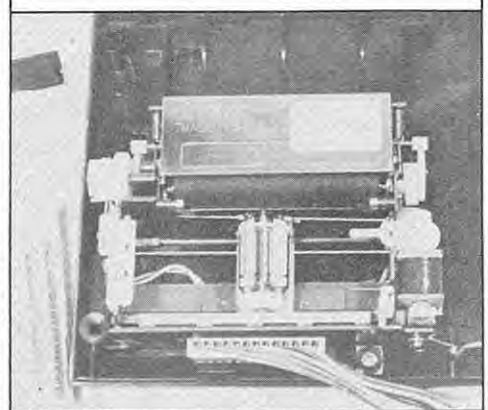

Photo 12. Print mechanism of the PC-2 cassette/printer interface. Printing head (center) actually draws on the paper roll, which moves up or down (the head moves left or right), using ball-point pen cartridges.

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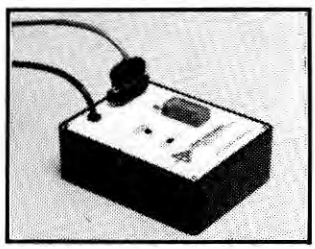

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computer (it takes a lot of pressure to force nearly 90 pins into various sockets simultaneously), this installation worked the first time.

Updates, Kudos, and Caveats

A bust across the jaw for me. Model I users who have installed the destreakifyer modification (January) should have no troubles with it. However, there is a theoretical problem that my friend Jack Decker pointed out. (I don't know whether to feel good or bad about this comeuppance, since Jack was an informal student of mine!) Anyway, Jack points out: "The problem is that the Q* output of the 74LS73 IC is connected directly to the CPU WAIT* line. The WAIT* line is normally held high by R51, the 4.7K resistor. Whenever a device wants the processor to wait, it places a low on the WAIT* line. The 74LS73 performs this function, but when it is not necessary for the CPU to wait, pin 8 (the Q* output) of the 74LS73 goes high, bypassing the 4.7K resistor. If any other device attempts to place the CPU into a wait state by pulling this line low, there will be a short between that device and pin 8 of the 74LS73 of the destreaker mod. Since it is not always possible to trace the circuitry of any accessory device to make sure that there is no conflict, it would be better to eliminate the problem at the destreaker itself."

Right you are, Jack. Just because I throw screwdrivers and soldering irons at everything I add to my system doesn't mean other folks do. I have not seen any peripheral device that uses WAIT*, but so what? And after jumping all over other authors for this type of design!

Jack suggests a good solution: "The easiest fix is to remove the wire from between pin 8 of the 74LS73 ('PIG55') and the bottom of resistor R51, and replace it with a silicon rectifier. (A 1N4001 or equivalent would do; the banded end goes to the 74LS73.)" See Fig. 2.

Another erratum: Color Computer ROM packs (August) had an anomally. The drawing presented as Fig. 1 actually belonged on page 354 in the update to the Color Computer keyboard improvement, at the top of the second column, which reads, "A revised section of the diagram is shown below." The real Fig. 1 ended up being labeled Fig. 5. and is found on page 348. Sic transeunt graphes caerulei ebriosi...

Model I support folks just won't give up. I'm now using a new Model I character generator available as a plug-in replacement from Exatron. It has prettier characters, plus POKEable reverse letters if you have transparent lowercase modification circuitry in place (Radio Shack style). Two character sets (256 characters) are standard, and if you want other characters (such as Kata Kana or European), rumors are that they will be available as well. Cost is a dirt-cheap $19.50 each (that's a generator on a PC board with gold standoffs, folks), with passable documentation, making it a far better deal than Radio Shack's lowercase upgrade.

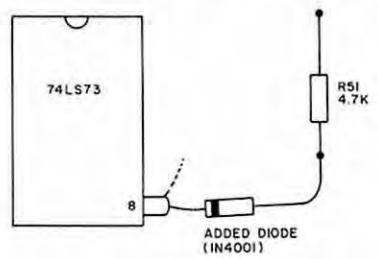

Fig. 2. Jack Decker's modification to destreakifyer that keeps external devices using WAIT from causing a power short.*

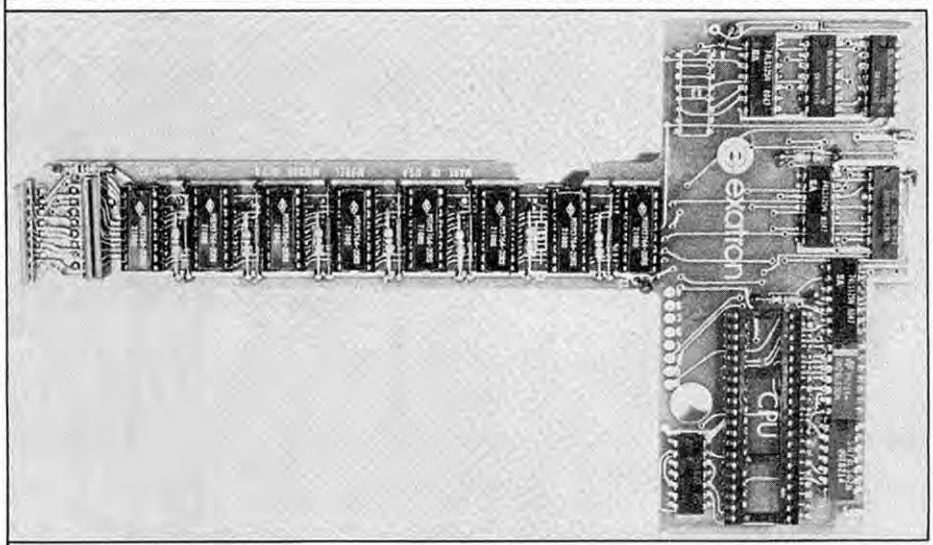

Photo 13. Odd-shaped Exatron MM-800 memory expansion must squeeze around the insides of the Model I to make all the connections with minimal soldering.

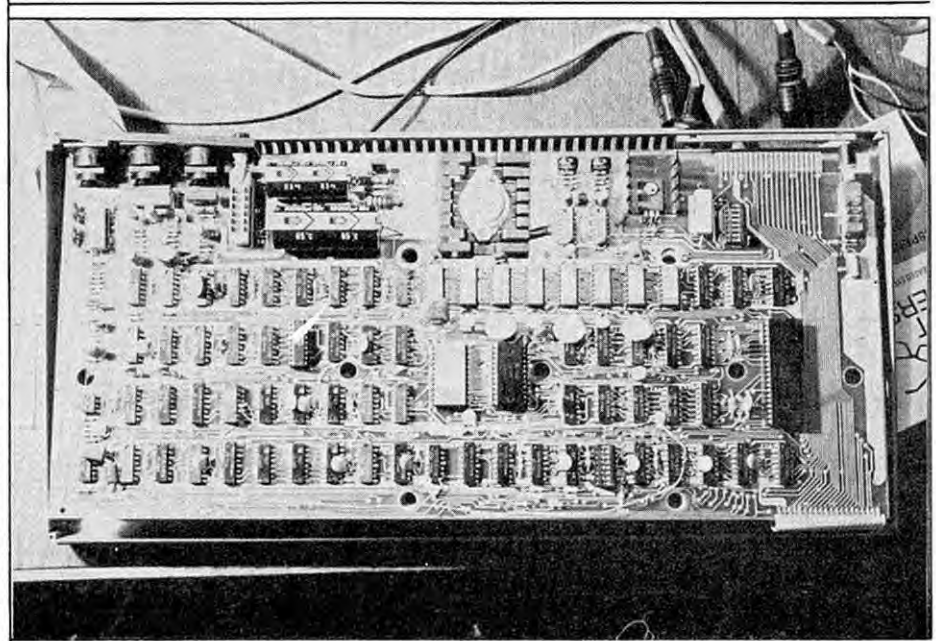

Photo 14. The Model I ready for work. CPU is at right, memory below the heat-sinks at the top.

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Never-thought-I'd-use-it department: Power Draw is an unlikely program. Its job is to permit users to create graphics or mixed graphics/text screens and store them on tape or disk. Although I had to fool around a bit to relocate the graphics screens in memory so I could call them up as needed, Power Draw made a potentially arduous task (manipulating and storing 15,360 bytes of screen graphics) a two-hour job; you'll see the results in an upcoming game program. (Game program? From Kitsz?) Kim Watt, one of the big boys in the utility biz, is the author of Power Draw. Power Draw, if you need it, is spectacularly prompted and error-checked. Available from Breeze/QSD, Inc. 11500 Stemmons Expressway, Suite 125, Dallas, TX 75229. The cost is $39.95 for a Model I/III disk. (Software freaks will also marvel at how Kim managed to make individual tracks both single and double density. Nice work, Kim.)

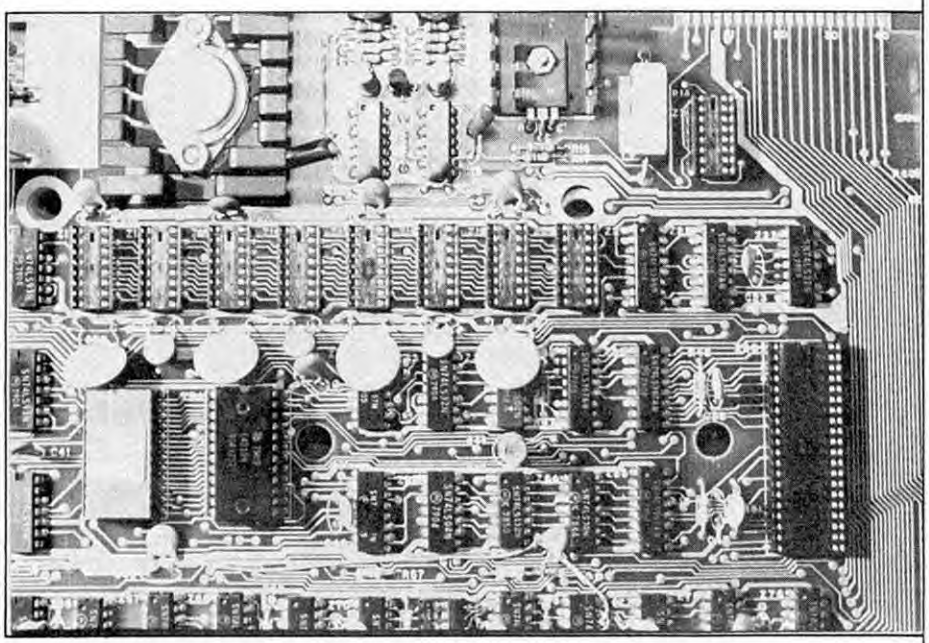

Photo 15. Memory, CPU, and DIP shunt X3 have been removed to make way for the Exatron memory board. 16K memory and DIP shunt are not reused, but CPU is replaced in the Exatron board. Exatron recommends a Z80A for higher-speed options.

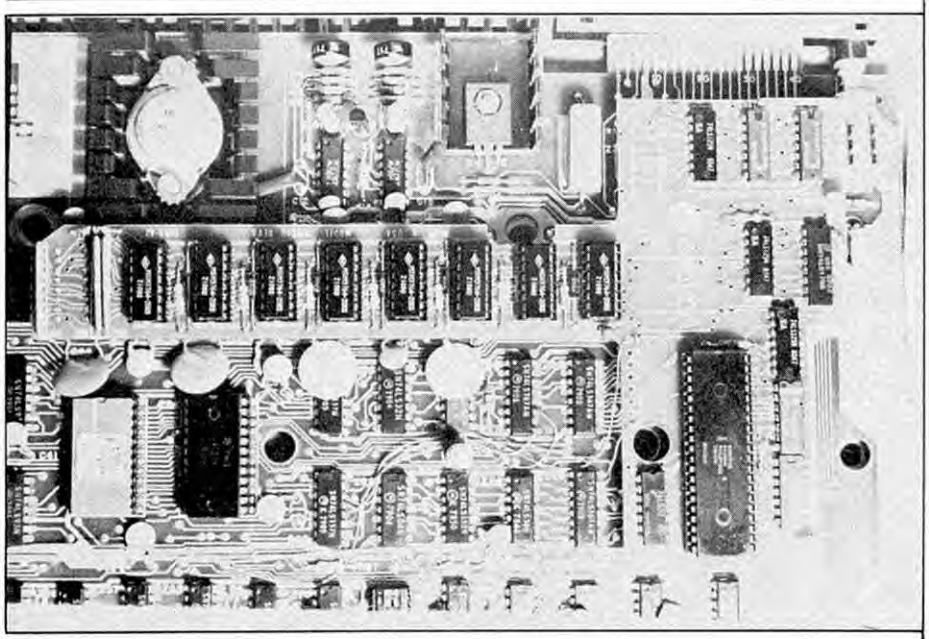

Photo 16. The MM-800 board installed. Only four extra wires (visible snaking along the bottom center) are installed to make the 64K memory board functional.

LNW-80 is "100 percent compatible with TRS-80 software?" Not quite. Don't get me wrong; the LNW-80 is a great computer. As mentioned at the beginning of this article, I recently ordered a kit version so I could modify it to run in my car—I just can't do without a computer when on the road! (Oops! I'm giving away my next column) But don't expect the LNW-80 to run all Model I software. There are enough hardware discrepancies to make the more sophisticated stuff (especially fancy games) trip up now and again. And, as I pointed out last time, LNW's support still needs lots of help. So if you plan to place an order based on "100-percent compatibility," first check out your needs with LNW (if they'll help) or, even better, contact the LNW Clearinghouse (c/o Steve Redmond, Redmond Designs, 456 North Street, Burlington, VT 05401).

Bad Model I Keys

Model I keys not working right? You've cleaned your old-style keyboard—or you're wondering what to do with your new ALPS keyboard—but you have to hit the keys really hard to get them to work, and sometimes they skitter a half dozen letters across the screen? I had the problem, too, and cleaning used to work. But later I would clean and clean with no results. By chance I turned the keyboard over to do some other work and noticed that after years of the shock of typing, the solder had actually broken loose from the circuit board where the key bottoms were soldered, causing intermittent contact and fake bounce. To check whether you have this problem, open the computer, gently turn the keyboard over, and examine the key bottoms with a magnifying glass. Some may show ridges of solder instead of smooth hills. Suspect these as bad connections; quickly and gently reheat each connection, applying a tiny bit of extra solder to form a good flow. Don't heat too much, or you may loosen the contacts inside the key. After this treatment, my most-used keys—colon, space, arrows, enter—worked like new. ■

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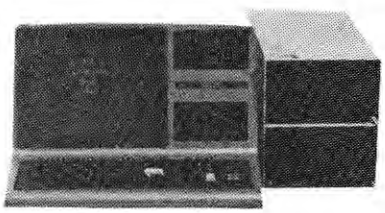

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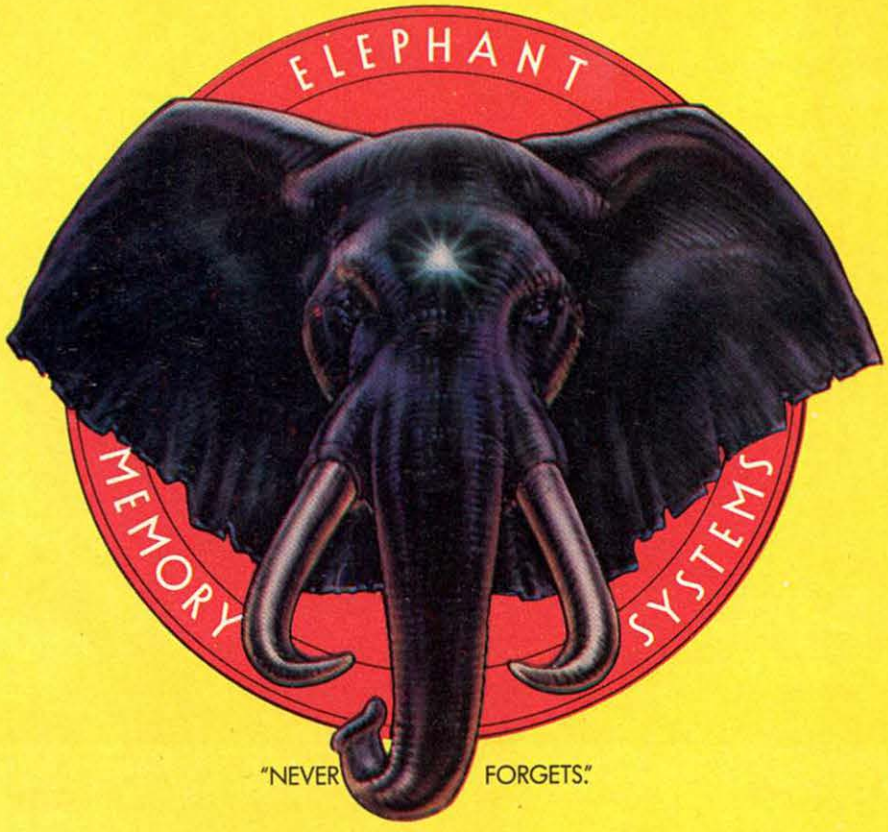

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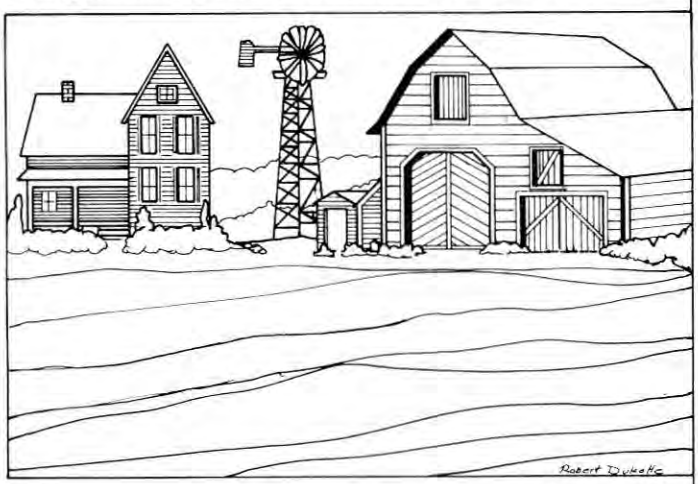
Tandy and Harris help v-text take root on Midwest's farms

By G. Bert Latamore
80 Micro Contributing Editor

Videotext is taking root in the Midwest where a small publisher using Tandy computers has struck a need of farmers and agribusinessmen.



"The market response has been overwhelmingly favorable. It's incredible," said Tom Bell, marketing director of Harris Electronic News.

Located in Hutchinson, KS, HEN is a branch of Harris Enterprises Inc., a chain of 11 newspapers and several tv and radio stations. The electronic news service slated its first public demonstration for the Kansas State Fair in August. But, Bell said, by the end of June—with no advertising beyond a single news release—more than 100 potential customers had contacted Harris, some of them looking to subscribe immediately, sight unseen.

Bell expected it to take years for the service to become self-supporting, but the initial demand for it has changed his mind. Now he sees a good chance it will become economically viable within two years. To break even, the service needs about 300 subscribers and a reasonable amount of advertising. But if the response of Hutchinson-area merchants is any indicator, Bell said, there will be no problem selling ads.

He maintained the keys to the positive response to the service is its use of Radio Shack hardware—making it inexpensive—and its data base, carefully designed to meet farm needs unmet by traditional media.

A subscription to the service costs $15 a month for unlimited off-line service—an access method used by Tandy in its Tarrant County, TX, Star-Text electronic newspaper.

Videotext systems like CompuServe and The Source use on-line access. A subscriber logs on, searches through a series of menus for wanted information, uses it on line and disconnects when finished. This involves long log-on times, an expensive proposition for users charged per minute of access time.

Harris's service supplies subscribers with a printed menu. The subscriber programs his or her terminal to request information, then calls the service's data base housed in a TRS-80 Model II. The information is downloaded and the system disconnects, allowing the subscriber to view the information off line. The amount of information a user can receive is limited by the memory capacity of his or her terminal. For instance, a 4K Tandy Videotex terminal holds eight screens of material.

This approach is a major reason the service can offer subscriptions at—by industry standards—a ridiculously low price. It also minimizes the time a user accesses the data base. The more time users are on line, the more problems a videotext system will have.

A disadvantage of the off-line system is it virtually precludes interactive services like electronic banking and electronic shopping. On the Harris service, those features would require two phone calls: one to get information from the data base and another to complete a transaction.

Bell noted the service provides subscribers a measure of interaction by giving them a limited amount of free classified advertising. Essentially, this creates a public bulletin board where subscribers can post anything from used-car ads to personals.

The service taps the resources of the eight Harris newspapers in Kansas, but is totally independent of them in content.

It offers commodity prices at local grain elevators and on the Kansas City and Chicago markets. Prices are updated continuously. It also carries market analysis by a University of Kansas professor, columns on animal health by veterinarians, and news and columns on other agribusiness areas.

The service's weather information gives farmers data available to professional meteorologists. It includes specialized data such as the soil temperature one foot underground where seeds germinate; columns on the effect of weather on specific crops; and weather information for other major crop growing regions, so a farmer can develop a sense of the worldwide supply-demand picture at harvest time.

In an exclusive interview with *80 Micro*, Bell praised Tandy's hardware: "At our level of operations, you cannot beat Tandy. The equipment is adequate and dependable without being expensive. And the company has given HEN excellent service, both by quickly replacing the one piece of hardware that did fail and developing answers to technical problems."

Although a Tandy Videotex terminal cannot handle color and offers only primitive graphics, Bell said a TRS-80 Color Computer can duplicate virtually

continued

MIDWEST V-TEXT *continued*

anything more expensive terminals can do, and its $399 price tag is less than many of them.

Bell said farmers are no strangers to computers. Many of them worked with computers when they attended agricultural colleges, which began to use them in the 1950s, and now use the machines as a matter of course. The service estimates 700 to 800 microcomputer users live in the Hutchinson area and many more use computer services supplied by Kansas State University.

Videotext appeals to a farmer's sense of fierce independence, Bell contended. Over the last generation, agriculture has become more complex and less accessible to the average yeoman. Farmers have had to rely increasingly on experts and middlemen to make critical marketing decisions. Videotext can help farmers make decisions and free them from the control of others. According to many computer market experts, it is that reason, more than any other, that the farm belt is becoming a center for computer communications. ■

Deep in your heart it will creep

30 percent of nation's office workers dread computers

BY JOHN P. MELLO JR.
80 MICRO NEWS EDITOR

When you sit at your TRS-80, you probably don't break out in a cold sweat and become wracked with nausea and vertigo, but for people with extreme cases of cyberphobia—fear of computers—that's exactly what happens when they confront any computer.

Although most cyberphobes experience only a vague uneasiness when they deal with a computer, 5 percent of them experience the traditional symptoms of severe phobia, according to Prof. Sanford B. Weinberg. The researcher at Philadelphia's St. Joseph's University College of Business estimates 30 percent of the U.S.'s office workers are cyberphobes. And the problem will get worse.

"I forecast an immediate rise as voice-activated systems increase the number of users," he predicted to *80 Micro*. "There will be a gradual decline after that."

He said major problems will crop up in non-technological countries like India and Nigeria, where 90 percent of the office workers have shown signs of cyberphobia. "One reason for the high incidence," he maintained, "is there's a political as well as psychological factor there. They equate computers—which use English—to Great Britain and the United States and colonialism."

Since 1979, with the help of private and corporate grant money, Weinberg has canvassed and tested 523 corporate managers and college students, even wiring some to a galvanic skin-response machine to measure their perspiration rates as they sat before computer terminals.

"Individuals who are afraid of different technologies taking over are more likely to have a cyberphobic reaction," Weinberg told *80 Micro*. "But since the computer, in essence, replaces a brain, it creates a greater fear. The computer somehow replaces how you think and that seems much more threatening to people."

He added the people he tested did not fear machines in general.

He also found cyberphobia affected men and women equally. "We tested extensively for that," he said, "and found no sex difference."

"Cyberphobia is a direct result of a fear of loss of control," he said. "It apparently is preceded by some kind of bad experience: using a system before it's perfected or receiving an erroneous computerized billing or some other experience that develops a fear in a person that they lose control when they deal with a computer."

Two workshops have been created by Weinberg to address cyberphobia problems. The more successful program, he said, is one training managers how to introduce computers into a company without causing cyberphobia. The workshops have included participants from Fortune 500 companies in the United States, Canada, Japan, Switzerland and Germany.

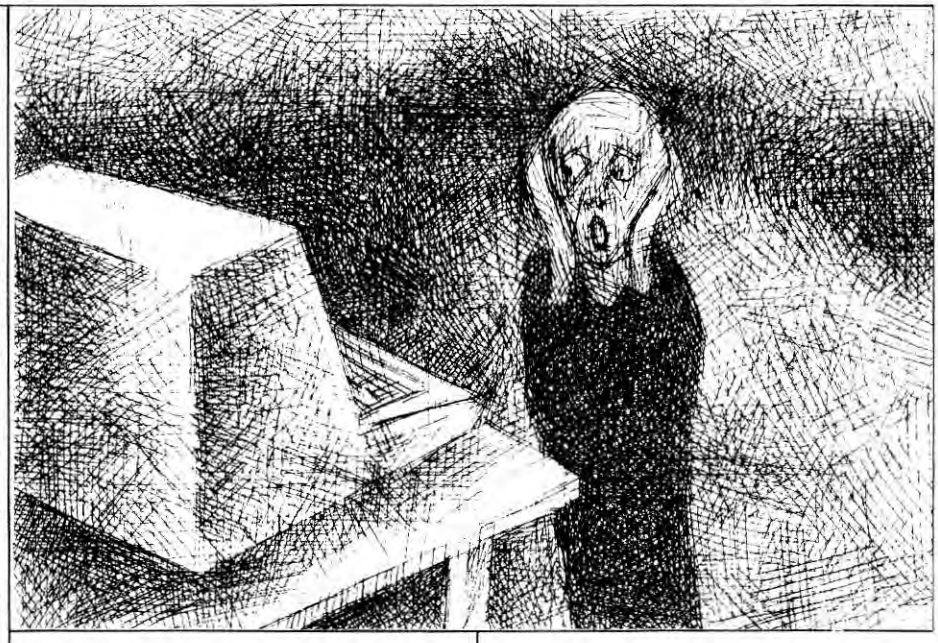
The other workshop—described by some as aimed at deprogramming cyberphobes—has been in service for two and a half years. "I don't like to use the word deprogram," Weinberg observed. "It's a behavior modification. We explain how computers work and get people to try them and get some successes. Then they see they are tools and useful and not threatening."

"It has some success," he said, "but I'm not sure it's long-term."

At the University of Pennsylvania's Wharton School they call cyberphobia "terminal shock." It used to be accompanied by "symbol shock" when APL was the primary language taught

continued

CYBERPHOBIA*continued*



MBA candidates, according to David V. Cossey, director of the school's computer center.

But he hasn't seen the severe symptoms of cyberphobia Weinberg's seen: "We don't see sweat or anything like that. The only symptom we see is students asking a lot of questions before they do anything. They come into the consultant area every five minutes. They're afraid they're going to destroy their program or something."

"After the first day or so," he added, "that seems to disappear."

Cossey, who teaches on the graduate level, said MBA students are under pressure to mask any anxiety they may suffer: "A lot of them would not admit being afraid of the computer. The reason for that is peer pressure. There's tremendous peer pressure when you see 25 other people in the terminal room sitting down and appearing to know what they're doing."

If there's cyberphobia among undergraduates, "we get them over it pretty fast," noted Louis Miller, associate professor of decision sciences. "Our attitude is sort of heartless. With our students, we don't do that much hand holding."

Miller, who taught the introductory computer course at Wharton during the 1981-82 academic year, explained instructors initially go through a terminal session and tell the students to do the same thing. "We orient our early exercises so students are worrying about the terminal and not trying to do anything very creative," he noted. "That seems to work."

For his MBA class, Miller appeals to his budding executives' sense of power: "I tell them certainly in their positions they don't let people intimidate them, why should they let a stupid machine intimidate them?"

"One of the things that's been done here in the past with these people is let them play games," he added. "One teacher used to let them play Adventure and they loved that. Her experience was it really got them over it."

Dr. Howard Brown said as medical director of the *New York Times* his experience did not indicate cyberphobia affected 30 percent of the people working with VDTs: "It's more like 2 or 3 percent."

"We had one experience with a reporter who got very uptight and anxious," he noted. "I think the problem there was he was in his late 50s. He had a hell of a time learning to use the VDTs. We had a couple of others that got so upset they took early retirement."

He went on to say: "All my experiences have been with workers over 50. I have not had any experiences with younger workers. They tend to pick up the new techniques and training programs fairly well."

"From my experience," he said, "this is not a serious problem, but I think it may be the tip of an iceberg. As more and more people talk about it, more and more people will come up with symptoms. Some people may have the symptoms and may just be hiding them. This is relatively common. The more you talk about a syndrome, the more cases you uncover. Toxic shock syndrome is an example of that."■

English stirs no fear in **Japanese**

Her Majesty's tongue may contribute to cyberphobia in some non-English-speaking countries (see main story), but not in Japan.

According to the computer newspaper *InfoWorld*, Japanese professionals go through rigorous training in English to deal with the English-speaking world and its major computer markets.

Japanese programmers also must have rudimentary knowledge of English because many computer programs are written in English-based instructions using Roman characters. The same can't be said of English-speaking programmers and the Japanese language written in kanji script.

The result is the Japanese have a reservoir of technical personnel capable of copying, analyzing and improving U.S. software. Such a reservoir doesn't exist here.

The language problem has also spurred the Japanese to take the lead in developing laser printers to produce kanji, optical character readers for reading handwriting, and voice-recognition systems.■

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Think tank's network used to bind minds of nation's leaders

BY KERRY LEICHTMAN
80 MICRO STAFF

A West Coast think tank is using microcomputer networking to shave thousands off the cost of educating high-powered executives and hopes its program will be the cornerstone of a network linking the nation's most important leaders.

"The problem in the education of our leaders in all three sectors of American life—not just corporate, but government and non-profit as well—has been they don't have the time to go away and get the kind of graduate education that might be appropriate for facing a very uncertain and complex future," said Dr. Richard Farson.

The president of the Western Behavioral Science Institute of La Jolla, CA, added, "The people that need the education the most and desire it the most can't get away for even a brief period of time."

"They are now able to learn what is necessary for them to learn and stay on the job at the same time," Farson explained. "They don't miss a beat. And, on a daily basis, they are able to tap into a learning network that includes people like themselves, whom they enjoy immensely and have come to count on. And our faculty is available to help them in a way that they'd have to pay a fortune for if they tried to hire them as consultants."

Before the institute's seminar became wired, executive education was cost ineffective. Farson explained: "The cost of these programs was enormous, not necessarily the tuition, but the cost to the company. To send someone away for a year costs a couple of hundred thousand dollars. It's a terrible loss to an organization to lose its leaders for any extended period of time."

So what's a think tank to do? Link the seminar students together with a microcomputer network. In the institute's two-year seminar, which costs $10,750 per student annually, executives meet at the institute at six-month intervals for eight days to begin another aspect of the seminar. They return home and continue the seminar linked by a microcomputer network.

Although the concept behind the seminar appeared sound, its developers saw a possible stumbling block: the common belief executives eschew using micros because they equate keyboard work with low-status clerical duties.

When the seminar began in January, "the resistance was very easily overcome," Farson said. "They learned it quickly and enjoyed it immensely.

"I think that's where computer people, generally, have been missing the boat in their sales pitch to executives. They haven't played upon the communications aspects.

"We offer it as a communication medium. That's what executives like to do. They don't like to delegate that. You put one of these in their hands and they know what to do with it. The computer industry's failure to realize that and sell to corporate leaders has slowed down the development of information systems."

The first seminar participants were linked through the New Jersey Institute of Technology's Electronic Information Exchange System—chosen for its storage, indexing and privacy features—and used Apple II+s with single disk drives. The second class, which began in July, will use Kaypro computers manufactured by Non-Linear Systems.

"The Apple comes with no software," Farson said, "and this one comes with about $1400 worth: Select word processor; Profit Plan, which is a VisiCalc-type program; SBasic; and the CP/M operating system.

"Another reason for the switch is we have had to convert the Apples to an 80-character screen width at a cost of $300 per unit. The Kaypro is already an 80-character unit."

Moreover, Farson explained, participants were unable to take their Apples with them when shuttling from place to place. Andrew Kay, president of Non-Linear, designed the new computer with the busy executive in mind. It is completely portable, has two disk drives and—unlike the Osborne—has a 9-inch screen. Farson added: "It's a brand-new system. It hasn't gone through the debugging that the Apple has, but they're a very high-powered outfit and we know of their work from years ago."

The micro network encourages honest, bare-bones correspondence between participants, according to seminar participant Marvin Braude, a Los Angeles city councilman. "It's a new form of intimacy," he explained. "It also imposes a rigorous discipline. It forces you to eliminate rhetoric and chit-chat in favor of being succinct. It has another nice quality: People are tolerant of misspellings, bad grammar, and inconsistencies."

The micro's ability to provide a constant avenue for discussion is one of the seminar's aspects that has captivated Braude: "Ordinarily you have to write an article or publish a paper to get your idea reviewed by peers. Here you just go to the computer, type it in, and see many and varied responses right away."

"I am fascinated by the question of how you truly use the computer as a communication and educational tool," said another participant, Carl Hodges, director of a research lab for Superior Oil in Tucson, AZ.

"I bought my son a TRS-80 when he was 13," he continued, "and I've been very fascinated watching the new generation and computers.

"I am also interested in this question of how busy people really keep up to speed as far as what's going on in the world, what the latest techniques of management and science are. I think that after awhile the techniques we are

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Robert L. McAndrews, executive director of the School of Management and Strategic Studies, works on network for high-powered executives.

THINK TANK*continued*

using in the program can be adapted for use within organizations."

The overall goal of the seminar is to enable executives to enlarge their perspective so they can react intelligently and quickly in an ever-growing field of situations.

"Our job," Farson explained, "is to get them to think differently about the implications of technology and some of the paradoxical effects of it." He cited a case used in the seminar: the time it takes to wash clothes today versus the time when washing was done with scrub boards. "All the labor-saving devices have actually increased the time it takes to perform the function," he claimed. "The seminar group tries to figure out why that is, and then derive its implications for other kinds of technology in industry and government.

"The seminar is really an effort to enable people to see that technology doesn't always work the way it seems to work."

One of the institute's faculty contends much of our technology is out of control. "But we still keep thinking that the technology we have is controllable, that it is a question of decisions," Farson added. That faculty member, Langdon Winner, maintains society no longer has a mechanism for decisions and for the most part, technology has become autonomous. "For example," Farson explained, "we can't decide not to have automobiles now. They have become autonomous and are now out of our decision-making power."

Farson's long range goal for the institute's School of Management and Strategic Studies could not be achieved without microcomputers: "Our ultimate goal is the creation of a network of people who have been through this intensive two-year program and to keep that network available to them as a resource so questions of great import to our future as a society will be deliberated in a new way by these people who are most influential in shaping it.

"The network at first will just be a few dozen, then, conceivably, it will be hundreds of these influential people networked in significant ways."

The members of this strategic thinking network—college presidents, government agency heads, corporate leaders of Fortune 500 companies—will have two important common experiences: attending the seminar and being at the top. "It's a lonely job at the top," Farson said, "and now, for the first time, these people have a network, a support system, enabling them to communicate with others in the same position of responsibility." ■

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Country of homebodies

V-text will encourage people to stay home

Videotext may make the United States a nation of homebodies, according to a $225,000 technological assessment funded by the National Science Foundation.

The assessment—done over a period of 18 months by the Institute of the Future in Menlo Park, CA—maintained 40 percent of America's households will have videotext terminals by the end of the century.

"Videotext and teletext will move into the home all sorts of activities and transactions people have had to leave home to do," observed Richard Adler, one of the authors of the assessment.

"What will happen," he said in an interview with *80 Micro*, "is there are a whole bunch of things—paying your bills, cashing your check, shopping, mailing a letter—that up to now you haven't had a choice about. You had to go into the outside world. The new technology will bring the focus of that stuff into the home, so the definition of the home will change."

The 320-page report published by McGraw-Hill predicted there will be a shift away from conventional workplace and school socialization. Friends, peer groups and alliances, the report said, will be determined electronically, creating classes of people based on interests and skills rather than age and social class.

It maintained there will be a return of the extended family because the elderly will be able to provide additional household income by working at home on the computer network.

Adler observed, "We see these electronic systems offering a serious alternative to traditional schooling."

He said, "The whole political process will be transformed by on-line polling and televoting. You will see the decline of the two-party system and the rise of dozens, scores or even hundreds of mobilized, highly-effective, special-interest groups, who are able to keep a very tight pulse on how their issue is faring in government."

"The technologies in no sense exist in a vacuum," he said. "They exist in a society where things get better or worse. If we build a society that's a decent one—where there are decent public places, where people feel safe about venturing out into the streets, where commuting isn't an awful pain and its cost terribly high—then my opinion is people, for a variety of reasons, are going to leave home."

He maintained there are people who will welcome working at home—shut-ins, the handicapped, the elderly, young children, housewives—and the new technology will allow them to do that. "On the other hand," he added, "we don't see the offices withering away because those environments give people a lot of social interaction which is valued.

"It's a competition. If the home becomes a more pleasant, more enjoyable place to be than out in the social world, people are going to choose to stay at home."

But the new technology will not be all wine and roses. Individuals may use the new videotext systems to create newspapers, design curricula and compile consumer guides, the report said, but the systems also create new dangers of manipulation for political or economic gain. While an abundance of new information will be brought into the home, it noted, a stream of information about its inhabitants' behavior and preferences will be brought out of it.

Adler said, "One of my worries about these kinds of systems is the guy who puts up the menu of your choices has a lot to say about defining social reality."

"We're not saying any of these things will come about," he explained. "What we're saying is these are all possibilities inherent in the technology. Whether or not they will come about will depend a lot on the decisions made over the next 20 years. Those decisions will deflect how the technology goes."

"The hopeful thing about doing a technological assessment is that by identifying these issues early enough, you're doing it at a time when you still have chances to make choices about them. The underlying principle of a technological assessment is not technological determinism." ■

Bringing to press the **future**

Computers played an important role in bringing the Institute of the Future's videotext report to print.

Adler (see main story) said the book version of the report "came out looking terrific" and "the whole process of turning the report into a book couldn't have happened that way without computers."

It took 2½ months to turn the manuscript of the report into a book. "You just couldn't have done that if someone had to keystroke the manuscript into a typesetter," Adler observed.

The institute prepared the report's manuscript on a Xerox 850 word processor. The word-processing disks were sent to the Information Science Corporation in Washington, DC.

According to Production Manager Mark Hoffman, the disks were sent to another firm with Xerox equipment and telecommunicated to ISC's DEC PDP-11/34. Once in the corporation's machines, compositors embedded typesetting codes in the manuscript, then fed it into the firm's typesetter, a Mergenthaler Line-A-Tron 202.

The galley proofs from the Mergenthaler were proofread by ISC, then sent to the authors and publisher for corrections. Those corrections were incorporated into the manuscript by ISC and another set of galleys run. Those galleys were used in page makeup.

"This is a standard method used by publishers throughout the country," Hoffman said. ■

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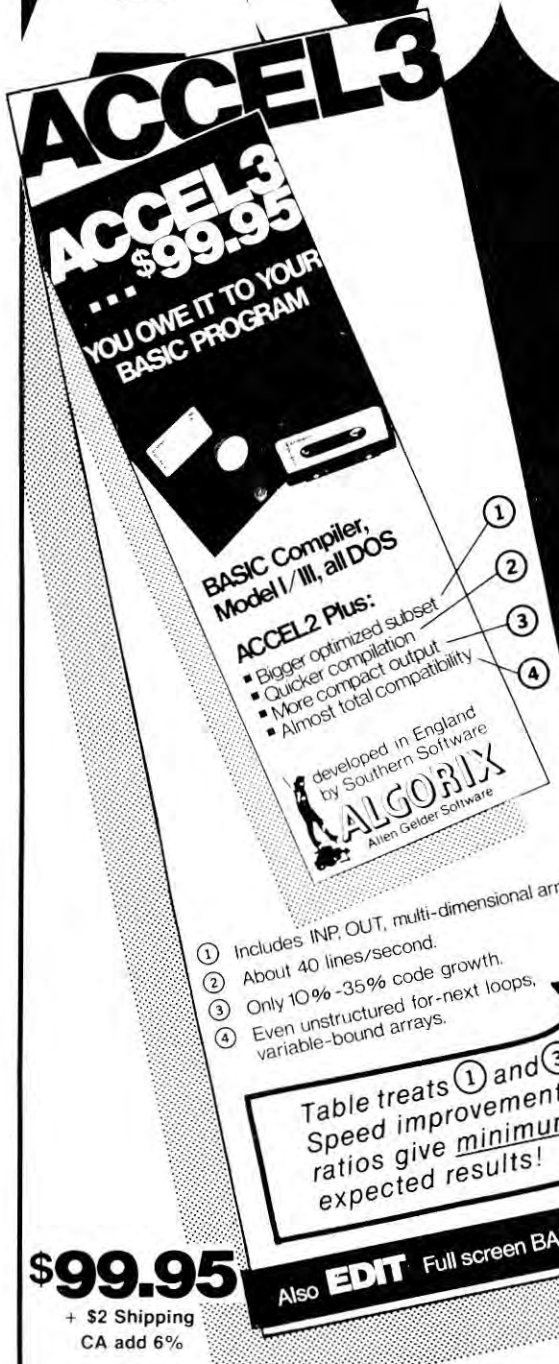

SPEED/SPACE Performance Table.

Speed Improvement (Ratio)				Operation	Space Degradation (Bytes)			
INT	SNG	DBL	STR		INT	SNG	DBL	STR
178	28	20	7.3	Assignment (LET)	−4	0	0	0
3.5	3.6	3.6	3.5	Array Reference (1-dim)	13	13	13	13
3.0	3.0	3.0	3.0	Array Reference (2-dim)	12	12	12	12
35	1.8	1.6		AND, OR	4	7	7	
23	2.0	1.6	6.6	Compare (=,>,<, etc.)	3	10	10	3
57	1.8	1.4	3.6	Add, Concatenate (+)	1	6	6	2
48	1.8	1.3		Subtract (−)	4	6	6	
1.5	1.5	1.1		Multiply (*)	6	6	6	
1.08	1.17	1.02		Divide (/)	6	6	6	
77	70	84	9.3	Constant Reference	0	6	4	4
7.1	1.9			FOR—NEXT	6	23		
111	6.8	4.8		POKE	−1	5	5	
10	4.5	3.6		SET, RESET	−1	5	5	
47	4.6	3.0	8.1	IF THEN ELSE	3	9	9	3
33	4.3	3.5		ON expression GOTO	−2	0	0	
50	6.8	5.1		ON expression GOSUB	0	3	3	
1.2	1.01	1.03	1.2	PRINT simple-variable	−1	−1	−1	−1
61	5.0	3.7		OUT	5	11	11	
				Flow of Control				
	216			GOTO		−7		
	74			GOSUB/RETURN		−10		
				Functions				
inf	inf	inf	inf	VARPTR				
5.2	1.9	1.7		POINT	−3	−3	−3	−3
38	2.3	1.7		INP	3	9	9	
149	2.3	2.0		PEEK	5	8	8	
					0	3	3	
				String Functions				
	53			ASC				5
	258			LEN				0
	4.8			LEFT$				1
	4.7			RIGHT$				1
	6.4			MID$				2
	25			CHR$				0
	36			CVI				0
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Math and science teacher cadre defecting from Golden Horseshoe

There are two high tech meccas in the United States and one of them is having its educational underpinnings eroded.

According to a report released by Northeastern University's Institute for the Interdisciplinary Study of Education, the Massachusetts public school system—the beginning of the talent pipeline to high tech firms forming Route 128's "Golden Horseshoe" north of Boston—is facing a math and science teacher drain.

While some schools are already losing teachers to industry, said the report authored by Dr. Elizabeth Useem, data from a survey of math and science teachers in the system shows only two-fifths of them intend to remain in the public schools teaching. Meanwhile, the number of people being trained for these slots in the state's colleges and universities is "miniscule."

This may create an ironic situation for high tech firms thirsting for talent. "Student interest at all levels in Massachusetts is moving in a direction congruent with industry needs, but the capacity of educational institutions to respond to that demand remains in doubt," wrote Useem in her 75-page study.

Her report, titled "Education in a High Technology World: The Case of Route 128," added that "at a time when students are gravitating toward training in high technology fields, there is an erosion of staff and facilities needed to provide high quality programs."

"Every administrator complained about the lack of computer hardware in the face of accelerating student demand. . . All the schools believed that financial constraints had prevented them from acquiring the computer hardware necessary to accommodate student demand," reported Useem, an associate professor of sociology at the University of Massachusetts-Boston.

She wrote that all the school systems surveyed were having difficulty hiring instructors for courses in electronics, computers, math and sciences.

This is a national problem. However, the report maintained the Northeast has

not resorted to the solution adopted by other parts of the country: using unqualified teachers. Useem wrote that the percentage of newly-employed but unqualified science and mathematics teachers in the Northeast is sharply lower—9 percent—than the national average of 50 percent and the Pacific Coast average of 84 percent.

The school systems in the Golden Horseshoe were conforming to the Northeast norm, the report said, but misassignment problems were occurring on the junior high level, where senior elementary teachers with K-8 certification were "bumping" less experienced junior high math and science specialists.

"We're going to have a terrible shortage of teachers," predicted one assistant superintendent to Useem. A mathematics chairman added: "Five years ago, we had over two feet of job applicants' folders and now we have one inch.

Administrators also were worried about the quality of the candidates applying for jobs. One commented to Useem, "We're getting the crumbs." Another said, "Today, we'll take any warm body." The report indicated the administrators' fears are justified. The average SAT scores for Massachusetts high school seniors intending to major in education were 383 verbal, 409 math.

Since high tech employees' children attend the schools around Route 128, the firms are a natural ally for the systems' fight against the quality of science education backsliding. But, the report noted, the relationship between the groups is strictly hammer and tongs.

"Around here high tech is a nasty word," a science department chairman told Useem. A mathematics department chairman added, "I have a terrible hatred for high tech."

The report explained the relationship between the groups has never been strong, but it worsened when the industry's political arm—the Massachusetts High Technology Council—funneled $229,000 in support of a property tax cutting proposal called Proposition 2½.

Since public school systems are the major burden on property taxes, educators felt tax cuts would be translated into school cuts. The high tech firms didn't feel that way, according to Useem. "Most felt that if academic programs were cut, it would be the result of politically motivated mismanagement and not due to real fiscal shortfalls," she wrote.

Despite disagreements between the groups, Useem, who conducted a similar study of the Silicon Valley, found Route 128 corporate officials' criticisms of the schools "tempered by a general feeling of respect for many suburban school systems." She added, "Expressions of outright contempt toward the schools, which characterized some of the comments of Silicon Valley executives, were absent."

Useem maintained there are other obstacles blocking collaboration between the groups:

"[T]he very dynamism, innovation

continued

TEACHER DRAIN*continued*

and rapid growth which characterize most high technology firms undermines attempts at extra-institutional ties.

"These companies, many of whom have growth rates exceeding 30 percent a year, operate in a competitive environment under the intense pressure to get new products into the market. One company studied, for example, develops a new product every 12 working days.

"The firms need their cash to put back into research and development and need to focus their energy on the central task of the company. Outreach to schools in this context, except by large older companies like Raytheon, is of rather peripheral concern."

The companies tend to have short-term planning cycles, the report noted, which conflict with the schools' tendency to operate on five-year planning cycles.

Also, the report said, the groups have difficulty interacting because they're at different points in their history. High technology is at the zenith of the American economy, while education is in "a dismantling mode." "It is hardly an atmosphere conducive to harmonious relations," Useem wrote.

She argued conservative social planners talking about "shared responsibility" and a "new partnership" between industry and education are ignoring these substantial barriers.

So are the high tech companies. "Industry is sticking its head in the sand by not going to Washington and talking about the national crisis in engineering education," one college president told Useem. "It is a national problem and we have no national policies... The companies believe in small government and are thus caught on the horns of a dilemma."

A coordinator of a large university-industry program added, "Companies really need to be scared before they will get their act together and lobby for federal support."

Useem concluded: "The obstacles to industry-education cooperation [at the secondary school level] are formidable. The national administration's proposals for a 'new partnership' between business and public education are unlikely to lead to solid programs of measurable impact.

"The response of American education to the economic transformation wrought by modern electronics is uneven and constrained by forces largely beyond its immediate control. Without national direction and support, it is unlikely that a satisfactory response will be forthcoming in the 1980s."■

More or less **technicians?**

Will the high tech industry need more or less technicians? That question cropped up time and again in Dr. Useem's study.

"Uncertainties exist over workforce projections for technicians," the UMass sociologist wrote. "Company officials in a few firms cautioned that technological changes are automating the work of some of their technicians, resulting in lower employment demand. Others, however, pointed to countervailing trends that will increase the need for technicians."

Useem went on to report: "Every type of training institution—private, proprietary, CETA, and public colleges—has experienced some difficulty in placing their technician graduates in jobs during 1981–82. The problem is not severe (Sylvania Tech said its graduates now had only one or two job offers rather than the five or six they had in previous years), but enough slack in hiring exists to make school administrators nervous."

"Executives at several companies," Useem noted, "said they did not anticipate either a short-term or long-term demand for technicians, especially manufacturing test technicians, and cautioned that educational administrators should not expand programs too quickly."

"A human resource manager with recent experience in two companies pointed out that there has been a dramatic drop in the need for electronics technicians in those firms in the last year," she wrote. "At the same time, other high technology companies claim they have a continuing demand for technicians."

Useem reported current economic conditions are a major reason for the softness of the market for electronics technicians but technological changes have also influenced the situation.

She points to one minicomputer company's products with 'built-in diagnostics' informing a field service technician what is malfunctioning. Instead of determining what is wrong with a circuit board, the technician simply replaces it with a new one. Built-in diagnostics and board swapping, she explained, have resulted in reducing the skill level needed in the technician's job.

"Since almost half of all technicians work on repair of some kind, these technological changes have important implications for that occupation," Useem wrote.

She added: "At the same time, there are countervailing trends which argue for both greater numbers of technicians and high skill levels among them.

"Applications of computers to various areas of human activity are just beginning to occur, and many of those applications will require technicians to help develop and maintain them.

"Products are becoming more complicated and a certain percentage of technicians will have to understand the way they operate.

"There is also some awareness among executives that many tasks which engineers perform could be farmed out to skilled technicians, thus alleviating the engineering shortage."■

PULSE TRAIN

Three-inch disk drive TRS compatible

A 3-inch disk drive offering 250K double-density single-sided storage capacity is being marketed by Amdek Corporation of Arlington Heights, IL.

Wayne Green Inc. obtained a prototype of the drive and *80 Micro*'s Jake Commander tried it out on his TRS-80 Model I. After rigging up a power supply for the drive, Jake said it proved plug-compatible with his 5.25-inch drives.

In a statement, Amdek said the drive will be sold with a built-in power supply.

Disks for the drive come in a plastic cartridge measuring .179 by 3.15 by 3.94 inches. The cartridge features a hinged head cover that protects it from dust, scratches, or fingerprints, and flips open when inserted in the drive.

The drives are priced at $899 each.

Philly brokers pick high-tech high-yield stocks

Although high tech stocks are most likely to take a beating during a recession, a pair of Philadelphia brokers are urging their clients to pad their portfolios with the stocks.

According to the *Boston Globe* Richard Yashewski and Joseph Barthel of Butcher & Singer contend emerging technology stocks will be the stock market's hottest performers during the next 12 to 18 months, racking up individual gains of at least 50 percent and in many cases, more than 100 percent.

The high tech hot stocks identified by the duo were Anatogic Corp., Electromagnetic Sciences, DBA Systems, Algorex Corp., Mathematica Inc., Information Intl., HBO & Co., Sof-Tech, Intermagnetics General, Xidex Corp., ADAC Laboratories, Valleylab Inc., National Micronetics, Network Systems, Tandon Corp., Unitel Video, Ask Computer Systems, Codis Corp., Survival Technology and Electronics, and Missiles & Communications.

On average, the analysts told the *Globe* those companies have the potential to turn in annual earnings gains of 25 to 35 percent a year in the next three to five years.

Products produced by the firms include the manufacture of telecommunications and computer peripheral equipment, computer software products and services and medical instrumentation.

In recommending the stocks, the pair warn many are unseasoned companies spending above-average amounts of capital on research and development, making them well-above average risks should their fortunes go sour.

Bob Rosen sets up second BBS for CC

First Bob Rosen established the only bulletin board system dealing exclusively with the Color Computer (see "Bob Rosen —A Colorful Success Story" by Kerry Leichtman in the June-July 1982 *80 Micro*). Now Rosen's BBS#2 is up and running and is using the Color Computer as its hardware medium.

"The reaction has been great," Rosen said in a telephone interview. "Advertisers can display their products in full color and hires graphics."

He established the second BBS because running BBS#1 even seven days a week couldn't handle all the calls. "Access to the new BBS#2 can be made in two ways: by dialing (212) 441-3766 directly or by calling the original bulletin board, (212) 441-4755, and being automatically switched to the second number if the first is busy."

Rosen uses a 32K Color Computer with three disk drives. Drive zero is a Shugart drive while one and two are Radio Shack Color Computer drives. "The Shugart is a wonderful drive," Bob explained, "but the Shack drives are inconsistent and not as dependable."

Both bulletin board systems run continuously. Access time, like Rosen's original setup, costs only as much as the phone company charges. Eventually Rosen hopes to add multi-user capability to his service, but until then all a user can do is keep dialing.

Nationals win "Greatest Game Never Played"

The outcome was the same but the game was "a lot more interesting," Don Weber said of the "Greatest Game Never Played." (See *80 Micro*, June-July, 1982.)

Weber, vice president of BFV&L Promotions, said the National League won the computer simulation of an all-star game pitting the greatest baseball players of all time against each other.

The game was broadcast July 14 on more than 200 radio stations and Armed Forces radio.

The American League jumped on National League starter Sandy Koufax for two runs in the top of the first. They later tagged Warren Spahn for a tally in the third and Christy Mathewson for one in the eighth.

The National League touched up starter Whitey Ford for a run in the second inning, squeezed two more scores off Lefty Grove in the seventh and got its fourth run across the plate off Bob Feller in the eighth.

With the game tied 4 to 4 in the ninth, Grover Cleveland Alexander shut down the Junior Circuit. Hank Aaron led off for the Nationals in the bottom of the frame. He ran the count to 3 and 1 against Walter Johnson, then slammed a round-tripper off the "Big Train" to make the final 5 to 4 National League.

Weber, whose firm conceived and promoted the game, said a cassette recording of the contest will be available this fall. His company has already sold 8,000 copies of an LP containing the highlights of the game and selling for $9.95 plus $2 shipping.

Call for education papers

A Learning Place—an educational center located in Oakland, CA, specializing in reading, math and learning disabilities —is looking for papers for publication in its *Journal of Computers Reading & Language Arts.*

According to a statement from ALP, "the journal's purpose is to support the rapidly growing interest in computers and their relationship to reading-language arts and related issues."

"The theme of the journal," the statement said, "will be pragmatic in perspective. It will emphasize presenting papers which have clear classroom-teaching implications. The journal will be interdisciplinary and directed toward an audience of reading-language arts teachers, educational specialists, classroom teachers, educators of teachers

continued

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PV-CODE ($995.00) is a menu driven design program which interactively designs complete pressure vessels including shells, heads, stiffeners, reinforcements, and flanges. It is based on the ASME Code and includes mathematical models of the required charts and tables. A complete design report is generated.

Manuals w/demonstration diskette available for the above programs $30.00 each.

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MACRO-80C

The Micro Works is pleased to announce the release of its **disk-based editor, macro assembler and monitor**, written for Color Computer by Andy Phelps. THIS IS IT — The ultimate programming tool!

The powerful 2-pass macro assembler features conditional assembly, local labels, include files and cross referenced symbol tables. MACRO-80C supports the complete Motorola 6809 instruction set in standard source format. There are no changes, constraints or shortcuts in the source language definition. Incorporating all of the features of our Rompack-based assembler (SDS80C), MACRO-80C contains many more useful instructions and pseudo-ops which aid the programmer and add power and flexibility.

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DCBUG is a machine language monitor which allows examining and altering of memory, setting break points, etc.

The editor, assembler and monitor — as well as sample programs — come on one Radio Shack compatible disk. Extensive documentation included. MACRO-80C **Price: $99.95**

SDS80C — Our famous editor, assembler and monitor in Rompack. Complete manual included. **Price: $89.95**

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PULSE TRAIN *continued*

and educational researchers."

Papers or requests for information should be sent to Gerald H. Block, The Journal of Computers Reading & Language Arts, P.O. Box 13039, Oakland, CA 94661.

Japanese make most human-like robot in world

A Japanese firm claims it has produced a prototype of the most human-like robot in the world, according to a report by the Associated Press.

Sumitomo Electric Industries Ltd. said its new robot has basic human functions—perception, hearing, speaking—and is equipped with arms and legs.

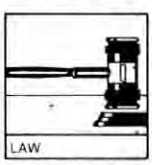
Following instructions from a human voice the robot is capable of moving towards a group of objects, selecting the right one and carrying it to a designated place.

The Japanese firm plans to use the robot for assembling electronics parts at its plant in Osaka in a few years and after that, Sumitomo will sell it to others.

The robot is 3 feet tall and sees objects with two movable "eyes" made of 300,000 optical fibers, allowing it to differentiate shapes and sizes through "image recognition technology" developed by Sumitomo.

It has a carbon-fiber arm that can grip and carry objects weighing up to 2.2 pounds. Its leg is equipped with an optical character reading device permitting the robot to follow written instructions and detect objects in its path.

Golden State pirate sent to slammer



A southern California computer rogue is serving a five-month sentence in a county jail after pleading no contest to charges he illegally accessed a Digital Equipment Corporation computer owned by the U.S. Leasing Corporation of San Francisco.

According to the computer industry newspaper *InfoWorld*, the rogue, Lewis DePayne, was a member of a loosely-knit group of computer freaks who got their kicks illegally accessing computers.

DePayne, who will be on three-years probation after serving his jail term, and two friends were arrested last year for breaking into the offices of a Pacific Telephone computer-maintenance center in Los Angeles and attempting to obtain information on the company's switching equipment.

The DePayne gang is also alleged to have—

- Shut down Pacific Telephone's Traffic Position System Office;
- Obtained information from computers at the California Department of Motor Vehicles;
- Broken into Digital's ARK computer in Massachusetts and stolen proprietary software; and
- Cracked the security of an airline-reservations computer and issued tickets to friends.

Earlier this year, DePayne distributed a press release announcing a new consulting service, the MPS Systems Consulting Group. He claimed the group offered customizing software packages, computer security analysis and lectures on the dangers of home computing and current bank rip-off schemes. He also said the firm offered time-sharing on a DEC system.

Firm plans to mass market software

Software for the masses. That's the goal of Jim Edlin, former editor of *PC Magazine* who has formed Bruce & James Program Publishers to market a $50 state-of-the-art word-processing program this fall.

Retailing at $49.95, Wordvision for the IBM Personal Computer is scheduled for release by the middle of this month. A few months later, versions of the program will be released for the Commodore VIC, Atari, and Timex computers.

According to the computer industry newspaper *InfoWorld*, Edlin plans to market his software primarily through bookstores. Computer stores, a statement from Bruce & James noted, "serve too narrow and technically-oriented an audience, and are also ill-equipped to handle products priced according to the company's high-volume philosophy."

To make it in the mass market, *InfoWorld* reported, Edlin plans to replace a sales staff with advertising and support personnel with good documentation and clear program prompts.

The report said Wordvision would be available for new generation computers with features like bit-mapped graphics for fast typing, upper- and lowercase character sets, function keys for one-keystroke operations, and video-display attributes like reverse video, color and blinking characters.

InfoWorld said when Wordvision was announced at the Booksellers Association's annual convention earlier this year, it received little of the attention it would have received at a computer show. "No one seemed to realize $49.95 was cheap!" Edlin told the newspaper.

It added Edlin was confident despite the lukewarm reception by booksellers. Besides, Edlin is quoted as quipping, "we can always mark it up a couple of hundred dollars and sell it in computer stores."

Aaron: hypothetical homer garners win for Nats.

Aetna offers computer crime insurance

One of the largest insurers of banks in the United States has started offering computer fraud insurance. In announcing the move, the Aetna Life & Casualty Co. of Hartford, CT, is following in the steps of Shand, Morahan & Co. and Lloyd's of London (see *80 Micro*, September 1982).

Aetna is offering its computer fraud coverages as riders to a standard insurance policy carried by many banks called "the banker's blanket bond."

According to a statement from Aetna, the standard policy includes coverage for fraudulently transmitting instructions to, by, or on behalf of a bank. However, that coverage is limited to transactions between a bank and five major systems for transferring funds. Aetna's policy extends that coverage to fraud committed on the bank's computer system.

In a telephone interview, Joseph P. Kiernan, commercial insurance

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PULSE TRAIN *continued*

division assistant vice president, said of Aetna's coverage, "It's a part of the banker's blanket bond which eliminates the concern that a loss could occur that might fall between the two policies."

While the standard coverage excludes losses from actions by an employee of one of the big five transfer systems, Aetna's coverage would pick up that loss.

Fraudulent transfers by using a telephone are also excluded from standard coverage, but covered by Aetna, as long as the phone calls are tape recorded.

Aetna's coverages also protect banks from dishonest acts by employees of software contractors and legal liability for acting on fraudulent information sent to them from a bank customer's terminal.

"The premium for all four of Aetna's computer fraud extensions," Kiernan said in the statement from Aetna, "will be less than the cost to purchase the (standard) coverages."

Like Lloyd's computer crime policy, Aetna's only applies to banks. Unlike Lloyd's, however, a bank must buy its blanket bond from Aetna if it wants the additional computer crime coverage. Dick Lahue of Aetna's commercial insurance division explained:

"It's a marketing technique.

"We are a domestic insurer and write 20 percent of the banker's blanket bond premiums in the United States. We offer the coverage because we have a lot of existing customers. Lloyd's is not a domestic carrier, but they do write some business in the United States. They offer a separate computer crime policy so they can go to someone that isn't their customer and try to sell them computer crime."

When you talk to your micro, it programs back

Haters of typing rejoice! Programming by voice is here.

Two Sunbelt high-tech firms have wedded a voice-recognition device and a program generator, a marriage sure to be blessed by everyone who lives by speech and not the keyboard.

The system—designed by Southwest Microcomputer Systems of San Diego, CA, and Scott Instruments of Denton, TX—uses The Last One (a program generator produced by AI Systems, Ilminster, England) to ask a user a series of simple English questions appearing on a CRT. The user responds through a microphone, selecting numbers, indentifying key phrases and labelling operations. Following the Q and A, the computer produces a Basic program.

"Managers, executives, and other white collar workers who are more accustomed to dictation or cannot type will now be able to create their original programs without touching the keyboard," Southwest Micro's President Richard Housand said in a statement.

"Introduction of the system also means that thousands of handicapped individuals will now have the opportunity to become computer programmers and computer users without problems."

The voice-recognition device, Shadow/VET, can recognize any vocabulary—even one consisting of grunts, whistles and other sounds, a feature permitting the severely speech-impaired to use the system.

Using an Apple II and Applesoft Basic, the system did in an hour what would ordinarily take a week—create an original error-free computer program of 774 lines.

FISH BACK AND RELAX. After learning about experiments at the University of Pennsylvania revealing the relaxing effect of fish on people, Candle Corporation of Los Angeles, CA, released a fish tank videotape aimed at "helping viewers reduce stress by creating a calming environment." The firm is currently experimenting with other "environmental videotapes," including clouds, fire and waves.

Maine accent stumps computer

Every day people are discovering computers can do more and more things, but understanding a Maine accent isn't one of them.

According to United Press International, Bell Labs researchers are finding their computers can't understand Downeast talk.

The researchers are trying to design a computer program capable of understanding human language, but when they tested a prototype in Portland, ME, they found the computer heard "four" and interpreted it as "zero."

"When Mainers speak, four is often split into two syllables and the o stressed," New England Telephone Company spokesman John McCatherin told UPI. It comes out sounding like a "fo-wah."

"The computer kept confusing that hard o with the o in zero," he said.

The New Jersey researchers selected Maine as the first test of its system because of the unique Downeast twang. After the data was analyzed and fed into the machine's memory, the researchers found that when they went back a second time, the computer understood.

First New England v-text experiment launched

The first videotext experiment in New England is being conducted by WGBH, Boston's public television affiliate.

Channel 2 offers a 70-page electronic newspaper and 30-page education section for students. The primary source for the e-paper's information is the Associated Press.

Shelly Isaacson, manager of the project, said the e-paper is loaded into special tv sets located at 22 public sites—several local universities, the science and children's museums, public schools, a bank, an airport and Bloomingdale's.

A person using one of the one-way terminals finds out what's in the e-paper by calling up several indexes. Once a page is called up, a viewer may look at it as long as he or she wants.

continued

PULSE TRAIN*continued*

Isaacson told *80 Micro* WGBH hopes to learn several things from the one-year experiment: possible educational and community applications; the reaction of the Boston market to videotext; and gain some technical production expertise.

Computer mess at SSA

Computers haven't exactly been the savior of the Social Security Administration, according to the *Wall Street Journal*.

Earlier this year, a coding mixup ended up in more than 500 retirees receiving thousands of dollars in overpayments.

To avert the catastrophic consequences of a power failure, the administration invested $2 million in a complex of storage batteries and jet-powered turbine generators that is supposed to keep the power running at all times. On two occasions this year, the power has failed.

Two power failures, Social Security's Associate Commissioner for Systems John R. Wicklein told the *Journal*, is still better than last year's record without the backup system: 19 power failures.

The administration complained about the problem to the system's builders, Exide Electronic Corp. of Randolph, MA, but the firm maintained the failures are not its fault. To identify who's really at fault, the federal agency proposes to install more high-tech gear: an electronic diagnostic system costing $659,000.

The agency also has installed a computerized access-control system designed to discourage fraud, theft and damage. The *Journal* reported this system apparently works; however, an employee in Riverside, CA, managed to beat the system for $104,500.

Todd Skinner, a 34-year-old claims representative at that office, created six clients and had $3,402 a month funneled into their accounts. On several occasions, Skinner's deviltry triggered electronic alerts in the computer system. He was told there was something wrong with the accounts and instructed to audit them, an event akin to assigning the fox to guard the henhouse.

Because Skinner had only rudimentary knowledge of computer operations and even had gotten his supervisor's initials wrong when forging them to get computer access, the U.S. Attorneys interviewing him concluded the administration's computer system—which generates $170 billion in benefit checks a year—offered total vulnerability to lower-level employees bent on fraud.

Wicklein told the *Journal* the agency is installing "intelligent terminals" in the field offices. They will reduce the system's vulnerability by keeping a record of the author of each computer entry and providing an audit trail making it easier for investigators to trace fraud. Unfortunately, the computers now used by the administration can't store the additional information from the new terminals. However, Wicklein said, five years from now, when the new computers arrive, the administration will know all it needs to know.

Micro makes best 3-D tv

The best 3-D tv to date has been produced by Philips Research Laboratories in the Netherlands using a microcomputer.

Philips uses two of its Laservision video disk systems and a pair of projectors with special filters to produce 3-D, according to a report in *New Scientist*, a British weekly magazine.

Viewers still need special glasses when viewing the Philips system, but their lenses are polarized rather than red and green.

The images for each eye are recorded on separate video disks. When the disks are played back, a microcomputer synchronizes the frames and passes control signals to the disk player. The player's output is fed into the color tubes of a projection tv, which are carefully aligned to produce a double image in color.

Polarizing filters over the tubes allow viewers wearing the special glasses to see a separate image with each eye.

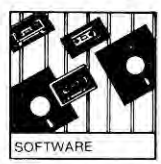
Chinese trade abacuses for computers

When electronic calculators were introduced, a promotion was held pitting a man and his calculator against a man—a machine versus mind affair. The results surprised the promoters, who held the event to prove the superiority of the machine. The man won, although he did have one aid, an abacus.

Now, however, even the most hard-core proponents of the abacus—the Chinese—have surrendered to the electronic revolution. The People's Republic has purchased 21 IBM computers to conduct its census. Its censuses in 1953 and 1964 were tabulated by abacus.

The most ambitious census in world history—some one billion people will be counted—involves 1,000 computer technicians, 4,000 data-entry workers, 100,000 coders, a million census supervisors and four million census enumerators.

A proposal to curb piracy



Losses from software piracy amount to 50 to 100 percent of sales, estimated the chairman of the board of VisiCorp of San Jose, CA.

Dan Fylstra said in an interview appearing in *ICP Interface* that pirating appears prevalent on Apple computers. "The Apple has a totally software-driven disk recording scheme where other machines often have it essentially built into the hardware," explained the executive whose firm, formerly Personal Software Inc., is known for its pioneer efforts in marketing VisiCalc.

He maintained moves by the software industry to prevent copying has spun off a new industry: creating copying programs. "There are several of these programs around—including one designed especially to copy VisiCalc," he said.

Fylstra suggested a method to reduce copying but not backups:

"A possible method would be to sell a diskette and sell some kind of hardware key with it. It could be a chip that you plug into a board, a magnetic card or some other thing that is separate from the disk itself and not easily copied.

"You supply the software and according to an ordinary format, it can be backed up to your heart's content. The software makes many references to the hardware device which has been plugged into the computer in such a way that the software can read it or sense it.

"There you have a situation where anybody can make copies of the software, but it will only run on the machine where the chip is plugged in."

Bronx cheers for electronic cottage

Being wired to your job through a computer network isn't the bowl of cherries futurists would like you to believe it is.

That's the opinion of several computer professionals appearing at an office automation conference held last spring in San Francisco.

In a report in the computer industry newspaper *InfoWorld*, Ralph DeMent, manager of communications systems planning at Digital Equipment Corporation, Tewksbury, MA, said his company's elaborate electronic mail system, which allows staff to send and receive messages at home, gave employees little time for rest.

"There is this competition among my bosses and subordinates," he told *InfoWorld*, "to see which of us is the last to use the system at night and the first to sign on in the morning. I found myself getting up at 5:30 a.m. in order to be the first to send a message."

Don Tapscott of Trigon Systems Group, Toronto, said he used to read his electronic mail before going to bed. "Then I'd look at the ceiling all night thinking about the problems that arose from my mail," he observed.

"The nicest part of the day for me is leaving home for work," Booz Allen & Hamilton's Ira Cotton said of working at home at his computer terminal. ■

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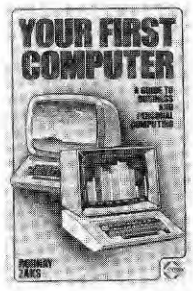

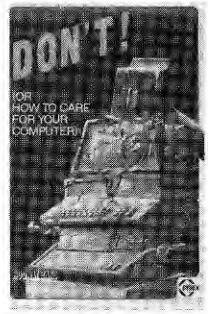

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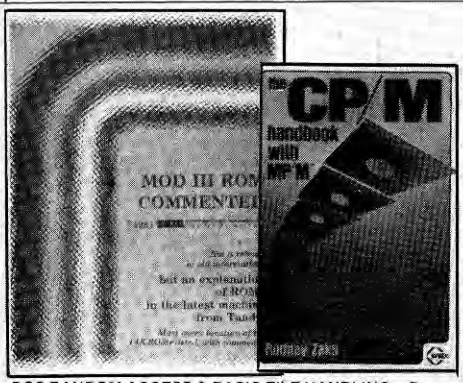

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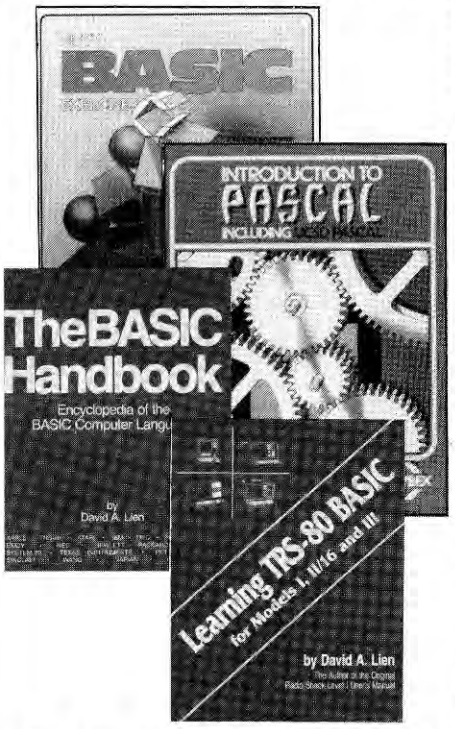

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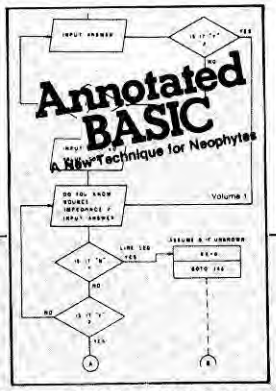

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Z80

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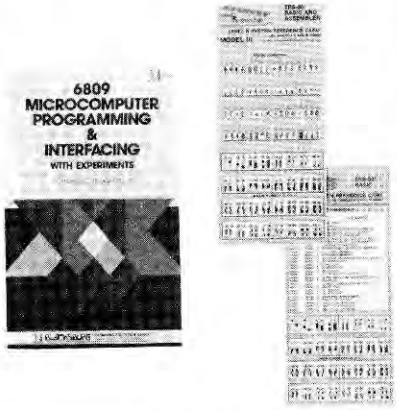

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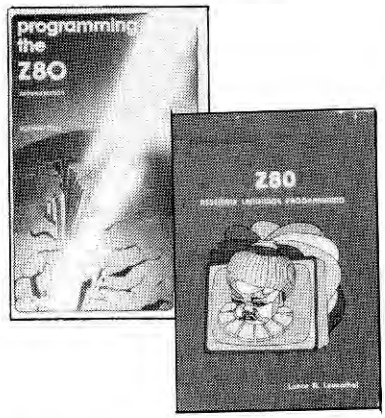

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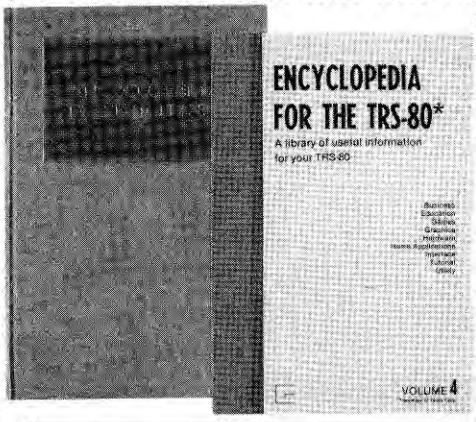

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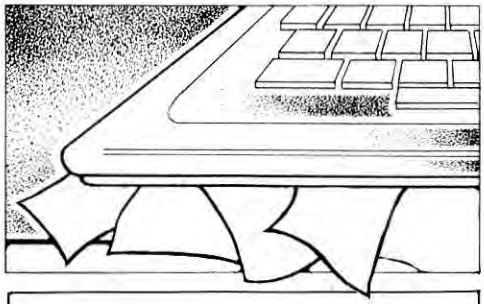
BENEATH the KEYBOARD

by Paul Wiener



Interfacing your micro with the stars

Many of us invest $1,000–$2,000 in a computer system expecting to make the new hobby pay for itself within a few months. But the payoff isn't always that easy. Either there's no demand for the service you planned to offer, or the competition's too intense (the 12-year-old genius down the street has already cornered the market). The bank on the corner doesn't want a neighborhood hacker to print amortization charts for its customers, and the precocious pre-adolescent programmer (PPP) has already signed up the local bowling league.

If you're still looking for a microcomputer-based home business with a reasonable potential for profit, I have an idea for you.

Computer Astrology

If you're a TRS-80 owner and a practicing astrologer, you have probably already considered (or even acted upon) the possibility of computerizing your operation. This month's column is more for non-astrologers looking to enter the field.

You may be wondering how a neophyte can provide such a technical service competently. Before I address that question, I'd like to bring up another that is probably on many of your minds. Is astrology a valid science or is it a domain of superstition and larceny?

I don't think it matters. If you don't believe in astrology, you can still sell astrological services without feigning hypocritical belief. Don't hesitate to inform your clientele that you don't place much stock in astrology. Surprisingly, such an attitude doesn't seem to discourage business. Perhaps people are impressed by candor and impartiality.

You have two sets of potential clients. You can deal directly with people who desire astrological consultation, or you can offer support services for professional astrologers.

There are probably more practicing astrologers in your area than you realize. Most of them don't own their own computer, except perhaps for an inexpensive special purpose computer (SPC). Astrological SPCs are fairly useless to practicing astrologers because of their limited scope and their inability to produce printouts.

Whether you serve the general public or other astrologers, you will have to learn something about astrology. Most consultations will require casting a natal (astro jargon for birth) horoscope if the client doesn't know his. This used to be a somewhat arduous task requiring the availability of several special reference tomes, such as ephemerides, a time-changes book and rigorous calculations.

There are several pitfalls to casting a chart by hand. The most obvious is miscalculation, and the other is discovering the time zone of the natal event. Time-zone borders often don't follow lines of longitude. Also, they shift from time to time, hence the requirement for such books as *Time Changes in the U.S.*

Astrologers frequently have to decide how to handle clients who don't know their precise time of birth. The most common solutions include attempting to determine the moment of nativity by an astrological process known as rectification, or just drawing the chart as if the birth occurred at noon or midnight.

Microcomputer software has automated most of the tedium of horoscope casting, virtually eliminating calculations. But you still need to know enough about the field to overcome the other problems I described. There are many astrological texts available to guide you. If you'll be working with a professional astrologer, he could probably lend you the books you'll need, and guide your studies.

Radio Shack offers a program for casting horoscopes. I don't recommend it. The program's main inadequacy is that it doesn't allow you to enter the time zone of the nativity. It tries to deduce the time zone from other information. Since that's impossible without a huge data base, the program sometimes fails resulting in an inaccurate chart.

Matrix Software, of 315 Marion Ave., Big Rapids, MI 49307, is the hero of this column. They offer a variety of astrological programs, including horoscope casters. None of Matrix's programs deprive you of the opportunity to enter the proper time zone. The Matrix software also has options that accommodate many of the divergent astrological schools. The horoscope may be tropical or sidereal, geocentric or heliocentric. It can include asteroids, Uranian planets, and Arabian parts. A large number of house systems are also supported. They draw attractive, professional looking charts on a printer. If you have an Epson, they will actually draw the astrological glyphs. The chart programs also print tables reiterating the data depicted on the chart.

Matrix also has a program to interpret charts. It produces a lengthy printout similar to those provided by mainframe computer astrology services like Astro Flash.

Most of Matrix's software is affordable—in the $15–$100 range. But the interpretation package costs—hold on to your hat—$500. You shouldn't buy it unless you're planning to make it work for its keep.

If you decide only to run a service for professional astrologers, the programs Matrix offers can do a lot more than draw charts and give canned interpretations. They can perform rectification; calculate midpoints, parts, progressions, and returns; and numerous other factors. In short, they can drastically simplify the work of a professional astrologer. But you have the TRS-80 and the astrologer doesn't, ha, ha, ha! Since astrologers won't ask you to elaborate on the computer's interpretation, your lack of astro-awareness won't be much of a hindrance.

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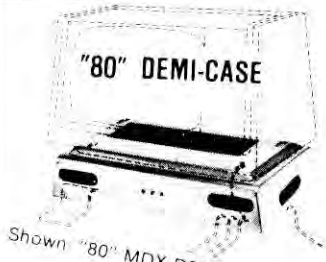

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Testing the Market

A possible approach would be to obtain Matrix's catalogue and show it to local astrologers. If any would like the benefit of some of the programs, arrange on a price per run. Then buy the programs and you're in business.

I took a slightly different approach. I wasn't interested in starting an astrology business, but I wanted to be able to report on the feasibility of making such a venture fly. Armed with complimentary software from Matrix I introduced myself to Judy Havey, our area's leading astrologer. I explained what I was doing and showed her a sample of my (TRS-80's) work. She was impressed.

Judy charges $40 for an initial consultation. This includes drawing a horoscope and one hour of consultation. We decided that I could charge $5 for a computer chart and $25 for a computer interpretation. Judy told me her preference in house systems, aspect orbs, and other details, and I agreed to abide by them. That way, if a customer had me print a chart, he or she could take it to Judy and get $10 off on her initial consultation.

We developed a mutual referral arrangement. Whenever a customer approached me, I'd disclose my agnostic attitude toward astrology. I'd also let them know that if there is anything to astrology, no canned interpretation, no matter how good the program, was likely to be as good as a human's chart analysis. I'd tell the customer that he or she might get a better interpretation from Judy, but for a higher cost. Everyone who approached me elected to have me do a chart and interpretation, despite all my disclaimers.

"Microcomputer software has automated. . . the tedium of horoscope casting."

After reading the program's printout, if any of my customers wanted more detailed information, or additional astrological counseling, I would send them to Judy. Judy, on the other hand, would refer customers that couldn't afford her services to me.

I ran a small classified and display ad for a few weeks in a local newspaper. The two ads cost me less than $20 a week. They paid for themselves, but just barely. Shortly after starting this experiment, I got involved in writing a book called *Inside Super Utility*. Then my computer system blew up. I had to drop the astrology project and turn all my attention to getting the book out.

If I had bought the astro software, I would have suffered a near total loss on my investment. If, on the other hand, I had continued my efforts, and possibly increased my advertising, I probably would have done well. A word of warning: Matrix doesn't want its interpretation program customers competing with each other. Before they will sell you the program, you must sign an agreement prohibiting you from offering your services through national advertising.

Oh, Something Else

Here's a news bulletin for you business types. Kim Watt, of Super Utility fame, is teaming up with Micro Systems Software, authors of DOSPLUS, to create a brand new operating system for the Model II. Judging this team by the past accomplishments of its individual players, the finished product ought to be an improvement over existing Model II operating systems. ■

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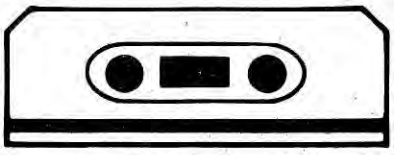

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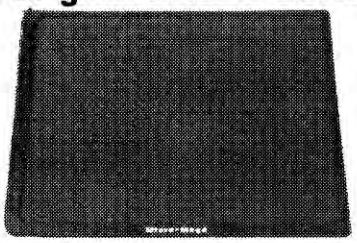

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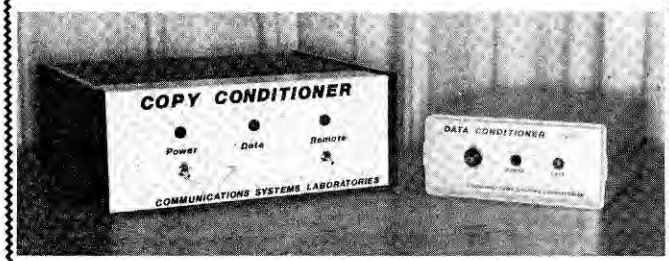

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MEDICAL OPINION

by Phillip R. Mills, M.D.

Model II for your medical office

It is easy to understand why Model II owners sometimes feel frustrated. Information on the computer is slow in coming, there are only a few expensive utilities, few books. . . .This month's column will open with two suggestions for Model II users. We discovered them only recently.

First, for several months we were annoyed by an episodic problem with back-ups. Certain disks would begin the back-up process perfectly, then suddenly the back-up would abort and the error message "Illegal Disk Access Operation Aborted" would appear on the screen. At first we thought there must be a hardware bug, but when we found that the same disks would refuse to back-up on any Model II we were very perplexed. After losing our entire mailing list by this strange error, we finally stumbled onto the solution almost by accident.

There is a software incompatibility between TRSDOS 2.0 and TRSDOS 2.0a. Occasionally a secretary would boot-up the Model II with a 2.0a disk, then in the course of the day's work, interchange disks containing TRSDOS 2.0 with only a warm boot. There was no software warning that a mistake had been made, but files being written to 2.0 disk were usually making the disk impossible to back-up.

The solution is quite simple: Use TRSDOS 2.0a exclusively. We have transferred all software to this version, and erased all copies of earlier TRSDOS versions. We have had no further difficulties.

Second, we have also discovered the solution for another TRSDOS back-up problem. TRSDOS' back-up is so slow (approximately 11 minutes) that it is virtually impossible to get secretarial cooperation to do daily, weekly, monthly and yearly back-ups as recommended.

The slow back-up was unnecessary. My Pickles and Trout CP/M did a complete back-up with verification in less than one minute. Three companies have now produced software to provide TRSDOS users with the same efficiency in back-up. Compliance with back-up routines in our clinic has increased dramatically with this program. (One company marketing the rapid back-up is Racet's, $75.)

Model 16

I have just had the opportunity to use a Model 16. Tandy's microcomputer catalogue gives its overall dimensions as $14 \times 2\frac{1}{4}(!) \times 23\frac{1}{2}$. Its correct dimensions are $14 \times 21\frac{1}{2} \times 23\frac{1}{2}$. The keyboard itself seems slightly more compact than the Model II, however this could simply be an optical illusion because of the Model 16's color difference.

For our clinic the Model 16's primary advantage will be the two data-terminal capability it provides. In time we plan to upgrade our Model II to the Model 16. We intend to install one terminal at the front desk for scheduling and information. Another terminal will be installed at the insurance clerk's desk. The computer itself, along with the hard-disk drives, will be put in the accounting office.

I am told that the Model 16 is selling well. We plan to wait until sufficient software is available for it before we purchase the upgrade board for our Model II. This should allow enough time for any Model 16 hardware and software bugs to be removed.

Our clinic not only plans to upgrade the Model II, but also our trusty Model I. We will add Radio Shack's new double-density board (made by Percom). During office hours the Model I will continue to be used primarily for secretarial word processing.

We are purchasing Superscripsit with the spelling dictionary. Superscripsit is much like Model II's Scripsit 2.0, and appears to be an excellent program, particularly when combined with the spelling dictionary. For routine medical letters, our secretary is happy with the original Model I Scripsit enhanced by Acorn's Superscript modification. However, our clinic is very active in health education and Superscripsit will give us better capability for handout preparation and mass mailing of "personalized" computer letters.

For personal use, my favorite word processing program is still Wordstar, but since it is a little slow on the Model I, and we do not have any CP/M spelling dictionary, a simpler, faster program is more efficient for office use.

Model II Versafile

One computer area which we have yet to utilize in our office is information retrieval and filing. Whenever my wife looks at my office, she accuses me of having a bad case of "the piles!" I always have stacks of magazines waiting to be filed. For me, filing is complicated by a poor memory. It is not enough simply to file an article—I must go to the extra work of making several cross-references or I may never be able to find the article again. An internist neighbor of mine, Dr. John Williams, has found Model II Versafile to have solved the filing problem for him.

When he first mentioned Versafile, I almost had renal shutdown. My experience with this program had been very negative. In fact, Versafile was the first non-word processing program I ever used on the Model I. I found it slow. It had upper/lowercase quirks making it seem unreliable for my purposes. Within hours after trying it, I returned the program to the local Radio Shack store.

Versafile on the Model II is far superior, however. It is much faster. Furthermore, a caps lock is available. By removing *no* words, letters or phrases and building the key words around the body systems (cardiac, pulmonary, endocrine, CNS, GE, renal and others are the key words Dr. Williams uses). The system works quite well for information retrieval.

Dr. Williams reads all journals seated at his computer. He types in his own abstract containing the reference and any important points he wants to be able to recall. When he has finished reading an article in this manner, he throws it away.

He has now used Versafile for over a year. When he wants to review the literature, Versafile quickly searches all references and prints out an abstract and bibliography of pertinent articles. If his abstract fails to provide sufficient information, he gives a copy of the bibliography to the librarian in the morning. She is able to pull all necessary journals for him by noon. He is well pleased with this method, feeling that it saves him time and space. He fanatically keeps *two* back-up disks, so nothing will destroy his complete cross-referenced file.

Dr. Williams uses his Model II in his practice to assist him with his diabetic patients. He uses a Basic program which evaluates five-hour GTT results with a graph and interpretation. A copy and explanation of this report is given to every patient. He has found this simple routine has increased patient compliance with dietary instruction.

Readers' Questions

Readers have contacted me by phone and letter. I have been unable to answer the following questions. There are many knowledgable readers who might be able to help.

Several physicians have inquired about differential-diagnosis software. At present I know of no such programs for micros. It should be possible to have a differential-diagnosis program in a limited area, such as low-back pain. Drop me a line if you are aware of such a program.

One physician has asked about drug-interaction programs. I have used only one such program. It contained such a limited data base, however, that I do not feel it would be of any significant use in an active clinic. Physician-programmer Mark Spohr has told me he is working on an advanced drug-interaction program; it has not been completed. Reader input on any such programs will be welcomed.

A non-physician reader has noted the high percentage of ham-radio operators among computer enthusiasts. He claims his wife would like a psychiatrist among our column readers to explain this association so that she could better understand his affliction. Any professional opinions on this phenomenon? If it's a *good* alibi, I may use it on my own wife!

A physician asked about using his Model I as a terminal for Medline for easier literature searches at his office and home. I know nothing about the various phone services—even CompuServe is $20/hour from our location—so we have not considered using it. Any help from metropolitan readers?

There are two groups of physician computer users which I have yet to hear from: Color Computer and Pocket Computer users.

The low-cost Color Computer certainly has potential in the waiting room for health-education purposes. The Pocket Computer has application in the clinic lab for calculations. We are considering purchasing the PC-2 for nerve conduction-velocity determinations. (I am having a hard time seeing much use for a four-color printer, however.)

Our most distant correspondent, Dr. Robinson, writes from England. His letter provides a glimpse of the programming needs British physicians have with socialized "medson." His letter is interesting, and it will be published in *80 Micro* in an upcoming issue. Here is part of it:

"In the U.K., considerable interest has been aroused in medical computing, especially for Family Practitioners. We frequently practice in groups (2–7), and with 2,200 patients each, patient records pose a problem. At the moment, there are 12 companies selling packages for patient records, a few of which are suitable for Tandy's. However, because of the fact that patients are not actually paying directly for our services, the packages differ markedly from those in the U.S.A. A major interest is in screening of patient populations for hypertension, cervical smear recall, infant vaccinations, endocrine (diabetes, thyroid) monitoring.

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comes to spotting drug interactions!"

Dr. Robinson's Newsletter suggests that Tandy is about to release a Model III with hard disks. I have been unable to confirm that information, but it certainly is a possibility. The British Newsletter can be obtained from:

Dr. N.D.P. Robinson
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Watford Road, Harrow
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United Kingdom

To close this month's column, I have some caveats on choosing medical software:

First, never purchase software on the basis of one raving magazine review. I have wasted nearly $1,000 on programs which I heartily dislike that some reviewer found titillating. Tastes vary, and magazines are sometimes under pressure to publish reviews favorable to products that they advertise. Support magazines that give honest reviews.

Second, don't refuse to consider software just because it received a terrible review. It may be a bad program, but it may also be reviewed by someone with greatly differing needs and perspective than you. (After saying that, I won't bother with any software review for this column this month!)

Third, insist on a refundable demonstration disk. Be willing to purchase the documentation. When testing the software, evaluate critically the time-consuming end-of-month routines, ease of installation, error trapping (make several deliberate errors, push the program), accuracy of mathematics over $10,000 (use numbers that include the numeral 5 to check for rounding errors).

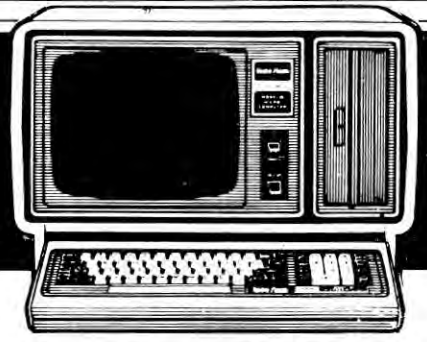
Fourth, determine if the company will give you the support your clinic needs. Our clinic, for example, does not need much support; other clinics may need a great deal. As a rule discounted software often means an older version, a new version is about to be produced, or the company will not give much assistance.

Fifth, allow time for the office to accept and use software. We have found that it helps to have the actual user make the final choice.

Sixth, if you find particularly helpful software, drop me a line or give me a call. It may be just the software another clinic is looking for. I'll try to mention it in the column.

Finally, encourage others to purchase Radio Shack computers. Right now many physicians are considering the purchase of a computer. For reasons I don't understand, the Apple computer is very popular. Its keyboard system is archaic. In our city, the nearest repair center is 300 miles away. Several local companies have folded, leaving little support. Most users end up purchasing a CP/M card and using it as a very expensive Z80 computer. I can't recommend it.

The Model II is cheaper, faster, and I believe better for most business purposes. ■



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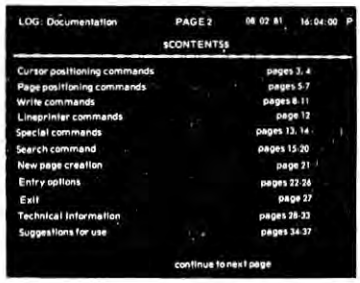

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by Terry Kepner

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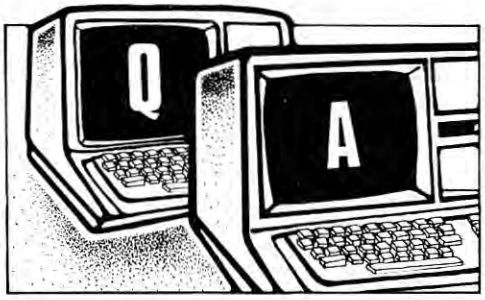


Problems and solutions

I use my Model I with Scripsit for word processing. I don't have the lowercase modification and don't miss seeing lowercase on the screen. My printer, however, will print lowercase if it receives the right output, so I'd like to find a patch to Scripsit that will let me output both upper and lowercase.

Alternatively is there a word-processing program out there that will accomplish this sans lowercase modification?

A.N.
Philadelphia, PA

Radio Shack says there's no way to get Scripsit to operate in uppercase/lowercase mode unless you have the modification installed in your computer. Scripsit/LC performs a check, when it's loaded into memory, to see if you have the modification. If you don't, it locks itself into uppercase mode.

I'm sorry, but I don't know of any patch to Scripsit that will let you operate it uppercase/lowercase in an unmodified machine. Nor do I know of a word processor that will allow you to do this.

Is there anyone out there who can help?

Is there a way to program a key to repeat when held down? I have never seen that feature in a Basic program.

T.B.
Glendora, CA

There is a Basic routine that will give automatic key repeat when the key is held down. The normal method of using INKEY$ in a Basic subroutine to retrieve user input does not allow for repeating keys. INKEY$ scans the keyboard once per keystroke, no matter how long you hold the key down. This is accomplished by checking memory location 14591 for a zero value. As long as you're holding down a key, that location will hold its value, and the INKEY$ routine won't retrigger a scan. When you release the key, the zero is sensed by the INKEY$ routine, and it will scan the keyboard when requested.

To use automatic repeating keys check the same location that the INKEY$ routine does, and have Basic add another character to the video and your variable if the key is being held down. This short program illustrates that point:

```
100 A$=INKEY$:IF A$=""THEN100
200 IF A$=CHR$(13)THENPRINT:
    PRINTX$:END
300 A=1
400 PRINT A$;:X$=X$+A$
500 IF PEEK(14591)<2THEN100
600 A=A+1:IFA<5THEN500ELSEA=1:
    GOTO400
```

The program uses the standard INKEY$ setup (lines 100, 200, 400, and 500, which include a test for a carriage return at the end of user input), with two additional lines (lines 300 and 600). Line 500 checks location 14591 to see if the user is still holding the same key down. If not, the routine bounces back to line 100 and the automatic key repeat is ignored. If the operator is still holding the key down, line 600 sends the computer back to line 400, which prints the additional character on the video and adds it to the string variable being used to store the user's response. I discovered, when writing this routine, that the scan rate is very fast and ddoouubbledd keys were impossible to avoid. This is why line 300 was added. And line 600 uses a counter before repeating the keystroke.

Line 500 checks to see if memory location 14591 contains a value less than two. This is because the location contains a zero if no key is pressed and a one if the shift key is held down. This way, if you're typing in uppercase letters, holding down the shift key between letters won't accidentally cause the last key typed to be repeated.

I have a TRS-80 Model I Level II (vintage July 1979) with Expansion Interface, three disk drives, a Micro-Cue 16K buffer, an Epson MX-100 printer, the Archbold speed-up kit, new Gold Plug-80 cable connectors, and a Percom Data Doubler. Everything has been working fine for the last three years, using NEWDOS80.

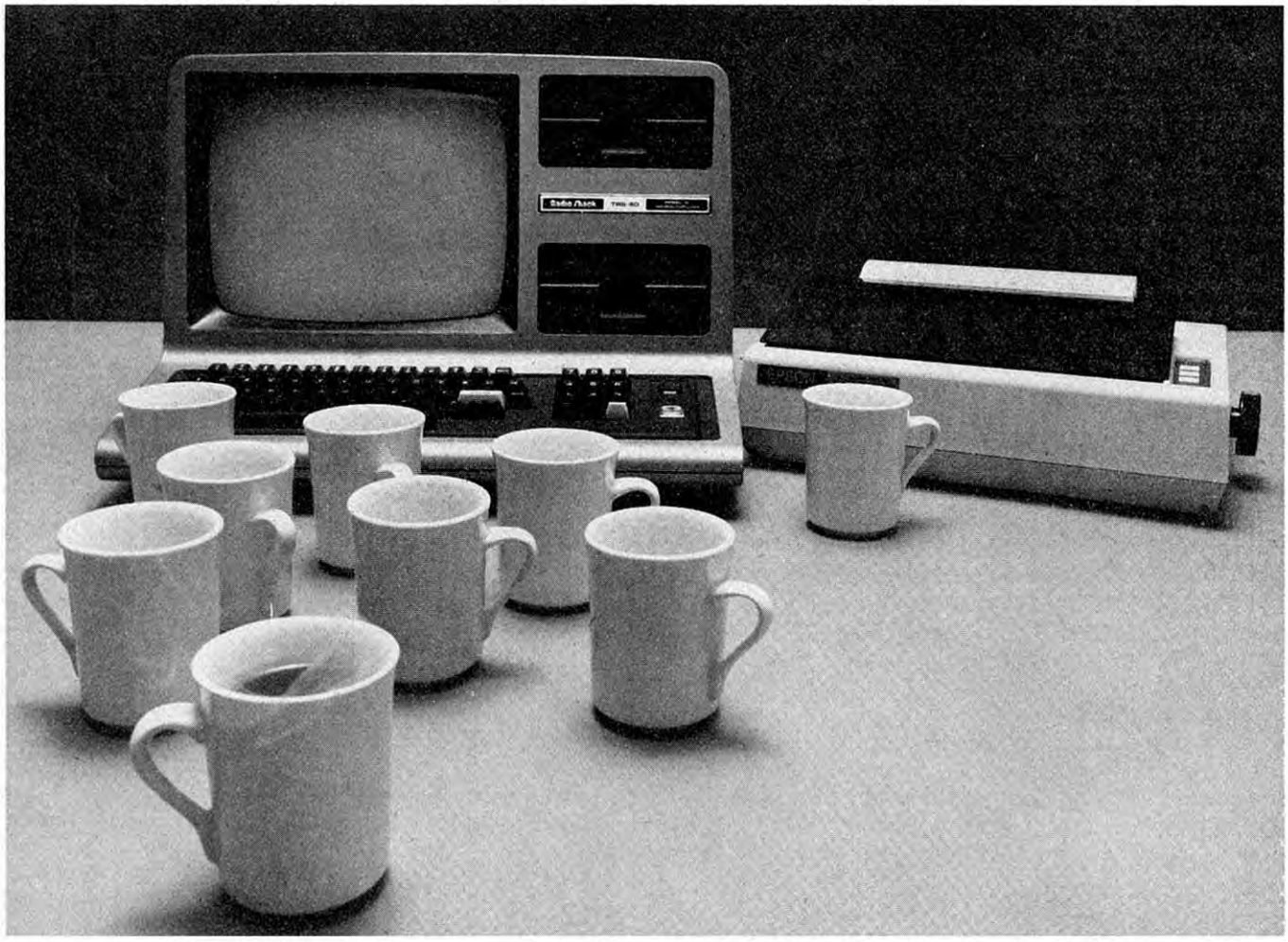
Suddenly a transformer in the Expansion Interface blew a fuse. After installing a replacement transformer the system operates erratically. The three drives start at random times and run for about three seconds while the program is running. Sometimes the program loses lines from the midpoint on, causing the program to stop. I can't relate the two problems except to say that I didn't have the problem until the transformer blew. I think the transformer was feeding the keyboard, but can't be sure.

The random disk operation isn't predictable. Some days it works perfectly and other times it starts every few minutes.

The local Radio Shack repair shop won't look at it because of all the modifications, but did suggest an IC, capacitor, and resistor change. These didn't help.

D.T.
Pleasant Valley, NY

Because your program starts disappearing at midpoint, I think your problem seems to be located in the Expansion Interface. The problem of losing the last half of a program (or a text file) is almost always symptomatic of memory problems in the Expansion Interface, or a bad Expansion Interface-to-keyboard cable connection. Since you're using Gold Plug-80 connectors on your keyboard-Expansion Interface cable, a poor connection shouldn't be the problem. Because the system operated correctly for several years and only began having problems *after* you replaced the power supply, I suspect



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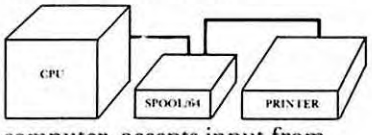

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the problem is with the power supply for the Expansion Interface.

If the Expansion Interface power supply is as old as the keyboard power supply was, it might also need replacing. Since you don't know which device was powered by the blown unit, you might have mistakenly hooked the replacement unit to the Expansion Interface rather than the keyboard. If so, it's possible the replacement power supply isn't as powerful as the previous one. (Variations in "standard" component values can radically affect the performance of "identical" devices.) Power instability would also affect the disk drives, as fluctuations can be incorrectly interpreted as commands.

The easiest way to double check the problem is to turn on your computer in Level II mode, then load and run several programs. In other words, play games for several hours and see if you still experience the same memory-loss problems. If you do, switch the keyboard and Expansion Interface power supplies (the keyboard uses less power than the Expansion Interface). If none of these work, run the memory test programs from your TRSDOS disk. If you have bad memory chips, the same locations will fail time and time again.

If you can't make the problem go away, your best bet is to take the Expansion Interface to Radio Shack and have their technician unplug Percom's data doubler and test your Expansion Interface (Radio Shack has changed their "modus operandi" and will work on modified computers for $15/half hour).

I just came back from a two-week vacation, during which I left my computer in my static-proof room with no outside contact. When I came back, my computer didn't work. The LED wouldn't light and the video remained blank. After leaving the computer at the local computer center a few days, they told me it would cost $669 to fix it. This came as quite a shock; I was expecting only a $50–$60 bill.

They told me that they needed to replace the logic board, the RAM, the ROM, the keyboard, the case, and a couple of other things.

What can I do?

J.G.
New York, NY

It sounds like you're being taken. I called the local TRS-80 repair center's technician and told him your problem. He was at a loss to explain what was happening. According to him, the only way you could have that high of a repair estimate would be if your entire computer had been destroyed.

"The Z80 can't address more than 64K of memory."

Since you mention a LED I assume you're talking about a Model I. Normally, when you take a trashed TRS-80 to the repair center, you're charged according to a strict service charge formula. If, as you say, the entire logic board has to be replaced, the rate is based on an exchange basis (the old board for the new one). On that basis, the maximum labor charge is $30, the exchange board costs $25, new ROMs cost $56.73, new 16K RAM is $99, and an exchanged keyboard is $25. So to totally rebuild the unit shouldn't cost more than $235.73. You don't mention an Expansion Interface in your letter, but if you had one and it also died, the cost on exchange would be: $74 for the board, $198 for the RAM, and $30 for the labor: a $302 total. Adding the keyboard unit to the Expansion Interface leaves a difference of $131.27 ($669 minus $537.73).

If you want to bring the price down substantially, tell the repair center to leave out the RAM chips and buy them mail order (as low as $19 per 16K) and install them yourself (or have them installed by a free-lance technician), saving about $240.

The only way the repair cost could be more than these figures is if the boards are so heavily damaged they can't be used as exchanges, in which case the CPU logic board would cost $286, the Expansion Interface logic board would cost $238.70, and the keyboard would cost $75. Fully assembled, the cost would be $1013.43, well *over* the estimate you were given. It would be better, at that price, to buy a Model III.

Incidentally, I wrote an article for *80 Micro* outlining Radio Shack's current pricing structure. Look for it in this issue's table of contents.

I own a 48K Model III double-disk system. The computer works fine, but the 48K is a bit small for my needs. I'm wondering what is on the market for expanding the Model III RAM from 48K.

K.K.
Whitehorse, Yukon
Canada

What you want isn't easily deliverable. The Z80 can't address more than 64K of memory. The design of the Model I and Model III uses the lowest 16K of memory for the ROMs and video RAM, with a portion of the lower 16K RAM for Basic and DOS overhead. This means that a 16K computer actually has a 32K memory: 16K for ROM, and 16K for user RAM. A 48K computer addresses the full 64K of memory. The memory numbers associated with the TRS-80 computers refer to the amount of RAM available to the user for programs and data.

To get more than 48K RAM requires an approach known as memory banking. This means that portions of memory, usually in 16K blocks, are switched in and out of the address range of the Z80 CPU. When a bank is switched out, the Z80 cannot access it, as if it doesn't even exist. It takes a sophisticated machine-language program to control this memory banking without losing control and botching things up.

Straight memory banking, with the appropriate control program, will let you create and use programs far larger than 48K. Another method of memory banking lets you use the port addressing mode of the Z80 to select a bank of memory that is located at an external port (rather like a disk drive, only it's RAM instead of a disk). You load two ports with the bytes specifying which byte in the memory bank you want. A third port is used for transferring the data to and from the bank. This second method limits you to using the memory bank only for data storage.

I don't know of any companies currently selling memory banking systems using the first method, but I have been told of one selling a product called ERAM that uses the second method to

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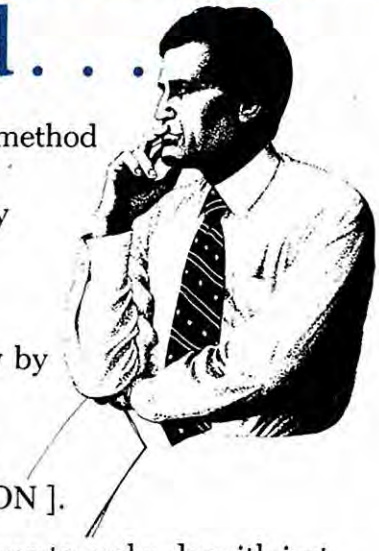

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support high-resolution graphics for the Models I and III. It should be fairly simple to convert the ERAM to your purpose.

The only other option you have is called program chaining. Several DOSes, as well as several commercially available machine-language cassette programs, support program chaining. Program chaining involves loading and running sections of a program while not losing any data in memory.

I can't get my printer, a Microline 82A, to accept the page-length commands (Escape F) from my Color Computer. Radio Shack says there's no POKE for the page length on the Color Computer.

J.P.
Cheshire, CT

According to the technical engineers at Okidata, the 82A and 83A printers do accept the top-of-form command (the command that tells the printer to go to the top of the next page of paper in the printer), but that it's decimal 12 (hex 0C) and not 15 (hex F). For this to operate correctly, set the page length switch (on the front panel) to position number seven (for standard 8½-by-11-inch paper with 66 lines per page). Whenever you turn the printer on, this switch setting determines the length of the paper, at least as far as the printer is concerned.

For the CC, the proper form-feed command is PRINT#-2,CHR$(12).

I have been comparing available disk drives for my Model III and have a few questions. What are the advantages and disadvantages of two 80-track, double-density, dual-head disk drives in comparison to four separate disk drives with single heads? A friend has a Model I with 40-track, double-density, single-head drives, operating with NEWDOS80. Will there be any problems in converting these programs over to the Model III with 80-track, double-density, dual-head drives? Do you feel the price of disk drives will be coming down in the next 12–18 months?

C.H.
Allentown, PA

The main advantage to using 80-track, double-density, double-sided disk drives is that you can store four times as much information per disk over a standard drive. The main disadvantage lies in manipulating available software to match your computer's configuration. (Software is usually sold on 35 or 40-track disks, and unless you use MULTIDOS or DOSPLUS as your operating system, you won't be able to read these 35 and 40-track disks with an 80-track drive.)

"The $50 Japanese disk drive rumor is at least a year old and still going strong."

Fortunately, most of the problems are restricted to the use of an 80-track, double-density, dual-head drive as your computer's drive zero. If you use a special drive as drive zero, you can't use *any* protected software, or software that is supplied with its own special loader routine. Programs like Eliminator won't boot up on 80-track drives, and can't be read by most DOSes on the market, although you can use Kim Watt's Super Utility to read the 40-track disk in an 80-track drive and copy it to an 80-track disk in another drive.

Unless you're using MULTIDOS or DOSPLUS, which double-step 80-track drives to read 40-track disks, you won't be able to make a back-up of any 40-track disks. Even this won't work on all software (such as CP/M, Forth, and Pascal programs). In any case, before you buy software try to get it in 80-track format.

If this 80-track/40-track incompatibility doesn't matter to you, then the next consideration is how your special drives will be operated by your DOS. LDOS and DOSPLUS consider each 80-track, double-headed drive as one drive with a side A and a side B. This approach lets you have three disk drives attached to your computer (maximum), instead of just two where each side of the disk is treated as a separate drive. The line that would normally be used to select drive four is now used to select side A or B of the drive currently being accessed. In order for this to work properly, you must use a keyed cable, which uses missing teeth in each of its sockets to determine whether a drive is zero, one, two, three, or four.

Because a third drive position is available, you can put two 80-track, double-density, dual-headed drives in positions one and two, and a standard 40-track drive in position three. You can also remove your computer and disk-drive covers and reconfigure the system to have the 40-track as drive zero when you have to boot a non-standard DOS. To do this, I suggest you get DIP switches (Radio Shack has them), replace the DIP jumper blocks, and use the switches to determine the position of each drive on the cable.

The only way you'll be able to read your friend's disks is if you use MULTIDOS (which can read 40-track NEWDOS80 Model I disks in 80-track disk drives) as your operating system. Unfortunately, there's little compatibility amongst Model III DOSes. (MULTIDOS can read and back up Model I NEWDOS80 only if the directory is only two grans in length.)

Another factor affecting the ability of DOSPLUS and MULTIDOS to read 40-track disks in 80-track drives is the number of tracks per inch (tpi) of the drives. Most 40-track drives are rated at 48 tpi. Most 80-track drives are rated at 96 tpi. But some drives are rated at 100 tpi, which are sometimes sold as 77, 80, 96, or 100-track drives. These last drives cannot read 40-track disks because the tracks won't align properly. You might even have some problems reading 80-track disks created with another system's drives. Be careful about which 80-track drives you buy.

Despite the rumblings and rumors, I don't expect floppy-disk drive prices to change much in the next 12 months. Percom was able to lower their prices by about $50 due to an increase in sales. A more substantial drop would require a technological breakthrough in disk drive electronics. Drive motors and heads are already state-of-the-art and not likely to change. The only real change possible is in disk I/O electronics. Condensing this aspect down to a

chip or two could knock $100 or so off drive prices. I don't think much effort is being channeled in this direction.

The $50 Japanese disk drive rumor is at least a year old and still going strong. But so far nothing has come of it. The rumor's vitality is based on this: If disk drive prices are going to come down in a substantial manner, it will have to be the result of cheaper labor. It is likely that the Japanese will someday build the low-cost disk drive, but at this writing, there is no real indication that day will be soon.

I've read Bill Barden's Assembly language book several times, and have plowed through Assembly Language *by Hubert S. Howe, and I've read every article on the subject I can find. I think I understand the idea of it, but just precisely what am I supposed to key in?*

The programs always come in nicely arranged columns, but which number/letter codes do I actually type in? Do I separate them with colons? With semi-colons? Commas? I recognize that this should be done with an editor/assembler, but won't the machine talk to me without it? I'd be deliriously happy if I could get to PRINTA with machine-language instructions.

Also, how do I upgrade to 48K? I do my own tv and radio repair work and ought to be capable of plugging in 16 chips by myself! It's only naked fear *holding me back. Are 4119s the correct chips to get? 200 ns or 150 ns? Which of your advertisers supply known reliable materials? How do I make sure to plug them in right? I've asked Radio Shack for the TRS-80 repair manual without success.*

L.G.
Chappaqua, NY

First, you don't need an editor/assembler to write machine-language programs, but life will be easier if you use one. Most machine-language program listings look like the Program Listing. This is the output of Radio Shack's EDTASM, as printed by EDTASM after the successful assembly of the in-memory program. Column 1 lists the actual starting location in memory of each line of code. Column 2 lists the machine-code bytes stored in the location listed. Column 3 is the editor/assembler line number (much the same as line numbers in Basic programs). Column 4 is for the labels used in the program to define subroutines or specific locations for the transfer of program control. Columns 5 and 6 are the Assembly-language mnemonics used by the editor/assembler to define the instructions the program is to follow (similar to the keyword commands used in Basic). Not shown is a column 7, used for comments. In Basic, the REM and the apostrophe (') are used to tell Basic that all the information following that mark is for the programmer and is not to be used by the program itself. In editor/assemblers, the semicolon is used for this purpose.

```
402D                00100 FINISH    EQU     402DH
900E                00110           ORG     900EH
900E 211790         00120 CODE:     LD      HL,FAULT
9011 CD2A90         00130           CALL    PRINT
9014 C32D40         00140           JP      FINISH
9017 55             00150 FAULT:    DEFM    'Hi there friend.
9028 0D             00160           DEFB    0DH
9029 00             00170           DEFB    00H
902A 7E             00180 PRINT:    LD      A,(HL)
902B B7             00190           OR      A
902C C8             00200           RET     Z
902D E5             00210           PUSH    HL
902E CD3300         00220           CALL    33H
9031 E1             00230           POP     HL
9032 23             00240           INC     HL
9033 18F5           00250           JR      PRINT
900E                00260           END     CODE
```

Program Listing 1. Sample Machine-Language Program

With an editor/assembler, you type only the information following column 3 exactly as it's printed. Unlike Basic, you can't have more than one Assembly-language instruction per line. The first two columns can be ignored.

If, on the other hand, you don't have an editor/assembler, the job becomes more difficult. You could start from Level II Basic and use the POKE command to punch the machine-code instructions (column 2) into memory, storing the information in either program statements (as separate POKEs) or in data statements. The main difficulty with this approach is translating the hexadecimal numbers into decimal numbers. Using this method requires that the machine-language program be stored in a Basic program, which tends to waste space. It also makes it very difficult to write programs since any problems will most likely require turning the computer off and on to recover control of the computer to Basic, followed by reloading the Basic program and mentally translating the decimal numbers into something you can understand and debug.

Another way to get the instructions into memory is to use a machine-language monitor, such as Ultra-Mon, to punch the code where you want it. In fact, you should get a machine-language monitor anyway. If you do any of your own programming, you'll need it for debugging purposes.

Your second problem is no problem at all. You want to use 4116s—the 200 ns will do fine, the 150 ns even better. (Radio Shack uses 250 ns memory.) Their orientation is even simpler. If you examine the board beneath the 16 empty sockets, you'll see silk-screened outlines of the DIP packages. One end of each outline is marked with a notch. When you plug the memory chips in place, make sure that the end of the DIP with the notch lines up with the silk-screened notch on the circuit board.

As far as finding the technical manual for the Model III, you'll have to look around. Some stores, especially computer stores, stock the manual as a regular item. Others don't. I worked at a Radio Shack store, briefly, and can say that some items ordered from the Fort Worth warehouse never seem to arrive no matter how many times they are ordered. All you can do is continue to look. ■

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2. All entries must be submitted on magnetic media and be accompanied by double-spaced, typewritten documentation.
3. You may submit as many entries as you like, but each must be submitted separately. Only one prize per person.
4. Entries must be original and unpublished.
5. All winning programs become the property of *80 Micro*.
6. The category in which you will be judged will be determined by your age as of November 1, 1982. You must not have turned 19 by that date.

****

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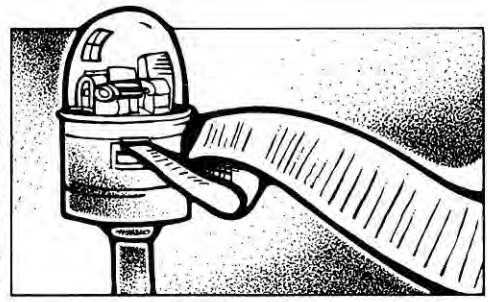
MONEY DOS

by J. M. Keynes



Avoiding stock-market hysteria

Run for your life, the sky is falling! So say the majority of the so-called soothsayers on Wall Street. They were bullish when the Dow Jones industrial averages were above 1,000. Now when the Dow is below 800 they realize that things are not exactly rosy. James Dines, the perpetual "gold bug" who extolled gold's virtues even when it hit $900 per ounce, has recently thrown in the sponge and told his subscribers (if there are any left) to sell at $300 per ounce. Howard Ruff suggested that you mortgage the farm to buy silver at $9 per ounce. (Those who did have already lost the farm.)

Every year thousands of investors pay millions of dollars to hundreds of self-proclaimed pied pipers of perspicacity for some super-secret information with which to work financial miracles. Forgive me for burdening you with logic, but does it make sense for ones so gifted to sell their talents for a paltry $100 to $500 per year? Why don't they invest their own money and quietly amass a fortune? Of course, it could be that they are just Good Samaritans with no interest in making a fortune.

In the closing days of every bear market, investors can't see the forest for the trees. They end up intellectualizing an obvious problem, even after the problem has begun to change its character. An almost inverse relationship exists between the tightening logic of pessimism and unrecognized cybernetic elements in the economy that have begun to eliminate the problem already.

At the end of the last bear market in December of 1974 gloom pervaded the country. At the critical turning point in late December the headlines dealt with the relationship of today (1974) with the crash of 1929. The masses had sold out, as they always do at market bottoms.

What can we learn from applying experience to the present? Again we see a large majority of investors, economists, advisors, and politicians mesmerized by the inevitability of high interest rates, parsimonious real growth, fears of depression, and further deterioration in the stock and bond market. The bottom line is this: The natural result of cyclical forces—that is, the automatic correctives that lean into any sustained excess—is creating almost the opposite set of outcomes from what most people are expecting. In December 1974 the Dow bottomed just below 600. Today, if one expresses the Dow in 1974 dollars, it is well below 600. In plain English it means that we are very near the *bottom* from which we shall see what I believe will be the most sustained advance in security values in history. As the Walrus said, "The time has come."

If you are interested in the stocks I favor for the coming years, call the toll-free MONEY DOS hotline on weekends (800-327-3389) or send your request c/o *80 Micro*. I'll send you my list and the rationale behind each recommended stock.

I can't leave without one hot tip. As this is written, DeBeers Consolidated (DBRSY), on the over-the-counter market, currently sells for about $3.12 per share. In 1980 it sold for $12.50 per share. They have a monopoly on the world diamond market as well as a multi-billion dollar portfolio of non-diamond investments. The dividend this year will be about 49 cents, which, after South Africa takes its 15 percent off the top, amounts to over 12 percent for you. "Hard money" investments (gold, silver, diamonds, and so on) are out of favor. I don't expect inflation to begin immediately, but sooner (if the liberals gain control of Congress this November) or later, it will. A fat dividend will make the waiting painless. ■

Here is the Keynes failsafe (?) stock-market program for today:

```
10 CLS
20 INPUT"TO DETERMINE IF YOU
   SHOULD BUY OR SELL, PRESS
   ENTER"
30 CLS: A=RND(2): IF A=1 THEN PRINT
   "BUY" ELSE GOTO 20
```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FUN HOUSE

THE LIGHTS FANTASTIC

Welcome back to the Fun House, a place for kids and adults who haven't forgotten what it was like to be a kid.

Walk down this dim hallway with me. See those glowing letters that read Point(X,Y) on that door? That's where we're headed. We're going to try four games that use Point(X,Y) commands to make the computer lights behave in interesting ways.

But first I want to help those of you who had trouble with last month's Fun House. In the Fun House program, you traveled through a maze in the dark and tried to find your way out. I promised last month that I would come in and find anyone who couldn't escape.

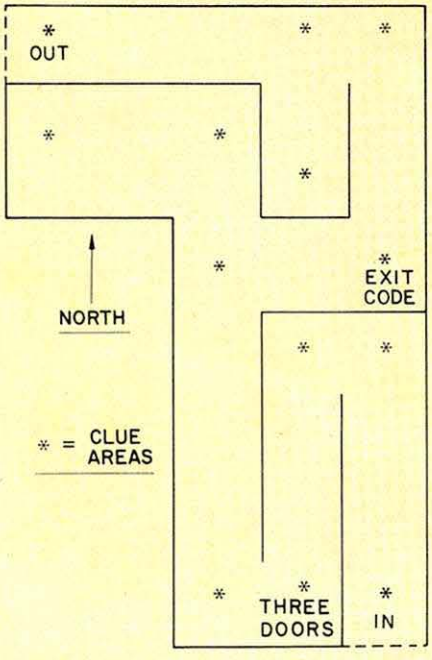

Figure 1. Floor plan for the Fun House.

Figure 1 is a Fun House floor plan; it shows where you go in and where you come out. All the places marked with an asterisk (*) are clue areas. You travel through the maze by pressing N for north, S for south, W for west and E for east.

The way through is obvious; however, there are two obstacles. In the area marked *three doors*, choosing the wrong door puts you back just inside the entrance. When you reach the area marked *exit code*, you have to remember the code. Why? Because when you reach the area marked *out* you must enter the code before you can escape.

Now that all the stragglers are back outside, let me explain last month's Motor Mouth program. In this program you were asked a series of addition problems. Not much time was given to answer, and to make matters worse, Motor Mouth kept interrupting. Then, suddenly, the computer tells the human to say aloud—not type—the name of a color. Then Motor Mouth guesses you said red.

If you tried this and said red, you're probably wondering how it was done.

It's a mind trick. Most people will say red if put in a tense situation; and that's what Motor Mouth does. If you didn't say red, you're unusual. I like unusual people.

On to Point(X,Y).

In the Fun House we don't care how the special effects work, only that they work correctly. Point(X,Y) is one of the most useful special effects to give movement to graphics and games using graphics. On the TRS-80, Point(X,Y) makes the lights dance, cluster, bounce, explode, lock in and other amazing things.

So let the games begin. There are four of them: Skeet, Stalactite, Automaze and Dodo Bird. They're written in Level II, and I've included a color version of Stalactite. Starting next month, the Color Computer will be given full support here in the Fun House.

SKEET

You might think I called this program Skeet because it's about the sport of shooting clay pigeons with a rifle, but you would be wrong.

The fellow in the picture is Skeet; his full name is Skeeter McVillain. When Skeet tries to take off in his airplane you fire the marshmallow rifle at the bottom of the screen by pressing any key except break or shift. If the marshmallow hits Skeet, he bails

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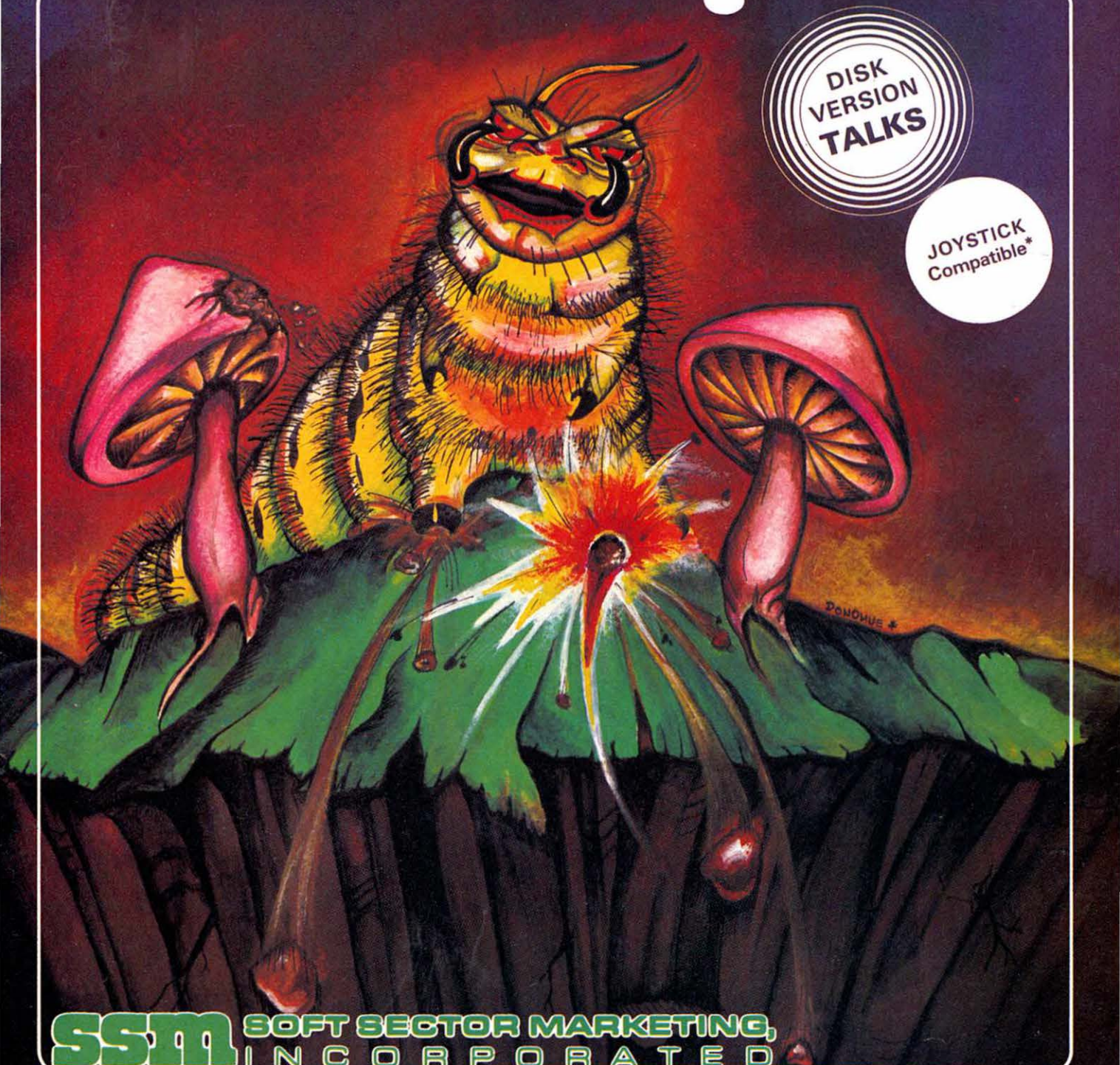
Caterpillar



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```
100 REM * SKEET *
110 CLS
120 PRINT @ 960,M;"HITS IN";N;"TRIES";
130 N=N+1
140 A$=CHR$(191)
150 B$=CHR$(128)
160 A=954
170 B=1018
180 PRINT @ A,A$;
190 PRINT @ B,B$;
200 FOR T=1 TO RND(200)
210 NEXT T
220 Y=30
230 X=RND(10)+80
240 Z=RND(0)
250 C$=INKEY$
260 SET(X,Y)
270 IF C$<>"" A=A-64: B=B-64
280 IF C$="" OR A<58 GOTO 330
290 PRINT @ A,A$;
300 PRINT @ B,B$;
310 IF POINT(X+1,Y)=-1 GOTO 390
320 IF POINT(X,Y+1)=-1 RESET(X,Y): X=X-2: GOTO 390
330 IF X=126 GOTO 460
340 RESET(X,Y)
350 X=X+1
360 Y=Y-Z
370 IF Y<0 GOTO 500
380 IF C$="" GOTO 250 ELSE GOTO 260
390 FOR Y=Y TO 47
400 SET(X,Y)
410 RESET(X,Y)
420 X=X-1
430 NEXT Y
440 M=M+1
450 GOTO 110
460 PRINT @ 0,"MISSED";
470 FOR T=1 TO 250
480 NEXT T
490 GOTO 110
500 PRINT @ 0, "OUT OF RANGE";
510 N=N-1
520 FOR T=1 TO 200
530 NEXT T
540 GOTO 110
550 END
```

Skeet

out. If not, try again. You have an unlimited supply of marshmallows.

STALACTITE

Oops, we've blundered into an underground cavern. I didn't plan to come here until next month, when we try an adventure program called Subterra.

Now we're here, the only way to escape is to build a stalactite and climb it. (A stalactite is an icicle-shaped cavern formation.)

I know stalactites don't really form as they do in this program, so we'll have to use magic.

Two people can play this game, though one can play alone. At the start, a player is asked to enter his or her initials. The bases for two stalactites are drawn at the top of the screen with players' initials above them. Then drops of stalactite material scurry across the screen to the right. When you press any key except break or shift, the drop shoots upward and sticks to whatever it hits (if it hits anything).

The winner is the player who builds his or her stalactite down to floor level.

The color version of this game works differently. One player builds with orange material, the

```
100 REM * STALACTITE - COLOR BASIC VERSION *
110 CLS
120 PRINT "ENTER INITIALS:"
130 FOR A=1 TO 2
140 PRINT "PLAYER";A;
150 INPUT A$(A)
160 NEXT A
170 CLS(0)
180 A=0
190 Y=7
200 FOR X=25 TO 35
210 SET(X,Y,8)
220 SET(X+20,Y,3)
230 NEXT X
240 PRINT @ 77,A$(1);" ";
250 PRINT @ 87,A$(2);" ";
260 Y=25
270 FOR X=0 TO 63
280 SET(X,Y,8)
290 NEXT X
300 A=A+1
310 IF A=1 THEN Z=8 ELSE Z=3
320 PRINT @ 0,"READY, ";
330 IF A=1 THEN PRINT A$(1);" ";
340 IF A=2 THEN PRINT A$(2);" ";: A=0
350 FOR T=1 TO 300
360 NEXT T
370 PRINT @ 0,STRING$(25," ");
380 Y=24
390 FOR X=0 TO 63
400 SET(X,Y,Z)
410 C$=INKEY$
420 RESET(X,Y)
430 IF C$<>"" GOTO 510
440 NEXT X
450 PRINT @ 439,"NAP TIME?";
460 C$=""
470 FOR T=1 TO 500
480 NEXT T
490 PRINT @ 439,STRING$(9," ");
500 GOTO 300
510 FOR Y=Y TO 1 STEP -1
520 SET(X,Y,Z)
530 IF Z=8 AND POINT(X,Y-1)=3 THEN RESET(X,Y): GOTO 590
540 IF Z=3 AND POINT(X,Y-1)=8 THEN RESET(X,Y): GOTO 590
550 IF POINT(X,Y-1)=Z GOTO 580
560 RESET(X,Y)
570 NEXT Y
580 IF Y=24 GOTO 600
590 GOTO 300
600 PRINT @ 0,"WINNER"
610 IF Z=8 THEN A=1 ELSE A=2
620 PRINT A$(A);
630 GOTO 600
```

Color Stalactite

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by Larry Ashmun

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CATERPILLAR

by Larry Ashmun

You are being attacked by a raging caterpillar. As he creeps down the valley, you must destroy it or be destroyed. If you escape from the first you will have only survived to fight another. Beware of the trained killer moth and tumblebugs. Another arcade simulation brought to you by Soft Sector Marketing, Inc.

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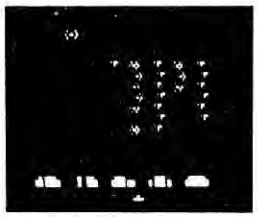

SUPER VADERS

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SKY SWEEP

by Mark Barlow

You are flying above an ever changing terrain. Missile after missile is launched at you from below, while you battle oncoming gun fire, only to enter an ominous cave where danger is tripled. Only skill will guide you through.

OUTHOUSE

by Factory Programming

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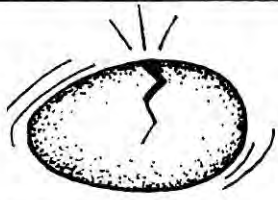

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```
100 REM * STALACTITE *
110 CLS
120 PRINT "ENTER INITIALS:"
130 FOR A=1 TO 2
140 PRINT "PLAYER";A;
150 INPUT A$(A)
160 NEXT A
170 CLS
180 A=0
190 Y=7
200 FOR X=80 TO 90
210 SET(X,Y)
220 SET(X+20,Y)
230 NEXT X
240 PRINT @ 104,A$(1);
250 PRINT @ 114,A$(2);
260 Y=21
270 FOR X=0 TO 126
280 SET(X,Y)
290 NEXT X
300 A=A+1
310 PRINT @ 0,"READY, ";
320 IF A=1 PRINT A$(1);
330 IF A=2 PRINT A$(2);: A=0
340 FOR T=1 TO 300
350 NEXT T
360 PRINT @ 0,STRING$(25," ");
370 Y=20
380 FOR X=0 TO 125
390 SET(X,Y)
400 C$=INKEY$
410 RESET(X,Y)
420 IF C$<>"" GOTO 490
430 NEXT X
440 PRINT @ 439,"NAP TIME?";
450 FOR T=1 TO 500
460 NEXT T
470 PRINT @ 439,STRING$(9," ");
480 GOTO 300
490 FOR Y=Y TO 1 STEP -1
500 SET(X,Y)
510 IF POINT(X,Y-1)=-1: GOTO 540
520 RESET(X,Y)
530 NEXT Y
540 IF Y=20 GOTO 560
550 GOTO 300
560 PRINT @ 0,"WINNER ";
570 IF X<91 PRINT A$(1); ELSE PRINT A$(2);
580 GOTO 560
590 END
```

Stalactite

other with blue material. The winner is the player whose color is built to floor level, no matter on which stalactite. This becomes a game of strategy because one player can change the color of sections of the other player's stalactite. You'll see what I mean when you play the game.

AUTOMAZE

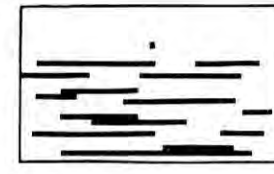
You are at the north end of a bare room. It seems easy to walk south and put your hand on the wall there. Trouble is, every step you take south or north causes a barrier to spring up somewhere ahead of you. This doesn't happen when you walk sideways, though.

Can you reach the south wall? Maybe you can in the early levels, but when you get to the fifth and highest level, the barriers get longer and longer.

To move within the room, press L for left, R for right, U for up and D for down. If the way is completely blocked ahead, press the asterisk (*) and try again at the same level.

Good luck!

```
100 REM * AUTOMAZE *
110 DEFSTR A
120 S=60
130 L=1
140 CLS
150 PRINT @ 340,"LEVEL";L
160 FOR T=1 TO 500
170 NEXT T
180 CLS
190 Y=0
200 FOR X=0 TO 127
210 SET(X,Y)
220 SET(X,Y+47)
230 NEXT X
240 X=0
250 FOR Y=0 TO 47
260 SET(X,Y)
270 SET(X+127,Y)
280 NEXT Y
290 X=60
300 Y=3
310 SET(X,Y)
320 A=INKEY$
330 IF A="*" GOTO 650
340 IF A="D" AND POINT(X,Y+1)<>-1 RESET(X,Y): Y=Y+1: GOSUB 400
350 IF A="U" AND POINT(X,Y-1)<>-1 RESET(X,Y): Y=Y-1: GOSUB 400
360 IF A="L" AND POINT(X-1,Y)<>-1 RESET(X,Y): X=X-1
370 IF A="R" AND POINT(X+1,Y)<>-1 RESET(X,Y): X=X+1
380 IF Y=46 GOTO 560
390 GOTO 310
400 SET(X,Y)
410 B=RND(47-Y)+Y
420 C=RND(2)
430 D=RND(S)
440 E=RND(126)
450 IF C=2 GOTO 510
460 FOR F=E TO E+D
470 SET(F,B)
480 IF POINT(F+1,B)=-1 RETURN
490 NEXT F
500 RETURN
510 FOR F=E TO E-D STEP -1
520 SET(F,B)
530 IF POINT(F-1,B)=-1 RETURN
540 NEXT F
550 RETURN
560 FOR C=1 TO 8
570 PRINT " WINNER ";
580 PRINT
590 PRINT "AT LEVEL";L
600 IF L=5 PRINT "YOU'VE MAXED THE COURSE!": END
610 S=S+10
620 L=L+1
630 INPUT "PRESS ENTER TO CONTINUE";X
640 GOTO 140
650 PRINT "NO WAY OUT, HUH? "
660 IF Q<Y Q=Y
670 PRINT "BEST AT LEVEL";L;":";Y
680 INPUT "PRESS ENTER TO CONTINUE AT SAME LEVEL";X
690 GOTO 140
700 END
```



Automaze

BUSINESS

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POSTMAN MASS MAILING SYSTEM

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For the serious businessman who has as little as 100 name mailing list or 200,000 names, THERE IS ONLY ONE SYSTEM FOR YOU!

FEATURES OF THE NEW POSTMAN MASS MAILING SYSTEM

The Postman system (version 2) is an almost COMPLETE rewrite, rethink, redesign of the original POSTMAN. The many features of the new POSTMAN system are quickly outlined below:

MULTI-DRIVE – True multi-drive operation is possible. POSTMAN will search all drives for address files and connect them together into one large file for the duration of that session. Once POSTMAN has found the data files on the disks, the operator "sees" just ONE CONTIGUOUS sorted list of addresses. The operator does not need to tell POSTMAN when to "switch" drives or manually "swap" sections of the data file in and out of the computer's memory. This is the foremost among the list of features because of its relative uniqueness among mail list handlers written for the TRS-80.

LARGE LIST SUPPORT – The multi-drive operation allows the user to access data files on ALL configured drives CONCURRENTLY (at the SAME time) for truly large mailing lists. Files need not be sectioned into smaller "byte size" chunks to fit into memory.

HARD DISK SUPPORT – (HARD DISK POSTMAN only) The FULL utilization of the space and speed of the new hard disk drives is possible with POSTMAN. For example, a 7.5 megabyte drive can be configured to hold almost 60,000 labels. Multiple hard drives can be accessed CONCURRENTLY allowing 200,000++ entry mailing lists.

FORM LETTER CAPABILITY – With the purchase of the separate POSTRITE program, the user is provided with an easy to use form letter generator which will merge a generalized letter produced from a word processing system (i.e. LAZY WRITER, etc.), with the name and address information from the POSTMAN MASS MAILER data base. POSTWRITER allows the user to insert any field from a POSTMAN label entry anywhere in the letter.

MENU OPERATION – As you would in a restaurant, choose your dinner from a list (or MENU), POSTMAN will allow you to direct its actions by selecting from various menus that it will display. A complete discussion of each menu is presented in the manual.

INSERT – New names can be quickly added to your list at any time. The new addresses are placed into the file in their proper sorted order eliminating the need for a separate sort operation after entering a stack of new names. POSTMAN will allow the operator to enter a "batch" of labels without returning to the control menu between each label insertion, thus speeding entry and reducing the aggravation of extra menu control keystrokes.

DELETE – Names can be removed at any time when they are no longer needed.

EDIT – Information in any name entry can be quickly changed at will with "word processor" ease. A "transparent" cursor simply is moved to the label displayed on the computer screen and corrections are just typed over the existing label. If you happen to change a field which is also used as a sort key, POSTMAN will automatically move the changed label to its correct position in the list to maintain the sorted arrangement of the labels.

OVERLAY – When identical changes are needed on many addresses, the OVERLAY feature can make them with one keystroke. The needed changes which are common to many labels are entered into the "overlay mask". When you wish to apply these common changes to any label, one command will do it.

SORT – Arrange your list in any alphabetic or numeric order. The ordering may use one or more fields to control the sort. A machine language heap sort assures fast execution. The sort need only be performed once, the sorted list will stay sorted through all subsequent insertions, deletions, and changes to existing labels. NO NEED to leave the POSTMAN program to use a separate program to sort your data. Your data is sorted quickly and after sort completion, POSTMAN is ready for your next command!

SPECIAL STREET ADDRESS SORT – For the user with many addresses on the same street, POSTMAN will sort your entries by the house NUMBER after grouping those on the same street together. Local city lists can be quickly sorted to aid post office dispatching.

PURGE – Unwanted duplicate addresses can be removed from your list automatically or under operator control.

SEARCH – Any address in your list can be quickly found with fast search and positioning commands. Three different types of searches are provided. A "fast" search which uses a hashing technique, a "selective sequential" search for labels with common fields, and "quick" positioning using the first or major sort field to get you into the general "ball park" of a label or sequence of labels.

LABEL PRINTING – One, a few or all addresses in your list can be printed on standard or non-standard label stock. Up to 6 labels across can be printed with a format YOU can easily control. TWO user definable 'ATTN' lines are provided for any use. Labels can be printed from many of POSTMAN's menus, search, edit, or during label insertion.

EFFICIENCY – POSTMAN is written in the machine's native language to gain the full advantage of the microcomputer's speed. Extensive use of program segmentation reduces the amount of use RAM needed to hold the program, allowing a greater number labels to be kept in core, resulting in faster operation. Little used routines need only be brought into memory when they are needed and once through with their task, release their space back to POSTMAN.

REPORT LISTINGS – A special program to produce columnar listings of address data from your label data base is provided. You can easily specify the information to be printed.

DATA DISK MERGING – Labels can be quickly transferred from one disk to another with the PSTMERGE program callable from the main POSTMAN SYSTEM menu. Source and destination drives needed not be separate drives, prompts to exchange diskettes if the same drive is used, are provided.

DATA DISK PREPARATION UTILITY – Provided with POSTMAN is the DPREP program which allows the user to prepare a floppy/hard disk for use with POSTMAN. This easy to use utility can be told to prepare any portion of the available space on a disk.

DATA INTEGRITY – All data transfers to the disk files are made using special write commands which instructs the operating system to check the validity of EACH write to the disk.

DATA GUARD® – is a special programming technique only offered by Soft Sector Marketing, Inc. If by chance your machine resets while writing information to the disk, you only lose the information that you were writing. Your files are always protected from the danger of losing all the work that you have put in that day. NO OTHER PROGRAM ON THE MARKET OFFERS THIS PROTECTION. If you reset with ANYBODY'S MAILING PACKAGE DURING WRITING you would destroy your ENTIRE data disk. We can't stop your machine from failing, but we can protect your data.

Description of Label Record Fields:

Length	Name	Description	Length	Name	Description
10	Code	User defined printable field	15	City	City, township, village
15	Last Name	Last name of addressee	5	State	State, province, territory
15	First Name	First name of addressee	9	Zip	Zip code, zone, route
26	Company	Name of company	2	Data 1	User definable field
26	Address	Street address	5	Data 2	User definable field

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The POSTMAN system requires Mod I or Mod III, 48K, 2 disk drives minimum.

Standard Version	Standard Version with POSTWRITER form letter writer	For DOSPLUS Hard Disk 4.0 Operating System
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DODO BIRD

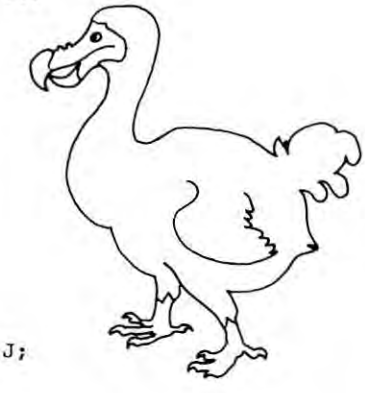
The dodo is an extinct bird; it faded because it wasn't very smart. Let's pretend the dodo isn't gone, that instead it reproduces on a grand scale.

Now, let's put you in a room where dodos are appearing all around you; you want to escape to any wall. To move, press N for north, W for west, S for south and E for east. If you come in contact with a dodo, the birds appear in a straight line blocking you from the wall. If you get blocked in two directions or twice in a row at the same place, you have to try again at the same level. Each time you complete a level, your ability to move is slowed while the dodos pop up at the same rate.

The level of difficulty increases with each level you complete.

I'm going to leave you here because I'm not much for exercise. One last topic: By blundering into the cavern where we found Stalactite, I blew next month's surprise. We're going adventuring. We hope to find a golden idol hidden somewhere in a series of underground passages and rooms.■

```
100 REM * DODO BIRDS *
110 DEFSTR B
120 H=80
130 I=39
140 J=1
150 CLS
160 PRINT @ 960,"LEVEL";J;
170 Y=0
180 M=0
190 FOR X=0 TO 82
200 SET(X,Y)
210 SET(X,Y+40)
220 NEXT X
230 X=0
240 FOR Y=0 TO 40
250 SET(X,Y)
260 SET(X+82,Y)
270 NEXT Y
280 X=41
290 Y=19
300 SET(X,Y)
310 FOR T=1 TO 300
320 NEXT T
330 B=INKEY$
340 FOR A=1 TO J
350 SET(RND(H),RND(I))
360 NEXT A
370 IF B="S" AND POINT(X,Y+1)<>-1 RESET(X,Y): Y=Y+1: GOTO 420
380 IF B="N" AND POINT(X,Y-1)<>-1 RESET(X,Y): Y=Y-1: GOTO 420
390 IF B="W" AND POINT(X-1,Y)<>-1 RESET(X,Y): X=X-1: GOTO 420
400 IF B="E" AND POINT(X+1,Y)<>-1 RESET(X,Y): X=X+1: GOTO 420
410 GOTO 430
420 SET(X,Y)
430 IF X=1 OR X=81 OR Y=1 OR Y=39 GOTO 630
440 IF POINT(X,Y-1)=-1 L=1: GOSUB 490
450 IF POINT(X,Y+1)=-1 L=2: GOSUB 490
460 IF POINT(X-1,Y)=-1 L=3: GOSUB 560
470 IF POINT(X+1,Y)=-1 L=4: GOSUB 560
480 GOTO 330
490 IF L=1 F=Y-1 ELSE F=Y+1
500 FOR G=0 TO 81
510 SET(G,F)
520 NEXT G
530 M=M+1
540 IF M=2 GOTO 690
550 RETURN
560 IF L=3 F=X-1 ELSE F=X+1
570 FOR G=0 TO 39
580 SET(F,G)
590 NEXT G
600 M=M+1
610 IF M=2 GOTO 690
620 RETURN
630 PRINT @ 960,"WINNER AT LEVEL";J;
640 FOR T=1 TO 1000
650 NEXT T
660 J=J+1
670 GOTO 150
680 CLS
690 PRINT @ 960,"THAT'S IT FOR THIS TRIAL. ";
700 PRINT "TRY AGAIN AT LEVEL";J;
710 FOR T=1 TO 750
720 NEXT T
730 GOTO 150
740 END
```



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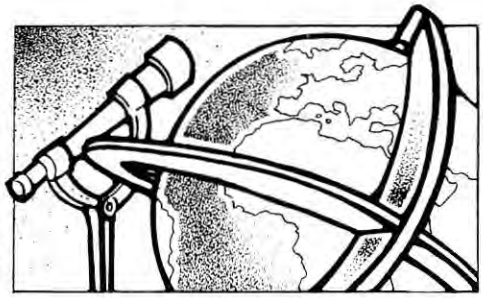
COPERNICA MATHEMATICA by Bruce Douglass



Statistical programming time-savers

This month let's look at a few math and science programs and books for the TRS-80 Models I and III.

First, Programs

Software Engineering Systems (3204 80th St., Lubbock, TX 79423) has produced two good programs. They cost $29 each, and run under Level II or Disk Basic.

The first program (Simulation System) allows you to simulate many phenomena on a micro without writing special application programs for each. The program solves differential or difference equations and allows you to plot the time-history of the dynamic system or send a listing of the history to the video or printer. This is the only commercial program that even approaches the problem of a general simulator of dynamic systems.

You can choose an Euler or 4th-order Runge-Kutta method for solving the system. You choose the step size, but it is not self-adjusting. You must enter the equations of your system in the program manually. This is clumsy, but every program that solves general equations for microcomputers uses it.

Now, you may be wondering about the difference between a system simulator and a garden-variety differential or difference equation solver. Essentially, there is very little; in fact, solving a single equation is a simple case of simulation. The general case, however, usually has several equations to be solved at the same time. One example given in the manual is an environmental energy flow problem involving plants, herbivores, carnivores, sediment, and environment and the amount of energy received by each.

The program works with initial value problems. An initial value problem is one in which the equations for the first order differential equations are known, and the values for the unknown functions are known at the start of the simulation. The program then calculates the state of the system at a later time. That is what is meant by the solution of the model—the state of the system is predicted for some future time on the basis of the behavior of the derivatives and the state of the system at the starting time. Many simulations are based on time-series models, or at least constitute initial value problems, so that the approach taken by this program is not greatly debilitating. Still, boundary value problems would be nice.

The plotting routines are so-so. The functions are plotted longitudinally. This means that the plots are not scaled for the screen, but keep scrolling. If you have a printer, this is not too bad, but it lessens the routines' usefulness.

The manual gives several examples, and explains the program's use fairly well. It also gives useful references.

The other program is called Mathematical Programming. By this procedure the value of some function can be optimized within a number of limiting constraints. This program actually contains three programs; one for linear programming, transportation problems, and network flow optimization problems.

The linear programming is done with the standard simplex algorithm. The algorithm gets its name since the solution falls within a convex hyperplane called a simplex in n-dimensional geometry. With this bit of hocus pocus, we can optimize functions within given constraints.

The transportation algorithm involves the movement of items from one set of origins to another set of destinations. The main concerns of transportation include cost and quantity, as well as capacity of the destination or other constraints. Again, this is an optimization problem.

Network flow problems are special cases of the linear programming problem. Network flow optimization involves optimizing flow of whatever you want to move along a network of nodes. The "out of kilter" algorithm used here concerns itself with flows in which flow at each node is conserved.

If you are unfamiliar with the technique, don't look to the manual for help. It primarily concerns itself with showing the program's operation and examples.

The program works, and, provided you understand the technique enough to know what the answer means, the program is inexpensive and a good buy.

I received three programs from Decision Science Software (865 Castle Ridge Road, Austin, TX 78746, (512) 327-1463).

Matrix-80, LP-80 and Future-80 sell for $39.95, $49.95, and $49.95, respectively. The programs come with well-reproduced, informative documentation.

Matrix-80 is a Basic program that allows the user to enter and manipulate matrices. Since they are dynamically dimensioned, you have a lot of flexibility in formatting their number and size. The program is visually attractive—a nice touch. You have commands available to manipulate the matrices including addition, multiplication, inversion, and transposition. You can access up to 26 matrices (depending on the size of the dimensions used). You may also choose single or double precision, allowing a further tradeoff between accuracy and memory utilization and speed. The program is well error-trapped.

LP-80 is another linear programming program. You may work with either single or double precision. The program is more user-friendly than SES's linear programming program. You may print or save your data, solve the system, change the step size used in the iteration process, and analyze the sensitivity of the optimized function. The program is also well error-trapped.

FUTURE is a statistical forecasting model program. Six statistical forecasting techniques are used, including arithmetic average, linear regression, seasonal averages, moving averages,

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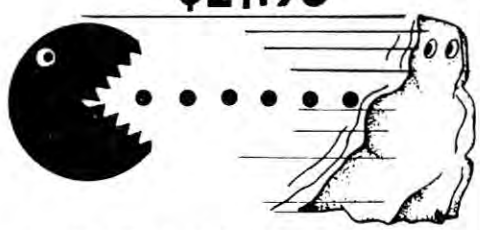

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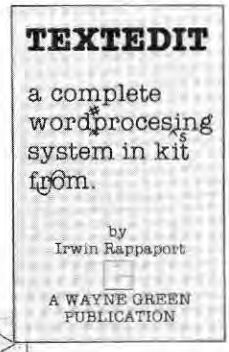

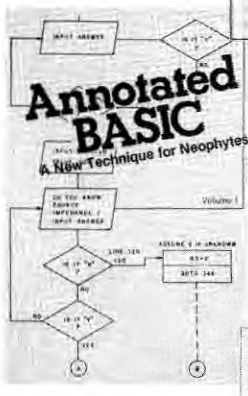

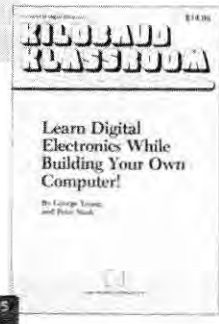

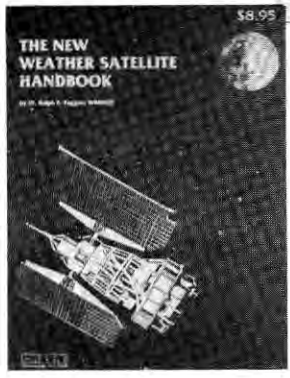

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exponential smoothing, and trend analysis. All these techniques are useful, and appropriate under various circumstances.

The user may enter up to 100 data points (time series information). The arithmetic average technique assumes that the data is normally distributed and tends toward the arithmetic mean of the data. This is a simple world view, but appropriate under many circumstances.

The next technique used is simple bivariate linear regression. It finds a line that best represents that data.

Seasonal analysis is well introduced in the manual. This technique is appropriate when the causal forces inducing the measured phenomena change periodically, from season to season. The method used in this seasonal analysis is a variation of the arithmetic mean approach: The mean for the season is used to predict behavior for future time intervals of that season.

Moving averages is a method of removing periodic fluctuations to reveal an overall trend in the time series data. Moving averages removes cyclical fluctuations of certain magnitudes, and may be thought of as a kind of data smoothing on inverse seasonal analysis.

Exponential smoothing also smooths data by removing unwanted fluctuations, but all past history is considered and the most recent history is treated as most important.

The trend analysis presents a forecast based upon an overall long-term trend containing seasons. Think of a sine wave superimposed over a line from the point (0,0) and rising at a 45-degree angle from the x-axis. Seasonal data variations are represented by the sine wave, and an overall trend by the upward 45 degree line.

These techniques are straightforward, and the program can produce good plots of the forecast. The program is well done and the results easy to understand.

Books

The *Basic Scientific Subroutines* series is written by Dynacomp's industrial scientist, F. R. Ruckdeschel. These excellent books include a large number of Microsoft and North Star Basic programs (commented and uncommented), and well-explained algorithms. Program disks are available from Dynacomp.

Basic Scientific Subroutines Volumes I and II cover a wide range of topics from elementary plotting routines (meant for line printers), complex numbers, vector and matrix operations, to least squares approximations, series approximations, roots of functions, and function optimization by steepest descent.

The books are $19.95 for Volume I and $23.95 for Volume II. Save yourself some programming and order these books—they are worth it!

Basic Programs for Scientists and Engineers by Alan Miller is another good book available from Sybex. Many routines are similar to their counterparts in the series mentioned above, but enough differences occur to warrant owning both this book and the books above.

Each chapter covers a topic, including vectors and matrices, simultaneous linear equations, polynomial curve-fitting, sorting, finding roots of equations, numerical integration, linearizing functions for curve fitting, and normal and other distributions.

This is one of the few references of this simplicity that discuss the Romberg algorithm for numerical integration. Various topics associated with the solution of simultaneous linear equations are discussed, including Gauss-Jordan method, Gauss-Seidel iterative method, and ill-conditioned matrices. The chapter on sorting is a good introduction to sorting and gives program listings for bubble, shell, and quick sorts.

Basic-Pack Statistics Programs for Small Computers was written by Dennie Van Tassel and is published by Prentice-Hall.

Little explanation of the methods is given with the 33 programs. Each program is presented with a purpose, computational method, discussion, instructions for running the program, examples, and the program listing.

The programs are all simple—no non-linear regression or confirmatory factor analysis here. These programs find the mean, standard deviations, and other descriptive statistics, sort and rank data, t-test, Mann-Whitney U-test, percentile rank for a t-test, chi-square, four different tests for independence, and four two-sample tests. Some statistical tables are also provided.

The book is of limited utility. The reader must understand the tests before using the programs.

Science and Engineering Programs, edited by John Heilborn and published by Osborne Books, is little more than a collection of program listings. Very little discussion of the programs is given, and then it is usually restricted to examples of program use.

This book presents some programs that are not to be found easily elsewhere, such as Lagrangian interpolation, non-linear regression, convolution and deconvolution, differential equations, structural analysis, thermodynamics and heat transfer. The chapter on eigenvalues and eigenvectors does not provide a program to compute all eigenvalues and eigenvectors for a general, non-symmetric matrix, but it does give all eigenvalues of a general matrix.

The main limitation of the book is the lack of tutorial information of the methods and lack of references. ■

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RELOAD 80

by Art Huston

Load 80 toasts third year

80 Micro will be 3 years old in January 1983, and we're celebrating with a special anniversary issue in addition to our regular January edition. This issue will be full of unique and exciting games, utilities, and tutorials. Surprise a friend, loved one, or just your computer with a very special Christmas gift.

A special Load 80 will be offered at our usual prices, $9.97 for cassette and $19.97 for disk. These programs are ready to load into Model I and IIIs and will save hours of typing. Owners of cassette-only systems must buy the cassette; disk owners can buy either.

What better way to please a computer nut than with a special *80 Micro* and an equally special Load 80 tape or disk? With luck he might find time to open the rest of his presents.

An Addition to A Utility Program

The August "RELOAD80" column began a discussion of Basic programs which POKE machine-language subroutines into memory. These programs require small modifications to work on systems with different amounts of memory and with or without disks. August's column described the changes needed to move the routine into the correct memory locations. September's column discussed how to tell the Basic interpreter where the routine is located. This month we will actually modify a program from the August 1982 Load 80.

First, let's consider an addition to the program published in September's RELOAD80 column. Option 5 of that utility program was "Add Bytes to Dec#." This option calculates where a routine should be located in memory by adding an offset to the existing locations—for example, a machine-language routine POKEd into locations 32000–32767 for 16K:

```
FOR X=32000 TO 32767:READ Y:POKE X,Y:NEXT
```

Option 5 could calculate the correct figures for 48K by simply adding 32K (32768) to the figures:

```
FOR X=64768 TO 65535:READ Y:POKE X-65536,Y:NEXT
```

This method works fine in cases where the routine is POKEd into high memory, but an occasional program POKEs a routine into a low area of memory not used by Level II. If you added an offset the routine would be POKEd into the wrong area of RAM.

The Program Listing adds Option 6, "Move Routine." It requests the starting and ending addresses of the machine-language routine and then asks if you want it moved to high memory for a 16, 32, or 48K machine. The results are printed as two decimal numbers.

Converting SUBCHOP2

The program SUBCHOP2 (August 1982, page 221) POKEs a routine into an area of RAM unused on a Model I, Level II machine. This area of RAM is used under Disk Basic and on the Model III. If you run SUBCHOP2 on one of these machines it will bomb and probably reset the machine.

The first thing to do is move the routine into the correct area of RAM. Examine the program listing to find the lines where the routine is POKEd in. This line will almost always be in the form:

```
FOR X= start address TO end address:READ Y:POKE X,Y: NEXT
```

You will find this form on line 70.

```
FOR A=16446 TO 16474:
READ D:POKEA,D:NEXT
```

Use Option 6 to calculate the correct figures for 16, 32 or 48K. (For 16K they will be 32739, 32767; for 32K 49123, 49151; for 48K 65507, 65535.)

Edit line 70 to reflect the correct amount of memory. For a 16K Model III line 70 would read:

```
FOR A=32739 TO 32767:
READ D:POKEA,D:NEXT
```

If you are converting this program to run with 32 or 48K you must change the POKEA,D to POKE A-65536,D. Remember that when POKEing over 32767 you must subtract 65536 from the address being POKEd.

When you set memory size you are declaring the first byte of protected high memory. For SUBCHOP2 you should set memory size at 32739, 49123 and 65507 for 16, 32 and 48K respectively.

The only thing that remains is to tell the Basic interpreter where the routine is

October Load 80 Directory

Program	Title	Page	Comments
1	COPYRGHT	—	None
2	QUIKCALC	114	None
3	BASICOMP	122	None
4	AUTOTRK2	203	None
5	MUSIC1	228	None
6	MUSIC2	228	None
7	SCRPTCH1/SRC	276	Needs EDTASM
8	SCRPTCH2/SRC	276	Needs EDTASM
9	CRYPTO	296	None
10	INVENTRY	342	None

The cassette version of INVENTRY will be used on the cassette, the disk version on the disk. Instructions for converting to disk or cassette will be in remark statements.

located. Because this program is meant to run in Cassette Basic, the memory address is POKEd into locations 16526 and 16527. This is done in line 70:

```
POKE 16527,64:POKE16526,62
```

The value in 16526 is the LSB, while the value in 16527 is the MSB. Remember that Memory Address = LSB + 256 * MSB. For the unmodified version of SUBCHOP2 this works out to 16446, the first byte of the routine.

If you have a cassette system you must find the correct LSB and MSB for your system's memory. Use Option 3, "Dec to LSB, MSB." Use the first address obtained from Option 6. For instance, if you have 16K you would input 32739 as the decimal number. The LSB and MSB would be printed as 227 and 127. Modify line 70 to read:

```
POKE 16527,127:POKE 16526,227
```

If you have disks you must use a DEFUSR = nnnn to point to the machine-language routine, where nnnn equals the first byte of the machine-language routine. For 16K it would be 32739, for 32K 49123, for 48K 65507. Since the values for 32 and 48K are above 32767 they would have to be expressed as nnnn–65536.

Charles Gillen, SUBCHOP2's author, uses the same method of storing machine language in all his programs. Martian Missile Attack (January 1982, page 265) and Space Chase (May 1982, page 292) are examples.

Disk to Cassette

A review of this year's *80 Micros* turned up a curious fact—there are no disk-based programs that use machine-language subroutines. Here is how to convert one.

First, move the routine into the correct area of memory for your machine. (Do this as described above and change the DEFUSR accordingly.) If you are using cassettes you must also change the DEFUSR statement to POKE 16526, LSB:POKE 16527,MSB.

Cautions and Limitations

Moving a machine-language routine into the correct area of RAM will not make all programs work correctly. For instance, if the machine-language routine is written for the Model I it might not function correctly on the Model III. This is the case for SUBCHOP2. After making the above changes the program will not crash on the Model III, but the machine-language sound routine will be silent.

Programs that use disk input/output will still not function on cassette. Programs that require 48K will still not run in 16K. Others may require that variables be changed to reflect the machine-language routine's new location. SLOTMACH (August 1982, page 222) is an example of this.

Some programs do not use high memory to store machine-language routines. CRAM (August 1982, page 234) uses AA$ in line 930. THRUASTR (August 1982, page 280) uses a remark in line 1. In cases like these there is no need to relocate the routine. If you were going to disk, however, you would add a DEFUSR statement. ■

```
20 PRINT"     1. Hex to Dec    2. Dec to Hex    3. Dec to LSB, M
SB
  4. LSB, MSB to Dec    5. Add Bytes to Dec#   6. Move routine
30 INPUT"CHOICE";A$:CH=VAL(A$):IFCH<1ORCH>6THEN30ELSEONCHGOSUB40
,60,80,90,110,121:GOTO20
121 REM ** Move to correct loc **
122 PRINT"FOR X=xxx TO yyy"
123 INPUT"  xxx";D1:IFD1<0THEND1=D1+65536
124 IFD1<0ORD1>65535THEN123ELSEINPUT"  yyy";D2:IFD2<0THEND2=D2+6
5536
125 IFD2<0ORD2>65535THEN124ELSEIFD2<D1THEN123
126 INPUT"  1. 16K   2. 32K   3. 48K";X:IFX<1ORX>3THEN126ELSEDE=
16383+X*16384
127 D1=DE-(D2-D1):D2=DE:DE=D1:GOSUB150:DE=D2:GOSUB150:RETURN
```

Program Listing

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Edited by Steven Frann

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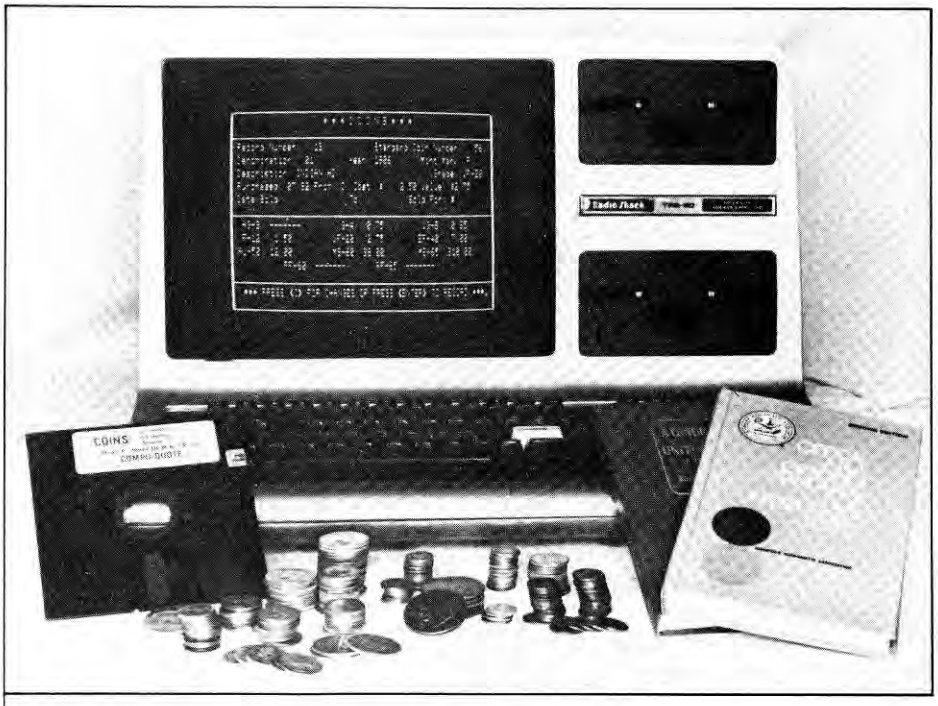

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Home Money Minder

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This product provides such reports

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Hurricane Tracking Program

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Better View a Zoo is an entertainment and education package for beginning readers, kindergarten, and early elementary-grade children. It is based on a story-poem about two children who encounter scary tigers, panthers, and snakes in the jungle. In-context learning activities deal with counting (up to nine), directions (up, down, left, right), and the alphabet. It also includes games like Tiger Hunt and a video game for young children, Around the Zoo.

This program is for use on a 32K Model I or III and comes on disk for $24.95. For more information contact Storybooks of the Future, P.O. Box 4447, Santa Clara, CA 95054.

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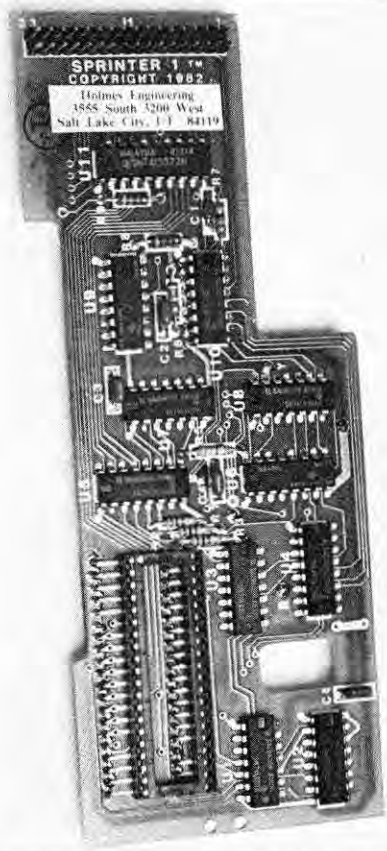

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Kitchen Sink and Sparrow Commander are arcade-type strategy games with sound. The background for both is an air kingdom under attack by eagles and sparrows. The defenders try desperately to protect their air castle home, while the sparrows follow a primal urge to reach their old nesting ground.

In Kitchen Sink you are the defender, trying to aim a variety of strange weapons (including the kitchen sink) at the invading sparrows. Sparrow Commander depicts the other side of the story.

Both programs are available on disk for $19.95 each for the Model I with 32K, and are Model III compatible. For more information contact Instant Software Inc., Peterborough, NH 03458, (603) 924-9471.

Reader Service ↙578

Church Management System

The Church Management System allows a church or similar organization to establish a data base for its members. It provides names and addresses for mailing labels, word processing for correspondence and sermon preparation, a member contribution record (including pledged and paid amounts), communion and Sunday school attendance records, and more.

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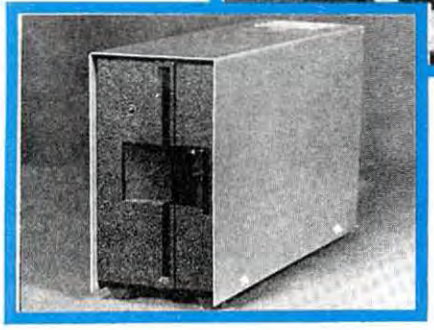

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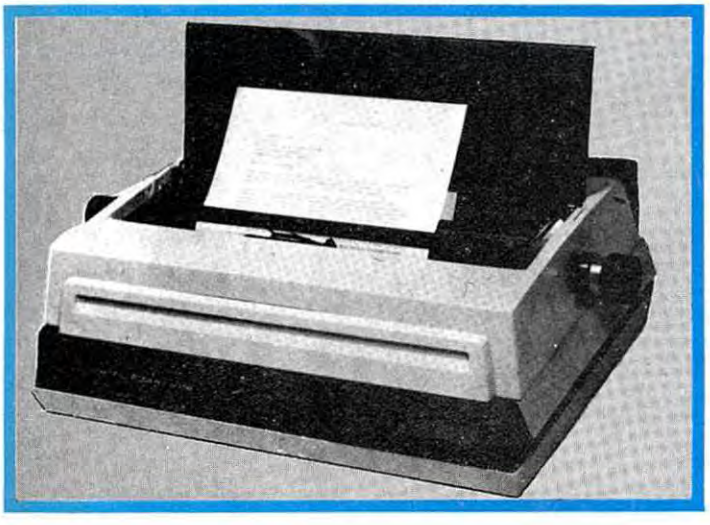

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met by a general ledger program which handles 200 accounts, a payables system with a check-writing option, and a special reporting module to produce budgeted versus actual operating information.

The complete package for a Model III with two disk drives and 48K is available for $500. For more information contact Simplified Software Systems, 118 Third Ave., N.W., Hickory, NC 28601.

Reader Service ✓579

TEST

TEST, a worksheet and test authoring program for the classroom teacher, is now available for the Model III disk system. TEST contains a maintenance program and a test and drill program.

The maintenance program allows you to create a test of up to 35 questions and save it on disk. Test and drill is a utility program which accepts the test prepared by the maintenance program. With the test and drill program students can either use the questions as a review, take a scored test, or the teacher can have the computer prepare a printed test or worksheet with an answer key.

Priced at $24.95 for a two-disk Model III system, it is available from TYC Software, 40 Stuyvesant Manor, Geneseo, NY 14454, (716) 243-3005.

Reader Service ✓577

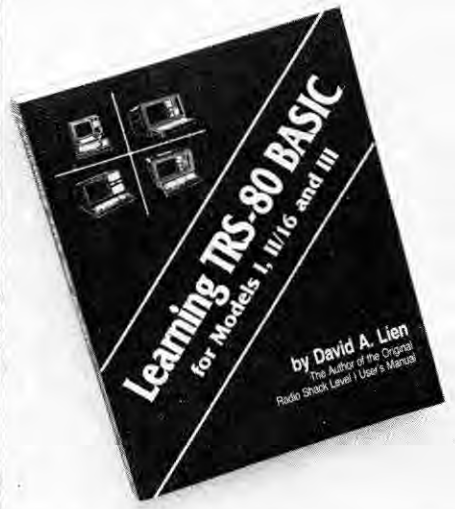
Subscription Management System

Publiphile is a microcomputer subscription management system designed specifically for small publishers. It provides subscriber mailing labels in a variety of formats plus other subscriber information such as separate billing addresses, purchase orders, credit card orders, "bill-me" orders, bad credit names, special offers and advance and multiple renewals.

The system runs on a Model II and allows on-screen verification of individual subscriber data and provides hard copy for circulation summaries, expiration counts, renewal analysis, cash receipts, bank deposits, accounts receivable, earned income and subscriber liability reports. It also has a unique report generator that allows creating customized reports.

The complete Publiphile Subscription Management System costs from $7,000–$20,000, including hardware and software that provide full-function word processing and input to such electronic publishing services as NewsNet. For more information contact WPL Associates Inc., 1105-F Spring St., Dept. 01, Silver Spring, MD 20910, (301) 589-8588.

Reader Service ✓575



Learning TRS-80 Basic

Learning TRS-80 Basic

Learning TRS-80 Basic combines the best of David Lien's earlier books (*User's Manual for Level I* and *Learning Level II*) and adds more. It is updated to include the Models I, II, III and 16. A question and answer section with most chapters tests your knowledge of new material.

Priced at $19.95, it is available from CompuSoft Publishing, 1050-E Pioneer Way, El Cajon, CA 92020, 1-800-854-6505.

Reader Service ✓554

Problem Solving in Math

Problem Solving in Math—Level 3 is a computer-assisted instructional program for students working at approximately the third-grade level in math or reading. The complete set of materials consists of 60 carefully sequenced lessons on the computer, a student book, and a teacher's manual. It is available in tape or disk versions for the Model III.

The price of Problem Solving In Math—Level 3 is $199. For more information contact Micro School Programs—Bertamax Inc., 101 Nickerson, Suite 202, Seattle, WA 98109, (206) 286-6249.

Reader Service ✓574

Power Ends CP/M Frustrations

Power is a menu program for the CP/M operating system which frees you from typing or mistyping file names. You need only select numbers from screen menus to perform normal CP/M housekeeping functions.

In addition to copying, typing, erasing and renaming files rapidly, Power gives you 45 other functions to reclaim erased files, test disks, fix bad disks, and move, display or change memory or actual information on your disks.

Fifty programs are combined in the Power software package for $149. For more information contact Computing!, 2519 Greenwich St., San Francisco, CA 94123.

Reader Service ✓581

Tax Master

The Tax Master Federal Income Tax Planning and Preparation System supports all of the lettered schedules and the most commonly used numbered forms. The system displays line-for-line images of the real IRS forms on the screen. These forms match the IRS versions in line numbering, item descriptions, and graphics. All you do is enter the raw data on each form; the computer performs all of the arithmetic and the cross-referencing of items between forms. All forms can be reviewed and recalculated as often as desired before final printing. The system also includes an integral text editor and numeric calculator to aid in entering data on the screen.

Tax Master is for use on the Models II and 16. It is priced at $1,300 with a $350 annual update fee after the first year, and is available from Impacc Associates, P.O. Box 93, Gwynedd Valley, PA 19437, (215) 699-7235.

Reader Service ✓580

Model III Terminal Program

SSSOFTRM/CMD V2.0 is a terminal program for the Model III. It fea-

DOES STRING COMPRESSION HAVE YOU TIED UP IN KNOTS?

LET TRASHMAN CLEAN UP THE MESS!

TRASHMAN is a machine language utility for the TRS-80 Models I and III. It was written by Glenn Tesler, the author of FASTER, and can reduce BASIC's string compression time by 95% (see table below).

WHAT'S STRING COMPRESSION?

When a BASIC program changes a string (words, names, descriptions), it moves it to a new place in memory, and leaves a hole in the old place. Eventually, all available memory gets used up and BASIC has to push the strings together to free up some space. This takes time. Lots of time. The computer stops running for seconds or minutes, and you may even think it's "crashed". The keyboard won't work, and until all the strings have been collected, you just have to sit and wait. Then things run for a while, until string compression is needed again. And again.

If you're using your computer for business, that wastes your money. If you're using it personally, it wastes your time.

WHAT'S THE SOLUTION?

As soon as you start using TRASHMAN, those delays almost disappear. It uses less than 600 bytes of memory, plus 2 bytes for each active string. It works with other machine language programs and with all major operating systems. It's easy to use, comes with complete instructions, and can be copied to your own disks.

WHAT'S THE CATCH?

If a BASIC program uses only a few strings, very little time is wasted in string compression, and TRASHMAN won't be helpful. But, if hundreds of strings, including large string arrays, are used, TRASHMAN is just what you need.

# STRINGS	SECONDS DELAY NORMAL	TRASHMAN	PERCENT IMPROVEMENT
250	11.8	0.7	94
500	45.8	1.6	96.5
1000	179.6	3.5	98
2000	713.2	7.8	98.9

(All timings done on TRS-80 Model I. Model III 15% faster, but pct. improvements identical. Listing of timing program available on request.)

Ask your software dealer for TRASHMAN, or order directly on our toll-free number. The price is just $39.95 (plus sales tax in California).

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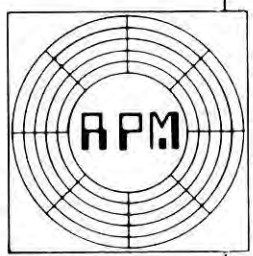

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tures automatic log-on with imbedded carriage returns; a modem-command buffer; uploading and downloading of both ASCII and CMD files; an internal binary-to-ASCII converter and ASCII-to-binary reconverter; spooler-type printer output; user-defined keys; and a local echo option for use in half-duplex operations.

The program is available on disk ($59.95) or tape ($54.95) with full documentation. For more information contact SSSOFT, P.O. Box 573, Memphis, TN 38101, (901) 767-8914.

Reader Service ✓566

Millionaire

Millionaire is a stock market simulation game. The game includes margin accounts, call and put options, stock and industry graphs, news reports, volume indicators, company histories, buy and sell transaction reports, and more.

Millionaire requires one disk drive and a 48K Model III system. It sells for $49.95. For more information contact Micro-Z Applications, 22704 Ventura Blvd., Suite 141, Woodland Hills, CA 91364, 800-835-2246, ext. 101.

Reader Service ✓564

Statistical Program

XTABS is a cross-tabulations program for the Models I and III. It provides the following statistics: chi-square, percentile rank of chi-square, G statistic, Phi, Cramer's V, contingency coefficient, and symmetric and asymmetric lambda. It also displays the frequency, percent of total, row, and column, and contribution to chi-square for each cell. It displays the output on the screen, formats it for professional looking hardcopy, or writes the results to a disk file to be merged with word-processor files.

XTABS sells for $49.95. For more information contact A-Priori Software, 1005 West Main, Vermillion, SD 57069, (605) 624-4214.

Reader Service ✓563

Code4

Code4 is an encryption program that protects sensitive programs or data, such as payroll files, from prying eyes. It encodes ASCII files with field lengths of 251 characters or less. Generally the file must not be longer than 13,056 bytes or 225 lines.

This program's 1.6×10^{19} keys make your encoded files undecipherable. The program also allows double encrypting your files. An easily modified random number generator lets you customize the program to your needs.

This menu-driven program features four modes: encode, decode, save decoded file and zero the file. It is for use on a 48K, two-disk Model I system. It is available on a single density TRSDOS 2.3 disk for $19.95 and comes with a source listing, BRun utility, and sample ASCII file. For more information contact HPB Vector, 130 Center St., East Stroudsburg, PA 18301.

Reader Service ✓557

TEXTEDIT

a complete word processing system in kit from.

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Build Your Own Word Processing System

Textedit teaches Model I and III owners how to convert their computer into an inexpensive, efficient word-processing system. As each unit of the program is developed the Basic programming techniques involved are explained so that the user learns while using the instructions.

The program is put together in modules and is easy to modify.

The price of the book and an accompanying disk holding the entire program is $9.97. For more information contact Wayne Green Books, Peterborough, NH 03458, (603) 924-9471.

Reader Service ✓576

Check Recording System

The Check Recording System keeps you up to date on the status of your checking account and aids you in reconciling bank statements. It also allows you to categorize all checks written into logical groups. It permanently stores check information on disk and produces reports from stored data.

This program runs on a 32K Model I or III. It comes on disk and includes user documentation. Priced at $29.95, it is available from Harrison and Harrison, 241 North Hills Drive, North Hills, WV 26101, (304) 424-5581.

Reader Service ✓559

Advanced Basic Editor

The Advanced Basic Editor (ABE) is for use with 32K Model I computers with a disk drive running under TRSDOS 2.3 or NEWDOS80 V2. It features a formatted screen on which listings of your programs are done page-by-page. A global search and replace feature allows you to change all or some occurrences of a word or phrase. This utility also copies lines from one part of a program to another.

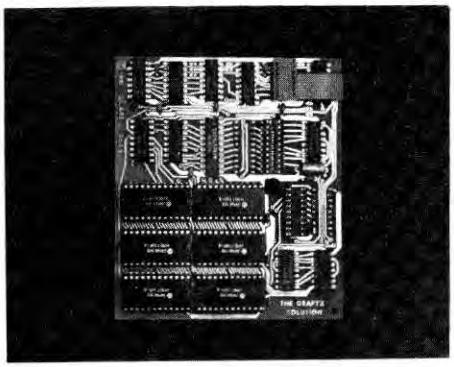
Priced at $19.95, ABE is available from Interpro, P.O. Box 4211, Manchester, NH 03108.

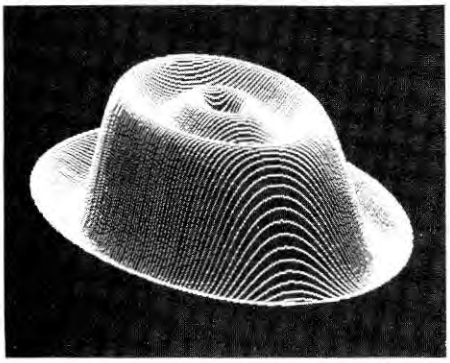
Reader Service ✓560

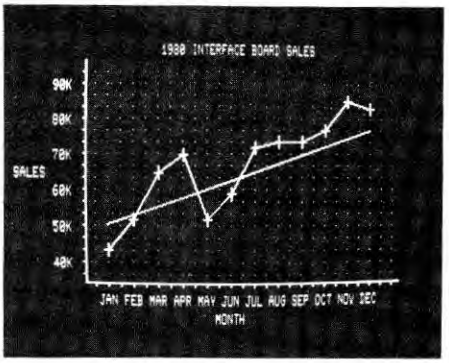
Ultra-Word

The Ultra-Word word processor offers full-screen editing, screen formatting, high-speed text-entry mode, line inserts/deletes, document merge, print from memory or document, up/down/left/right cursor movement, character delete key, character insert key, up to 999 key phrase retrievals, line erase, line-repeat function, block text move and copy, forward and backward tabbing, searches for existing words or phrases, and more.

This product runs on a 64K Model II under TRSDOS. Priced at $500, it is available from Microcon Digital







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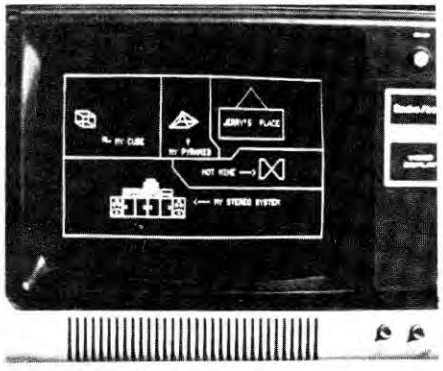

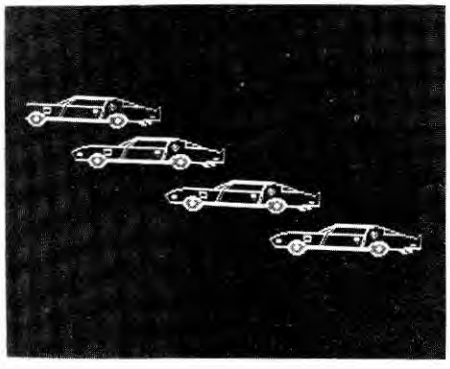

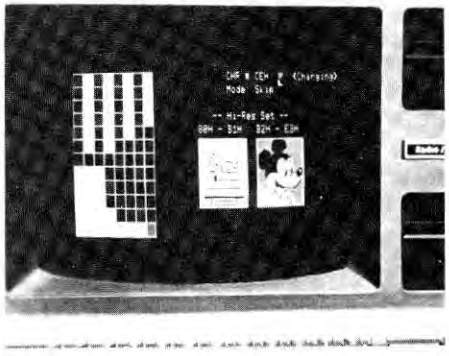

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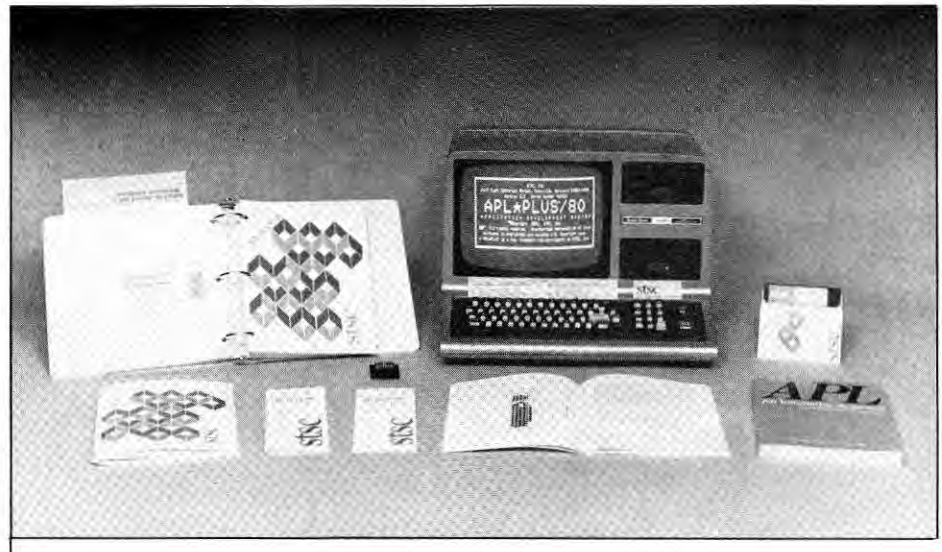

*APL*PLUS/80*

Systems Inc., 126 W. Walnut St., Kokomo, IN 46901, (317) 457-6623.

Reader Service ✓553

APL*PLUS/80

APL*PLUS/80 is a business application development system. It features formatting, exception handling (error trapping), the APL*PLUS Shared File System, all APL language primitive functions and operators, and system functions for space management in the workspace and for interface with non-APL programs. This product functions as a stand-alone processor or a communications terminal to a remote computer using either the APL or the regular ASCII character set.

APL*PLUS/80 runs under TRSDOS 1.3 or LDOS 5.1 on a 48K Model III with two disk drives. The system, including 1,110 pages of documentation, a custom APL-character ROM, and a self-adhesive label set, is priced at $295. For more information contact STSC Inc., 2115 East Jefferson St., Rockville, MD 20852.

Reader Service ✓558

Ultra-BizPac

Ultra-BizPac is a complete accounting and inventory control system for a small manufacturing business. It keeps a general ledger/journal of all daily business transactions along with accounts payable/receivable and payroll. The product's inventory control feature allows a manufacturer to control his raw material, in-process and finished-goods inventory through on-line batch processing of daily-inventory transactions. An alert feature monitors the inventory for maximum and minimum levels.

Ultra-BizPac consists of general ledger, accounts receivable, accounts payable, fixed assets accounting, mail list and payroll systems. It is written in CBasic2 and runs under CP/M version 2.2 on a 64K Model II. The system sells for $1,000 or $250 per module. For more information contact Microcon Digital Systems Inc., 126 W. Walnut St., Kokomo, IN 46901, (317) 457-6623.

Reader Service ✓552

Dataman

Dataman is a data manager for Model I and III users with no programming experience. Anyone can build a new file in minutes and print a sample format. The user must decide only the field names and lengths and the file name itself—the program does the rest.

Dataman allows multiple files on one data disk, unlimited backups, and uses the same System disk for accessing and maintaining all files. No data is stored on the System disk. Other features include automatic screen formatting, automatic subtotals and totals across and down the page, and automatic print formatting (including page numbering, title, date, and so on). You

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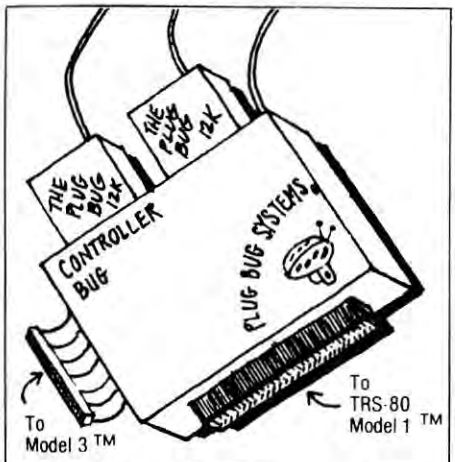

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THE IDEA

A Modularized REPROGRAMMABLE EPROM** memory system for user creation of up to 24K "burned" in BASIC or MACHINE LANGUAGE programs, instantly accessible without tapes or discs, for Model I and III. 48K options available. No soldering or EPROM handling: all units have their own power supplies!

THE SYSTEM

A CONTROLLER MODULE is plugged into the TRS 80* Individual "unburned" 12K or 6K EPROM memory packs are then plugged into the controller. Under direction of our system software, the user loads his target program and "burns" it into 1 or 2 packs, thus providing up to 24K storage. The CONTROLLER MODULE also provides the interface for transferring the "burned" programs or data into RAM avoiding tape and disc load errors! BASIC and MACHINE LANGUAGE programs/data can be called up by file name and start executing immediately. Disc and cassette functions still valid.

OR

Programs can be executed directly from a pack without the CONTROLLER MODULE by plugging them into the TRS 80* (Model I 16K, 32K) keyboard connector bus.

SYSTEM SUPPORT

Plug Bug RAM

6K static read/write memory for program development includes a write protect switch, thereby simulating EPROMs. Programs executed directly or accessed via CONTROLLER MODULE.

Software

PRBURN cassette system control program supervises burn, verify and filespec naming of programs. Can be transferred to disc.

Documentation

Complete, straightforward instructions. Machine language knowledge not required.

Burn Service

We provide a reprogramming service for your Plug Bug packs (non disclosure agreement provided).

PLUG BUG PACKS

6K (EPROM)	$84.95
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48K (EPROM SYSTEM)	INQUIRE
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CONTROLLER MODULE	$119.50
"BURN" SERVICE PACK	$14.95

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**Packs erasable with ultra-violet lamp.

✓377

may revise the default-print formats by a menu-driven formatter. You may also save a special format for later use. Dataman even lets you select as one of the menu options, the type of printer: Epson, Okidata or Radio Shack.

This product is supplied on disk without an operating system and requires 48K with two disk drives (double-density preferred). Priced at $49.95, it is available from A$string Systems, 1446 Hagen Lane, Rockledge, FL 32955, (305) 636-6913.

Reader Service ✓555

Medieval Magic

Medieval Magic

Medieval Magic is an adventure game for the Models I and III. Trapped in an ancient castle, you must uncover all its secrets, treasures, and tools in order to escape. Written as an introduction to the adventure format of game playing, Medieval Magic allows you to develop the logical, problem-solving approach necessary to become a master adventurer.

Medieval Magic is available on cassette for $13.95 and disk for $17.95. For more information contact The Liberty Software Company, 635 Independence Ave. S.E., Washington, DC 20003, (202) 544-6674.

Reader Service ✓583

XYZ Switchbox

Syzygy's RS-232 serial switchbox measures 7 by 10 by 3 inches and permits manual switching of a common port to any of three distribution ports. All components are solidly mounted on a 9 by 6 inch board. Four internally mounted 10-pole socket-mounted DIP switches allow each port to be separately configured for normal or null-modem use and can enable, disable and jumper lines 4,5,6,8 and 20. The versatile switching permits rapid configuration of the Syzygy XYZ serial switchbox for CRT terminals, LQ printers, and CPU ports. A CPU port may select any of three different printers or terminals, or three different CPU ports may select one printer or terminal, and so on. No batteries or external power is required and no wires are used.

This product sells for $185 and is available from Syzygy, 256 West San Bernardino Road, Covina, CA 91723, (213) 332-3320.

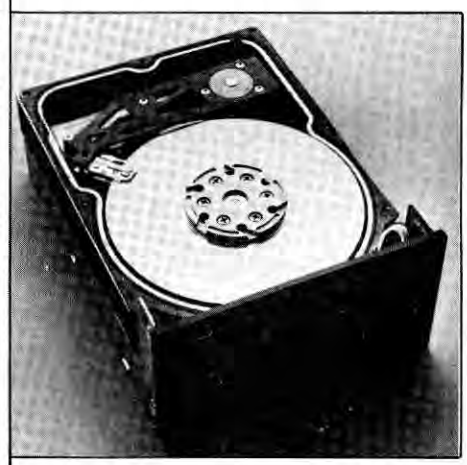
Reader Service ✓590

Griffin I

The Griffin I 5¼-inch Winchester disk drive combines 12.67 megabytes of capacity and an average access time of 35 milliseconds on only two platters. It offers a maximum access time of 55 milliseconds and 12.67MB unformatted capacity and 10.0 formatted capacity in a compact 3.25 by 5.75 by 8 inch package.

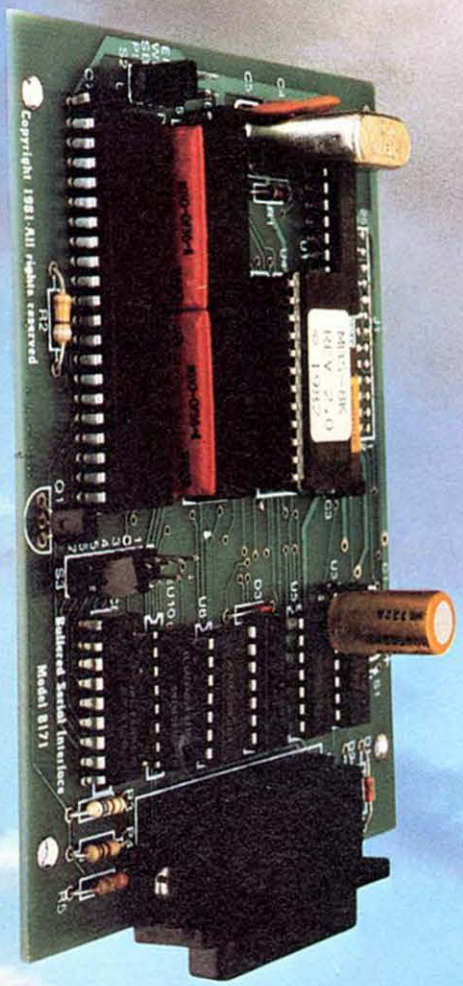
The Griffin I is priced at $1,675. For more information contact Micro Peripherals Inc., 9754 Deering Ave., Chatsworth, CA 91311, (213) 709-4202.

Reader Service ✓584



Griffin I

HOW TO USE YOUR EPSON WITHOUT WASTING COMPUTER TIME:



Your computer is capable of sending data at thousands of characters per second but the Epson can only print 80 characters per second.

This means your computer is forced to wait for the printer to finish one line before it can send the next. A waste of valuable time.

THE NEW MICROBUFFER™ ACCEPTS DATA AS FAST AS YOUR COMPUTER CAN SEND IT.

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PARALLEL OR SERIAL.

Microbuffer model MBP-16K is a Centronics-compatible parallel interface with 16,384 bytes of on-board RAM for data buffering.

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Either model fits the existing auxiliary interface connector inside the Epson MX-80, MX-80 F/T or MX-100 without modification, and is compatible with standard Epson cables and printer control software, including GRAFTRAX-80.

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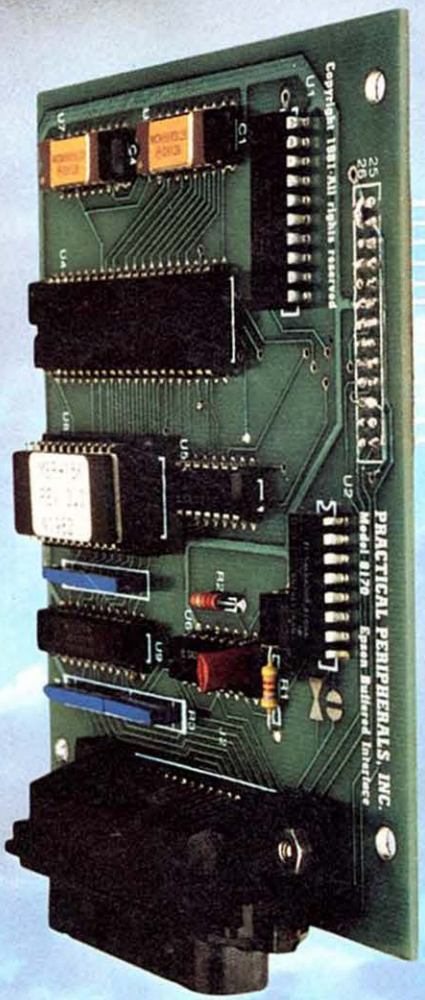
When you think how much time Microbuffer will save, can you afford *not* to have one? Call us for your nearest dealer.



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galaxy of features

A GALAXY of features makes the **LNW80** a remarkable computer. As you explore the **LNW80**, you will find the most complete, powerful, ready to run, feature-packed personal and business computer ever made into one compact solid unit.

MODEL I COMPATIBILITY – The **LNW80** is fully hardware and software compatible with the Model I. Select from a universe of hardware accessories and software – from VisiCalc® to space games, your **LNW80** will launch you into a new world of computing.

FULLY LOADED – A full payload includes an on-board single and double density disk controller for 5 ¼" and 8" single or double sided disk drives. RS232C communications port, cassette and parallel printer interfaces are standard features and ready to go. All memory is fully installed – 48K RAM, 16K graphics RAM and 12K ROM complete with Microsoft **BASIC.**

QUALITY CONSTRUCTION – Instrumentation quality construction sets **LNW80** computers apart from all the rest. Integrated into the sleek solid steel case of the **LNW80** is a professional 74-key expanded keyboard that includes a twelve key numeric keypad.

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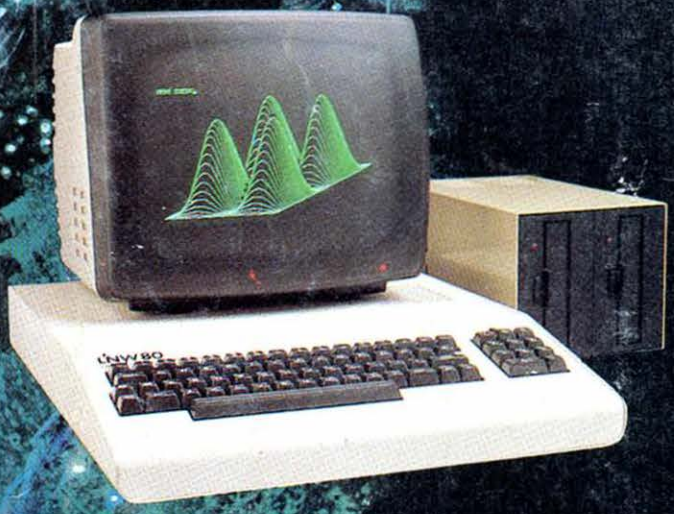

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