APRIL 1982
ISSUE NUMBER 44

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THE ORIGINAL MAGAZINE FOR TRS-80™* OWNERS

H&E COMPUTRONICS INC.

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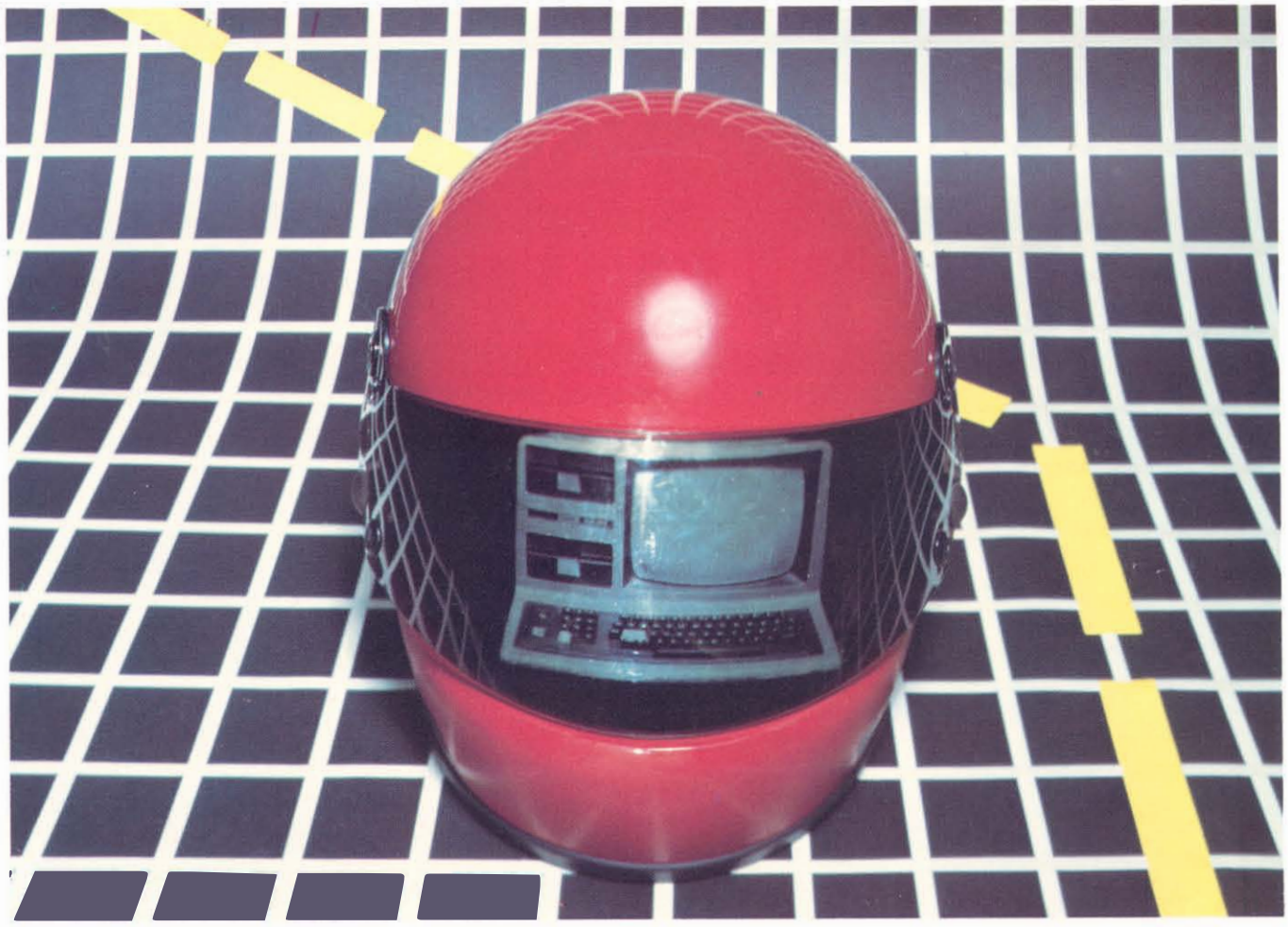

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BITS AND PIECES

Howard Y. Gosman

ON THE COVER: THE TRS-80 MEANS BUSINESS

The TRS-80 Means Business is the first book published just for TRS-80 MODEL II owners. The book is outstanding and an excellent introduction to the Model II computer. It is the first book to unscramble the use of the TRS-80 as a BUSINESS COMPUTER. Although written expressly for Model II owners, Model I and Model III owners interested in business applications will also benefit greatly from the book.

The TRS-80 Means Business is the first practical guide to small business computing that helps you and your TRS-80 really get down to business. What follows is a short review of **The TRS-80 Means Business** as described by the publisher:

"Here's the first introduction to computing with the best-selling TRS-80 Model II microcomputer that's geared specifically for business users. With **The TRS-80 Means Business,** you can turn your **Radio Shack Model II** microcomputer into an efficient business problem–solver. This crystal-clear guide explains what your new computer can and cannot do. And it covers the nuts-and-bolts aspects of business computing —from selecting the right system down to simple programming in easy-to-use Level III BASIC.

You'll discover a wide variety of useful TRS-80 applications you can put to work right away. Case studies show you exactly how programs are implemented in solving everyday business problems. Many ready-to-run subroutines help you transform your TRS-80 into a powerful 'filing cabinet'—for example, to store payroll or customer accounts. You also get outlined examples of business programs that you can develop into fully operational software

continued on page 6

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The purpose of the *H & E COMPUTRONICS MONTHLY NEWS MAGAZINE* is to provide and exchange information related to the care, use, and application of the TRS-80™ computer systems. H & E COMPUTRONICS, Inc. does not take any financial responsibility for errors in published materials. Users are advised to check and edit vital programs carefully.

The H & E COMPUTRONICS MONTHLY NEWS MAGAZINE encourages comments, questions, and suggestions. H & E COMPUTRONICS will pay contributors for articles and programs published in the magazine.

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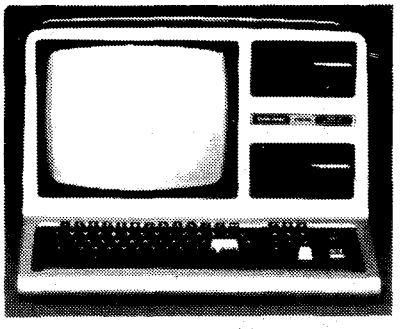

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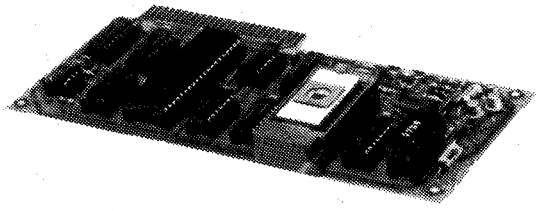

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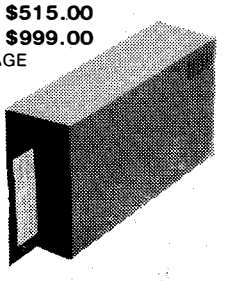

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	Poor	Fair	Good	Excellent
Performance	☐	☐	☐	☑
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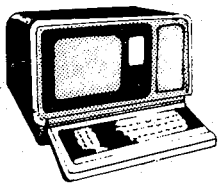

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THE CRYSTAL BALL

(News and Rumors of Interest to TRS-80™ Owners)

1. **Commodore International,** the manufacturer of the **PET Computer,** may soon be releasing one of the hottest computer items ever. Commodore plans to be the first personal computer manufacturer to come out with a computer that can **emulate** other computers. This is the first attempt by a major manufacturer to create a universal computer. No doubt, it will not be the last.

What is meant by a computer that can emulate other computers? Basically, it means that the computer will function exactly like the machine it is trying to copy. The scheme that is envisioned will be a computer that has a multi-position switch on the outside. One setting will read something like "Commodore Apple". Set the switch to this position and you will have an Apple "work-alike" computer. You will be able to run any software originally developed for the Apple in this position.

Now suppose that you want to run some TRS-80 programs on the computer. Just set the switch to "Commodore Tandy", and you have a TRS-80 "work-alike" computer. An IBM "work-alike" position is also planned for the computer, and no doubt other emulations are under consideration.

The main motivation for the development of such a machine is to allow access to the large software libraries that have been developed for the TRS-80, Apple, and other computers. The Commodore machine would have immediate access to the largest software library of all, because it would include several other machines' programs.

According to the *Wall Street Journal,* Commodore plans to introduce this new computer at a starting price of under $1,000. There will be two versions, one with a black and white display and one with a color display. Each machine will have an internal memory size of from 128K to 256K bytes. Shipments of this new machine are scheduled to begin in September, with product promotion beginning this Spring.

Is it really possible? Many experts believe that it can be done, but not for under $1,000 (or any place close to it). When you finish paying for all the options, you may wind up paying more than for any of the machines being emulated!

Emulation has long been a subject of concern in the large mainframe computer field, but never before with microcomputers. One of the amusing aspects of emulation is that sometimes the emulator is better than the machine it is emulating! In any event, the release of this new machine will certainly be a major event this year.

2. Several floppy disk manufacturers are working on new methods of encoding data that allow many times the storage capacity presently available on 5-inch diskettes. There already exist 40-track drives, 80-track drives, single and double density, and double-sided drives. A single double-sided double-density 80-track drive has storage capacity of over 700K bytes—equal to the entire storage capacity of a Model III TRS-80 with four drives, or almost double the capacity of a Model I.

The new drives will make these figures seem puny. All capacities will be measured in **megabytes**—millions of bytes! One manufacturer's system will allow 1.6 megabytes on a single diskette, and another is said to allow over 5 megabytes! But many problems remain to be worked out. The diskette quality will be critical. Handling and storage of diskettes will have to be done much more carefully than at present. While the diskettes will technically be removable, this will become a painstaking procedure, and diskettes will simply remain in the drives most of the time. Finally, the disk drives themselves must be introduced at a competitive price, because computer owners will also have hard disk drives available at very reasonable prices. Nevertheless, a major manufacturer of TRS-80 compatible disk drives promises to have a drive available by the end of the year with over one megabyte for under $1,000.

3. Future microcomputer owners may not be using floppy disks, however, because of two other attractive alternatives now being developed. One of these involves the **Sony Betamax** video cassette recorder being

continued on page 6

WHY IS THE ALPHA JOYSTICK SUCH A SUCCESS ?

Because of games like these.

THE LATEST BLAST FROM BIG FIVE...

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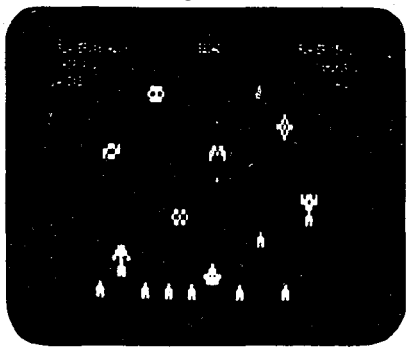

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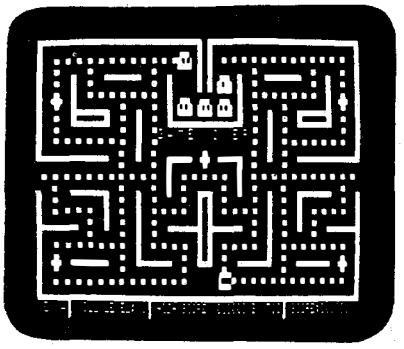

DEFENSE COMMAND

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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!

SCARFMAN

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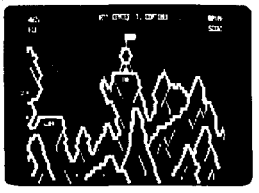
Asteroids float ominously around the screen. You must destroy the asteroids before they destroy you! (Big asteroids break into little ones.) Your ship will respond to thrust, rotate, hyperspace and fire. Watch out for that saucer with the laser! As reviewed in May 1981 Byte Magazine.



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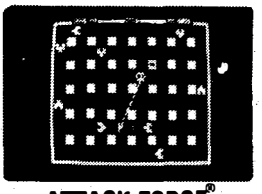

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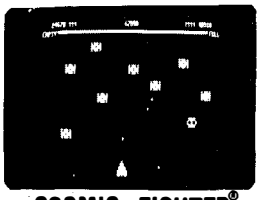

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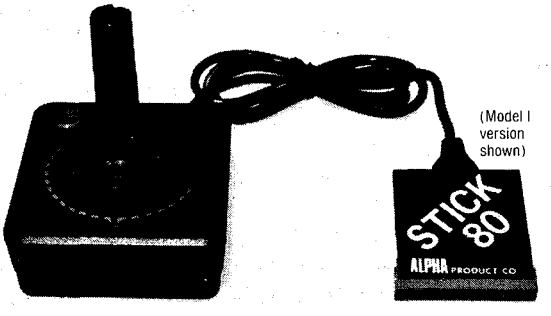

(Model I version shown)

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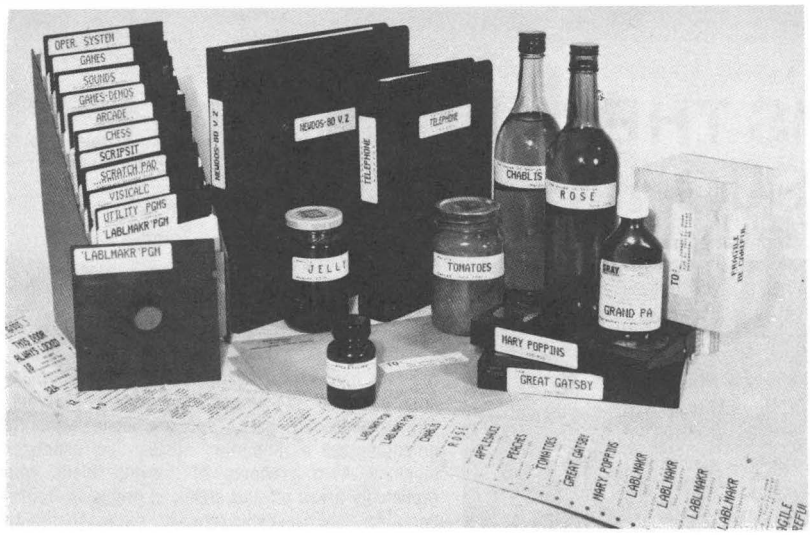

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hooked up as a storage device to the computer. Video cassette recorders of adequate quality for this purpose can now be purchased for between $700 and $1,200 retail. One video cassette tape can be encoded to hold over **5 megabytes**, and the data retrieval time is fast enough for this to be a reasonable competitor to floppy disks. The only disadvantage is that data can only be written or read sequentially, not in random access like floppy disks.

The other alternative involves the use of a **laser disk** similar to the RCA video disk. Here the storage capacities are truly staggering. One laser disk can contain over **227 megabytes** of data.

In order to keep costs down, one research firm is investigating the possibility of a read-only device employing commercially available video-type equipment. For example, you could buy a single laser disk that contained the entire series of *Scientific American* magazines ever published. The disk would come with a word-processor-type program that would let you have access to any page of any article in the set, which you could display on your screen or print on the printer or simply scroll through till you found something that interested you. Another potential application would be to have a single disk containing every software program ever published for the TRS-80.

Finally there will be a storage medium that allows more capacity that anybody really knows what to do with! Will it happen? One engineer has promised to have such a device by the end of the year. ■

continued from page 2

packages. Even the most difficult aspects of file structure programming are made easy.

With its straightforward explanations of 'computerese' and Basic programming concepts, this book lets you but the decision-making capacity of the TRS-80 to work for your business today."

The topics covered include:

WHO NEEDS A SMALL COMPUTER?
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THE COMPUTER AS FILING CABINET
INSTANT RETRIEVAL TECHNIQUES
THE LITTLE DATABASER
ANALYSIS OF SMALL-BUSINESS SYSTEMS
GETTING STARTED WITH MODEL-II BASIC

The TRS-80 Means Business will not teach the Model II owner how to program. It is meant as an introduction to BUSINESS COMPUTING. This book is basically an elementary introduction to *using* the TRS-80 in business. It is not a BASIC PROGRAMMING TUTORIAL. Those readers interested in actually learning to program their Model II would benefit by two other books published by John Wiley and Sons (TRS-80 BASIC and **MORE TRS-80 BASIC).**

But **The TRS-80 Means Business** has something that will also benefit every Model I, Model II, and Model III programmer out there. The book contains a chapter called INSTANT RETRIEVAL TECHNIQUES. In this chapter, the author discusses in detail HASH CODE FILE RETRIEVAL METHODS. For those of you who are not familiar with this technique, HASH CODING is a data storage technique that allows the programmer to instantly recover any file stored on a diskette instantly by any desired field. For example, if you store a name and address file on your diskette using hash code techniques, you can retrieve any particular name (or zip code) from the file instantly. ALL THIS IS DONE IN BASIC and without any machine language code at all.

The TRS-80 Means Business is brand new, published by John Wiley and Sons, Inc. and written by Ted G. Lewis. It is available through H & E COMPUTRONICS, INC. for $12.95 (plus P & H) and through local book stores and computer stores.

THE NEW RADIO SHACK TRS-80 POCKET COMPUTER MODEL PC-2

I hesitate to write too much about the new pocket computer, since all of this information is now available from your local computer store, but I can't hesitate to add my comments.

First, I should tell you that I am a little predisposed to pocket computing devices. Prior to purchase by first TRS-80, I had purchased the HEWLETT-

continued on page 8

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*TRS-80 is a product of Radio Shack, div. of the Tandy Corp.

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PACKARD HP-65 calculator ($750 at the time for about 1/4 of 1K or 250 bytes of memory). The HP-65 was the first programmable computing device ever available for under $1,000 (and probably under $5,000). Since that time, I have had the insatiable urge to purchase every new pocket computing device to come on the market. For those of you who remember the progression, there was the HP-55, HP-67, TI-59 followed by the HP41 (with many lesser devices in between). Next, RADIO SHACK came out with its first POCKET COMPUTER, which is actually the first pocket computing device to use BASIC. Of course, I ran out to get one. Now, RADIO SHACK has announced its new TRS-80 POCKET COMPUTER MODEL PC-2, and, of course, I have to get my hands on it.

Let's give credit where credit is due. In actuality, RADIO SHACK has nothing to do with either POCKET COMPUTER on the market. Both pocket computers and manufactured by SHARP. RADIO SHACK sells the SHARP POCKET COMPUTERS under the RADIO SHACK name. You can also purchase the exact same POCKET COMPUTER under the SHARP name.

I don't want to tell you too much about the new pocket computer since by the time you read this column, many of you will already have seen the ad from RADIO SHACK. I would like to summarize some of the outstanding features here (especially for the 7,500 readers of **COMPUTRONICS** living out of the U.S.A.).

The pocket computer sells for $279.95. Its enchanced BASIC (compared to the original pocket computer) contains 42 statements, 34 functions and 6 commands. It has many new string functions not previously available including 2-dimensional arrays. The display allows both upper and lower case characters. A built-in quartz clock is accesible from BASIC or from the keyboard and provides month, day, hour, minute and second. It comes with 2,640 Byte Memory. You can plug-in additional RAM or ROM to increase the memory size (up to 16K RAM, ROM or RAM/ROM combination). Additional 4K RAM sells for $69.95. The POCKET COMPUTER can be outfitted with a variety of peripherals including a printer /cassette interface.

AND EVEN MORE: THE RS-232 INTERFACE will allow users to transfer programs and information from the POCKET COMPUTER to any full size computer. The printer ($239.95) has outstanding FOUR COLOR GRAPHICS!.

MIKEEANGELO

MIKEEANGELO ($340) is the name of a new product that came across my desk recently. MIKEEANGELO, when installed in your TRS-80 will give you twelve times the normal amount of dots the Model I has and sixteen times the normal amount on the Model III. MIKEEANGELO also comes with complete reverse video. The installation of MIKEEANGELO effectively makes your TRS-80 Model I OR Model III into a high resolution graphics machine. MIKEEANGELO is easy to install. The complete system is built on two circuit boards. MIKEEANGELO comes with installation instructions, instructions on use, a machine language program for quick graphics, a BASIC DEMO PROGRAM, a BASIC driver program and helpful hints for using the system. MIKEEANGELO is not available through H & E COMPUTRONICS, INC. For more information contact MIKE ELECTRONICS CORPORATION, P.O. BOX 3813, Bellevue WA 98009 or call (206) 451-0574. VISA and MASTERCHARGE are accepted.

INCOME TAX TROUBLES

Anyone who ordered our heavily advertised INCOME TAX PAC C is aware that we were unable to supply the product. Here's the full story on the package.

As you know, H & E COMPUTRONICS, INC. has a 30-day money back guarantee on most of the software that we sell. Most of the products that we sell are obtained from a variety of vendors (including PERSONAL SOFTWARE, MICROSOFT, RACET COMPUTES, ETC.). In the case of INCOME TAX PAC C, the vendor that was to supply the package to us did not get it into our hands until January 3, 1982. Upon examining the package, our software committee decided that the package was not suitable enough to put into the hands of our customers. Therefore, we returned all of the packages and decided not to sell it. Fortunately, we were able to provide our customers with an alternative tax package from MICROMATIC PROGRAMMING called TAX/SAVER. This program was well done and did meet the needs of most of our customers.

It seems that this year almost all tax program vendors have dropped out of the market. There appear to be only two tax programs available for TRS-80 owners. The one from CONTRACT

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SERVICES sells for about $1,000 and is high above the price that we are able to market a tax package for (it is an excellent package). The TAX/SAVER from MICROMATIC PROGRAMMING sells for $119.95, and it was able to meet the needs of most of our customers.

CHEAP SHOTS AT RADIO SHACK

What follows is letter from William B. Herpin, Jr. of Colorado Springs CO.

Dear Mr. Gosman:

I didn't realize that "cheap shots" were necessary in your business. I refer to the comment in your "Bits and Pieces" column in the January 1982 issue of *Computronics*.

Have you ever stopped to think where you and *Computronics* would be if there were no Radio Shack? How many companies now survive on the TRS-80? It seems to me that you should remember the old adage, "Don't bite the hand that feeds you."

It is true that Radio Shack is not perfect. They were caught up in a storm larger than anyone expected. They suffered from the lack of microcomputer talent in the early days. Therefore, a lot of companies sprang up to service the growing TRS-80 market. Most of them prospered and cetainly we users benefited.

What other microcomputer manufacturer produces any monthly newsletter? Which one has such a network of dealers and service centers? How many software houses provide continuing support? How many manufacturers and software dealers have toll free HELP lines?

It is easy to sit back and criticize the management policies of RADIO SHACK (sour grapes?), but it is hard to argue with success. I would like to see you concentrate more on the positive aspects of this microcomputer explosion.

PUBLISHER'S REPLY

Mr. Herpin you are exactly correct. Please let me make some comments.

We are certainly grateful for the existence of RADIO SHACK. COMPUTRONICS runs its complete business on five MODEL-II TRS-80'S.

I personally own and have in my house a TRS-80 MODEL-III and COLOR COMPUTER. I have free access to an ATARI, IBM PERSONAL COMPUTER, PET and APPLE II computers (all available at COMPUTRONICS), but I choose the TRS-80s.

I am an expert in the microcomputer field. If COMPUTRONICS did not exist and I was faced with setting up a computer system for a small company, I would choose a RADIO SHACK computer every time.

Given a budget of $169 to $25,000 to buy computers for a small company, I would choose RADIO SHACK every time (the over $25,000 range is out of my field of expertise).

H & E COMPUTRONICS, INC. exists due to the help of five TRS-80 MODEL IIs, which help monitor our mailing lists, business records, invoices, inventory control and our payroll records.

I sincerely believe that at the current time, RADIO SHACK offers the best value in any computer under $25,000. I am very familiar with the PET, IBM PERSONAL COMPUTER, APPLE II and ATARI. I would choose the TRS-80 every time.

Any criticism that may appear in our magazine must be taken in the context of the above. Yes, we are sincerely greatful to RADIO SHACK, the services they provide and their spot in the microcomputer explosion. H & E COMPUTRONICS, INC. is one of the companies that grew as RADIO SHACK grew. We always tried to fill the void that RADIO SHACK missed. For example, COMPUTRONICS was able to provide our customers with lower case modification kits and word processors two years before RADIO SHACK came out with similar products. Our criticism at the time was that RADIO SHACK was neglecting the word processing market. RADIO SHACK does listen. Now they have both lower case characters and a word processor. (For those of you who don't remember the beginning, RADIO SHACK's original computer only used upper case characters.) Any criticism or comments that we make about RADIO SHACK or their management policies should be taken with all this in mind. H & E COMPUTRONICS, INC. is part of the microcomputer explosion. We certainly acknowledge that RADIO SHACK has grown and has worked hard to meet the needs of their customers. At COMPUTRONICS, we try to fill the void that RADIO SHACK is currently

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Spelling checking alone is not enough! No one else has anything like Grammatik! It analyzes your document for common typos, punctuation errors, misused phrases, and poor writing style. Grammatik is receiving rave reviews from both critics and users. Bob Louden in InfoWorld (12/7/81): "Grammatik is a surprisingly fast and easy tool for analyzing writing style and punctuation. If you are currently doing original writing on a word processor, you should consider this product." Eric Balkan in The Computer Consultant: "I'm impressed with the imagination that went into this product." A user: "Thanks for making my life easier!"

Grammatik and Proofreader are compatible with all CP/M, MS-DOS (including IBM PC), and TRS-80 word processors.
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Please specify your system configuration when ordering. Dealer inquiries invited.
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	Proofreader	Grammatik
CP/M, MS-DOS	$129.00	$149.00
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missing. After all, if RADIO SHACK had it all, there would be no need for COMPUTRONICS. On the other hand, RADIO SHACK watches companies such as COMPUTRONICS very carefully. They digest all of the information and ideas coming from COMPUTRONICS and similar companies. This helps RADIO SHACK to grow.

So, Mr. Herpin, I thank you for your letter. We won't hesitate to criticize RADIO SHACK in the future if we find something that we feel needs some change, but it all has to be taken in context. We do believe that RADIO SHACK offers the most cost effective computers available for under $25,000.

COLOR COMPUTER SOFTWARE FROM THE RAINBOW CONNECTION

The RAINBOW CONNECTION has announced the availability of several reasonably priced cassette programs including: BRICKOUT, WORD GUESS, STARFIGHTER-4, TIC-TAC-TOE, B-17 BOMBER, METRIC MAGIC, BIO-RHYTHM, MINEFIELD, BLACKJACK, MATH TUTOR, COMPUTRATION, CHUCK-A-LUCK, LUNAR LANDER, MATH DRILL, COMPUMIND, JACKPOT and a FOOTBALL FORECASTER. For more information, contact the RAINBOW CONNECTION directly, 3514 6th Place N.W., Rochester MN 55901 or call (507) 288-3555. ■

LETTERS TO THE EDITOR

Disagrees with Comments about Radio Shack

Regarding your comments titled "NEW PROBLEMS AT RADIO SHACK?" (January 1982 - issue 41), I disagree. The items you list in no way indicate to me that Radio Shack is running scared. Copyright laws exist to legitimately protect creative efforts. How fair is it for an ex-employee (or anyone else) to use copyrighted material for personal gain? The same holds true for hardware infrigements. RS is good enough to publish technical manuals for its machines, but that doesn't mean everyone should manufacture their own, using copyrighted material.

As far as agreements not to compete, the reported length of one year seems very lenient. Agreements not to compete for five years are quite common in many industries, most notably electronics.

And why do you knock them for wanting to spin off their computer operations? If you had a company that sold flashlight batteries and computers. would you manage both operations the same way? I hope not. Establishing computer centers was the first step, spin off is the next logical step. It's not an indication of running scared, but of steady and continued growth.

No one denies the existence of quality software and peripherals from non-RS sources. But no one supports what they sell better than Tandy. That includes everything from computers to flashlight batteries.

Finally, Radio Shack does indeed deny rumors. Who doesn't? What did your "Crystal Ball" ever report which Radio Shack denied and later produced?

Let's not lose objectivity in reporting. It could very well cause a loss of readership.

Robert P. Graham
2709 N. Sibley St.
Metarie, LA 70003

The publisher has also added some comments about this matter in this month's Bits and Pieces *column.*

Preventing Model I Crashes

Following up my letter printed in your November-December issue dealing with the Model I crashing, a later improvement was a stainless steel grounding rod just outside the wall of the office. This was plugged directly into a ground hole in the power socket into which the computer was plugged.

I agree with you wholeheartedly in your comments on the brush plating of the board terminals. I have had some discussions with technicians who are involved with this, and it is a general assumption that some sort of clamp that will ground all of the pins at once and serve as one of the terminals in the plating process will be necessary. Just how successful this will be in a ready filled board, working through the port in the case of the TRS-80, is another thing.

It would seem to this writer that RS could perform a well-needed service to its customers by making such plating available in their service centers, by a trained operator who could clean and plate the terminals properly and eliminate the possibility of an amateur goofing it up.

I should also note in passing that an offer for the Model I came along that I could not turn down, and a new Model III has taken its place. I have had no program crashes in a month's use of it, so apparently RS has solved our problem in the new configuration.

Bob Forman
The Forman Company, Inc.
Box 68
Monmouth, IL 61462-0068

Using a Teletype as a Printer

I hope this letter will help anyone among your readers who wants to try a used teletype as a printer with his or her TRS-80. Earlier this year, some answers you published seemed to be saying that one could have problems doing this. Well, maybe I was just LUCKY, but my only problem was finding a source for the hardware and software after I found a used TTY.

My TTY is a model 33KSR. It cost me $100, and I bought it from an individual after seeing it offered in a classified advertisement in a local newspaper. I had read somewhere that it was fairly easy to use one as a printer, but only after I bought it did I realize I had a problem. About two months after I bought it, I finally got my TRS-232 Interface from Small Systems Software, hooked it up, and have had absolutely no problems. The TRS-232 provides for a 20 MA current loop, and that means that to hook it up to my TRS-80, 2 wires are required and that's it. It will work with an expansion interface, the directions state, but I don't have one. My TRS-80 is 16K Level II and I don't have disk. Small System Software at one time advertised the TRS-232 in your magazine, but that was several years ago. However, they still sell it. The cost is now $59.95 + $2.00 for shipping. I got their phone number from the telephone company, but I never could get an answer when I called. So I wrote them, and a month later I received a few sheets of paper listing their products. I ordered a

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LOW PRICES: Standard MICROPROOF is available for $69.50 (TRS-80). Standard ELECTRIC WEBSTER is available for either $89.50 (TRS-80 Model I or III, Apple) or $149.50 (CP/M, TRS-80 Model II and all others). The optional correcting feature can be added at any time for an additional $60. Correction feature can be ordered with patch to integrate with your word processing software. For each patch, optional Grammatical Checking feature, or optional Hyphenation feature, add $35. (Integration patch not necessary for Wordstar.™)

SPEED is the single most important factor in a dictionary program. All dictionary programs will find your potential errors but if the program is too slow, you are not likely to use it. ELECTRIC WEBSTER's speed is outstanding. It can proofread a several page letter in 20 seconds.

ELECTRIC WEBSTER's FULL 50,000 WORD VOCABULARY saves you time and allows you greater confidence in the lists of potential errors that ELECTRIC WEBSTER identifies. The mini-dictionary programs, with their 10,000 and 20,000 word vocabularies, have many correctly spelled words omitted from their vocabularies. Consequently, they identify as potential "errors" many words that are actually spelled correctly; five to ten times as many such words as does ELECTRIC WEBSTER. So, when you use ELECTRIC WEBSTER, you will have far fewer extra words to evaluate, a major time savings. There will be less need to look up words in order to verify that they are in fact spelled correctly. The extra 30,000 words in ELECTRIC WEBSTER's vocabulary assures you confidence in the error lists that Electric Webster generates.

HERE'S WHAT THE REVIEWERS HAVE TO SAY ABOUT MICROPROOF:

"I have already found that the use of (MICROPROOF) has greatly enhanced the quality of my letters and reports. This is a very useful product and should be obtained by anyone who uses a word processor."

Michael Tannenbaum, CPA
80 Microcomputing, August 1981

"The summary review of this program? One word — Excellent. I highly recommend it for anyone using a word processor for any need — articles, manuals, reports, and even letters of substantial length."

A. A. Wicks - Program Previews
Computronics, September 1981

In a comparative review of proofreading programs (with smaller dictionaries), MICROPROOF was found to be considerably faster than all the others, when tested against a 400 word sample document.

Phillip Lemmons
BYTE Magazine, November 1981

"(MICROPROOF) operates with good speed and efficiency. A 1500 word document took 26 seconds to load, process, and proof when the program was run on a TRS-80 Model II under CP/M."

"Once the program is integrated, it is very friendly and any person able to use a word processing program can master it in moments."

Frank Derfler
Info-World, January 1982

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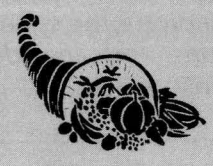

CORNUCOPIA SOFTWARE

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continued from page 10

"Formatter" package from them in addition to the interface, but have not found a need for it. The TRS-232 includes some software on cassette to drive the printer, and the hardware is deceptively simple. It's about 1"x2"x3". It has 2 female plugs, and you plug the male "aux" from the TRS-80 into either one. It has a female ribbon-cable plug and I bought a male plug and some ribbon cable from Radio Shack. Two of the wires from the ribbon cable go to the TTY. That's all you need, but I also bought 2 male "aux" plugs and connected them so that one goes to the "aux" jack on my cassette, the other to the unused female jack on the TRS-232. This way, you can use the recorder with the TTY hooked up, without having to unplug from the TRS-232 to the recorder.

You load the software, answer a few questions, and then run other programs, since the printer driver is poked into high memory and doesn't require much space.

As a matter of fact, you may have guessed that this letter was written using my TTY and the TRS-232 and your "word processor" or "text editor" program, for which I hereby thank you. It is slow, as your magazine said it would be, but I love the price.

If anyone needs any assistance with the TTY hook-up, they can write me with a stamped, self-addressed envelope. I'll try to help them, but I'm just an amateur.

R. H. Long
2106 Valleywood Drive
Carrollton, TX 75006

Errors in "Determinant Challenge"

My January issue just arrived today. I rekeyed everything in to check the programs in my article, and all seems to be fine!

There are, however, a few typos in the article, none of which really change anything, and all could really go "un-fixed" I guess. But, just for the record, here is what I caught:

1. page 32, 1st column, 5th line up from bottom, end of line, change: "equation." to: "equations."

2. page 32, 2nd column, 2nd line down from top, change: "prceeds" to: "proceeds."

3. page 32, 2nd column, 3rd line down from top, change: "XXsi" to: "Xi."

4. page 32, 2nd column, 4th line down from top, change: "linea" to: "linear."

5. page 36, 1st column, 16th line down from top, change: "equations and does get too big . . . " to: "equations and D does get too big . . . "

6. page 36, 2nd column, 6th line following the end of the program segment at the top of the column, change: ". . . and generate the equation and then . . . " to: " . . . and generate the equations and then . . . ".

7. page 37, 2nd column, in the table, 4th row of data, change: "33" to: "133."

Hope the readers like it, have fun with it, find it useful, etc.!

Other random thoughts:

- new covers and layout . . . nice!
- I've written quite a few articles for some of the other journals, etc. including Green's "Encyclopedia", "80-micro . . . " etc. and while they've got you beat by several lengths on pay, I'm not so sure that the extra cash has compensated for the other problems. For example, you quickly learn that for those magazines Green is the only one that can be other than dead serious! Any attempts at anything half-way humorous, are immediately edited out. Also, I have sort of come to the conclusion that they've surrounded themselves with a bunch of young copy editors, at low pay, and put them all into what must be a zoo to work in, and they all seem they HAVE to make massive changes to everything submitted. Now I'm not the world's greatest writer by a long shot, but I do have 9 college texts to my credit, with #10 in the works, and I've dealt with a few publishing folks before. For me, writing books and articles, etc. is fun. Teaching my classes is fun. (Its the &%$# meetings, paper grading, and that sort of stuff that I take my salary for doing!) Anyway, the bottom line, is that I think there is a lot to be said for working up an article in a way that you think people will enjoy and profit from, and then seeing it printed in just about the way you wrote it! I sure appreciate that, and I'll bet your other authors do too, even if they've not said so. Just thought you'd like to know!

C. Brian Honess
22 Shaftesbury Lane
Columbia, SAC 29209

Bug in SCRIPSIT

On two occasions while using the Model III SCRIPSIT program with my Model III, I bombed all of the buffer while editing. A careful check to see what I had done to make it bomb disclosed that when the control key and the "T" key are depressed at the same time, the machine goes back to "cass?".

Thinking that something must be wrong with the particular tape that I had, I called Computer Customer Services in Ft. Worth and explained my problem. I stated that I felt that the program should be "idiot proof", so that even I could not bomb it. However, I was told that "the computer knew something that no one else did. It would lock up or do crazy things when these two keys were depressed at the same time, and they could not correct it." The only suggestion they had was to "be very careful".

This, to me, is a rather unsatisfactory answer. Just do not think that this machine is smart enough to fool everyone. Felt that you would have the answer as to what could be done to make this program really "idiot proof".

Thank you for any help you may be able to give me. A self addressed stamped envelope is enclosed.

F. G. Taylor
Rt. 6, 304 Government Street
Gulfport, MS 39503

We don't have a fix for this, but if we print your letter maybe someone who does have one will let us know.

Warning

I have been a subscriber to your fine magazine for over a year and have read avidly all letters to the editor, especially from people who have warned against purchasing products. Unfortunately, I ordered and paid for a printer, "BYTEWRITER-I" from MICROTEK, INC. of 9514 Chesapeake Road., San Diego, CA. 92123 back in September 1981. I have subsequently received an order confirmation and

continued on page 14

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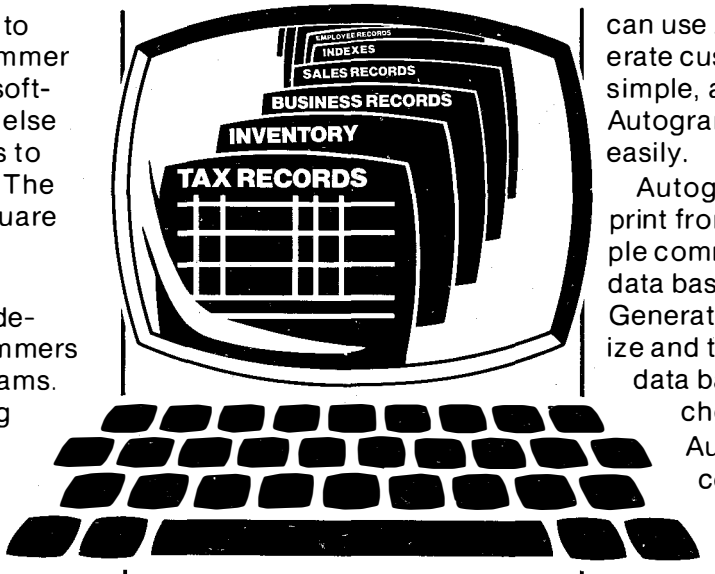

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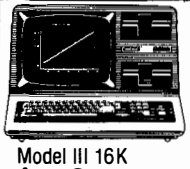
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continued from page 12

written two letters inquiring as to the status of the printer. To date I have not received a reply from MICROTEK. I am stationed overseas, and cannot easily walk down to visit this company. Being somewhat at the mercy of the mail system, I would like to warn potential mail order buyers of this printer that they most likely will face a similar demise.

I would greatly appreciate any action which could lawfully pursue on my behalf. I am enclosing a copy of the order confirmation and my letters to MICROTEK. You may publish this letter if you so desire.

I am currenlty working on a very realistic Boeing 747 aircraft simulator and very complex Dungeon & Dragons type game. The use of a printer would be unmeasurable in speeding up my progress on both of these programs.

Keep up the fine work, and may my next letter be written using your excellent text writing program.

Geoffrey M. McLean
Comnavsurfgru Westpac
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Praise for Computronics

As a newcomer to the world of computers I want to take this opportunity to tell you how much help you have already been. At 70 I do have to learn fast. And I find that people who are really interested are willing to share the things they have learned.

I do not agree with Mr. Greffe (see *Letters to the Editor,* November-December 1981 issue), but then may be he doesn't feel he is getting his money's worth. I do, so enclosed find my check for 2 years of Business Computing.

And in closing let me tell you how I manage keeping tabs on my correspondence. As you can see I'm using Scripsit. I listened to all the advice about keeping 2 copies of everything. So I write protect the Scripsit disk. Then start with two formatted disks. First, I opened a 30 line file filled with blanks (copy enclosed) on both disks. Also another idea that I thought of myself. I set up a header that supports my letter format and save under DIR list as HEAD. When this letter is finished the way I want it I will save it on both disks then get the list and enter it on both disks.

Hope you can forgive a 70 year young man for being so long-winded.

Seymour E. Long
Flowers for Charity, Inc.
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PROGRAM PREVIEWS

A. A. Wicks

This Month: REFWARE THESAURUS

Having been associated with computers in some form or another for more years than I care to recall, I feel somewhat blasé regarding their vast capabilities. But with the advent of the microcomputer industry and the applications developed for this equipment in the personal and business world, I am continually and delightfully surprised at some of the unusual programs that are being created for their user's needs.

As a writer and a person interested in lexicography, I was quite intrigued when I received a new program called the REFWARE THESAURUS. This program is produced by the REFWARE Reference Software Division of David C. Whitney Associates, Inc. The program receives credence from the fact that David C. Whitney has been editor-in-chief of the World Book Encyclopedia, Encyclopedian Americana, and the Reader's Digest Almanac. Release information on the program does not state that he actually wrote the program, but that he developed it, which would indicate it has certainly benefitted from his background, in any event.

We all probably know what a thesaurus is, and probably the best-known publication of this nature is the one originally written by the English physician, Peter Roget in 1852. That document was more in the form of a dictionary or encyclopedia, but later editions become more limited in being a large collection, or "treasury" (which we received from the Latin source word "thesaurus"), of synonyms and words associated with one another.

How does all this fit into the program we are about to review, and how may it be useful to you? First of all, it will be of little value to you if you are not using words in your business, trade or profession, where they are extremely important to your documentation. For instance (although this is not restrictive), if you are an Accountant and your work is income tax returns, you may not even have a book copy of a thesaurus on your desk. But if you are a college professor, doctor, executive, journalist, writer, etc., you are undoubtedly interested in producing intelligent and cohesive reports and other writings. And you have also probably wracked your mind for a "better" word than the one that first came to mind. So the needful writers probably far outstrip the casual or disinterested ones. Now that we have disclosed some of the potential users, let's get into the program description and operation.

The REFWARE series comprises three programs on separate disks—"NOUNS," "ADJ" (for adjectives), and "BUILDER." The first two operate similarly, and will be discussed presently. BUILDER, the largest and most extensive of the three (and the most expensive), contains no words within its own file; its prime purpose is to enable the user to create a thesaurus containing specialized words of trades or professions, frequently misspelled words that bother the user, or any words that are associated with one another and which the user may wish to have available for recall at any time.

Commencing with BUILDER, the program dialog is offered in a series of screen frames that either direct the user to perform certain actions, or provide information. Various subprograms within BUILDER facilitate these functions. For instance, "Prepare" allows you to enter groups of synonyms for your future use, and saves these words in a random access file. In a similar way, "Alphfile" permits the making of alphabetical files of the words you have included. There are many others, allowing complete freedom of access, change, addition and deletion, etc. Choice is by menu selection.

Where do the words come from that you wish to have filed? The choice is yours—perhaps you may wish to use a printed thesaurus as your base source. However, if you are using REFWARE's THESAURUS, you will probably be in a business or profession wherein the words you use are not readily available in a standard thesaurus. Therefore, as a specialist, you will create files for your future needs. As an example in the manual suggests, a medically oriented individual might enter a selection of words such as: blood, leucocyte, granulocyte, lymphocyte, erythrocyte, hemoglobin, plasma, corpuscle, polycythemia, and leucopenia. Upon later recall, entering "blood" will display all of the above associated words, or for that matter, entering any one of the above will cause all of the others to be displayed. Any word group may be changed or added at any time. There will be room on a formatted disk for 620 word groups, for a total of 6200 words (35-track, single density).

Once you have prepared your disk file records of the thesaurus you are building, you may use it at any time as a screen-displayed list, or you may have your words printed. You have a choice here of selecting specific groups of ten words, or all of the words in groups of ten. The program "Alphfile" will also transfer up to 200 words at a time into a new set of alphabetic files, recording, as it does, the location of each word within the random access word file, to enable you to locate a specific word for change or correction.

As previously observed, there are a number of file commands available, permitting some rather unique records of the words in your files. "Addalph" will allow your master record disk to have alphabetical records of up to 5000 words, but after 2500 words have been recorded, it is recommended by the manual that another disk be opened.

When asking for associated words, the program "Find" is called, and you will have two choices to selected from (or you may select both, in turn). These are for a list of words associated with the word you are enquiring about, or, your sentence (which you will then enter), will be displayed up to ten times with the alternate choices of words inserted in the appropriate place—permitting you to view it to see how it "sounds." The latter choice is probably the most useful display, as a word in context is much easier to evaluate.

The other two REFWARE THESAURUS programs mentioned operate essentially the same as BUILDER. However, each already has the nouns or adjectives as the case may be, installed on the program disk, ready for call. These programs

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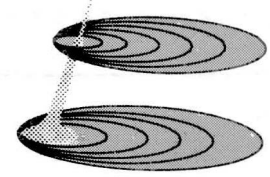

commence with a brief refresher in grammar as applied to nouns/adjectives, and then immediately go into the "find" mode, as described for BUILDER, with the choices of screen or printer output available. Unless your needs require the specialization of BUILDER, NOUNS and ADJECTIVES might have a greater usefulness for you as, for instance, in looking for "hard-to-spell" words of similar meaning (e.g. shabby = dilapidated). Also, the hard work of word entry has already been performed. And if there is any question that the word (adjective/noun), you are specifying may not be in the THESAURUS, the odds are good that it will be there, for there are 6200 adjectives, and 6200 nouns. If you are wondering if it might be faster to locate the word association in a printed thesaurus, consider that a word search will take from a minimum of only three seconds to a maximum of 70 seconds, depending on the disk location of the words. Unless you are lucky in your printed copy search, the computer is faster. While searching, by the way, the screen constantly displays how many words have been searched for a matching synonym. But what if that particular word is not included in the disk THESAURUS? The display will then state "The THESAURUS does not have any other alternate nouns (adjectives) for - word -." You then have a choice of searching for more nouns (adjectives), or ending. Of course, you may be misspelling the word, so that the program does not recognize it.

Because of some of the peculiarities of the English language, when a sentence-choice is selected for word or synonym display, some peculiar sentences may result—that sound as if they came from a foreign-source English instruction manual. Unless you are not too familiar with English, you will immediately recognize and reject these sentences.

The manuals accompanying each of the REFWARE programs are well-written, fully explanatory documents. The Introduction to each is the same, but is most interesting from a lexicographic and historical viewpoint. Each page of the text of the manuals simulates a screen display, with explanatory detailed text below each display. The BUILDER manual has 96 pages, NOUNS and ADJECTIVES 32 pages each. Typography is by dot-matrix printer, offset printed. Covers are of flexible plastic material, three-ring type, with the front covers gold-ink stamped. The only typographical or spelling error in all of the documentation is a rather consistent one-letter omission in a number of the simulated displays. Considering the length of the documents, this is a good record. For good, clear and consistent writing, and good manual production, the manual rates a 6.

No problems whatsoever were encountered in loading or running these programs. This does not happen too often—there usually appears to be some little difficulty or misunderstood direction that impedes start up with many of the programs that I review. In the case of THESAURUS, this may have been obviated by the fact that two disk drives were required, an operating system is always present, and there is no need to place the program on a system disk. It was not possible to obtain a disk-read using DOSPLUS—but then the documentation does not suggest that the program will run with any particular DOS. It operated perfectly with TRSDOS 2.3, and a "zap" to DOSPLUS would probably enable it to operate with that system also. Incidentally, absolutely no programming knowledge whatsoever is required with this program, it is "user-friendly" (a phrase that is about to be done-to-death in the personal computer field, but is nevertheless quite descriptive).

All of the screen and printout information is presented in upper case. I would have liked to have seen the more professional aspect of lower-case capability, particularly as the alternative words are presented.

These are very satisfactory programs if their exclusivity fits your requirements (an obvious criterion for all programs, but of particular importance in this case). The best visualization I have of these programs would be in the reviewing of draft copy, with improvements or changes in mind. Merely check the copy and call up alternate or associated words wherever you feel the need for better text readability or understanding. The other choice would be to have a computer dedicated to storing THESAURUS for rapid access. You will be the judge of these requirements; enough to say that the program works as specified, and is usefully unique.

REFWARE THESAURUS: BUILDER 1.0 - $149.95
REFWARE THESAURUS: NOUNS 1.0 - $39.95
REFWARE THESAURUS: ADJECTIVES 1.0 - $39.95

All require Model I or Model III with 48K and two disk drives. From REFWARE, P. O. Box 451, Chappaqua, NY 10514.

A. A. Wicks
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Agoura, CA 91301 ■

CORRECTION

Listed below are small corrections to the CHAINER program printed in the February 1982 issue of *Computronics*. These are enhancements to the program. There was one small "bug" in the video listing routine which is also corrected below:

Changes to make:

1. Change line 2170 to 'CLS'
2. Change line 2250 to 'IF PEEK(16193) <>32 THEN 2380'
3. Change line 2380 to 'IF A=LC THEN 2460'
4. Change line 2400 to 'ON INSTR(" CcQq",INKEY$) GOTO 2410, 2440, 2440, 180, 180
5. Change line 2410 to 'GOTO 2400'
6. Change line 2730 to 'PRINT FN T$;'
7. Change line 2660 to 'FOR A=1 TO LC: A$(A)=" ": B$(A)=" ": NEXT'
8. Change line 180 to 'CLS: ON ERROR GOTO 0'

Lines to delete:

1. Delete lines 2180, 2240, 2420, 2430, 2670, 2690, 2700

(Thanks to Jay R. Newirth, 3208 Bonnie Road, Baltimore, MD 21208.)

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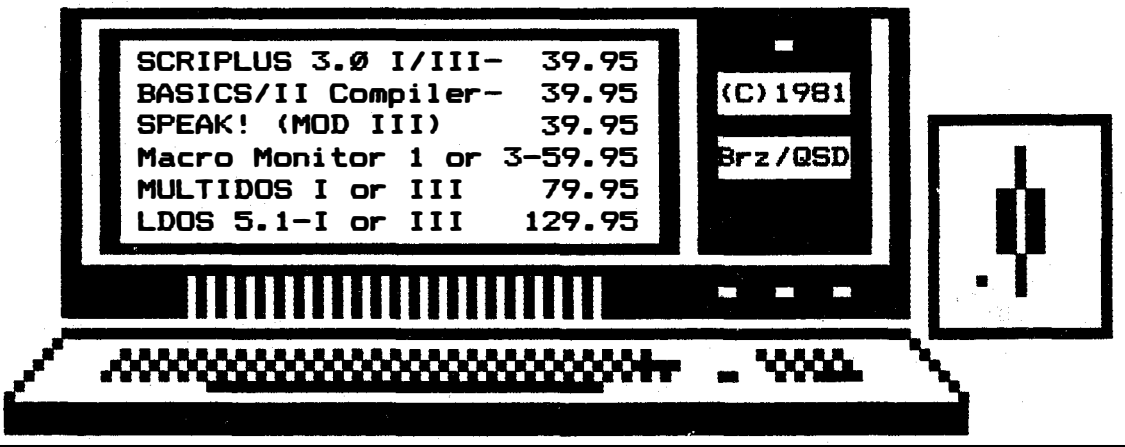

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BEGINNERS CORNER

Sherry M. Taylor

PERIPHERALS AND PARAPHERNALIA FOR THE TRS-80 (PART IV)

While I sat here reading *Isaac Asimov's Science Fiction Magazine,* I was reminded of his novel *I, ROBOT.* Robotics, a term Asimov coined in the 50's, is now in widespread use and is an expanding field of research. His robots talked. So far, the robots in use today do not have humanoid shape, but some of them ARE talking. The means used for this is "voice-response technology." Voice-response technology is much simpler than the voice-recognition technology we discussed in the last column.

Voice response technology takes on three forms:

1) Playing back prerecorded messages.

2) Synthesizing messages by piecing together individually prerecorded words.

3) Synthesizing messages by first forming words from a set of speech elements, or phonemes, and then piecing the words together into sentences.

One of the first generally available devices that used synthesized speech is the Texas Instruments "Speak and Spell." In the developmental stage, their "toy testers" (children of the employees) were given two versions to try, one with the prerecorded messages and one with the true synthesized speech. The children very much prefered the version with the synthesized speech. Why? No one knows for sure, but some speculate that the children liked their machines to SOUND like machines.

So, what does this have to do with your TRS-80? Well, have you ever had your TRS-80 talk to you? If it did, it was probably in a nightmare after a frustrating evening of debugging a troublesome program, or you have one of those nifty TRS-80 Voice Synthesizers marketed by Radio Shack or some other company.

My Model III has never ever spoken to me. The Voice Synthsizer put out by Radio Shack doesn't work on the Model III as is, but I *have* had a Model I talk to me. The nice folks at the Gateway Mall Radio Shack in St. Pete, FL let me spend an entire Saturday afternoon playing with their Synthesizer. (I probably drove them all crazy.) Believe me, having the computer talk is a strange experience at first. After a while, though, it becomes quite natural.

For part of my experiments, I used the "Talking Eliza" program. ELIZA is supposed to simulate artificial intelligence in portraying a psychoanalyst. It takes what you have typed into the computer and makes comments based on what you have said. Rather than the response being displayed on the screen, though, the voice synthsizer "speaks" its answers.

As far as the program went, I found ELIZA to be a better comedienne than a psychoanalyst, but the words pronounced by the synthesizer were quite recognizable, although in the stereotypical monotone. There were no inflections of the words to show any emotion, which may be why it seemed so funny!

After getting my psyche analyzed (which proved beyond a shadow of a doubt that I am off my rocker), I tackled programming the synthesizer myself. Voice synthesis is accomplished by stringing together vocal sounds. Human speech is broken down into phonemes. For example, the word "cat" has three phonemes: k, aah, and t. By typing into a STRING the symbols for those phonemes, the voice synthesizer "speaks" the word.

You are given a dictionary in the manual that will show you the most common of words and their combination of phonemes. For other words, you must sound them out and find the matching symbol for that sound. I found that the English language is quite facinating when broken down into sounds. My attempts at programming the synthesizer to say "I love you" were rewarded by a very good rendition of the words, and my friend there helping me understood it quite well.

There are a few voice synthesizers on the market. The obvious one to mention is the TRS-80 Voice Synthesizer that was marketed by Radio Shack. I understand that it has been discontinued because it is NOT compatible with the new Model III. But, if you are a Model I owner, you may very well find a few left out there in some of the stores. Ask at your local Shack if they can locate one for you. Also, there are a few of them floating around that are being sold by previous owners.

Progressive Electronics offers a Model I/III voice synthesizer called the "Speak Easy." Their ads boast human quality voice for $229.95. (I wrote to these folks for further information, but as yet have not heard from them.) The 297 vocabulary is contained in ROM, which means that you don't have to figure out phonemes.

Micro Mint Inc. offers a MICROMOUTH. The Model I version is $175, and the Model III version is $200. Their ads say it will say 144 expressions. (I have written to these people for information, too, but have not received any.)

Well, now, let's say you found one of the TRS-80 Voice Synthesizers really cheap somewhere, but you own a Model III computer. All is not lost. Somebody out there heard you crying. Design Solution, Inc., Box 125, Fayetteville, Arizona 72702 may have the answer. They have a Model I/III interface (the AN-587) that allows the TRS-80 Model III owner to connect and interface MOST port based Model I hardware with the Model III. They did not specifically mention the Voice Synthesizer in their literature as a device that could be interfaced, but it is certainly worth checking into. The unit comes complete with external power supply module and a well-written operation manual, all for $49.95.

You can also go to Design Solution, Inc. for an Audio Signal Processor which can digitally create sounds as music, speech and sound effects through an built-in amplifier-speaker system. (Sounds like a combination Voice Synthesizer/Vox-Box.) You can get isolated word speech synthesis or phoneme based speech synthesis, voice pattern data

continued on page 33

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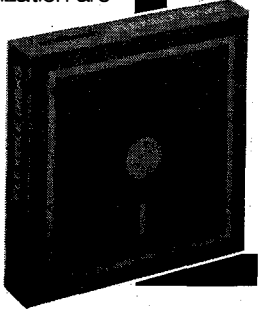

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ASSEMBLY LANGUAGE FOR RANK BEGINNERS (PART II)

Joseph Rosenman

Decimal - Hexadecimal Conversions

Before the serious study of assembly language can be undertaken, it is necessary to become familiar with the base 16 or "hexadecimal" number system. The 16 symbols used in "Hex" are: 0 1 2 3 4 5 6 7 8 9 A B C D E F.
At this point, take a look at figure 1. This table presents all the numbers from 0 to 52 in Decimal, Binary, and in Hex. Several points should be noticed right from the start. Since Hex is in base 16, there is a new column at every power of 16. The second column is added at 16 (or Hex 10), the third is added at 256 (or Hex 100), the fourth is added at 4096 (or Hex 1000), and the fifth is added at 65536 (or Hex 10000). We will confine ourselves (for the most part) to the first two columns, the "ones" and the "sixteens." Examine the numbers 0 to 16 (10H) in figure 1. For every count of syxteen, the binary numbers (in a set of four) will go through a complete sequence (from 0000 to 1111). If you are beginning to suspect that there is a direct correlation between every Hex column and every four binary columns, you are right! Consider:

```
ØØØØ ØØØØ =  ØH     ØØØ1 ØØØØ = 1ØH
ØØ1Ø ØØØØ = 2ØH     ØØ11 ØØØØ = 3ØH
Ø1ØØ ØØØØ = 4ØH     Ø1Ø1 ØØØØ = 5ØH
Ø11Ø ØØØØ = 6ØH     Ø111 ØØØØ = 7ØH
1ØØØ ØØØØ = 8ØH     1ØØ1 ØØØØ = 9ØH
1Ø1Ø ØØØØ = AØH     1Ø11 ØØØØ = BØH
11ØØ ØØØØ = CØH     11Ø1 ØØØØ = DØH
111Ø ØØØØ = EØH     1111 ØØØØ = FØH

     ØØØ1 ØØØØ ØØØØ = 1ØØH
     ØØ1Ø ØØØØ ØØØ8 = 2ØØH
     ØØ11 ØØØØ ØØØØ = 3ØØH
```

Let's see how the multiples of 16 correspond to the Hex numbers.

```
  Ø =  ØH     128 = 8ØH
 16 = 1ØH     144 = 9ØH
 32 = 2ØH     16Ø = AØH
 48 = 32H     176 = BØH
 64 = 4ØH     192 = CØH
 8Ø = 5ØH     2Ø8 = DØH
 96 = 6ØH     224 = EØH
112 = 7ØH     24Ø = FØH
      256 = 1ØØH
```

Now, using the techniques presented in the last issue, let's convert numbers from Hex to Decimal. Try the numbers 12H, 30H, 17H, 9H, 2BH, 0DH, 7FH, 5EH, and 12CH. Then, convert the Hex numbers into Binary (you can check all the numbers less then 53 by comparing the results to figure 1). When a Hex number begins with one of the letter symbols (A-F), the number is preceded with a 0 (as in 0DH).

```
12H:
 1 * (16 to the first)  =  1 *  16  = 16,
 2 * (16 to the zero)   =  2 *   1  =  2,
                                      ---
                                       1Ø

3ØH:
 3"* (16 to the first)  =  3 *  16  = 48,
 Ø * (16 to the zero)   =  Ø *   1  =  Ø,
                                      ---
                                       48

17H:
 Ø * (16 to the first)  =  1 *  16  = 16,
 7 * (16 to the zero)   =  7 *   1  =  7,
                                      ---
                                       23

9H:
 9 * (16 to the zero)   =  9 *   1  =  9

2BH:
 2 * (16 to the first)  =  2 *  16  = 32,
11 * (16 to the zero)   = 11 *   1  = 11,
                                      ---
                                       43

ØDH:
13 * (16 to the zero)   = 13 *   1  = 13

7FH:
 7 * (16 to the first)  =  7 *  16  = 112,
15 * (16 to the zero)   = 15 *   1  = 15,
                                      ---
     Binary = Ø111 1111,              127
```

Decimal	Binary	Hexadecimal
Ø	ØØ ØØØØ	Ø
1	ØØ ØØØ1	1
2	ØØ ØØ1Ø	2
3	ØØ ØØ11	3
4	ØØ Ø1ØØ	4
5	ØØ Ø1Ø1	5
6	ØØ Ø11Ø	6
7	ØØ Ø111	7
8	ØØ 1ØØØ	8
9	ØØ 1ØØ1	9
1Ø	ØØ 1Ø1Ø	A
11	ØØ 1Ø11	B
12	ØØ 11ØØ	C
13	ØØ 11Ø1	D
14	ØØ 111Ø	E
15	ØØ 1111	F
16	Ø1 ØØØØ	1Ø
17	Ø1 ØØØ1	11
18	Ø1 ØØ1Ø	12
19	Ø1 ØØ11	13
2Ø	Ø1 Ø1ØØ	14
21	Ø1 Ø1Ø1	15
22	Ø1 Ø11Ø	16
23	Ø1 Ø111	17
24	Ø1 1ØØØ	18
25	Ø1 1ØØ1	19
26	Ø1 1Ø1Ø	1A

Decimal	Binary	Hexadecimal
27	Ø1 1Ø11	1B
28	Ø1 11ØØ	1C
29	Ø1 11Ø1	1D
3Ø	Ø1 111Ø	1E
31	Ø1 1111	1F
32	1Ø ØØØØ	20
33	1Ø ØØØ1	21
34	1Ø ØØ1Ø	22
35	1Ø ØØ11	23
36	1Ø Ø1ØØ	24
37	1Ø Ø1Ø1	25
38	1Ø Ø11Ø	26
39	1Ø Ø111	27
4Ø	1Ø 1ØØØ	28
41	1Ø 1ØØ1	29
42	1Ø 1Ø1Ø	2A
43	1Ø 1Ø11	2B
44	1Ø 11ØØ	2C
45	1Ø 11Ø1	2D
46	1Ø 111Ø	2E
47	1Ø 1111	2F
48	11 ØØØØ	3Ø
49	11 ØØØ1	31
5Ø	11 ØØ1Ø	32
51	11 ØØ11	33
52	11 Ø1ØØ	34

FIGURE 1

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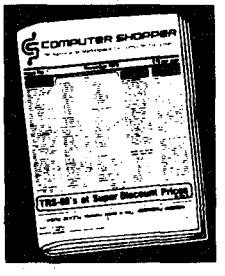

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```
5EH:
 5 * (16 to the first)  =   5 * 16  =  8Ø,
14 * (16 to the zero)       14 *  1  =  14,
     Binary = Ø1Ø1 111Ø,                 94

12CH:
 1 * (16 to the second) =  1 * 256  = 256,
 2 * (16 to the first)  =  2 *  16  =  32,
12 * (16 to the zero)   = 12 *   1  =  12,
     Binary = ØØØ1 ØØ1Ø 11ØØ,          3ØØ
```

What about Decimal into Hex? Well, it's not quite as straightforward as Hex into Decimal. Needless to say, there is a way. Recall the powers of 16: 1, 16, 256, 4096, 65536. By selecting the appropriate number to divide by, it is possible to convert the number into Hex. Of course, you must convert the numbers 10-15 into A-F. Let's try reconverting the numbers we just converted into Decimal back to Hex.

```
65536 = 1ØØØØH
4Ø96  =  1ØØØH
256   =   1ØØH
16    =    1ØH
1     =     1H
```

The method used is to select the Decimal number in the above table that is larger then the "target" number, and begin dividing. So, let's try a large number 115211.

```
(1ØØØØH) 115211 / 65536 =  1, R = 49675
(1ØØØH)  49675  / 4Ø96  = 12, R = 523
(1ØØH)   523    / 256   =  1, R = 11
(1ØH)    11  <is less than 16, so field = Ø>
(1H)     11     / 1     = 11, R = Ø
```

Now, we multiply the Hex field value by the column value, and add the resumts together. Remember that all numbers between 10 and 15 need to be converted to their respective Hex symbols, A-F.

```
1ØØØØH * Ø1H = 1ØØØØH
1ØØØH  * ØCH = ØCØØØH
1ØØH   * Ø2H =   2ØØH
1ØH    * ØØH =    ØØH
1H     * ØBH =    ØBH
                1C2ØBH
```

Ok, they say that practice makes perfect. Here are the numbers to reconvert:

```
18:
18 / 16 = 1, R = 2  <1ØH>
2  /  1 = 2        < 2H>
                    12H

23:
23 / 16 = 1, R = 7  <1ØH>
7  /  1 = 7        <Ø7H>
                    17H

48:
48 / 16 = 3, R = Ø  <3ØH>
Ø  /  1 = Ø        < ØH>
                    3ØH

43:
43 / 16 = 2, R = 11 <2ØH>
11 /  1 = 11       <ØBH>
                    2BH

9:
9 /  1 = 9          9H

13:
13 /  1 = 13        ØDH

127:
127 / 16 = 7, R = 15 <7ØH>
15  /  1 = 15       <ØFH>
                     7FH

94:
94 / 16 = 5, R = 14 <5ØH>
14 /  1 = 14        <ØEH>
                     5EH

3ØØ:
3ØØ / 256 = 1, R = 44 <1ØØH>
44  /  16 = 2, R = 12 < 2ØH>
12  /   1 = 12       < ØCH>
                     12CH
```

Now, since we have established that practice makes perfect, I will provide a list of numbers to convert. In the next installment of this column, I will provide the answers. Convert into Decimal: 10H, 7BH, 2694H, 3F2, 0ABCH, 309H, 0DADH, 7BE, 162E, 0BACH. Convert into Hex: 467, 22, 4013, 3053, 645, 747, 999, 135, 2000, 3771.

LOGICAL OPERATIONS

In the study of Logical operations, we are going to learn some aspects of different mathematical system, known as "Boolean Algebra." Instead of the familiar arithmetic operations we use (plus, minus, multiplication, division), we will examine ANDing, ORing, XORing (exclusive ORing), and NOTing. We will primarily be concerned with Binary numbers, so make sure you have a pretty good grasp of binary before you attempt this new material.

Recall that a four bit value is also known as a nybble. We will examine logical operations with bytes, nybbles, and with single bits. Logical operations are of two types: Unary (with one bit), and Binary (with two bits). The operation "NOT" is a unary type, while "AND", "OR," and "XOR" are all binary.

Frequently, when working with bits, a 1 is known as "True," and a 0 is known as "False." If you consider that each bit can be used to contain the result of a yes/no question, you will see how logical operations form the basis of "decision making" routines. In fact, you will notice that the numbers respond to ORs and ANDs in much the same way we would use those words in expressing conditional statements in English.

NOT—This operation causes a bit to become the opposite of what it was. What was true becomes false, and what was false becomes true. In other words, a 1 becomes a 0 and a 0 becomes a 1. Let's examine some examples:

```
1ØØ1 becomes Ø11Ø  (9 becomes 6),
ØØØØ becomes 1111  (Ø becomes F),
Ø1Ø1 becomes 1Ø1Ø  (5 becomes A), etc.

ØØØØ ØØØØ becomes 1111 1111  (ØØ -> FF)
ØØ11 Ø1Ø1 becomes 11ØØ 1Ø1Ø  (35 -> CA),
1ØØ1 Ø11Ø becomes Ø11Ø 1ØØ1  (96 -> 69), etc.
```

AND—This operation causes a bit to be true only if both bits are true. Otherwise, the resulting byte is false. There are four possible combinations of bits in any given binary operation. The results of these operations can be easily seen in the table below.

```
 Ø  Ø  1  1
 Ø  1  Ø  1
-----------
 Ø  Ø  Ø  1
```

In other words, only when both bits are true will the logical AND also be true.

```
ØØØØ   1111   1Ø1Ø   111Ø   1ØØ1   Ø11Ø
ØØ3Ø   ØØØØ   1111   Ø1ØØ   ØØ11   Ø111
-----  -----  -----  -----  -----  -----
ØØØØ   ØØØØ   1Ø1Ø   Ø1ØØ   ØØØ1   Ø11Ø

ØØØØ Ø111   ØØØØ Ø111   1111 ØØØØ
1Ø1Ø 1Ø1Ø   ØØ11 11ØØ   Ø11Ø 1ØØ1
---------   ---------   ---------
ØØØØ ØØ1Ø   ØØØØ Ø1ØØ   Ø11Ø ØØØØ
```

OR—This operation causes a bit to be true if either bit is true. The result is false only if both bits are also false.

```
 Ø  Ø  1  1
 Ø  1  Ø  1
-----------
 Ø  1  1  1
```

Some examples of the Logical OR:

```
ØØØØ   1111   1Ø1Ø   111Ø   1ØØ1   Ø11Ø
ØØØØ   ØØØØ   1111   Ø1ØØ   ØØ11   Ø111
-----  -----  -----  -----  -----  -----
ØØØØ   1111   1111   111Ø   1Ø11   Ø111

ØØØØ Ø111   ØØØØ Ø111   1111 ØØØØ
1Ø1Ø 1Ø1Ø   ØØ11 11ØØ   Ø11Ø 1ØØ1
---------   ---------   ---------
1Ø1Ø 1111   ØØ11 1111   1111 1ØØ1
```

XOR—This operation causes a bit to be true only if 1 of the two bits are true, and the other is false. The result is false if both bits are false, or if both bits are true. It is known as the "Exclusive OR" because the OR operation is true only if 1 of the two bits (exclusive of the other) is true, not both of the bits.

```
    Ø  Ø  1  1
    Ø  1  Ø  1
-------------
 Ø  Ø  1  1  Ø
```

Some examples of the Logical XOR:

```
ØØØØ   1111   1Ø1Ø   111Ø   1ØØ1   Ø11Ø
ØØØØ   ØØØØ   1111   Ø1ØØ   ØØ11   Ø111
-----  -----  -----  -----  -----  -----
ØØØØ   1111   Ø1Ø1   1Ø1Ø   1Ø1Ø   ØØØ1

ØØØØ Ø111   ØØØØ Ø111   1111 ØØØØ
1Ø1Ø 1Ø1Ø   ØØ11 11ØØ   Ø11Ø 1ØØ1
---------   ---------   ---------
1Ø1Ø 11Ø1   ØØ11 1Ø11   1ØØ1 1ØØ1
```

continued on page 47

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MODEL III CORNER

Hubert S. Howe, Jr.

This Month: The TRS-80 Model III ROM

A few years ago, back in 1979-80, I authored a series of columns on assembly language programming for the TRS-80 Model I. These were ultimately expanded and published in book form by Prentice-Hall. In the next few columns in this space, I would like to bring some of the materials covered in the previous series up to date concerning the Model III. This material is not just for persons interested in understanding assembly language programming, but for anyone who wants to understand what is really inside the Model III's memory. Because it is so necessary for assembly language programming, I will concentrate on those applications. Persons unfamiliar with some of the technical terms and other details used in this column may find the previous series helpful.

Memory Addressing

All 8-bit microprocessors have the limitation that the maximum address space they can access is 64K bytes. The reason for this is that they allow a single memory location to be specified in just two bytes, and the maximum value that can be contained in two bytes is 65,535 (which is referred to as 64K because "K" equals 1,024 in computer terminology). Extending this to three bytes would increase the address space to over 16 million bytes, but it would mean that an extra byte would have to be accessed for every memory read or write instruction.

The memory addressing space can be filled in a variety of ways by the computer manufacturer, and this is where all microcomputers are different even though they may use the same microprocessors. Looking over all the memory locations in the TRS-80 Model III, we see what is shown in Figure 1: locations 0000 to 37FF (all addresses will be referred to in hexadecimal) contain ROM (read-only memory). From 37FF to 3FFF we find some memory-mapped input/output (I/O) devices, and from 4000 to FFFF is the space reserved for the RAM (random-access memory). You will be familiar with the fourth alternative if you don't have 48K RAM: the address space is empty!

Before you can write an assembly language program for the TRS-80, you must know the organization of its memory and how to use the various parts of it. In this column, we will examine the TRS-80's ROM and dedicated I/O areas in detail, and we will also discuss the functions of the various I/O ports on the Model III. A future column will be devoted to the RAM.

Some of this information is contained in the TRS-80 MODEL III OPERATION AND BASIC LANGUAGE REFERENCE MANUAL, but in fact this book contains only the barest outlines of the system. Other publications give many more details. Most books on this subject provide a disassembly of the ROM together with comments about the what the instructions are doing. The main reason why Radio Shack doesn't give more details is not that it doesn't want you to understand the innards of your computer, but that it will not commit itself to preserving the present organization of the computer in new versions and releases. By restricting the documentation, it has promised to preserve the published addresses and functions.

The ROM contains the Level II Basic interpreter, as well as the software for accessing the I/O devices, including the keyboard, video display, cassette recorder, line printer and RS-232-C Interface. There is also a "bootstrap loader" program for the mini disk drives, but most of the disk I/O software is read in from the disk when the system is initialized or reset. The main reason for placing software in ROM is so that it cannot be accidentally erased.

The dedicated input/output addresses contain locations where certain devices are interfaced to the TRS-80 through MEMORY MAPPING. Only the keyboard and video display are connected in this way, whereas almost all the peripherals on the TRS-80 Model I were interfaced in this manner. Most peripherals on the Model III are interfaced through I/O ports.

The RAM is where your programs and data must be located, but many addresses at the bottom of RAM are reserved for special purposes. In a non-disk Level II Basic system, 1000 locations are reserved. When you connect a disk drive to the TRS-80, the software needed to operate the disk must be loaded off the system drive into low RAM. This area of RAM then functions as an extension of the ROM, and if you accidentally destroy it, you must reboot the system. The TRSDOS disk operating system reserves over 5K, and Disk Basic requires an additional 5K.

The Model III ROM

The TRS-80 has an unusually large ROM for a microcomputer. Most micros have just some kind of monitor or

Starting Address			
Decimal	Hex	Use	Details
0	0	ROM area	12K Model III BASIC
12288	3000		2K ROM for system use
14336	3800	Dedicated	Keyboard Matrix
14465	3881	I/O area	Unused
15360	3C00		Video display
16384	4000	RAM area	Reserved RAM
17385	43E9		User memory
32767	7FFF		End of 16K RAM
49151	BFFF		End of 32K RAM
65535	FFFF		End of 48K RAM

Figure 1: Basic organization of the TRS-80 Model III's memory.

operating system in ROM, containing only the software for accessing the primary input/output devices. The TRS-80 has all that, but it also has the Level II Basic interpreter, which is huge by comparison. Level II Basic is an extremely complicated assembly-language program, written by Microsoft. Understanding how it works is both beyond the scope of this column and unnecessary. Most of the Level II interpreter is unusable to assembly-language user programs anyway.

The primary reason we need to know about the ROM is to be able to use the input/output software. We may also be interested in knowing the general organization of Level II Basic, and how to find out more about it. When confronted with even an outline of the ROM, most users are bewildered at first. What is all that stuff in there, and why is it organized in the way that it is? These are difficult questions to answer even when you do understand it! Some of the reasons for this organization has to do with the history of the TRS-80 and the relation of the Model III to the Model I. Much of the rest is essentially arbitrary and actually quite haphazard. If you look at a detailed map of the ROM, you will see that there are many unused bytes in it, that many routines jump all around for no apparent reason, and related sections of code are by no means all in the same area.

A general outline of the Level II ROM is shown in Figure 2. This is only a bare outline, and we will go into more detail below. Note that the ROM is divided into five sections: 0 to 0707, 0708 to 1607, 1608 to 1935, 1936 to 2FFF, and 3000 to 37FF. The first of these sections contains system initialization and I/O routines or vectors, the second floating-point math, the third tables of the BASIC reserved words, functions, and addresses, the fourth most of the Level II BASIC Interpreter, and the fifth additional I/O routines. The fifth section has been added to the Model III, whereas the other sections were adapted from the Model I's ROM, much of them lifted verbatim.

Before we go into these areas in detail, it is necessary to understand some terminology:

A VECTOR is simply a branch or jump to another location. Vectors are used when you want to put all the addresses that relate to carrying out specific functions in one area, but carry out the details elsewhere.

A DRIVER program is the software necessary to communicate with a device. The driver for the video display, for

Addresses	Purpose
0000 - 0707	System initialization, RST and I/O vectors, Graphics routines, Line printer and Video display drivers
0708 - 1607	Floating-point math
1608 - 1935	Tables of Level II Basic reserved words, entry points for Level II commands, RAM initialization and messages
1936 - 2FFF	Level II BASIC interpreter
3000 - 37FF	Keyboard driver, cassette and RS232 I/O routines, misc. tables, initialization and Model III special routines

Figure 2: Outline of the Model III ROM.

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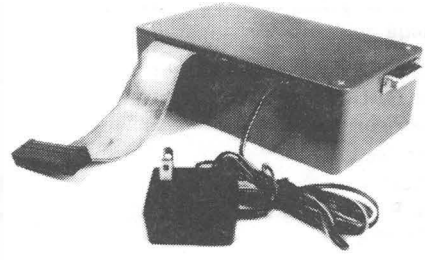

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4) Allow line feeds
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   b) Turn off RTS,
   c) Receive data only from terminal,
   d) Receive data only from host,
   e) Send data only to host,
   f) Send data only to terminal,
   g) Operate in dumb terminal mode,
   h) Operate in ST80™ mode,
   i) Check CTS status. (clear to send)

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example, contains all of the instructions necessary to display characters. Driver programs are used to simplify communications: you need simply to CALL the driver with the byte you want to display, which may involve executing hundreds or thousands of additional instructions.

INITIALIZATION code contains information that is moved from the ROM to various areas in the RAM upon system power-on or reset, as well as the code necessary to move the bytes. In order to run the computer under normal conditions, this code is expected to be in various locations.

Addr.	Name	Description
0000		System initialization, RST vectors (discussed in connection with the RAM), I/O subroutine vectors:
0013		General purpose read byte subroutine
001B		General purpose write byte subroutine
0023		General purpose read/write subroutine
002B	KBCHAR	Input from keyboard, return immediately
0033	VDCHAR	Display byte at cursor location
003B	PRCHAR	Line print byte
0040	KBLINE	Input line from keyboard, echo to screen
0049	KBWAIT	Input from keyboard, wait till key pressed
0050	RSRCV	RS232 input byte
0055	RSTX	RS232 output byte
005A	RSINIT	Initialize RS232
0060	DELAY	Delay loop
0066	NMI	Non-maskable interrupt vector
0069	INITIO	Initialize all I/O drivers
006C	ROUTE	Re-route I/O devices
0075		Non-Disk Basic initialization
0132		Graphics routines: SET, RESET, POINT
019D	INKEY$	Scan keyboard
01C9	VDCLS	Home cursor, clear screen
01D3	RANDOM	Seed random number generator
01D9	PRSCN	Print screen routine
01F8	CSOFF	Turn cassette off
01FB	DELAY	(continued from 60)
021B	VDLINE	Print line of text on video display
0235	CSIN	Read byte from cassette
0264	CSOUT	Output byte to cassette
0287	CSHWR	Write cassette leader and sync byte
028D	KBBRK	Check BREAK key
0296	CSHIN	Read cassette leader and sync
0298	CLKON	Turn on clock
02A1	CLKOFF	Turn off clock
02A9	SYSTEM	Read SYSTEM tape
032A		Basic LIST routine
0358		Single key input
0361		Multiple key input
0384		Wait for key input
038B		Reset LIST device
039C		Basic printer routine
03C2		Line printer driver
0452		Reset I/O drivers
0473		Video display driver
05D9	KBLINE	Input line from keyboard, echo to screen
0674		I/O Dispatcher

Figure 3: Low ROM outline

The term ROUTINE is used to describe a logically independent section of code that performs some function. If the routine can be entered and exited by means of a CALL and RETurn instruction, it is called a SUBROUTINE. Calls to subroutines can be placed into the mainstream area of a program without affecting its operations, provided that the appropriate registers are saved and restored.

Low ROM Outline

As shown above, the low ROM area of the Model III contains system initialization, various vectors and drivers, and some miscellaneous Basic routines. It contains almost all of the documented subroutine addresses, but in fact most of these are vectored elsewhere. Figure 3 contains a detailed listing of all the principal routines in the low ROM area. It shows the starting or entry address (in hexadecimal), the name of the routine if it is referred to by a Basic reserved word or listed as a subroutine in the REFERENCE MANUAL, and a brief description of the function.

Floating-point Mathematics Outline

The floating-point mathematics routines are some of the most complicated in the Level II Basic interpreter. Entire books have been written explaining how to perform these calculations and to access these subroutines from assembly language. Of all the functions performed by the ROM, these are best left to Basic programs. For this reason we will not go into this subject here, but leave it for the specialists.

ROM Tables and Reserved Words Outline

This area of the ROM contains information used by the Level II Basic interpreter to decode and execute statements. Radio Shack was very concerned with upward compatibility from the Model I when it introduced the Model III. While there are many differences between the Model I and Model III ROMs, the one area where complete compatibility exists is in the addresses where Basic statements are executed. This allows assembly-language programs which were written for the Model I to be executed on the Model III without revision. While we cannot go into all these details, we can at least show you how it is organized and to discover more yourself.

Figure 4 is an outline of the tables in this area, and figure 5 summarizes much of what you can get from inspecting the tables.

Address	Contents
1608	Function address table
1650	Level II Basic reserved word table
1822	Reserved word address table
189A	Precedence table for mathematical operations
18A1	Mathematical operator index
18C9	Error codes
18F7	RAM initialization code for 4080-40A6 (division support routine)
191D	Messages: "Error", "in", "Break", "Ready"

Figure 4: Outline of tables of Basic reserved words and addresses.

The Model III ROM map shown in Figure 4 does not go into the decoding of Basic statements. If you are interested in this subject, the following information will explain how to find out more about it.

Each of the Level II Basic reserved words is represented internally by a unique byte, called a "token", with a value from 80H to FBH. When you type in a Basic program, only the tokens are stored -- not the complete words you type. The table at locations 1650 to 1820 is a list of all the reserved words, in numerical order of the tokens. The first byte of each word is indicated by having bit 7 set, which is not used in ASCII code. There are two tables of jump addresses, located at 1608 to 164F and 1822 to 1899, plus a third area starting around 24B0, that give the addresses where each command is executed. If you figure all this out, you can construct the table in Figure 5, which is shown by tokens, in alphabetical rather than numerical order.

If you want to know more about the ROM, the best thing to do is to get a disassembler program and look at a disassembled listing of the ROM. A disassembler is the reverse of an assembler, showing the machine instructions corresponding to the program stored in memory. This would enable you to understand better the functions of the Level II Basic interpreter, which are located in the area from 1936 to 2FFF. We will not outline that area in any detail here.

High ROM Outline

It was mentioned above that the high ROM area was added to the Model III, whereas much of the rest of the

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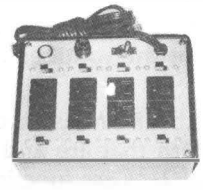

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ASC	F6	2A0F	ERROR	9E	1FF4	MKD$	EE	4170	SQR	DD	13E7
ATN	E4	15BD	EXP	E0	1439	MKI$	EC	416A	STEP	CC	2B01
AUTO	B7	2008	FIELD	A3	417C	MKS$	ED	416D	STOP	94	1DA9
CDBL	F1	0ADB	FIX	F2	0B26	NAME	A9	418E	STR$	F4	2836
CHR$	F7	2A1F	FN	BE	4155	NEW	BB	1B49	STRING$	C4	2A2F
CINT	EF	0A7F	FOR	81	1CA1	NEXT	87	22B6	SYSTEM	AE	02B2
CLEAR	B8	1E7A	FRE	DA	27D4	NOT	CB	25C4	TAB(	BC	2137
CLOAD	B9	2C1F	GET	A4	417F	ON	A1	1FC6	TAN	E3	15A8
CLOSE	A6	4185	GOSUB	91	1EB1	OPEN	A2	4179	THEN	CA	----
CLS	84	01C9	GOTO	8D	1EC2	OR	D3	25F7	TIME$	C7	4176
CMD	85	4173	IF	8F	2039	OUT	A0	2AFB	TO	BD	----
CONT	B3	1DE4	INKEY$	C9	019D	PEEK	E5	2CAA	TROFF	97	1DF8
COS	E1	1541	INP	DB	2AEF	POINT	C6	0132	TRON	96	1DF7
CSAVE	BA	2BF5	INPUT	89	219A	POKE	B1	2CB1	USING	BF	2CBD
CSNG	F0	0AB1	INSTR	C5	419D	POS	DC	27F5	USR	C1	27FE
CVD	E8	415E	INT	D8	0B37	PRINT	B2	206F	VAL	F5	2AC5
CVI	E6	4152	KILL	AA	4191	PUT	A5	4182	VARPTR	C0	24EB
CVS	E7	4158	LEFT$	F8	2A61	RANDOM	86	01D3	+	CD	249F
DATA	88	1F05	LEN	F3	2A03	READ	8B	21EF	-	CE	2532
DEF	BD	415B	LET	8C	1F21	REM	93	1F07	*	CF	----
DEFDBL	9B	1E09	LINE	9C	41A3	RESET	82	0138	/	D0	----
DEFINT	99	1E03	LIST	B4	2B2E	RESTORE	90	1D91	↑	D1	----
DEFSNG	9A	1E06	LLIST	B5	2B29	RESUME	9F	1FAF	—	D4	----
DEFSTR	98	1E00	LOAD	A7	4188	RETURN	92	1EDE	=	D5	----
DELETE	B6	2BC6	LOC	EA	4164	RIGHT$	F9	2A91	+	D6	----
DIM	8A	2608	LOF	EB	4167	RND	DE	14C9	'	FB	----
EDIT	9D	2E60	LOG	DF	0809	RSET	AC	419A	"	22	2866
ELSE	95	1F07	LPRINT	AF	2067	RUN	8E	1EA3	&	26	4194
END	80	1DAE	LSET	AB	4197	SAVE	AD	41A0		2E	0E6C
EOF	E9	4161	MEM	C8	27C9	SET	83	0135			

Figure 5: Summary of Level II Basic reserved words, tokens, and entry points for executing Basic statements.

ROM was taken from the Model I. If you look at this area in detail, you will see that it has a completely different organization from the rest of the ROM and is really very logical. Almost all of the information here relates to new features of the Model III or to improvements in the Model III over the Model I. A general outline of the routines in this area is shown in Figure 6.

One final word of caution about the ROM is in order: there are different versions of the ROM that are and have been sold by Radio Shack. All of the ROMs are functionally identical, but exactly what the differences are and why different ROMs are being sold is not known at this time.

ROM Subroutines

The ROM contains an enormous number of subroutines, but few of them are useful for assembly-language programs. Those that are useful are summarized below. This list shows the entry point (in hexadecimal), the registers containing parameters for the subroutine, the registers used (destroyed), and the operation of the subroutine. (Subroutines are always entered by a CALL instruction.)

Keyboard Subroutines

002B KBCHAR: scans the keyboard and returns zero in A if no key is depressed, else returns character. Uses AF, DE.

0049 KBWAIT: scans the keyboard and waits for a key to be depressed. Returns character in A. Uses AF, DE.

0040 KBLINE: accepts an entire line of input, terminated by ENTER or BREAK. Displays characters typed, recognizing control functions (backspace, etc.). When called, HL => address of buffer where text is to be put, B = maximum number of characters in line. On exit, B = number of characters typed, including terminator. C set if line ends with BREAK. Uses AF, DE.

028D KBBRK: checks for BREAK key. If pressed, NZ set. Uses AF.

Video Display Subroutines

0033 VDCHAR: prints ASCII character in A at current cursor position on video display. Cursor located at 4020. Uses AF, DE, IY.

01C9 VDCLS: Clears screen and homes cursor. Uses AF.

021B VDLINE: prints all text pointed to by HL up to a carriage return (0DH) or NULL (00) at current cursor position. Uses HL, AF.

Address	Name	Description
3000		Vectors to specific routines
3045		Portion of keyboard driver
3145		Table of characters for printer
31A5		Cassette I/O routines:
31C0	CSOFF	Cassette off
31D1		Cassette on
3203		Slow cassette read byte routine
324		Slow cassette write byte routine
325E		Slow cassette write header routine
3274		Slow cassette read header routine
329B		Fast cassette write header routine
32BA		Fast cassette write byte routine
32CA		Fast cassette read byte routine
32DA		Fast cassette read header routine
338E		Keyboard driver
3455	RESET	System bootstrap (continued from 0)
34AB		Warm bootstrap
35A0	TIME$	
35BB	DATE$	
35C2		Maskable interrupt handler
35FB	RSINIT	RS232 initialization subroutine
363A		Disable RS232 routine
365A	RSRCV	RS232 input routine
3680	RSTX	RS232 output routine
36AA		Low RAM initialization (4000-404B)
36F9		RAM initialization (41E5-4224)
3739	ROUTE	I/O device re-router
377B		Part of Basic LIST routine
3779		Basic TIME$
37AF		Non-disk initialization
37B5	SETCAS	Set cassette baud speed

Figure 6: Outline of high ROM area.

Line Printer Subroutines

003B PRCHAR: print byte in A on line printer. Waits till printer ready, can be terminated by pressing BREAK. Uses DE.

01D9 PRSCN: print current contents of video display on line printer. Uses all registers.

Cassette Subroutines

01F8 CSOFF: Turns cassette off. Uses no registers

0287 CSHWR: Write leader and sync byte. Uses AF, C.

0264 CSOUT: Write byte in A to cassette.

0296 CSHIN: Read leader and sync byte: locates beginning of program and positions for reading next bytes. Motor keeps running. Uses AF.

0235 CSIN: Read byte: next byte on cassette returned in A. User must call often enough to keep up with cassette speed.

3042 SETCAS: Prompt user to set cassette baud rate. Uses all registers.

GRBASIC

GRAPHICS ENHANCEMENT PACKAGE FOR THE TRS-80 MODEL I AND MODEL III

The TRS-80's Level II BASIC contains no easy to use, fast commands for handling graphics. GRBASIC 3.0 fills this void by adding a set of commands to Level II BASIC that allow line drawing, shape handling, circle generation, and sound generation. Corner to corner lines are drawn in less than 8/100 of a second!

FEATURES OF GRBASIC

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SDRAW..USING...: Draws or erases the designated shape at the designated coordinates, including extended space.

CIRCLE: Draws a circle around a designated center with a designated radius, including drawing in extended space.

TURN: Rotates a shape in 45 degree increments.

SIZE: Sets the scaling factor for shape drawing.

AUDIO: Sends modulated sound to speaker.

All existing Level II programs are upward compatible with GRBASIC 3.0. No existing BASIC commands are altered, and all GRBASIC commands are tokenized. GRBASIC includes versions of GRBASIC for 16K, 32K, and 48K machines, SEDIT, a shape editor program, and MISSILE, a real-time arcade game written entirely in GRBASIC. The manual has been rewritten for clarity and contains more examples.

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RS232 Subroutines

0050 RSRCV: receive a character. Uses DE.

0055 RSTX: transmit character in A.

005A RSINIT: initialize RS232 interface as indicated in locations 41F8-41FA. Uses DE.

Miscellaneous I/O Subroutines

0013 Inputs a byte from an input device. On entry, DE => DCB of device. On exit, Z is set if ready. Uses AF.

001B Output a byte to a device. On entry, A=output byte, DE => DCB of device. On exit, Z is set if device is ready. Uses AF.

0023 Output a control byte to an I/O device. On entry, A = control byte, DE => DCB of device. On exit, Z is set if device is ready, A = status. Uses AF.

0060 Delay loop in 15-microsecond increments. On entry, BC = number of delay pulses. Uses AF, BC.

0066 NMI reset location: jumps here on non-maskable interrupt. In effect, halt or reset.

Dedicated I/O Addresses: Keyboard

The area from 3000H to 3FFFH is used for direct memory access (DMA) input/output devices. On the Model III it is used only by the keyboard and video display, whereas on the Model I almost all I/O devices were interfaced in this area.

Figure 7 shows how the keys on the keyboard are connected to various locations in the area 3800 to 3880. When a location there is addressed, the computer actually reads the keys of the keyboard. Each key depressed causes a certain bit in a specific location to read "1" rather than "0". For example, if you type the "F" key, bit 6 in location 3801 will be set, causing the value at 3801 to read 40H. A keyboard-reading subroutine must simply check locations 3801 to 3840 to see if there is any non-zero value, and then decode the bits into the proper letter, checking location 3880 to see if either of the shift keys are pressed. This may seem like much work, but it actually happens so fast that a keyboard-debounce routine had to be incorporated into the Model I to prevent accidental double reading of typed letters. The keyboard debounce does nothing except insert a delay into the key-reading process. (This process was identical on the Model I, the one exception being that both shift keys were mapped to the same bit in location 3880.)

Memory	Bit							
Address	0	1	2	3	4	5	6	7
3801	@	A	B	C	D	E	F	G
3802	H	I	J	K	L	M	N	O
3804	P	Q	R	S	T	U	V	W
3808	X	Y	Z					
	!	"	#	$	%	&	'	
3810	0	1	2	3	4	5	6	7
	(	)	*	+	<	=	>	?
3820	8	9	:	;	,	-	.	/
3840	EN	CL	BK	UP	DN	LF	RT	SP
3880	LS	RS						

Figure 7: Mapping of keyboard to memory locations in TRS-80 Model III. Abbreviations used: EN=Enter, CL=Clear, BK=Break, UP=Up arrow, DN=down arrow, LF=left arrow, RT=Right arrow, SP=space bar, LS=left shift key, RS=right shift key.

continued on page 40

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continued from page 20

reductions, music synthesis and more. This device costs $99.95. (For Model III users, you'll need the Model I/III interface to use this.)

That is how to get your computer to talk back to you. The most obvious use for this technology for me is in teaching a child to read. (Of course, the child will imitate the synthesized speech. Someday, all children will be known by their "computer dialect.") This would especially be a boon to the child who would rather not read. Anything that resembles play is done with great fervor, but not so with something that resembles work! (That sounds like adults, too.)

Dictionary of Computerese

mole-electronics - (TV set for a burrowing animal?): a technique of growing solid-state crystals so as to form transistors, diodes, and resistors in one mass for micro-miniaturization. Also called molectronics.

MUMPS - (a childhood disease characterized by swollen glands in the neck?): a text-oriented language with built-in data base facilities and string matching. Used in HOSPITALS and other large organizations for unified accounting.

touch-up paint (that which is non-existent at Radio Shack repair centers): if you have scratched off the pretty silver paint on your computer, you cannot get touch-up paint from the Shack. (I tried.) I have found that the closest thing to it is Testors Pla Enamel (model airplane paint) #1180, Steel - NOT the Silver. You might make a closer match if you add a little of the #1146 Silver to the Steel. Try it on an inconspicuos spot first.

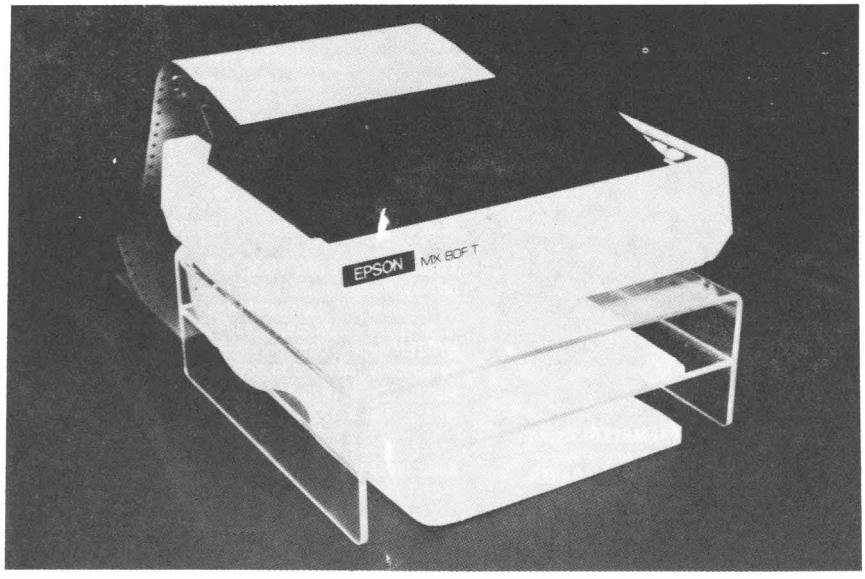
computer tape (the same thing as audio tape): some of the teachers I have been a consultant to have trouble with this one. Radio Shack sells what is known as Certified Computer Cassette tapes. There is NO difference in these tapes and the normal cassette tapes they sell for voice recording except that the magnetic coating on the computer tapes is a little thicker, and they have been tested to make sure the coating is not scratched off in some places.

The computer tape is not magical. The computer transmits an AUDIO signal to the tape recorder. If you pull the EAR plug and play back a program, you can hear the sounds. (No, it's nothing like Barry Manilow.)

Well, that's it. This is also my farewell article. Pressures with my job and at home have built up until I have decided that I am trying to do too much. As much as I hate to let the Beginner's Corner down, I have to start cutting back somewhere.

I hope that your experences with microcomputing continue to be rewarding, and that you never pass up the opportunity to try something new. Seek out a computer club in your area. The veteran programmers and computerists there just love to pass on what they know.

Sherry M. Taylor
322 South 21st Street
Haines City, FL 33844 ■



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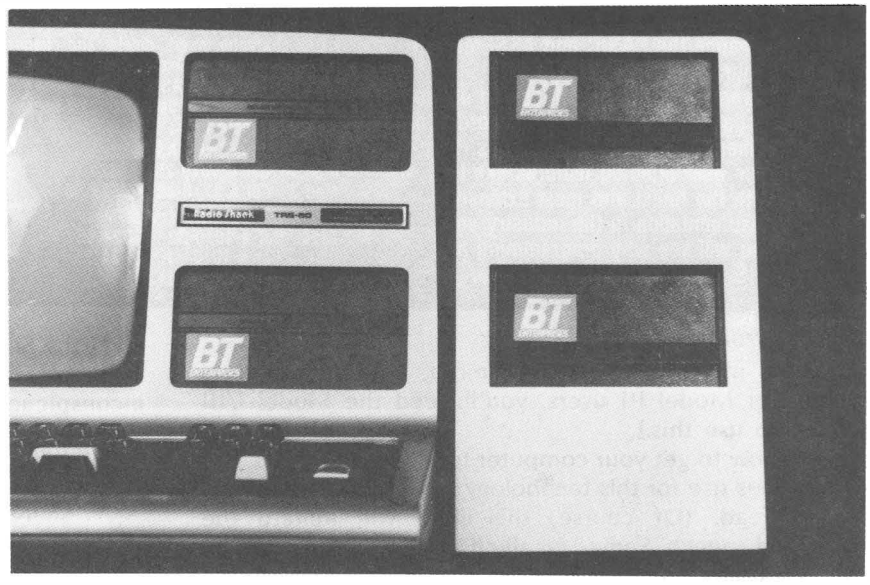

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PRACTICAL BUSINESS PROGRAMS

S. M. Zimmerman, Ph.D. and L. M. Conrad

Check Writing on the TRS-80 Model I

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For the small business person the act of writing monthly checks can be a long and expensive task. One local business concern took four days to write their checks by hand. This program did not solve all their problems relative to check writing, but it has helped reduce the job to manageable size. It still takes a day to complete the task, but that's much better than four days.

There are several interesting programming problems associated with a check writing routine. The conversion of the month's number to the month's name, and the conversion of the symbol of a number to the written word were two similar problems that had to be solved. Another problem not solved completely in this program was the storage and retrieval of data.

In the business under study it was necessary to write a series of two dozen mortgage checks each month. There is no reason to type in this information every month. The program allows for the creation of a disk file or a tape file to be used month after month. This data may be of value in other activities of a business.

The printers now available are both powerful and crammed full of individual abilities. We wrote the program for Radio Shack's old Line Printer I. With a minimum amount of effort we believe the program can be adapted to produce checks on a wide variety of printers. The reader must customize the output to the printer available.

The program is designed to produce either a page of checks for those with alignment problems on friction feed printers or to operate continuously with tractor feed printers.

If you decide to custom design your own checks you should be aware that a check must have the bank's name, the clearing house number, it must say "Pay to the order of" and it must have a signature as well as the account's magnetic number. You will not have a legal check if you leave anything out.

A custom check is fun to produce and use. Take care not to overdo the customization. People like checks to look like checks. When it comes to getting paid many individuals do not like to take fancy custom produced checks.

PROGRAM OUTPUT

Two sets of outputs are required from a check writing program as a minimum. The checks themselves must be produced and a record of the checks must also be maintained. It is also possible to maintain the balance of cash in the check book. However, this function is not included in our program.

The record of checks produced may be either electronic or hard copy. This program produces a check stub at the same time it produces a check. This approach was selected because it duplicated the manual method now being used and minimized the transition from the present system. It was felt the easier the transition to a computer system could be made, the more readily it would be accepted.

PROGRAM INPUT

The minimum input data was required. In this case the program needs to know the date, amount of the check and name of the person to whom the check is to be made. Debit and credit information is not needed because the data is not used directly for accounting purposes. It is possible to use the data set to produce accounting information. This possibility was left for future development.

RUNNING THE PROGRAM

The program starts with the usual program identification material on the CRT:

```
C H E C K   W R I T E R   L I M I T   $ 9 9 , 9 9 9 . 9 9
  M A X I M U M
  S T E V E N   M . Z I M M E R M A N , P H . D .   &
          L E O   M . C O N R A D
          1 9 8 1
```

In this case there is a limit of check size of $99,999.99. This did not seem to be too great a limit, so only a minimum amount of effort was spent in trying to program around this restriction.

Checks to be of any value must be printed out on a printer. This program assumes that you have a printer and that it is running.

The first question on the screen asks for the type of system you are using:

```
T Y P E   O F   S Y S T E M   ( T ) A P E   O R
    ( D ) I S K ?
```

The reason for this question is to control the computer's time clock when necessary to allow for tape input and output while using the disk system. (By the way, the reason we have written the headings skipping every other space is that we are using the 32 character mode for printout on the screen and we wanted to simulate this as close as possible in our explanation.)

We have a disk system and are using disks in our sample run, so we answered D to the above question. Do not try this unless you have a disk system in operation. The question wants to know what you have, not what you wish you had!

The next question is:

```
( R ) U N   O R   ( P ) A G E ?
```

If you have a tractor system you will wish to go into Run

ALL HARDWARE Model I Lowercase

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mode. If you have a friction feed system with alignment troubles, you may wish to print out three checks and then either feed an additional three checks or realign after three checks. Both options are available.

We now proceed to the next question:

```
DATE (YYMMDA)?
```

This may seem like a strange way to input a date. The date is written this way because the resulting number allows for the easy sorting of dates. We have not taken advantage of this fact in our current program but plan to do so in some future effort.

The next question asks :

```
STARTING CHECK NO?
```

This question needs no explanation.

There are three optional input procedures built into the program. You may either input from the keyboard, a disk or a tape recorder. Since it is assumed this is the first time you have used the program, the details of the procedure of inputing from the keyboard are given; i.e. your answer was K to the question:

```
SELECT INPUT KEYS, DISK, TAPE
(K/D/T1/T2)?
```

If you answered D for disk it is assumed you have a disk system and wish to open a disk file for the purpose of input of data. If you answered either T1 or T2, it is assumed the data is stored on tape and will be inputted from tape. If you only have a single tape recorder then you must use T1 for your input.

The next question asks you about your choice of output. You must print a check if you are using this program. The choice is whether you wish to record the input data, and if so, where to record the information.

```
RECORD NONE, DISK, TAPE
(N/D/T1/T2)?
```

If you select none you will have no record of the checks other than the checks and stubs you printed out. If you select tape be sure to set up a tape recorder to record. If you use the tape recorder, you must decide which of the two available tape recorders you want to use. If you only have a single tape recorder you have no choice. You must select T1.

The program is now ready to produce checks and to record the data as instructed above. Be sure to set up the printer as well as the recorder at this stage.

You will be asked several questions over and over again until you tell the computer you are finished. These questions are:

```
NAME PAYEE(END TO STOP)?
AMOUNT OF CHECK?
```

After you have answered these questions, you will first

continued on page 42

COLOR COMPUTER CORNER

Joseph Rosenman

This Month: Review of Technical Reference Manual

I think I'll start this column with a complaint to Radio Shack. Why has the software support been so skimpy? One might have hoped that Radio Shack would have learned from its experiences with the Model 1. I am referring to the slow release of Model 1 software. Instead, many companies sprang up to fill the void Radio Shack left. Who benefited? Much to the chagrin of Radio Shack (I suspect), we the users. Despite the fact that Radio Shack couldn't provide the software that its users required, new companies stepped in to fill the void.

Why isn't this happening with the Color Computer? Well, of course, to some extent it is. But there are a couple of reasons why this non-Radio Shack software growth is limited. I believe that the primary reason has to do with the Color Computer Disk Drive system.

The Model 1 microcomputer began as a more expensive machine then the Color Computer. By the time most people had heard of it, an Expansion Interface and a Floppy Disk were "standard" peripherals. When you considered purchasing a Model 1, you generally assumed that an Expansion Interface and a Disk Drive would follow. Since "everyone" had a disk, disk software became readily available. Now we come to the darker aspect of this problem. Since all Model 1 users had a cassette recorder, why should a disk drive make such a big difference? The answer lies with the hotly disputed topic of "software piracy." Some users believe that the cost of software can only be justified if they can "share" it with other users, and if they can "share" other users' software in the same fashion. This "trading" is, of course, technically illegal. (I am not equating this type of piracy with that of companies that re-package and re-sell other companies' software. If one is petty larceny, the other is clearly grand theft.) Now I am familiar with both points of view, and I don't intend to advocate any specific position in this column. For whatever it is worth, I believe that the "profit-less" software piracy that individual users have indulged in has probably helped more than it has hurt. I believe this has provided a readily available supply of software, which has in turn encourged users to purchase both microcomputers and new software. The end result has been a proliferation of both microcomputers and software. Of course, this begs the question of legalities. Clearly companies that develop software and invest both time and money in advertising and distribution deserve compensation for their efforts.

So what has happened with the Color Computer? First of all, the Color Computer is a less expensive machine. I believe that most Color Computer owners don't want to double their investment by buying a disk drive. Frankly, I am forced to agree. If you consider the cost of a 16K Extended Basic Color Computer with disk and a TRS-80 Model 3, I would go for the Model 3. If Radio Shack asked me for my advice, I would say "lower the cost of the disk!" As a result, very few Color Computer users have a disk. Worse yet, since Radio Shack took so long with the introduction of their disk, a competing company (Exatron) came out with a disk. To make matters worse, the Exatron disk is "data compatible" with the Model 1. And (you guessed it) the two systems are incompatible. In other words, the situation is a real mess.

There are many companies that are producing compatible disk systems for the Model 1 and 3. Why can't these companies do the same thing with the Color Computer? The Model 1 and 3 disks are "software independent." This means that as long as you have a certain "generic" type of disk, you just need to plug it in. All the software is contained on a diskette. The Color Computer system requires a special "plug in" Expansion Interface. This unit plugs into the same place where the cartridge ROMs go. This Interface connects to the disk. It also contains the Disk Operating System on a ROM chip. The disk drives used in the Color Computer are exactly the same as the disk drives used in the Model 1 (Shugart standard, 35 track). While many companies could replicate the Expansion Interface, the ROM Disk Operating System cannot be touched. If any company were to try, Radio Shack would undoubtedly sue the pants off of them. I guess I could say "I told you so." If you look back to issue 39, you will note that I had several reservations about the DOS-ON-ROM approach. Radio Shack tried to insure that only it could provide both the Software and the Hardware for the Color Computer disk, and it looks like we all came up to be the losers.

TRS-80 Color Computer Technical Reference Manual

Price: $14.95
Cat No: 26-3193

OK, now that I have raked Radio Shack over the coals, I must give it some credit. The Technical Reference Manual is very expensive for a 69 page manual, but contains a wealth of information. The information included is intended for "advanced" programmers and technicians. Of course, 99% of the Color Computer users will want to skip over the circuit diagrams. Of tremendous value to machine language programmers is the information on how to access and utilize the sophisticated circuitry in the Color Computer.

The Technical Reference Manual has 7 major topics:

(1) Introduction and Memory Map.
(2) Disassembly/Assembly of the Color Computer.
(3) Theory of Operation—a detailed description by topic.
(4) Trouble shooting.
(5) Parts List.
(6) Printed Circuit Board.
(7) Schematic.

COLOR COMPUTER

TRS-80

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Here is an official "Memory Map" of the Color Computer:

FFFF End of DMA area.
FF00 End of Cartridge ROM, start of DMA area.
C000 End of BASIC ROM, start of Cartridge ROM.
A000 End of Expansion BASIC ROM, start of BASIC ROM.
8000 End of RAM in 32K systems, start of Expansion ROM.
4000 End of RAM in 16K systems.
1000 End of RAM in 4K systems.
0600 End of normal Video, start of Graphics Video.
0400 Normal Video Display starts here.
0000 All RAM starts here.

"DMA" stands for Direct Memory Access. (More on this later.) Note that there is no "End of Graphics Video." This is because the Graphics Video area is variable. Graphics Video could occupy anything from 0 bytes to 1800H bytes (6K). One astonishing fact about the Color Computer is that it is possible to understand the operations of the Color Computer by examining the five Primary Integrated Circuits.

The "heart" of the Color Computer is contained in only 5 LSI (Large Scale Integration) Integrated Circuit Chips. They are:

(1) one MC6809E CPU (Central Processor Unit) chip.
(2) one MC6883L SAM (Dynamic RAM Controller) chip.
(3) one MC6847 VDG (Video Display Generator) chip.
(4) two MC6821 PIA (Peripheral Interface Adapter) chips.

In addition to these chips, there is ROM and RAM chips. There are either 1 or 2 8K ROM chips (in Extended BASIC systems, there are 2 ROM chips). In 4K or 16K systems, there are a total of 8 RAM chips. If you are upgrading from a 4K to a 16K system, the old chips would be replaced by the new higher density chips. While it doesn't say so, I'm pretty sure that the 32K upgrade works in the same way. The reason I believe this is that the diagram of the printed circuit board doesn't leave any space for an additional 8 memory chips. This would mean that, in order to expand to a 32K RAM system, one would need to replace the current RAM chips. CAUTION: The upgrade could include more than just chip replacement. It might also require different jumper settings or re-soldering of certain connections.

The CPU is an 8 bit device that performs all of the standard functions expected of a CPU. At some point in the future, I will be writing about 6809 Assembly Language programming. At that time, I will go into the architecture of the 6809 chip in more detail. (Well, it gives you something to look forward to, right?)

The SAM chip controls memory, but that's not all. SAM stands for Synchronous Address Multiplexor. This chip provides the clocks used to control all event timing in the Color Computer, and also generates video address lines. It is possible to set or change parameters of this chip by writing special values to the DMA area (FFC0 to FFDF).

The VDG chip is the "thing" in the color computer that takes the numbers in the RAM and turns them into a video

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Video Display Memory

The video display memory occupies locations 3C00 to 3FFF. This is a 1K buffer that is mapped directly to the 1024 (decimal) positions of the video display, starting in the upper-left corner and extending 64 characters across each line for 16 lines. If you store a number in one of these locations, its ASCII equivalent is displayed on the screen. (ASCII tables are in the REFERENCE MANUAL.)

If you store a value in video memory that has bit 7 set, it indicates a graphics character. Graphics divide each cursor position into six PIXELS. Bits 0-5 of the value stored determine which pixels are set. These bits are mapped into the graphics as shown in Figure 8.

- Port Number -
Decimal Hex Function

224 E0 Maskable Interrupt Latch
If reset, jumps to:
(bit) 0 3365 cassette routines (bit high)
1 3369 cassette routines (bit low)
2 4046 cursor blink and clock
3 403D (presently unused)
4 4206
5 4209
6 4040
7 4043

228 E4 Non-Maskable Interrupt Latch
Input bits:
5 RESET key pressed
6 Disk drive timeout
7 FDC controller interrupt
Output bits:
6 Enable timeout interrupt
7 Enable FDC controller interrupt

232 E8 RS232 Modem Status Register/Master Reset
Input bits:
1 UART pin 20
4 Ring indicator
5 Carrier detector
6 Data Set ready
7 Clear to send
Output bits: any value resets controller

233 E9 RS232 Configuration switches
Input bits:
0-2 Baud rate select
3 Parity: 0=enable, 1=disable
4 Stop bits: 0=1, 1=2 bits
5-6 Word length select:
00=5, 01=6, 10=7, 11=8 bits
7 Parity: 0=odd, 1=even
Output bits: baud rate select
0-3 Receive rate
4-7 Transmit rate

234 EA RS232 Status and Control Register
Input bits: Status register
0-2 unused
3 Parity error (1=true)
4 Framing error (1=true)
5 Overrun error (1=true)
6 Data sent (1=true)
7 Data ready (1=true)
Output bits: Control register
0 Data terminal ready
1 Request to send
2 Break
3 Parity enable
4 Stop bits
5-6 Word length select
7 Parity

234 EB RS232 Data Register
Input: Received data
Output: Transmit data

235 EC Miscellaneous Controls
Output bits:
1 Cassette motor (0=off, 1=on)
2 Large size video (0=off, 1=on)
3 Special character set select:
0=Kana, 1=Misc.

240 F0 FDC Status Register
241 F1 FDC Track Register
242 F2 FDC Sector Register
243 F3 FDC Data Register

244 F4 FDC Interface Control Port
Output bits:
0 Drive 0 select
1 Drive 1 select
2 Drive 2 select
3 Drive 3 select
4 Disk side select
5 Write precompensate select
6 Enable wait for data
7 Density select:
0=single, 1=double

248 F8 Line Printer port
Input bits: printer status
0-3 unused
4 Printer fault
5 Device select
6 Out of Paper
7 Printer busy
Output bits: data to print

255 FF Cassette port
Input bits: read status
7 Data bit: 0=low, 1=high
Output bits: output level
0-1 Level select:
00=0.85V 01=0.46 10=0

Figure 9: Summary of Model III input/output ports and their functions.

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Bits:	7	6	5	4	3	2	1	0
Pixel:	1	0	F	E	D	C	B	A

A	B
C	D
E	F

Figure 8: Correspondence between bits and graphics on Model III video display. (The diagram is meant to represent a 3x2 block in one cursor position, which may be divided into six pixels.)

Model III I/O Ports

As we mentioned above, most I/O peripherals on the Model III are interfaced through I/O ports. The Z-80 microprocessor allows up to 256 ports, and only a few of them have been used in the standard design of the computer. There is still much room for expansion.

I/O ports are often used for different functions on input or output, and each of the bits may be used for a different purpose. Figure 9 summarizes the functions of the Model III I/O ports.

We did not discuss the functions of the floppy disk controller (FDC) ports (F0-F4) because they will be discussed in detail in a later column. ■

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image. It is possible to modify or set information in the VDG chip. Some of the DMA inputs to the SAM chip are passed on to the VDG chip. In fact, when you set a PMODE in BASIC, that is exactly what happens. BASIC will write a specific value to the correct DMA address, and the SAM will change the internal setting of the VDG. In interpreting the video in RAM, this chip generates the character/block, color, and brightness for each fraction of the video image. The different parts of the Video signal are then mixed together in a MC1372 chip, and converted into an RF signal by UM1285-8 chip. (RF stands for Radio Frequency, and refers to the type of signal that a TV antenna can recieve).

The PIA chips put together the rest of the Color Computer. One PIA (U8) is used to interpret the keyboard (it also interprets the red "fire" buttons on the joysticks). The second PIA (U4) does quite a bit. It (1) controls a 6 bit DAC (Digital to Analog Converter), (2) drives the RS-232-C port, (3) drives the cassette port, and (4) transfers control from BASIC to a cartridge ROM and controls selection of the VDG chip modes.

Well, that gives you a taste of the Color Computer Technical Reference Manual. Needless to say, there is a great deal more. In future issues, I will explore the use of the DMA address in more detail. Should you purchase this book? Unless you intend to use the Color Computer purely as a "plug in the program and hit GO" type of computer, I would say yes. The information in this book permits a more profound understanding of what makes the Color Computer tick, and can greatly enhance your ability to make use of this machine's features.

Joseph Rosenman
35-91 161st Street
Flushing, NY 11358 ■

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hear the data being recorded, either on the selected tape recorder or on a disk. Then the printer will print a check. When you answer END to the first question, you will hear this data being recorded and the program will end.

PROGRAM NOTES

Lines 420-460 include the name and address, phone number and such of the organization producing the checks. Please replace the name and address of XYZ Management Service Inc. with your own name and address. These lines are noted with REMark statements to help you identify where these changes must be made. Note line 460 is the clearing house number for your bank. It is critical you get it right.

If you have the clearing house number printed by the supplier of your checks then line 460 should simply be removed.

The biggest problem you will run into when using the check writing program is spacing. Unless you wish to use exactly the form selected, you will have to get into this aspect of the program. Line 380 is used to control the spacing at the begining of the first check on a page and between the remaining checks on the page. Experiment with the value of N in line 380 for the between check spacing. In the case of the first check it is assumed you will line up the top of the first check so that no spacing is required. There is no fast and easy method to work around the task of counting, such as to line up the output as it is needed.

Some of you may not wish to include the print out of a name and address or the information may be on your checks already. The easiest way to get around this problem with minimum reprogramming is to set all of the variables in lines 420-450 equal to blanks (i.e. Z1$=" ", etc.) if the name and address are preprinted on the checks.

```
10 CLEAR 500: CLS : PRINT CHR$(23): REM  "CHECK"
20 PRINT "CHECK WRITER   LIMIT $99,999.99 MAXIMUM": PRINT
" STEVEN M. ZIMMERMAN PH.D. & LEO M. CONRAD": PRINT "   1981"
30 PRINT : INPUT "TYPE OF SYSTEM (T)APE OR (D)ISK";TS$: NO=0:
INPUT "(R)UN OR (P)AGE";QQ$
40 INPUT "DATE(YYMMDA)";D#: INPUT "STARTING CHECK NUMBER";NX
50 INPUT "INPUT KEYS,DISK,TAPE (K/D/T1/T2)";IO$
60 IF IO$<>"K" THEN 170
70 INPUT "RECORD NONE, DISK, TAPE (N/D/T1/T2)";R$:IF R$="D"
THEN LINEINPUT "FILE:DISK ";G$: OPEN "O",1,G$
80 INPUT "NAME PAYEE (END TO STOP)";N$
90 IF N$="END" THEN LET AM#=0.0:GOTO 110
100 INPUT "AMOUNT OF CHECK";AM#
110 IF R$="D" THEN PRINT#1,CHR$(34);N$;CHR$(34),AM#
120 IF TS$="D" THEN CMD"T"
130 IF R$="T1" THEN PRINT#-1,N$,AM#
140 IF R$="T2" THEN PRINT#-2,N$,AM#
150 IF N$="END" THEN END
160 GOTO 280
170 IF IO$<>"D" THEN 220
180 LINEINPUT "FILE:DISK ";FD$
190 OPEN "I",1,FD$
200 INPUT#1,N$,AM#
210 GOTO 280
220 IF TS$="D" THEN CMD"T"
230 IF IO$="T1" THEN INPUT "LOAD TAPE#-1 TO PLAY HIT RETURN";DU$
240 IF IO$="T2" THEN INPUT "LOAD TAPE#-2 TO PLAY HIT RETURN";DU$
250 IF IO$="T1" THEN INPUT#-1,N$,AM#: PRINT N$,AM#
260 IF IO$="T2" THEN INPUT#-2,N$,AM#
270 IF TS$="D" THEN CMD"R"
280 IF N$="END" THEN CLOSE : END
290 NO=NO+1: IF NO=4 THEN IF QQ$<>"R" THEN INPUT "RELOAD
CHECKS";DU$: NO=1: REM NOTE IF=NUMBER CHECKS PER PAGE +1 ***
300 DY%=D#/10000:DY#=DY%
310 DM#=D#/100.-DY#*100:DM%=DM#:DM#=DM%
320 DD%=D#-DY#*10000-DM#*100
330 FORI=1 TO DM#
340 READ M$
350 NEXT
360 DATA "JANUARY", "FEBRUARY", "MARCH", "APRIL", "MAY", "JUNE",
"JULY", "AUGUST", "SEPTEMBER", "OCTOBER", "NOVEMBER", "DECEMBER"
370 RESTORE
380 N= 9: IF NO<=1 THEN 420
390 FORI= 1 TO N
400 LPRINT" "
410 NEXT
420 Z1$="XYZ MANAGEMENT SERVICES INC.": REM REPLACE WITH YOUR
OWN NAME
430 Z2$="1111 UNDER WATER ROAD": REM REPLACE WITH OWN ADDRESS
440 Z3$="MOBILE, ALABAMA 36605": REM REPLACE WITH OWN CITY
450 Z4$="(111) 111-1111": REM REPLACE WITH OWN PHONE NUMBER
460 CH$="61-142/651": REM REPLACE WITH YOUR BANKS' CLEARING
HOUSE NUMBER
470 C$="                                    %
        %":D$="NUMBER ######                    %
                  %                NUMBER ######"
480 LPRINT USING C$;Z1$: LPRINT USING D$;NX,Z2$,NX: LPRINT USING
C$;Z3$:NX=NX+1
490 B$="%      % ## , 19##                %
         %%      % ## ,  19##    "+CH$
500 LPRINT USING B$;M$;DD%;DY%;Z4$;M$;DD%;DY%
510 N=0
520 FOR I= 1 TO N
530 LPRINT" "
540 NEXT
550 A$="%                   %    PAY TO THE ORDER OF:%
                      % $###,###.##"
560 LPRINT USING A$;N$;N$;AM#
570 EE$="         $###,###.##      ":LPRINT USING EE$;AM#;
580 HT%=AM#/100000
590 IF HT%>9 THEN LPRINT "VOID": END
600 IF HT%<=0 THEN 660
610 FOR I=1 TO HT%+12
620 READ N$
630 NEXT
640 RESTORE
650 LPRINT N$;" HUNDRED ";
660 DATA "ONE", "TWO", "THREE", "FOUR", "FIVE", "SIX", "SEVEN",
"EIGHT", "NINE", "TEN", "ELEVEN", "TWELVE", "THIRTEEN",
"FOURTEEN", "FIFTEEN", "SIXTEEN", "SEVENTEEN", "EIGHTEEN",
"NINETEEN", "TWENTY"
670 DATA "THIRTY", "FORTY", "FIFTY", "SIXTY", "SEVENTY",
"EIGHTY", "NINETY"
680 MA=AM#
690 IF HT%>0 THEN LET MA=AM#-HT%*100000
700 T%=MA/1000: IF T%>0 AND T%<20 THEN LET E%=T%+12: GOTO 730
```

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```
71Ø IF T%<=Ø THEN 76Ø
72Ø F%=T%/1Ø:D%=T%-F%*1Ø:E%=F%+3Ø
73Ø FOR I= 1 TO E%: READ N$: NEXT : RESTORE
74Ø FOR I= 1 TO D%+12: READ M$: NEXT : RESTORE : IF T%=Ø THEN
LET N$=" NO "
75Ø IF D%>0 THEN LPRINTN$;" ";M$;" THOUSAND ";:
ELSE LPRINT N$;" THOUSAND ";
76Ø MB=AM#
77Ø IF T%>0 THEN LET MB=AM#-T%*1ØØØ
78Ø IF HT%>0 THEN MB=MB-HT%*1ØØØØØ
79Ø H%=MB/1ØØ
8ØØ IF H%<=Ø THEN 86Ø
81Ø FOR I= 1 TO H%+12
82Ø READ N$
83Ø NEXT
84Ø RESTORE
85Ø LPRINT N$;" HUNDRED  ";
86Ø MC=AM#
87Ø IF H%>Ø THEN LET MC=AM#-H%*1ØØ
88Ø IF T%>0 THEN LET MC=MC-T%*1ØØØ
89Ø IF HT%>0 THEN LET MC=MC-HT%*1ØØØØØ
9ØØ DX%=MC:IF DX%>0 AND DX%<2Ø THEN LET E%=DX%+12: GOTO 93Ø
91Ø IF DX%<Ø THEN 96Ø
92Ø F%=DX%/1Ø:D%=DX%-F%*1Ø:E%=F%+3Ø
93Ø FOR I= 1 TO E%: READ N$: NEXT : RESTORE
94Ø FOR I= 1 TO D%+12: READ M$: NEXT : RESTORE : IF DX%=Ø
THEN LET N$= " NO "
95Ø IF D%>0 THEN LPRINT N$;" ";M$;" DOLLARS ";: ELSE LPRINT N$;
" DOLLARS";
96Ø IF HT%>0 THEN LET AM#=AM#-HT%*1ØØØØ
97Ø IF T%>0 THEN LET AM#=AM#-T%*1ØØØ
98Ø A=AM#:X%=A
99Ø CT#=AM#-X%
1ØØØ IF CT#<Ø THEN LET CT#=Ø.Ø
1Ø1Ø CT%=CT#*1ØØ: Z#=CT#-CT%/1ØØ.: IF Z#>.ØØ7 THEN LET CT%=CT%+1
1Ø2Ø LPRINT" AND ";CT%;" CENTS"
1Ø3Ø IF IO$="K" THEN 8Ø
1Ø4Ø IF IO$="D" THEN 2ØØ
1Ø5Ø IF TS$="D" THEN CMD"T"
1Ø6Ø GOTO 25Ø
```

SUMMARY

A check writing program can be used in all types of business. It is of maximum value when used in combination with other programs. It will be necessary for you to make some adjustments in this program to produce the custom check you require.

In addition to our check writing routine a file handling program has been prepared. This program will be published in next month's issue of this magazine. These file handling routines are designed to handle both the disk and tape files produced by our check writing program. This program is designed for the novice to learn the basics of file handling by tape and disk.

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PROGRAM CONVERSION (PART 3)

Richard Kaplan

This month I will discuss several elements of program conversion between the Models 1, 2, and 3. After reading this article, any TRS-80 owner should have a reasonably good idea of what is involved in program conversion for his machine.

PRINT @

Perhaps the most common problem when converting programs is the use of PRINT @ statements. This statement prints something at a specific position on the screen; however, since the Model II has a larger screen than do the Models I and III, PRINT @ coordinates must be converted.

Both the Model I and Model III screens consist of 16 lines of 64 characters, for a total of 1024 screen positions. These print positions have been assigned a value from 0 to 1023. The statement PRINT @ 0, "THIS IS A TEST" would print the text in quotes along the top of the screen. PRINT @ 64 would print starting at the beginning of the second line. PRINT @ 96 would print in the middle of the second line, etc.

The Model II screen consists of 24 lines of 80 columns each, for a total of 1920 print positions. These print positions are numbered from 0 to 1919. As with the Models I and III, PRINT @ 0 would print at the top of the screen. With the Model II, though, PRINT @ 80 would print at the beginning of the second line, *NOT* PRINT @ 64.

If you are converting a Model I program to run on the Model II, there exists a formula to convert PRINT @ locations. First, insert the following line somewhere at the beginning of your program:

```
DEF FNA(X)=(INT(X/64)*80)+(X-(INT(X/64)*64))+320
```

Whenever you encounter a PRINT @ statement in your Model I program such as PRINT @ X,"THIS IS A TEST" you can now replace it with PRINT @ FNA(X), "THIS IS A TEST".

Converting a Model II program to run on the Model I or III is a bit more difficult. Since the Model II screen is larger than the Model I and III screens, it is simply not possible to duplicate the entire Model II screen.

To give a general idea of where on the Model I or III screen a particular Model II screen location would lie, you can use the formula (INT(X/80)*64)+(X-INT(X/80)*80)). Note, however, that this formula will generate some erroneous screen locations. For example, Model II locations 70 and 54 BOTH give the SAME location when plugged into this formula. This is because there are simply more Model II locations than there are Model I or III locations. Using this formula, however, will approximate how to format the Model I or III screen. The only acceptable conversion procedure is really to reduce the amount of information on the screen at one time.

RANDOM DISK ACCESS— VARIABLE LENGTH FILES

Both the Models II and III support a type of file structure called a variable record length file. This file structure causes some problems when converting a program to the Model I, since Model I TRSDOS does not support variable record length files.

When a random access file is in use, information is stored as "records" on a disk. A "record" usually consists of 256 bytes of information. TRSDOS GET and PUT statements instruct the computer which record to access, and any record can be accessed in any order. Thus, if you are creating a mailing list, each name and address on the list can occupy one record, and you can look at any individual name without first reading in all previous names, as with a sequential file.

It would be rare in a mailing list program, for instance, if your records occupied exactly 256 bytes. Perhaps you have allocated a maximum of 100 characters as the total maximum length for each record. It would be wasteful to consider 100 characters to be a record all by itself. If you did this, TRSDOS would add 156 blank bytes at the end of each record, because standard files have 256 bytes per record. On the other hand, each name on the mailing list MUST have its own record number. If record 1, for instance, consisted of names 1 and 2 (200 bytes) and 56 bytes of name 3, it could get very confusing to keep track of the location of each name.

A variable-length record is a way of telling the computer that your records will only be 100 bytes each. In this way, you do not waste disk space. Unfortunately, this feature is not available on the Model I.

If the OPEN statement on your Model II or III program has a comma and then a number at the end, i.e. OPEN "R",1,"DATA",128 then you have a variable-length file. If you wish to convert this to the Model I, you have two options: ELIMINATE THE VARIABLE-LENGTH FILE STRUCTURE AND WASTE DISK SPACE, OR PURCHASE AN OPERATING SYSTEM WHICH SUPPORTS VARIABLE-LENGTH FILES, SUCH AS DOSPLUS.

If you wish to use TRSDOS with your program and your program uses variable-length file structure, simply delete the comma and the number at the end of every OPEN statement. For example, suppose your Model II or III program reads as follows:

```
10 OPEN "R",1,"DATA",128
```

The preceding program line could be rewritten on the Model I as:

```
10 OPEN "R",1,"DATA"
```

If you eliminate the variable file structure, the disk capacity for your program will be severely diminished. In the preceding example, for instance, EXPANDING 128-BYTE RECORDS TO 256 bytes (standard records) WILL CUT YOUR DISK CAPACITY IN HALF.

DOSPLUS is an operating system which can replace TRSDOS. DOSPLUS enhances the operation of your Model I in many ways. First of all, program loading time is shortened considerably. Second, double-density disk drives will work with DOSPLUS as double density. Many feature are added

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into disk BASIC. Model I disks can be written on the Model III which are DIRECTLY compatible. But, as I said earlier, perhaps one of the nicest features of DOSPLUS is that variable record lengths are supported on DOSPLUS. A Model III program which uses this file structure will not have to be converted (or at least the disk access will not).

RANDOM DISK ACCESS—OPEN "D"

The Model II supports two types of OPEN statements for random-access files. OPEN "R" and OPEN "D" both open a random access files, and they have exactly the same parameters. THERE IS ABSOLUTELY NO DIFFERENCE BETWEEN OPEN "R" AND OPEN"D" ON THE Model II.

OPEN "D" is not supported on the Model I or Model III under TRSDOS. If you encounter a Model II program which uses OPEN "D", simply replace every occurence of OPEN "D" with OPEN "R". The effect of each of these statements is identical.

SEQUENTIAL DISK ACCESS—OPEN "E"

A sequential disk file is a file where data must be read or written in the same order every time. If you have a mailing list, for instance, and you want to look at name number 100, you must first load in ALL 99 records before that one. Sequential files, therefore, are not very efficient and are not used often in good programs, but for a beginning programmer or for an application which requires a very short file (such as simply a date) sequential files are very useful, since they are easier to use than are random access files.

OPEN "I" and OPEN "O" are two statements which are supported on the Models I, II, and III. OPEN "I" specifies that a file is to be opened as an INPUT file, whereas OPEN "O" specifies that data is to be output into the file. Thus, let's say we wish to open a file called DATE which is to contain the date 04/01/82:

```
10 OPEN "O",1,"DATE"
20 A$="04/01/82"
30 PRINT #1, A$
40 CLOSE
```

Line 10 opens the file as file number one. Line 30 instructs the computer to print the contents of A$ into the file. Line 40 closes the file.

Let's supppose that you wanted to add another date to your file. Up until now, the procedure has been the same for the Models I, II, and III. The procedure to add to an ALREADY EXISTING file is different on the Model III.

On the Model III, there is a special type of OPEN statement called OPEN "E". This OPEN statement causes the file to be opened as an output file, but the first record printed will be printed AFTER THE LAST RECORD ALREADY INPUTTED INTO THE FILE. To clarify this, let's add a second date into our DATE file.

```
10 OPEN "E",1,"DATE"
20 A$="04/02/82"
30 PRINT #1, A$
40 CLOSE
```

On the Model I and Model II, the OPEN "E" statement does not exist. If the OPEN "O" statement is used, however, the computer will erase all previous contents of your file. Thus, you must first read in all data from your file, then OPEN the file again and save the old data and the new data. Our converted program would read:

```
10 OPEN "I",1,"DATE"
20 INPUT #1,A$
30 CLOSE
40 OPEN "O",1,"DATE"
50 B$="04/02/82"
60 PRINT #1,A$
70 PRINT #1,B$
80 CLOSE
```

One final note for Model I owners: The Model I under DOSPLUS supports the OPEN "E" statement. If you have a Model III program to convert, you may, therefore, wish to purchase DOSPLUS. Exercising this alternative has the added advantage of allowing your Model III disk to be DIRECTLY readable by the Model I. Therefore, you may be spared some unnecessary typing or unnecessary time with an RS-232 interface, depending on the original method of transfer you used (see last month's column).

GRAPHICS

Converting graphics is probably the hardest of all conversions necessary. Before detailing the conversion process, it is necessary to have an understanding of the graphics capabilities of both computers with which you will be working, since each of the Models I, II, and III handles graphics in a substantially different manner.

All three TRS-80's can print special graphics characters. These characters are accessed by means of the CHR$ function. For example, on the Models I and III character codes 128-191 are special graphics characters. To print any of these characters, you would simply type PRINT CHR$(X), where X is the appropriate code. For example, PRINT CHR$(191) would print as a solid block. The complete set of Model I/Model III characters is listed in the Radio Shack Reference Manuals.

The Model I and Model III can also treat the screen as a mathematical coordinate system. The TRS-80 screen is divided into a 128 by 48 array, any block of which may be simply turned on or off. The screen is 128 block wide and 48 blocks high.

The SET statement can be used to turn on any specific point. Executing the command SET (X,Y), where X is the horizontal location and Y is the vertical location will turn on the desired block ("pixel"). To "erase" this point, simply use the RESET statement, which has the same form as the SET statement but a reverse effect.

As an example, the following program will draw a border around the screen and then erase it after pressing the +ENTER− key:

```
10 CLS
20 FOR X=0 TO 127:SET (X,47):SET(X,0):NEXT
30 FOR X=0 TO 47:SET (0,X):SET(127,X)
40 PRINT @ 544,;:INPUT"PRESS ENTER TO CLEAR SCREEN";ZZ$
50 FOR X=0 TO 127:RESET (X,47):RESET (X,0):NEXT
60 FOR X=0 TO 47:RESET (0,X):RESET (127,X):NEXT
```

The Model III has a set of 96 additional special characters. 64 of these (CHR$ codes 192-255) can be printed with the CHR$ funtion. However, a special statement must be executed prior to printing any of these characters.

Initially, codes 192-255 represent "space compression" characters. CHR$(192) would be no spaces, etc., until CHR$(255), which would be 63 spaces. Typing PRINT CHR$(21) replaces these space compression characters with the special characters shown in the illustration. Thus, typing PRINT CHR$(21):PRINT CHR$(252) would print a question mark in reverse video. CHR$(21) is what is known as a "toggle switch". This means that every time this statement is executed, the Model III switches from space compression codes to special graphics characters or from graphic characters to space compression codes. CHR$(21) alternates between these two character sets.

The Model III also has a set of Japanese characters, codes 199-255. These can be selected with the toggle switch CHR$(22). CHR$(22) **AND** CHR$(21) must be selected in order to print the Japanese characters.

The Model II does not have SET statements available. It does, however, have graphics characters. These graphics characters are codes 128 through 159. To print any of these character, simply type PRINT CHR$(X), where X is a value from 128 to 159. Consult the chart to see what each character looks like.

GRAPHICS CONVERSION

To convert Model I or Model III SET statements to the Model II, you should PRINT graphics character 158 at the appropriate position on the screen. First, convert the SET statement's X and Y coordinates into an appropriate PRINT @ coordinate. The PRINT @ coordinate for the statement SET (X,Y) would be Y*64+X. This number (Y*64+X) should then be plugged into the previous formula under "PRINT @" conversion to determine the appropriate coordinate. Thus, let's say you have entered in the function described under "PRINT @" and you have the following statement in your program:

```
10 SET (X,Y)
```

This statement could be replaced with:

```
10 PRINT @ FNA(Y*64+X),CHR$(158)
```

Other than the preceding instruction, there really is no set method to convert graphics. The main point to keep in mind is how the original program works. As long as you understand this, the best method is to choose an acceptable character available on the other computer and use that character.

As always, reader correspondence is welcomed. If you have any questions, or if there is a specific topic which you would like to see covered, simply write to Richard Kaplan, c/o H & E Computronics. ■

continued from page 25

Logical operations are very frequently used an assembly language programing. In future columns, I will be showing ways that logical operations are actually used in programming. For the time being, all that YOU (as a beginning programmer) can do is to become familiar with the "language" of programming.

NEGATIVE NUMBERS

Last but not least, is the negative number. Computers usually store negative numbers in a special format known as two's complement. To find the two's complement of a number, get the logical NOT of the number, and add 1 (the logical NOT is also known as the one's complement). In two's complement notation, the left most bit is known as a "sign bit." If it is a zero, the number is positive. If the sign bit is a one, the number is negative. One drawback of the use of two's complement notation, is that the maximum number size that can be represented is reduced. For example, let's take a nybble. Since a nybble is 4 bits long, the maximum number that could be represented would be a 15. In two's complement, the maximum becomes 7. Consider the following table:

```
ØØØØ = Ø     1ØØØ = -8
ØØØ1 = 1     1ØØ1 = -7
ØØ1Ø = 2     1Ø1Ø = -6
ØØ11 = 3     1Ø11 = -5
Ø1ØØ = 4     11ØØ = -4
Ø1Ø1 = 5     11Ø1 = -3
Ø11Ø = 6     111Ø = -2
Ø111 = 7     1111 = -1
```

So, now we know how to convert positive numbers into negative. What about negative into positive? Believe it or not, the same way. Get the logical NOT of the number, and add 1. Of course, when working with binary numbers, it is necessary to know whether the numbers being used are two's complement integers or positive integers. With byte values (8 bits) the situation isn't quite as limited as with nybbles. Two's complement representation in bytes permits a number in the range of −128 to +127. Just a few examples to clarify:

```
1111 1ØØØ =  -8H
ØØ11 1Ø11 =  3BH
1Ø11 11ØØ = -44H
1ØØØ Ø1Ø1 = -7BH
1Ø1Ø ØØ1Ø = -5EH
```

After you have become familiar with the above discussions, you will be ready to examine the idea of "computer architecture" and addressing. In my next column, I will explore those concepts on the Zilog Z-80 microcomputer.

Joseph Rosenman
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CASTLE ADVENTURE

Dave Trapasso

After playing the original adventure game by Crowthers and Woods, I got bitten by the "Adventure" bug. This made up my mind to finally purchase a TRS-80 Model III, and play these games at home into the hours of the night when most people are having dream fantasies.

I spent the better part of the first month that I owned the computer solving adventures by Scott Adams and other honorable mentions. This turned my wife into an instant computer widow who patiently waited for me to get CRT burns in my face.

Well, it never happened, and I never lost interest in playing them. That's when my wife decided to help me come up with an idea for writing one. (If you can't beat them, join them!)

For those of you who are not familiar with adventure games, they are a kind of computer simulated fantasy. They transport you through time and space, to another place where anything is possible, whether it be a pyramid or a ghost town.

At any rate, the adventure game is only an assistant to your imagination, and it works by painting a description of where you are and the objects around you. The game presents you with obstacles which you must first overcome before you obtain your goal, which in this game is to rescue the maiden and get her out of the castle.

Your response to the computer should be in the general form: (verb) (noun) such as: TAKE TORCH. The computer's response might be: TORCH TAKEN, YOU'RE ALREADY CARRYING IT, or YOU CAN'T DO THAT YET, depending on the circumstances. All objects presented to you in the game have some function in the game. For example, you must be carrying the mace before you can ring the bell. I won't give you any more hints, because that would ruin the fun.

Some authors like to put in objects or clues to throw you off the track, but these mostly occur in games written for the experienced adventurer. I rate this game for the novice adventurer. You will find out how well you did at the end of the game anyway.

To move about the game, you only need to enter a single letter for a direction, such as E (for east), etc., with the exception of obstacles like water or stairs. The key to playing the game is to watch all portions of the screen after you give a command. If you don't watch carefully you may miss a clue. In general the top portion of your screen will display what you see and where you are. The bottom portion of the screen will give clues and commands.

If, at any time, you want to know what you're carrying, type "INVENTORY". If you want a description your surroundings or a closer look for hidden clue - type "LOOK".

Since this is the first time I've tried to write a program that is longer than about 10 lines, I encountered several difficulties. First of all, you have to find a decent theme and stick to a logical flow of thought. Next, from my experience of playing adventure games written in BASIC, I found them to be too slow in responding, and I would find myself getting impatient for the result. To rectify this problem, I structured this program to respond in most cases within a couple of seconds' time.

This was accomplished by searching the verb data list within the program and jumping directly to the verb handling subroutine for that verb as soon as the verb is found in the list. You will notice that, if you type in a verb that the program doesn't recognize, it will take longer to respond. Some of the verbs don't need to know what the noun is, so the program will not bother to search the noun data list, such as for a direction. Also, the verbs used the most were put at the front of the list so that the program would find them faster. The end result is a relatively fast adventure program written in BASIC.

Many things pop up which logically have to be taken into account. For example, in real life situations you have to open a door before you walk through it, whereas in playing or writing an adventure game this could be very easily forgotten.

Another example would be that, in real life you can only carry so many objects at once. This is true in many versions of adventure games. It's a pain in the keyboard having to drop items and go back to pick them up as you need them. This serves no useful purpose as I can see, so I let you carry as many objects at once as you wish.

Many of the things you do can be dangerous, such as fooling around with the crocodiles. Most adventure games would decide to kill you at that point and make you start over again. Out of the goodness of my heart I let you live in this game.

Some of the verbs the game recognizes are: TAKE, PULL, DROP, HIT, SAY, KILL, UNLOCK, CATCH, THROW, BREAK, RING, and SWIM. Some of the nouns it will recognize are: SAW, DUCKS, GUNPOWDER, MACE, DAGGER, TORCH, BUCKET, ROPE, WATER, and ARMOR. There are more, but if I told you them all it would ruin the fun. If you have to know more, you can always look at the data list, but that's cheating. This is another good reason to write adventures in machine language.

This program requires 16K of memory, so if you have

any problems with room, remove the comment statements f om the first few lines of the program. This program was written in upper case only to make it more compatable with most of the Model I's. Happy adventuring.

```
1 'WRITTEN BY DAVE TRAPASSO
2 'JULY,1981
3 ' COPYRIGHT D. TRAPASSO, JULY 1981
4 '29 BOULEVARD PARKWAY, ROCHESTER, N.Y. 14612, (716) 663-3925
5 CLS : PRINT @ 18,"WELCOME TO CASTLE ADVENTURE, " : PRINT
"THE OBJECT OF THE GAME IS TO ENTER THE CASTLE AND RESCUE THE
FAIR MAIDEN FROM THE CLUTCHES OF THE BLACK KNIGHT AND RETURN
   WITH HER TO THE FRONT "
1Ø PRINT "OF THE CASTLE.  I RECOGNIZE SIMPLE TWO   WORD
COMMANDS LIKE TAKE BUCKET, AND ONLY NEED ONE LETTER TO MOVEIN A
DIRECTION SUCH AS N (NORTH), S (SOUTH) ETC.  SOME OF THE"
12 PRINT "OTHER WORDS THAT I KNOW ARE LOOK AND INV
(INVENTORY)--GOOD LUCK!"
17 CLEAR 4ØØ
2Ø DIM V$(33),P$(26,5),N$(35,1),M$(12)
25 FOR N=Ø TO 33 : READ V$(N) : NEXT
3Ø FOR N=Ø TO 26 : FOR X=Ø TO 5 : READ P$(N,X) : NEXT X : NEXT N
35 FOR N=Ø TO 35 : FOR X=Ø TO 1 : READ N$(N,X) : NEXT X : NEXT N
4Ø FOR N=Ø TO 12 : READ M$(N) : NEXT N
44 INPUT "BEFORE WE CAN PLAY PLEASE TELL ME YOUR NAME";Z$
45 P=Ø : N2=Ø : N3=Ø : N11=Ø : N12=Ø : N8=Ø : F=Ø
46 G=5
47 CLS
48 GOTO 2Ø5Ø
49 GOTO 55
5Ø PRINT @ Ø,STRING$(255," ")
55 GOSUB 2ØØØ
6Ø RANDOM : B=RND(2Ø) : IF B=6 THEN PRINT @ 512,"A HEART
STOPPING FEMALE SCREAM IS HEARD FROM SOMEWHERE"
62 F=F+1
65 PRINT @ 896,STRING$(63," ") : PRINT @ 896,"---NOW WHAT "; :
INPUT QM$
7Ø X1=LEN(QM$) : IF X1<3 THEN 1ØØ
71 X3=Ø : FOR X2=1 TO X1 : M$=MID$(QM$,X2,1) : IF M$=" "X3=X2
74 NEXT X2
8Ø IF X3=Ø THEN 9Ø
85 X5=X1-X3 : R$=RIGHT$(QM$,X5) : R1$=LEFT$(R$,3)
9Ø L$=LEFT$(QM$,3) : GOTO 112
1ØØ L$=LEFT$(QM$,1)
112 FOR I=Ø TO 33
113 IF L$=V$(I) THEN 18Ø
114 NEXT I : G=2 : GOTO 2Ø5Ø
116 GOSUB 21ØØ
117 IF JJ<Ø THEN 13Ø
12Ø ON S GOTO 3ØØØ, 3Ø1Ø, 3Ø2Ø, 3Ø3Ø, 31ØØ, 32ØØ, 33ØØ, 67ØØ,
7ØØØ, 35ØØ, 37ØØ, 38ØØ, 39ØØ, 4ØØØ, 41ØØ, 42ØØ, 43ØØ, 44ØØ,
45ØØ, 46ØØ, 47ØØ, 48ØØ, 49ØØ, 34ØØ, 97ØØ, 81ØØ, 82ØØ, 85ØØ,
33ØØ, 43ØØ, 855Ø, 855Ø, 855Ø, 855Ø
13Ø G=2 : GOTO 2Ø5Ø
18Ø S=I+1 : IF S<8 OR S=22 OR S=19 OR S=27 OR S=14 OR S=29
THEN 12Ø ELSE 116
2ØØØ IF P=6 THEN 9ØØØ
2ØØ1 PRINT @ Ø,STRING$(255," ") : PRINT @ Ø,"YOU SEE :
 ";P$(P,Ø)
2ØØ4 R=Ø
2ØØ5 PRINT @ 64,""; : FOR N=Ø TO 35 : IF P=VAL(N$(N,1)) THEN
2ØØ7
2ØØ6 NEXT : GOTO 2Ø4Ø
2ØØ7 PRINT "*";N$(N,Ø); : R=R+1
2Ø1Ø IFR=3 THEN 2Ø6Ø
2Ø15 IFR=6 THEN 2Ø65
2Ø2Ø NEXT
2Ø4Ø PRINT @ 256,STRING$(63,"*") : RETURN
2Ø5Ø GOSUB 685Ø : PRINT @ 384,M$(G) : GOTO 55
2Ø6Ø PRINT @ 128,""; : GOTO 2Ø2Ø
2Ø65 PRINT @ 192,""; : GOTO 2Ø2Ø
21ØØ JJ=-1 : FOR J=Ø TO 34
211Ø L1$=LEFT$(N$(J,Ø),3)
2111 IF L1$=R1$ THEN 212Ø
2112 NEXTJ : RETURN
212Ø JJ=J : RETURN
3ØØØ P1$=P$(P,1) : GOTO 3Ø4Ø
3Ø1Ø P1$=P$(P,2) : GOTO 3Ø4Ø
3Ø2Ø P1$=P$(P,3) : GOTO 3Ø4Ø
3Ø3Ø P1$=P$(P,4)
3Ø4Ø IF VAL(P1$)<Ø THEN 36ØØ
3Ø45 IF VAL(P1$)=4Ø THEN 3Ø7Ø
3Ø5Ø P=VAL(P1$) : GOTO 46
3Ø6Ø G=Ø : GOTO 2Ø5Ø
3Ø7Ø G=3 : GOTO 2Ø5Ø
31ØØ IF P=7 THEN 311Ø
31Ø5 G=4 : GOTO 2Ø5Ø
311Ø IF R1$="NOR" OR R1$="BAN" OR R1$="CAS" THEN 313Ø
312Ø IF R1$="SOU" OR R1$="MOA" THEN 314Ø
3125 G=4 : GOTO 2Ø5Ø
313Ø P=8 : GOTO 46
314Ø P=6 : GOTO 46
32ØØ IF P=8 OR P=9 OR P=11 OR P=24 THEN 321Ø
32Ø5 G=1 : GOTO 2Ø5Ø
321Ø IF P<1Ø THEN 327Ø
322Ø IF P<22 THEN 323Ø
3222 GOTO 329Ø
3225 G=4 : GOTO 2Ø5Ø
323Ø IF P=11 THEN 3232
3231 GOTO 32Ø5
3232 IF R$="UP" THEN 3235
3233 IF R$="DOWN" THEN 324Ø
3234 GOSUB 685Ø : PRINT @ 384,"YOU CAN ONLY GO UP OR DOWN ON
STAIRS" : GOTO 6Ø
3235 P=1Ø : GOTO 46
324Ø P=12 : GOTO 46
325Ø IF JJ=28 THEN 327Ø ELSE G=9
326Ø GOTO 2Ø5Ø
327Ø IF P=8 THEN 328Ø
3271 IF P=9 THEN 3275
3272 G=Ø : GOTO 2Ø5Ø
3275 P=8 : GOTO 46
328Ø IF N8=Ø THEN 3285
3282 P=9 : GOTO 46
3285 GOSUB 685Ø : PRINT @ 384,"THE VINES ONLY REACH ABOUT HALF
WAY UP THE WALL" : GOTO 6Ø
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3290 IF P<>24 THEN 3293
3291 IF R$="DOWN" THEN 3294
3292 IF R$="UP" THEN 3295
3293 GOTO 3234
3294 P=23 : GOTO 46
3295 P=25 : GOTO 46
3300 GOSUB 2000 : IF JJ=34 AND P=9 AND VAL(P$(9,5))=1 THEN 3330
3303 IF P$(15,5)="1" AND P=15 AND R1$="PIC" THEN 3340
3305 IF VAL(P$(P,5))=0 THEN 3320
3310 G=8 : GOTO 2050
3320 G=7 : GOTO 2050
3330 P$(9,5)="0" : N$(6,1)="9" : GOTO 3310
3340 P$(15,5)="0" : N$(9,1)="15" : GOTO 3310
3400 GOSUB 8000 : IF N4=0 THEN 60
3410 IF JJ=15 THEN 3420
3415 G=1 : GOTO 2050
3420 IF N$(0,1)="30" AND P=19 THEN 3440
3430 G=0 : GOTO 2050
3440 IF N$(14,1)="6" AND N$(25,1)="22" THEN 3460
3450 GOSUB 6850 : PRINT @ 384,"DING,...NOTHING HAPPENS" :
GOTO 60
3460 N$(13,1)="40" : N$(14,1)="40" : P$(19,3)="23"
3470 GOSUB 6850 : PRINT @ 384,"DING,...THE WHITE KNIGHT COMES
CHARGING OVER THE DRAWBRIDGE AND ENGAGES IN A FIERCE BATTLE WITH
THE BLACK KNIGHT, WHERE UPON    THEY BOTH DISAPPEAR IN A PUFF OF
SMOKE"
3480 GOTO 50
3500 IF JJ=18 THEN 3540
3502 GOSUB 8000 : IF N4=0 THEN 60
3503 IF JJ=3 THEN 3525
3505 IF JJ=18 OR JJ=19 THEN 3550
3515 G=12 : GOTO 2050
3525 GOSUB 6850 : IF VAL(N$(2,1))=30 THEN 3535
3530 PRINT @ 384,"THE DUCKS TRY TO BITE YOUR FINGERS" : GOTO 50
3535 PRINT @ 384,"THE DUCKS EAT YOUR GRAIN AND BECOME FRIENDLY"
: N2=1 : N$(2,1)="40" : GOTO 50
3540 IF N$(18,1)="-6" THEN JJ=19
3543 GOTO 3502
3550 GOSUB 6850 : IF VAL(N$(3,1))=30 THEN 3560
3555 PRINT @ 384,"OK, THE CROC'S RUN AFTER YOU TRYING TO EAT
YOU, BUT YOU'RE TOO  FAST SO THEY GIVE UP" : GOTO 50
3560 N$(18,1)="-6" : N$(19,1)="6" : P$(6,4)="7" : PRINT @
384,"THE CROCS TAKE YOUR DUCKS AND DESPITE THEIR QUACKING AND
     COMPLAINTS GET EATEN FEATHERS AND ALL" : N$(3,1)="-5"
3565 GOTO 50
3600 PRINT @ 768,STRING$(64," ") : G=0 : IF P=6 AND L$="W" THEN
PRINT @ 768,"THE CROCS ATTEMPT TO BITE YOU AS YOU APPROACH THE
MOAT SO YOU  RETREAT" : GOTO 50
3605 IF P=16 THEN PRINT @ 768,"THE ARMOR WON'T LET YOU BY" :
GOTO 50
3610 IF P=7 THEN PRINT @ 768,"I DON'T THINK YOU CAN WALK ON
WATER" : GOTO 50
3615 IF P=8 AND L$="N" THEN PRINT @ 768,"YOU JUST WALKED INTO A
CASTLE WALL" : GOTO 50
3617 IF P=12 AND L$="S" THEN PRINT @ 768,"YOU JUST BUMPED INTO A
WALL BUT IT SOUNDS HOLLOW" : GOTO 50
3620 IF P=9 THEN PRINT @ 768,"IT'S A LONG WAY DOWN TO THE BANK,
BUT THE VINES OVER THE EDGE   LOOK PRETTY STURDY" : GOTO 50
3625 IF P=11 OR P=12 THEN PRINT @ 768,"DON'T YOU KNOW THAT YOU
HAVE TO LIFT YOUR FEET UP WHEN YOU CLIMBSTAIRS?" : GOTO 50
3635 IF P=17 THEN PRINT @ 768,"THE STONE WALLS LOOK SOLID BUT
YOU FEEL A DRAFT COMING FROM ONE OF THEM" : GOTO 50
3640 IF P=19 THEN PRINT @ 768,"THE BLACK KNIGHT WON'T LET YOU
BY" : GOTO 50
3645 IF P=20 THEN PRINT @ 768,"THE GATE SEEMS TO BE LOCKED" :
GOTO 50
3650 IF P=22 THEN PRINT @ 768,"YOU HAVE TO LET DOWN THE
DRAWBRIDGE BEFORE YOU CAN WALK ACROSS  IT" : GOTO 50
3655 IF P=23 THEN PRINT @ 768,"DIDN'T YOU EVER LEARN TO OPEN A
DOOR BEFORE YOU WALK THROUGH IT" : GOTO 50
3660 IF P=24 THEN PRINT @ 768,"DON'T YOU EVER LEARN, YOU HAVE TO
LIFT YOUR FEET WHEN YOU CLIMB STAIRS!" : GOTO 50
3665 IF P=6 THEN PRINT @ 768,"THE DRAWBRIDGE IS RAISED SO YOU
CAN'T CROSS THE MOAT ON IT" : GOTO 50
3670 G=3 : GOTO 2050
3700 IF JJ=11 THEN 3725
3705 IF JJ=26 THEN 3735
3715 GOSUB 6850 : PRINT @ 384,"YOU CAN'T BE SERIOUS" : GOTO 60
3725 GOSUB 8050 : IF N4=1 AND P=26 AND N$(10,1)="-26" THEN 3750
3726 IF N4=1 THEN 3790
3727 JJ=31 : GOSUB 8050 : IF N4=1 THEN 3790 ELSE 6720
3735 GOSUB 8050 : IF N4=1 AND P=22 AND N$(24,1)="22" THEN 3780
3736 IF N4=1 THEN 3790
3737 JJ=17 : GOSUB 8050 : IF N4=1 THEN 3790 ELSE 6720
3750 N11=1 : N$(16,1)="26" : G=5 : GOTO 47
3780 P$(22,2)="6" : P$(6,1)="22" : N$(32,1)="-6" :
N$(33,1)="6" : P$(22,3)="7" : P$(22,4)="7"
3785 P$(22,5)="0" : N$(24,1)="-22" : N$(25,1)="22" :
GOSUB 6850 : PRINT @ 384,"YOU HEAR THE SOUND OF MACHINERY" :
GOTO 50
3790 G=4 : GOTO 2050
3800 IF JJ=11 AND P=25 THEN 3805
3801 GOSUB 8000 : IF N4=0 THEN 60
3802 IF JJ=11 THEN 3810
3803 GOTO 3850
3805 IF VAL(N$(6,1))=30 AND VAL(N$(31,1))=25 THEN 3860
3810 G=0 : GOTO 2050
3820 G=5 : N$(31,1)="-25" : N$(5,1)="25" : GOTO 55
3850 G=12 : GOTO 2050
3860 GOSUB 6850 : PRINT @ 384,"THE BLADE SEEMS TO BE TOO DULL" :
GOTO 60
3900 GOSUB 8000 : IF N4=0 THEN 50
3905 IF JJ=3 THEN GOTO 6700
3910 IF JJ=18 OR JJ=19 THEN GOTO 3550
3915 IF JJ=13 OR JJ=14 OR JJ=15 OR JJ=17 THEN GOTO 3930
3920 G=4 : GOTO 2050
3930 GOSUB 6850 : PRINT @ 384,"I WOULDN'T DO THAT IF I WERE YOU
HE'S LIABLE TO CHOP YOUR HEAD  OFF" : GOTO 50
4000 IF R1$="CHA"4003
4001 IF P=20 AND N$(9,1)="30" THEN 4050
4002 GOSUB 8000 : IF N4=0 THEN 60
4003 IF P=17 THEN 4010
4005 G=1 : GOTO 2050
4010 IF N$(17,1)="17" AND N$(9,1)="30" AND R1$="CHA" THEN 4020
4015 G=0 : GOTO 2050
4020 P$(17,5)="0" : N$(17,1)="40" : P$(17,2)="18" : GOSUB 6850 :
N$(35,1)="17"
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4025 PRINT @ 384,"THE SKELETON SAYS 'THANKS, NOW I'LL SHOW YOU
THE WAY OUT'..... PUSHES A STONE IN THE WALL AND DISAPPEARS
CHAINS AND ALL"
4030 GOTO 50
4050 GOSUB 6850 : PRINT @ 384,"THE GATE IS SO HARD IT WEARS THE
TEETH OFF THE SAW" : GOTO 60
4100 GOSUB 8000 : IF N4=0 THEN 60
4103 IF JJ=34 THEN 4110
4105 G=1 : GOTO 2050
4110 IF VAL(N$(8,1))<0 THEN 4120
4115 GOSUB 6850 : PRINT @ 384,"IT'S NOT LOADED" : GOTO 60
4120 IF N$(7,1)="30" AND N$(6,1)<>"-9" THEN 4130
4125 G=0 : GOTO 2050
4130 IF N$(14,1)="-6" THEN 4140
4135 GOSUB 6850 : PRINT @ 384,"YOU CAN'T, YOU DON'T HAVE ANY
MORE GUNPOWDER" : GOTO 60
4140 N$(14,1)="6" : GOSUB 6850 : PRINT @ 384,"THE CANNON
EXPLODES WITH A FLASH AND A BOOM, AND YOU HEAR THE  SOUND OF
HOOF BEATS FROM SOMEWHERE NEAR THE MOAT" : GOTO 50
4200 GOSUB 8000 : IF N4=0 THEN 60
4203 IF JJ=34 THEN 4210
4205 G=1 : GOTO 2050
4210 IF VAL(N$(8,1))>0 THEN 4220
4215 GOSUB 6850 : PRINT @ 384,"THE CANNON IS ALREADY LOADED" :
GOTO 60
4220 IF N$(8,1)="30" AND P=9 THEN 4230
4225 G=0 : GOTO 2050
4230 N$(8,1)="-14" : G=5 : GOTO 2050
4300 IF P=13 OR P=16 THEN 4305
4302 IF P=23 AND JJ=29 THEN 4330
4303 IF P=20 THEN 4360
4304 GOTO 4306
4305 IF JJ=29 THEN 4335
4306 G=4 : GOTO 2050
4310 IF JJ=22 THEN 4360
4320 IF JJ=24 THEN 4350
4330 IF P$(23,3)="-24" THEN 4340
4335 GOSUB 6850 : PRINT @ 384,"IT'S ALREADY OPEN" : GOTO 60
4340 P$(23,3)="24" : G=5 : GOTO 2050
4350 G=0 : GOTO 2050
4360 IF N$(4,1)="30" THEN 4380
4370 GOSUB 6850 : PRINT @ 384,"YOU CAN'T IT'S LOCKED" : GOTO 60
4380 IF P$(20,2)="21" THEN 4335
4383 IF P<>20 THEN 4350
4385 P$(20,2)="21" : N$(22,1)="-20" : N$(23,1)="20" : GOTO 46
4400 IF JJ=12 AND P=26 AND N$(16,1)="26" THEN 4460
4401 IF JJ=12 AND P=26 AND N$(16,1)="-26" THEN 4480
4403 IF JJ>12 THEN 4485
4405 IF JJ=3 OR JJ=4 OR JJ=5 THEN 4470
4406 GOSUB 8000 : IF N4=0 THEN 60
4410 IF JJ=12 THEN 4430
4420 N3=1 : GOTO 7000
4430 GOSUB 6850 : PRINT "AT WHAT "; : INPUTAZ$
4440 IF AZ$="ARMOR" THEN 4447
4445 IF AZ$="VINES" THEN 8100
4447 IF P=16 THEN 4450
4448 GOTO 4720
4450 N$(12,1)="7" : N$(20,1)="-16" : N$(21,1)="16" :
P$(16,4)="17" : GOTO 46
4460 P$(26,5)="0" : N$(16,1)="-26" : N$(10,1)="26" :
N$(4,1)="26" : GOSUB 6850 : PRINT @ 384,"THE WATER GETS ADSORBED
INTO THE GROUND" : P$(26,5)="0" : GOTO 50
4470 G=1 : GOTO 2050
4480 GOSUB 6850 : PRINT @ 384,"THE BUCKET IS EMPTY" : GOTO 60
4485 G=9 : GOTO 2050
4500 PRINT @ 640,"YOU ARE CARRYING THE FOLLOWING : "
4510 PRINT @ 704,"" : V1=0 : FOR H=0 TO 12 : V=VAL(N$(H,1)) :
IF V=30 THEN 4540
4520 NEXT H : IF V1<>30 THEN PRINT "NOTHING AT ALL"
4530 GOTO 60
4540 V1=V : PRINT N$(H,0);"* "; : GOTO 4520
4600 GOTO 4650
4602 GOSUB 8000 : IF N4=0 THEN 60
4610 IF JJ=11 OR JJ=26 OR JJ=28 OR JJ=1 THEN 4620
4614 G=1 : GOTO 2050
4620 GOSUB 6850 : PRINT @ 384,"WITH WHAT YOUR BEAR HANDS "; :
INPUTGN$
4622 IF GN$="YES" THEN 4630
4625 GOTO 60
4630 IF N$(31,1)="25" AND P=25 THEN 4660 ELSE PRINT
"SORRY...YOU'RE TOO PUNY!" : GOTO 60
4650 IF P=17 AND JJ=26 AND N$(17,1)="17" THEN 4620
4652 IF P=25 AND N$(31,1)="25" THEN 4620
4655 GOTO 4602
4660 GOSUB 6850 : PRINT @ 384,"I DON'T BELIEVE IT BUT YOU JUST
BROKE THAT ROPE WITH YOUR BEAR  HANDS-I GUESS YOU'RE NOT SO PUNY
AFTER ALL" : GOTO 3820
4700 '
4702 IF JJ=5 OR JJ=10 OR JJ=11 OR JJ=13 OR JJ=18 OR JJ=19 OR
JJ=20 OR JJ=22 OR JJ=24 OR JJ=26 OR JJ=29 THEN 4720
4705 GOSUB 8000 : IF N4=0 THEN 60
4710 IF JJ=15 THEN 3400
4720 B=JJ+1 : GOSUB 6850
4730 ON B GOTO 4750, 4620, 4750, 3530, 4750, 4805,
4750, 4750, 4760, 4750, 4815, 4825, 4750, 4835, 3930, 3400,
4750, 3930, 4845, 3555, 4855, 3930, 4865,4750,4875, 4750, 4755,
4750, 4755, 4885, 4755, 4750, 4755, 4750, 4760, 4750
4750 G=12 : GOTO 2050
4755 G=4 : GOTO 2050
4760 PRINT @ 384,"I WOULDN'T DO THAT IF I WERE YOU, IT MIGHT
EXPLODE" : GOTO 60
4800 G=6 : GOTO 2050
4805 GOSUB 8050 : IF N4=1 THEN 4750
4807 JJ=31 : GOSUB 8050 : IF N4=0 THEN 6720
4810 GOTO 4750
4815 GOSUB 8050 : IF N4=1 THEN 4750
4817 JJ=16 : GOSUB 8050 : IF N4=0 THEN 6720
4820 GOTO 4750
4825 GOSUB 8050 : IF N4=1 THEN 4750
4827 JJ=31 : GOSUB 8050 : IF N4=0 THEN 6720
4830 GOTO 4750
4835 GOSUB 8050 : IF N4=1 THEN 3930
4837 JJ=14 : GOSUB 8050 : IF N4=0 THEN 6720
4840 GOTO 3930
4845 GOSUB 8050 : IF N4=1 THEN 3555
4847 JJ=19 : GOSUB 8050 : IF N4=0 THEN 6720
4850 GOTO 3555
4855 GOSUB 8050 : IF N4=1 THEN 3930
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4857 JJ=21 : GOSUB 8Ø5Ø : IF N4=Ø THEN 672Ø
486Ø GOTO 393Ø
4865 GOSUB 8Ø5Ø : IF N4=1 THEN 4755
4867 JJ=25 : GOSUB 8Ø5Ø : IF N4=Ø THEN 672Ø
487Ø GOTO 4755
4875 GOSUB 8Ø5Ø : IF N4=1 THEN 4755
4877 JJ=25 : IF N4=1 THEN 4755
488Ø JJ=32 : GOSUB 8Ø5Ø : IF N4=1 THEN 4755
4882 JJ=33 : GOSUB 8Ø5Ø : IF N4=1 THEN 4755
4884 GOTO 672Ø
4885 GOSUB 8Ø5Ø : IF N4=1 THEN 4755
4887 JJ=3Ø : GOSUB 8Ø5Ø : IF N4=1 THEN 4755
4890 IF P=13 THEN 4755
4892 GOTO 672Ø
49ØØ IF JJ=1 AND N$(1,1)="3Ø" THEN 491Ø
49Ø5 G=Ø : GOTO 2Ø5Ø
491Ø IF VAL(N$(2,1))=P THEN JJ=12
4915 IF P=7 THEN JJ=12
492Ø IF JJ<>12 OR JJ<>2 THEN 494Ø
4925 GOSUB 685Ø : PRINT @ 384,N$(JJ,Ø);" TAKEN"
493Ø N$(JJ,1)="3Ø" : GOTO 5Ø
494Ø INPUT "WITH WHAT ";ZN$
4945 JJ=4Ø : IF ZN$="GRAIN" THEN 497Ø
495Ø IF ZN$="WATER"498Ø
4965 GOSUB 685Ø : PRINT @ 384,"SORRY ";ZN$;" WON'T FIT IN THE
JAR" : GOTO 6Ø
497Ø JJ=2 : GOSUB 8ØØØ : IF N4=Ø THEN 6Ø
4975 GOTO 4925
498Ø JJ=12 : GOSUB 8ØØØ : IF N4=Ø THEN 6Ø
4985 GOTO 4925
5ØØØ DATA N, S, E, W, SWI, CLI, LOO, TAK, DRO, FEE, PUL, CUT,
CAT, SAW, FIR, LOA, OPE, THR, INV, BRE, HIT, SAY, FIL, RIN, KIL,
POU, FUC, CLO, EXA, UNL, TOU, FEE, SME, TAS
5Ø1Ø DATA FOREST ,Ø,2,1,Ø,Ø,FOREST ,1,3,1,Ø,Ø,FOREST &
BUSHES,Ø,4,3,5,1,FOREST ,1,3,3,2,Ø,BUSHES ,2,4,4,4,Ø,FOREST
,5,5,2,6,Ø,CASTLE ENCIRCLED BY MOAT ,-22,6,5,-2,Ø,MOAT
,-8,-6,-7,-7,Ø
5Ø2Ø DATA BANK & CASTLE,-9,7,8,8,Ø,GUARDS
WALK,9,-8,1Ø,9,1,GUARDS WALK NEAR TOP OF SOME STEPS
,11,1Ø,1Ø,9,Ø,STAIRS ,4Ø,-11,4Ø,-11,Ø,HALLWAY NEAR FOOT OF
SOME STEPS ,4Ø,-13,11,15,1,SECRET DOOR,12,14,4Ø,4Ø,Ø,
ARMORY,13,4Ø,4Ø,4Ø,Ø
5Ø3Ø DATA HALLWAY WITH PICTURES OF FIERCE LOOKING BEARDED
KNIGHTS,4Ø,4Ø,12,16,1,HALLWAY ,4Ø,4Ø,15,-17,Ø,DUNGEON
,4Ø,-18,16,4Ø,1,SECRET PASSAGEWAY,17,4Ø,19,4Ø,Ø,COURT YARD &
WELL,26,2Ø,-23,18,Ø, ,19,-21,19,19,Ø
5Ø35 DATA TUNNEL ,2Ø,22,4Ø,4Ø,Ø,,21,-6,-7,-7,1
5Ø4Ø DATA DOOR NEAR FOOT OF SOME STEPS ,4Ø,4Ø,-24,19,Ø,STAIRS
,-24,-24,-24,-24,Ø,WATCH TOWER ,4Ø,4Ø,24,4Ø,Ø,WELL
,4Ø,19,4Ø,4Ø,1,MACE ,17,JAR ,4,GRAIN ,1,DUCKS ,5,KEY ,-26,MAIDEN
,-25,DAGGER ,-9,TORCH ,15
5Ø45 DATA GUNPOWDER ,14,SAW ,-15,BUCKET ,-26,ROPE ,26,WATER ,7
5Ø5Ø DATA KNIGHT DRESSED IN BLACK ARMOR ,19,KNIGHT DRESSED IN
WHITE ARMOR ,-6,BELL ,19,BUCKET OF WATER ,-26,SKELETON CHAINED
TO WALL ,17,CROCS WITH EMPTY BELLYS ,6,CROCS WITH FULL BELLYS
,-6,ARMOR ,16,RUSTY SUIT OF ARMOR ,-16,GATE ,2Ø
5Ø55 DATA OPEN GATE ,-2Ø
5Ø6Ø DATA DRAWBRIDGE ,22,LOWERED DRAWBRIDGE ,-22,CHAIN
,22,,4Ø,VINES ,8,DOOR ,16,DOOR ,19,MAIDEN TIED UP WITH ROPE
,25,DRAWBRIDGE ,6,LOWERED DRAWBRIDGE ,-6,CANNON ,9,SECRET
PASSAGE ,-17
5Ø7Ø DATA SORRY-BUT YOU CAN'T DO THAT...YET!!,I DON'T KNOW WHAT
YOU MEAN,WHAT?,SORRY YOU CAN'T GO THERE,NOTHING HAPPENS,OK,SORRY
SIR LANCELOT...WRONG GAME,YOU SEE NOTHING SPECIAL,THERE'S
SOMETHING THERE ALL RIGHT
5Ø75 DATA IT'S BEYOND YOUR POWER!,TAKEN
5Ø8Ø DATA DROPPED,YOU MUST BE WEIRD
6Ø1Ø IF VAL(N$(12,1))=P THEN N$(12,1)="3Ø"
6Ø15 IF VAL(N$(2,1))=P THEN N$(2,1)="3Ø"
6Ø2Ø GOTO 674Ø
6Ø25 P$(2,5)="Ø" : GOTO 6Ø1Ø
61ØØ IF VAL(N$(1,1))=3Ø THEN 674Ø
611Ø PRINT @ 384,"THE GRAIN SLIPS THROUGH YOUR FINGERS AS
YOU TRY TO TAKE IT" : GOTO 5Ø
62ØØ IF N2=1GOTO 674Ø
621Ø PRINT @ 384,"THE DUCKS FLY AWAY FROM YOU AS YOU APPROACH
THEM" : GOTO 5Ø
63ØØ P$(12,2)="13" : P$(12,5)="Ø" : PRINT @ 384,"YOU HEAR THE
SOUNDS OF GEARS AND CHAINS CLANKING COMING FROM SOMEWHERE DOWN
THE HALLWAY" : N$(JJ,1)="3Ø" : GOTO 5Ø
64ØØ IF VAL(N$(1,1))=3Ø THEN 643Ø
641Ø PRINT @ 384,"YOU'VE NOTHING TO CARRY IT IN" : GOTO 5Ø
643Ø G=1Ø : GOTO 674Ø
65ØØ IF N11=Ø THEN 652Ø
651Ø GOTO 674Ø
652Ø PRINT @ 384,"YOU CAN'T TAKE THE ROPE YET IT SEEMS TO BE
ATTACHED TO SOMETHING" : GOTO 5Ø
67ØØ GOSUB 685Ø : C=JJ+1 : IF C>13 THEN 677Ø
67Ø5 G=1Ø : IF VAL(N$(JJ,1))=3Ø THEN 675Ø
67Ø7 IF JJ=1Ø THEN 69ØØ
67Ø8 IF JJ=5 THEN
67Ø9 IF JJ=5 THEN 83ØØ
671Ø IF VAL(N$(JJ,1))=ABS(P) THEN 673Ø
672Ø G=Ø : PRINT @ 384,"I DON'T SEE IT HERE" : GOTO 6Ø
673Ø IF VAL(N$(JJ,1))=P THEN 676Ø
6735 G=Ø
674Ø IF G=Ø THEN 2Ø5Ø
6743 N$(JJ,1)="3Ø" : PRINT @ 384,"TAKEN" : GOTO 5Ø
675Ø GOSUB 685Ø : PRINT @ 384,"YOU'RE ALREADY CARRYING IT!" :
GOTO 6Ø
676Ø ON C GOTO 674Ø, 6Ø25, 61ØØ, 62ØØ, 674Ø, 674Ø, 674Ø, 63ØØ,
674Ø, 674Ø, 69ØØ, 65ØØ, 64ØØ
677Ø G=9 : GOTO 2Ø5Ø
685Ø PRINT @ 384,STRING$(255," ") : PRINT @ 64Ø,STRING$(255," ")
: : RETURN
69ØØ IF N$(16,1)="26" AND N$(1Ø,1)="-26" AND P=26 THEN 694Ø
691Ø IF VAL(N$(1Ø,1))>0 AND VAL(N$(1Ø,1))<>3Ø THEN 674Ø
692Ø IF VAL(N$(1Ø,1))>Ø AND VAL(N$(16,1))<Ø THEN 672Ø
693Ø G=Ø : GOTO 2Ø5Ø
694Ø GOSUB 685Ø : PRINT @ 384,"THE BUCKET'S TOO HEAVY" : GOTO 6Ø
7ØØØ IF VAL(N$(JJ,1))=3Ø THEN 7Ø2Ø
7ØØ5 GOSUB 685Ø : PRINT @ 384,"YOU'RE NOT CARRYING THE ";
N$(JJ,Ø) : GOTO 6Ø
7Ø2Ø IF JJ=12 THEN 7Ø5Ø
7Ø21 IF JJ=1 THEN 7Ø6Ø
7Ø22 IF N3=Ø THEN 7Ø24
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continued on page 58

THREE BASIC PROGRAMS

Gordon Speer

NATIONAL DEBT

Eighteen-percent interest, or even twelve percent is almost impossible to explain in terms the average person relates to. There was a story about a modern-day Rip Van Winkle who, upon waking after 40 years of sleep, called his stock broker to find out how his shares were doing. He was rejoicing at the news that they were over a million dollars a share when the telephone operator interrupted to ask for another hundred-thousand dollars for the next three minutes.

I wondered how much money George Washington would have had to invest, upon taking office in 1789, to accumulate enough interest to pay off the trillion dollar national debt of today. The program uses 12% interest. You won't believe the answer. If you'd like a real shock, try replacing the .12's with .18's, (the interest rate your VISA card used to charge, before it was raised). The program also compounds the interest only annually. Monthly compounding would be even more incredible.

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100 '   NATLDEBT
110 CLS
120 PRINT "       WASHINGTON PAYS OFF THE NATIONAL DEBT!":PRINT
130 DEFDBL D              'DOUBLE PRECISION VARIABLE
140 REM HOW MUCH WOULD GEORGE WASHINGTON HAVE NEEDED TO
150 REM INVEST IN 1789 AT 12%, TO COVER THE TRILLION DOLLAR
160 REM NATIONAL DEBT OF TODAY?
170 LET D=1D12            'ONE TRILLION, DOUBLE PRECISION
180 FOR Y=1982 TO 1789 STEP -1
190 PRINT @ 320,Y
200 LET D=D/1.12          'COMPOUNDED ANNUALLY, BACKWARDS
210 NEXT Y
220 PRINT USING "$####.## INVESTED AT 12% BY GEORGE WOULD BE
WORTH";D
230 FOR Y=1789 TO 1982
240 PRINT @ 640,Y
250 LET D=D*1.12          'COMPOUNDED ANNUALLY
260 NEXT Y
270 PRINT "$"D"TODAY"
```

BOX

The CALCULETTER column in Popular Science Magazine recently posed this problem: what is the smallest square of sheet metal that can be folded into an open-top box which will contain 13 gallons? There are actually two questions here. The first is, what are the relative dimensions of a box which has the maximum volume from a given sheet size. (The sheet dimension becomes two heights plus one side of the base.) The second is easier: given the relative dimensions, what actual dimensions will produce a volume of 13 gallons, each of which is 231 cubic inches. The second part is a proportion question, volumes are proportional to the cubes of linear dimensions (V/v = S cubed/s cubed).

Now let's get to the tough part. Finding the relative dimensions of a box with a maximum volume is a calculus problem, unless you have a computer. But we all have computers so we'll use the BRUTE FORCE method instead of calculus. We'll change the dimension of the little square you cut out of each corner of the sheet to make the box, and figure the volume the box would have, again and again until the volume starts to decrease. Then we'll use steps half as big in the opposite direction until the volume once again reaches a peak and starts to decrease, then again, and again. It's like tuning a radio—you tune past a station until is starts to fade, then go the other direction a little slower until it fades again, etc.

The answer I came up with has 3 3 3 4 5 and a decimal, but not in that order. See what you can do with it.

Here is another problem which is similar. What is the longest I-beam, six inches wide, which can be wheeled around a right angle corner where a ten foot wide hallway meets an eight foot wide hallway. I'll answer that in a future issue. Send me your solution if you want a prize.

```
100 'BOX
110 '   FIND THE PROPORTIONS OF A MAXIMUM VOLUME OPEN-TOP BOX
120 '   FORMED FROM A GIVEN SQUARE OF MATERIAL BY CUTTING
130 '   SQUARES OUT OF THE CORNERS AND FOLDING UP SIDES
140 CLS                   'CLEAR THE SCREEN
150 GOSUB 380             'DRAW THE PATTERN
160 DEFDBL A-Z            'EXTRA PRECISION
170 PRINT:PRINT:PRINT
180 PRINT "    MAXIMUM VOLUME BOX FORMED FROM A 10 X 10 SHEET:"
190 PRINT
200 PRINT @ 661,"VOLUME (CUBIC UNITS)";
210 PRINT @ 384,"CORNER NOTCH (UNITS)";
220 S=10                  'LENGTH OF A SIDE OF MATERIAL
230 LET I=1               'INCREMENT
240 LET D=1               'DIRECTION OF STEP
250 LET N=L+I*D           'NOTCH=LAST SIZE +/- INCREMENT
260 LET V=(S-2*N)*(S-2*N)*N  'VOLUME OF BOX
270 PRINT @ 725,V;        'CURRENT VOLUME AND NOTCH SIZES
280 PRINT @ 454,USING"#.########";L;  'CURRENT NOTCH SIZE
290 IF V < SV THEN 330    'PAST MAXIMUM-GETTING SMALLER
300 LET SV=V              'SAVE VOLUME FOR COMPARING
310 LET L=N               'SAVE LAST NOTCH SIZE
320 GOTO 250
330 '    VOLUME GETTING SMALLER - CHANGE THE DIRECTION
340 LET D=-D              'CHANGE DIRECTION OF STEP
350 LET I=I/2             'CHANGE SIZE OF INCREMENT
360 GOTO 250
370 '   DRAW THE PATTERN
380 DATA 20,40,80,80,20,25,25,80,92,92,25,40
390 DATA 40,80,92,80,40,45,45,40,80,40,40,45
400 DATA 40,28,40,28,25,40,25,28,40,40,20,25
410 FOR A=1 TO 6
420 READ Y,FH,TH          'FROM AND TO HORIZONTALLY
430 FOR X=FH TO TH
440 SET(X,Y)
450 NEXT X
```

```
460 READ X,FV,TV
470 FOR Y=FV TO TV
480 SET(X,Y):SET(X+1,Y)     'MAKE VERTICALS DOUBLE WIDE
490 NEXT Y,A
500 FOR DELAY=1 TO 1000:NEXT
510 RETURN
```

ROOTS

Everyone, at one time or another, gets interested in genealogy. Sometimes it's just to show the kids who their ancestors were, or how they are related to their cousins. Sometimes it becomes a detailed search through volumes of lineage records. The microcomputer is certainly suited to this kind of work, but would generally be used with disk drives and a printer to list all the descendants. Working backwards, however, we all have two parents, four grandparents, eight great-grandparents, etc., and all of those will fit on your video display very nicely. The question becomes, how do you teach the computer to decide who is related to whom? Here is where the programmer has at least three choices. First, he can study up on genealogy and try to teach the computer to code people by some accepted method (education). Second, he can read computer books until he finds out how some other programmer has done it and do it similarly (plagiarism). Third, he can program it any way he pleases, whether it's acceptable, or not, as long as it works (invention). In writing programs you will always have these three choices, and will probably use all of them at one time or another.

The method used in ROOTS was to assign each person a unique birthdate and to list the name, birthdate, father's birthdate, and mother's birthdate of each family member in a sequential file. (DATA statements in a BASIC program constitute a single sequential file. Using DISK BASIC you may access more than one sequential file, as well as random files, but writing the files requires a little more work than DATA statements.)

When the program is run you are asked to enter the birthdate of the person whose roots you want to trace. The computer then looks for the person with that birthdate, prints his name at the right of the screen, notes the birthdates of his parents, looks them up, prints their names, notes the dates of their parents, etc. Unknown dates and duplicate dates must be supplied with unique suffixes to avoid confusion. The example supplied shows how these might be handled. Try the program with your own ROOTS and see how it works.

```
100 '   Roots
110 CLEAR 10000
120 INPUT"Enter the birthday of the descendant (1-30-1882)";D$
130 CLS
140 PRINT,,"R  O  O  T  S"
150 PRINT @ 128,"- - - - - - - -";
160 PRINT @ 256,STRING$(27,"-");
170 PRINT @ 384,"- - - - - - - -";
180 PRINT @ 512,STRING$(37,"=");
190 PRINT @ 640,"- - - - - - - -";
200 PRINT @ 768,STRING$(27,"-");
210 PRINT @ 896,"- - - - - - - -";
220 LET S$=D$: GOSUB 800        'search birthday
230 IF N$="" THEN 280           'no data on file
240 LET F1$=F$:M1$=M$           'father and mother birthdays
250 PRINT @ 550,N$;
260 PRINT @ 624,B$;
270 '   parents
280 LET S$=F1$: GOSUB 800
290 IF N$="" THEN 320
300 LET F2$=F$:M2$=M$
310 PRINT @ 284,N$;B$;
320 LET S$=M1$:GOSUB 800
330 IF N$="" THEN 370
340 LET F3$=F$:M3$=M$
350 PRINT @ 796,N$;B$;
360 '   grandparents
370 LET S$=F2$:GOSUB 800
380 IF N$="" THEN 410
390 LET F4$=F$:M4$=M$
400 PRINT @ 142,N$;B$;
410 LET S$=M2$: GOSUB 800
420 IF N$="" THEN 450
430 LET F5$=F$:M5$=M$
440 PRINT @ 398,N$;B$;
450 LET S$=F3$: GOSUB 800
460 IF N$="" THEN 490
470 LET F6$=F$:M6$=M$
480 PRINT @ 654,N$;B$;
490 LET S$=M3$: GOSUB 800
500 IF N$="" THEN 540
510 LET F7$=F$:M7$=M$
520 PRINT @ 910,N$;B$;
530 '   great grandparents
540 LET S$=F4$: GOSUB 800
550 IF N$="" THEN 570
560 PRINT @ 64,N$;B$;
570 LET S$=M4$: GOSUB 800
580 IF N$="" THEN 600
590 PRINT @ 192,N$;B$;
600 LET S$=F5$: GOSUB 800
610 IF N$="" THEN 630
620 PRINT @ 320,N$;B$;
630 LET S$=M5$: GOSUB 800
640 IF N$="" THEN 660
650 PRINT @ 448,N$;B$;
660 LET S$=F6$: GOSUB 800
670 IF N$="" THEN 690
680 PRINT @ 576,N$;B$;
690 LET S$=M6$: GOSUB 800
700 IF N$="" THEN 720
710 PRINT @ 704,N$;B$;
720 LET S$=F7$: GOSUB 800
730 IF N$="" THEN 750
740 PRINT @ 832,N$;B$;
750 LET S$=M7$: GOSUB 800
760 IF N$="" THEN 780
770 PRINT @ 960,N$;B$;
780 GOTO 780                    'lock the display
790 '
800 'subroutine to search for ancestors by birthday
810 RESTORE
```

continued on page 64

TWO GRAPHICS PROGRAMS

Airdrie Ferguson

GRAPHIC COMBINATIONS

Anyone designing graphic material (borders, frames, etc.) need only to run this program to get some ideas for pattern makeup. I have used this extensively over the last two years—it saves a lot of spade work. Running is self-explanatory, and the program requires well under 4K in Level II.

```
1Ø RANDOM : CLS : PRINT CHR$(23) : PRINT @ 266, "GRAPHICS
COMBINATIONS" : FOR T=1 TO 1ØØØ : NEXT : CLS : PRINT @ 271,
"PRESS SPACE BAR TO CONTINUE DISPLAY"
15 PRINT @ 4Ø4, "PRESS 'BREAK' KEY TO STOP" : PRINT @ 528,
"SELECT MAGNITUDE OF COMBINATIONS"
2Ø PRINT @ 649, " BY PRESSING 2, 3, 4 OR 5 .....NOW"
3Ø I$=INKEY$ : IF I$ < "2" OR I$ > "5" THEN 3Ø ELSE I=VAL(I$) :
ON I GOTO 3Ø,7Ø,9Ø,14Ø,38Ø
4Ø GOTO 3Ø
5Ø '***** GRAPHICS DISPLAY OF LINES USING COMBINATIONS OF UP TO
FIVE GRAPHICS CODES AT RANDOM AND DISPLAYING IDENTIFICATION ****
6Ø '*** AIRDRIE FERGUSON,BOX 4Ø2Ø6 CASUARINA,
N.T. 5792,AUSTRALIA ***
7Ø L=Ø : CLS : FOR K=1 TO 8 : A=RND(62)+128 : B=RND(62)+128 :
FOR N=L TO L+62 STEP 2 : PRINT @ N, CHR$(A); : NEXT
75 FOR M=L+1 TO L+63 STEP 2 : PRINT @ M, CHR$(B); : NEXT :
PRINT @ L+64, "A="; A; "B="; B; : L=L+128 : NEXT
8Ø A$=INKEY$ : IFA$ = " " THEN 7Ø ELSE 8Ø
9Ø L=Ø : CLS : FOR K=1 TO 7 : A=RND(62)+128 : B=RND(62)+128 :
C=RND(62)+128 : FOR N=L TO L+6Ø STEP 3 : PRINT @ N, CHR$(A); :
NEXT : FOR M=L+1 TO L+61 STEP 3
95 PRINT @ M, CHR$(B); : NEXT : FOR O=L+2 TO L+62 STEP 3 :
PRINT @ O, CHR$(C); : NEXT : PRINT @ L+64, "A="; A; " B="; B;
" C="; C;
1ØØ L=L+128
11Ø NEXT
12Ø A$=INKEY$
13Ø IF A$=" " THEN 9Ø ELSE 12Ø
14Ø L=Ø
15Ø CLS
16Ø FOR K=1 TO 7
17Ø A=RND(62)+128
18Ø B=RND(62)+128
19Ø C=RND(62)+128
2ØØ D=RND(62)+128
21Ø FOR N=L TO L+6Ø STEP 4
22Ø PRINT @ N, CHR$(A);
23Ø NEXT
24Ø FOR M=L+1 TO L+61 STEP 4
25Ø PRINT @ M, CHR$(B);
26Ø NEXT
27Ø FOR O=L+2 TO L+62 STEP 4
28Ø PRINT @ O, CHR$(C);
29Ø NEXT
3ØØ FOR Q=L+3 TO L+63 STEP 4
31Ø PRINT @ Q, CHR$(D);
32Ø NEXT
33Ø PRINT @ L+64,"A="; A; " B="; B; " C="; C; " D="; D
34Ø L=L+128
35Ø NEXT
36Ø A$=INKEY$
37Ø IF A$=" " THEN 14Ø ELSE 36Ø
38Ø L=Ø
39Ø CLS
4ØØ FOR K=1 TO 7
41Ø A=RND(62)+128
42Ø B=RND(62)+128
43Ø C=RND(62)+128
44Ø D=RND(62)+128
45Ø E=RND(62)+128
46Ø FOR N=L TO L+59 STEP 5
47Ø PRINT @ N, CHR$(A);
48Ø NEXT
49Ø FOR M=L+1 TO L+6Ø STEP 5
5ØØ PRINT @ M, CHR$(B);
51Ø NEXT
52Ø FOR O=L+2 TO L+61 STEP 5
53Ø PRINT @ O, CHR$(C);
54Ø NEXT
```


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```
55Ø FOR Q=L+3 TO L+62 STEP 5
56Ø PRINT @ Q, CHR$(D);
57Ø NEXT
58Ø FOR R=L+4 TO L+63 STEP 5
59Ø PRINT @ R, CHR$(E);
6ØØ NEXT
61Ø PRINT @ L+64, "A="; A; " B="; B; " C="; C; " D="; D;
" E="; E;
62Ø L=L+128
63Ø NEXT
64Ø A$=INKEY$
65Ø IF A$=" " THEN 38Ø ELSE 64Ø
66Ø END
```

THE LADDER

The object is to climb the ladder, one "rung" at a time, to the top of the wall. The "rungs" are blocks which light up (in order as required) but with random delays in lighting up and staying on for random lengths of time. Each move up the ladder must be made while the rung is "on", but before it goes "off". A reward display is there for success.

```
1Ø RANDOM : CLEAR 25ØØ : CLS
2Ø ' *** THE LADDER *** AIRDRIE FERGUSON BASIC II 38Ø8 8/8Ø
3Ø GOTO 5Ø
4Ø GOTO 3ØØ
5Ø CLS : FOR N=256 TO 318 STEP 2 : PRINT @ N, CHR$(135); :
NEXT : FOR M=257 TO 319 STEP 2 : PRINT @ M, CHR$(133); : NEXT :
FOR A1=22 TO 982 STEP 64 : PRINT @ A1, CHR$(17Ø); : NEXT
55 FOR A2=28 TO 988 STEP 64 : PRINT @ A2, CHR$(149); : NEXT :
FOR Y=38 TO 41 STEP 3 : SET(44,Y) : NEXT : FOR Y=35 TO 41 STEP
3 : SET(57,Y)
6Ø NEXT : IF SS = Ø THEN 4Ø
7Ø A=663 : B=664 : C=665 : D=Ø : E=667 : F=727 : G=728 : H=729 :
J=731 : K=791 : L=792 : O=795 : P=855 : Q=856 : S=858 : T=859 :
U=922 : V=92Ø : W=923 : X=44
75 FOR Y=5 TO 35 STEP 3 : RESET(X,Y) : NEXT : X=57 : FOR Y=5 TO
32 STEP 3 : RESET(X,Y) : NEXT : X1=15447 : X2=15451 : FOR XX=1
TO 11 : FOR YY=X1 TO X2 : POKE YY,128
8Ø NEXT : X1=X1+64 : X2=X2+64 : NEXT : RR=32 : LL=35 : M=Ø
9Ø PRINT @ G, CHR$(168); : PRINT @ H, CHR$(188); CHR$(148);
CHR$(176); : PRINT @ K, CHR$(184); CHR$(172); CHR$(191);
CHR$(156); CHR$(133);
95 PRINT @ P, CHR$(176); CHR$(19Ø); CHR$(143); CHR$(189);
CHR$(128); : PRINT @ V-1, CHR$(128); CHR$(128); : PRINT @ U,
CHR$(17Ø); CHR$(176);
1ØØ IF D <> Ø THEN 12Ø ELSE PRINT @ P, CHR$(176); : PRINT @ V-1,
CHR$(128); CHR$(128);
11Ø M=1 : GOSUB 26Ø
12Ø PRINT @ K, CHR$(138); : PRINT @ F, CHR$(176); : IF
POINT(44,LL) AND POINT(46,LL) THEN 13Ø ELSE 7Ø
13Ø M=M+1 : LL=LL-3
14Ø M=2 : GOSUB 26Ø : PRINT @ U, CHR$(128); CHR$(128); : PRINT @
T, CHR$(176); : FOR J1=1 TO 5Ø : NEXT : PRINT @ B, CHR$(16Ø);
CHR$(176); CHR$(144);
145 PRINT @ F, CHR$(176); CHR$(178); CHR$(191); CHR$(177);
CHR$(176); : PRINT @ K, CHR$(13Ø); CHR$(186); CHR$(191);
CHR$(181); CHR$(129);
15Ø PRINT @ P, CHR$(176); CHR$(149); CHR$(128); CHR$(17Ø);
CHR$(176); : GOTO 16Ø
16Ø FOR J1=1 TO 5Ø : NEXT : PRINT @ A, CHR$(176); CHR$(168);
CHR$(188); CHR$(148); : PRINT @ F, CHR$(138); CHR$(172);
CHR$(191); CHR$(156); CHR$(18Ø);
165 PRINT @ K, CHR$(128); CHR$(19Ø); CHR$(143); CHR$(189);
CHR$(128); : IF POINT(47,2) THEN 35Ø
17Ø IF POINT(44,LL) AND POINT(46,LL) THEN 18Ø ELSE 7Ø
18Ø M=M+1 : LL=LL-3
19Ø M=1 : GOSUB 28Ø : PRINT @ S, CHR$(128); CHR$(128); :
PRINT @ O, CHR$(176); : FOR J1=1 TO 5Ø :NEXT
195 PRINT @ J, CHR$(133); : PRINT @ E, CHR$(176); : IF
POINT(55,RR) AND POINT(57,RR) THEN 2ØØ ELSE 7Ø
2ØØ M=M+1 : RR=RR-3
21Ø M=2 : GOSUB 28Ø : PRINT @ P, CHR$(128); CHR$(128); : PRINT @
K, CHR$(176); : FOR J1=1 TO 5Ø : NEXT : PRINT @ B-64, CHR$(16Ø);
CHR$(176); CHR$(144);
215 PRINT @ B, CHR$(178); CHR$(191); CHR$(177); : PRINT @ F,
CHR$(13Ø); CHR$(186); CHR$(191); CHR$(181); CHR$(129);
22Ø PRINT @ L, CHR$(149); CHR$(128); CHR$(17Ø); : FOR J1=1 TO 5Ø
: NEXT : PRINT @ B-64, CHR$(168); CHR$(188); CHR$(148);
CHR$(176);
225 PRINT @ A, CHR$(184); CHR$(172); CHR$(191); CHR$(156);
CHR$(133); : PRINT @ F, CHR$(128); CHR$(19Ø); CHR$(143);
CHR$(189); CHR$(128);
23Ø IF POINT(55,RR) AND POINT(57,RR) THEN 24Ø ELSE 7Ø
24Ø M=M+1 : RR=RR-3
25Ø M=3 : GOSUB 26Ø : V=V-128 : A=A-128 : B=B-128 : C=C-128 :
E=E-128 : F=F-128 : G=G-128 : H=H-128 : J=J-128 : K=K-128 :
L=L-128 : O=O-128 : P=P-128 : Q=Q-128 : S=S-128 : T=T-128 :
U=U-128 : W=W-128 : D=1 : GOTO 9Ø
26Ø N=RND(3) : FOR I=1 TO N*5ØØ : IF INKEY$="Ø" THEN RETURN ELSE
NEXT : SET(44,LL) : N=RND(ZZZ)+2 : FOR I=1 TO N*2Ø : IF INKEY$
= "Ø" THEN RETURN ELSE NEXT : RESET(44,LL) : ON M GOTO
11Ø,14Ø,25Ø,27Ø
27Ø M=Ø : GOTO 11Ø
28Ø N=RND(3) : FOR I=1 TO N*5ØØ : IF INKEY$="Ø" THEN RETURN ELSE
NEXT : SET(57,RR) : N=RND(ZZZ)+2 : FOR I=1 TO N*2Ø : IF INKEY$ =
"Ø" THEN RETURN ELSE NEXT : RESET(57,RR) : ON M GOTO 19Ø,21Ø,29Ø
29Ø M=Ø : GOTO 19Ø
3ØØ PRINT @ 392, "THE"; : PRINT @ 519, "LADDER"; : PRINT @ 642,
"EASY....PRESS '4'"; : PRINT @ 77Ø, "HARD....PRESS '1'"; : PRINT
@ 896, "IMPOSSIBLE...PRESS 'Ø'";
3Ø5 C$=INKEY$ : IF C$ = "4" THEN ZZZ=4 ELSE IF C$ = "1" THEN
ZZZ=1 ELSE IF C$ = "Ø" THEN ZZZ=Ø ELSE 3ØØ : GOTO 34Ø
31Ø GOSUB 34Ø : PRINT @ 35Ø, "YOU CAN REACH FOR THE NEXT RUNG ";
: PRINT @ 482, "AS SOON AS IT APPEARS"; : PRINT @ 6Ø9, "BY
PRESSING THE 'Ø' KEY";
315 PRINT @ 737, "IF YOU MISS YOU FALL DOWN"; : PRINT @ 865,
"PRESS SPACE BAR TO START"; : A$=INKEY$
32Ø IF A$ = " " THEN 33Ø ELSE 31Ø
33Ø FOR PP=35Ø TO 862 STEP 128 : PRINT @ PP, CHR$(3Ø); : NEXT :
GOTO 7Ø
34Ø FOR J5=64Ø TO 896 STEP 128 : PRINT @ J5, STRING$(22,32); :
NEXT : RETURN
35Ø CLEAR 1ØØØ : I=22 : K=128
36Ø A$=" "+CHR$(K)+CHR$(168)+CHR$(188)+CHR$(148)+CHR$(K)+STRING$
(6,CHR$(24))+CHR$(26)+" "+CHR$(K)+CHR$(K)+CHR$(189)+CHR$
(K)+CHR$(K)
```

continued on page 64

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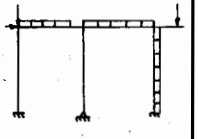

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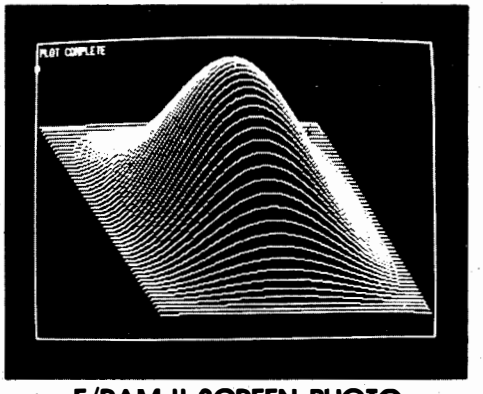

E/RAM II SCREEN PHOTO

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THE MODEL III—A STEP BACK FOR MANKIND?

M. Barlow

An axiom of the Better Mousetrap Building business is that to sell in any quantity, the new product must be an order of magnitude better or cheaper than the competition. With the Model I TRS-80, Radio Shack had the edge, partly because of a good choice of compromises in the basic TRS-80 design, but mainly because their marketing and back-up arrangements were right. In places where this was not so, e.g. Europe, the TRS-80 is nowhere near as popular. It is also noticeable that where Tandy was not so all encompassing, e.g. in software and specialized peripherals, a whole secondary industry arose to supply the needs of the 250,000 TRS-80 owners.

With the introduction of the Model III, I suggest that Radio Shack has not made an order of magnitude improvement, so that there is no clear advantage for those 250,000 buyers to go out and get the new model. At the same time, enough minor changes have been made to ruin the work of those other suppliers, who in most cases must now redo their work and supply separate items for Model I and Model III. This is bound to increase the cost of these items, and some companies will go out of business as a result. The TRS-80, therefore, is now a losing proposition, and no longer shows such pronounced advantages over the PET, Sinclair and Apple.

What are the incompatibilities, and can they be worked around? First, in the hardware, let us agree that the new packaging and its lack of RF interference are great. The necessity of breaking the warranty seals to install non-Radio Shack disk drives may put a crimp in the sales of such drives, which were selling like hot cakes for the Model I. The use of double density disks does not worry me, but the change in connector types for the modem and cassette are ridiculous decisions. The latter problem can be fixed by simply breaking off the end cylinder of the cassette plug, but why on earth was it made different? Printer cables with the same connectors on each end can be used on the Model I, but the hole in the Model III case won't accept the longer plug.

The software problems are more serious. The changes are slight, but the result is that every software program has to be checked, and often modified, to make it run on the Model III. The improvements obtained by giving up the extra 280 or so bytes of RAM are just not worth the extra work now involved. Having gone that far, Radio Shack might as well have changed the video format to 24 rows of 80 characters, as we all expected them to do. The problem is made worse by the deficiencies in the first version of Model III TRSDOS, which must be at least as bad as the early Model I TRSDOS. The writers of the DOS seem to have learnt nothing from the popularity of other DOS programs: the Model III TRSDOS, and conversion to and from Model I is extremely crude and time-consuming.

What then, can we do about it? First, we can use NEWDOS or DOSPLUS to solve the softwre problems. Second, we could buy an LNW80 or PMC-80 instead of the Model III. Third, we could ask Radio Shack to provide the necessary chips to make a Model III an exact replacement of a Model I. Fourth, we could upgrade the existing Model I chips to emulate a Model III with single density.

One can imagine the Radio Shack committee trying to decide which way to go with some of these decisions. No doubt they were much influenced by the need to increase sales, for all of the points above seem to be in the direction "buy R.S. or be inconvenienced". I question the wisdom of their choices. To me, the situation is similar to that of Kodak when they cut off their 250,00 users of regular 8 mm movies by introducing Super 8. I doubt if 1% of the previous users changed over—most took up another hobby. I fear Radio Shack may just have done the same thing for us.

M. Barlow
5052 Chestnut Avenue
Pierrefonds, Quebec
Canada H8Z 2A8 ■

continued from page 52

```
7Ø23 G=5 : N3=Ø : GOTO 7Ø25
7Ø24 G=11
7Ø25 N$(JJ,1)=STR$(P) : GOTO 2Ø5Ø
7Ø5Ø N$(12,1)="7" : GOSUB 685Ø : PRINT @ 384,"THE WATER SPLASHES
OUT AND GETS ABSORBED INTO THE GROUND" : GOTO 5Ø
7Ø6Ø IF VAL(N$(2,1))=3Ø THEN N$(2,1)=STR$(P)
7Ø61 IF N3=Ø THEN 7Ø64
7Ø62 N3=Ø : G=5 : GOTO 7Ø65
7Ø64 G=11
7Ø65 N$(JJ,1)=STR$(P) : IF VAL(N$(12,1))=3Ø THEN 7Ø5Ø
7Ø7Ø GOTO 7Ø25
745Ø P$(15,5)="Ø" : GOTO 7Ø4Ø
8ØØØ N4=1 : IF VAL(N$(JJ,1))=3Ø OR VAL(N$(JJ,1))=P THEN RETURN
8Ø1Ø GOSUB 685Ø : PRINT @ 384,"YOU CAN'T DO THAT YET BECAUSE
IT'S NOT HERE"
8Ø2Ø N4=Ø : RETURN
8Ø5Ø N4=1 : IF VAL(N$(JJ,1))=3Ø OR VAL(N$(JJ,1))=P THEN RETURN
8Ø51 N4=Ø : RETURN
81ØØ IF P=8 AND N$(12,1)="3Ø" AND JJ=12 AND N8=Ø THEN 812Ø
81Ø3 IF P=26 AND R1$="WAT"44ØØ
81Ø5 GOTO 7ØØØ
812Ø GOSUB 685Ø : PRINT @ 384,"THE GROUND RUMBLES AROUND YOU AND
THE VINE NOW SPROUTS ALL THE  WAY UP THE CASTLE WALL" : N8=1 :
N$(12,1)="7" : GOTO 5Ø
82ØØ GOSUB 685Ø : PRINT @ 384,"HEY, WATCH YOUR LANGUAGE" :
GOTO 6Ø
83ØØ IF P=25 AND N$(31,1)="25" THEN 834Ø
83Ø5 IF N$(5,1)="3Ø" OR VAL(N$(5,1))=P THEN 835Ø
831Ø GOSUB 685Ø : PRINT @ 384,"SHE'S NOT HERE" : GOTO 6Ø
834Ø GOSUB 685Ø : PRINT @ 384,"SHE'S NOT READY TO GO YET, SHE'S
TIED UP AT THE MOMENT" : GOTO 6Ø
835Ø GOTO 674Ø
85ØØ G=9 : GOTO 2Ø5Ø
855Ø GOSUB 685Ø : PRINT @ 384,"STOP THAT YOU WEIRDO" : GOTO 6Ø
9ØØØ IF VAL(N$(5,1))=3Ø THEN 9Ø5Ø
9Ø1Ø GOTO 2ØØ1
9Ø5Ø CLS : PRINT @ 34Ø, "CONGRATULATIONS YOU WON!""
```

continued on page 60

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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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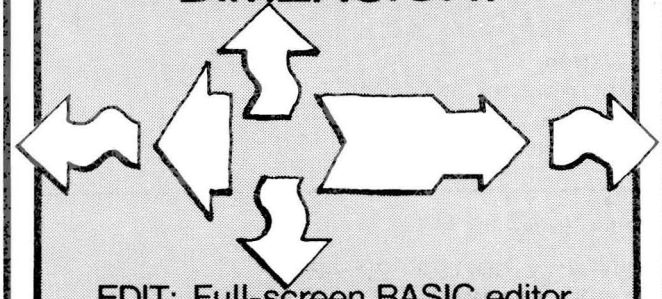

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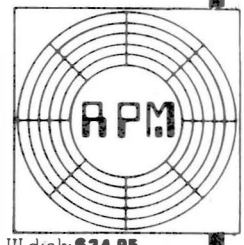

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APRIL FOOL

John Warren

One program may process information; another might provide amusement. This one simply drives people crazy!

When the victim runs "April Fool," the program clears the screen, displays Level II error message number 8, "Unidentified Line," and identifies the error location as "Line 70." Control is then transferred to a subroutine that displays what looks like a program-is-ended prompt. INKEY$ is used instead of INPUT because of the in-program prompt (?) produced by the INPUT command.

The victim's response is accepted one character at a time. As long as the inputs have an ASCII value greater than 13 (carriage return), they are concatenated to reconstitute the message. A carriage return breaks the INKEY$-concatenation loop and transfers control to a logical sieve.

Here the reconstituted command is matched against three possibilities; LIST, RUN, and EDIT. LEFT$ is used to discard any attached line numbers. If the command does not make a match, "Syntax Error" is displayed, and control is returned to the pseudo-prompt subroutine.

The command LIST provides what, on first glance, seems to be a program listing. String assignment, concatenation, Peeking and Remarks are all visible. On closer examination, things become curiouser and curiouser. The PEEK statement has two arguments and informs the victim "PEEK AB,U" (peekaboo?). The string concatenation tells him that he is a "turkey," and the line with the undefined GOTO reads "GOTO HADES."

The tricky part of this segment is to get realistic double quotes in the pseudo-listing, since a quote is a nonprinted delimiter. Since CHR$ converts its argument from decimal to the equivalent ASCII character, CHR$(34) yields quotes which can be added to the display at the appropriate points.

The command RUN elicits the rather snotty reminder from the computer that it had located an error in line 70, and, after a pause, the injunction "Fix it!" is displayed.

Requesting that the computer Edit 70 results in "70 GOTO HECK" and the return to the pseudo-prompt.

A problem in debugging this routine is the difficulty in discriminating between a real program-end prompt and the pseudo-prompt. After several embarrassing cases of mistaken identity, I replaced the "READY" with a series of asterisks until the debugging was complete.

When a program starts fooling the fooler, that's going too far!

```
10 CLS
20 PRINT "UNDEFINED LINE IN 70"
30 GOSUB 340
40 PRINT
50 IF LEFT$(Z$,4)="LIST" THEN 110
60 IF LEFT$(Z$,3)="RUN" THEN 220
70 IF LEFT$(Z$,4)="EDIT" THEN 290
80 PRINT "SYNTAX ERROR"
90 GOSUB 340
100 GOTO 40
110 'PHONY LIST
120 PRINT "10 CLS"
130 PRINT "20 A$=";CHR$(34);"PROGRAMMER";CHR$(34)
140 PRINT "30 B$=";CHR$(34);"TURKEY";CHR$(34);":UR$=B$+A$"
150 PRINT "40 PEEK AB,U"
160 PRINT "50 I=CU"
170 PRINT "60 REM BEGIN 4/1/80"
180 PRINT "70 PRINT GOTO HADES"
190 PRINT "80 CHANCES=10E6+2+1"
200 GOSUB 340
210 GOTO 40
220 'PHONY RUN
230 PRINT "I TOLD YOU--THERE IS AN UNDEFINED LINE IN 70"
240 FOR X=1 TO 300: NEXT X
250 PRINT "FIX IT"
260 FOR Y=1 TO 500: NEXT Y
270 CLS
280 GOTO 10
290 'PHONY EDIT
300 PRINT "70 GOTO HECK"
310 GOSUB 340
320 GOTO 40
330 END
340 PRINT "READY"
350 Z$="": PRINT ">";CHR$(95);
360 Z$=INKEY$: IF Z$="" THEN 360
370 PRINT CHR$(24)
380 PRINT Z$;
390 Y$=INKEY$: IF Y$="" THEN 390
400 IF Y$>CHR$(13) THEN PRINT Y$;
410 IF Y$<CHR$(14) THEN 440
420 Z$=Z$+Y$
430 GOTO 390
440 RETURN
450 STOP
```

John Warren
Assistant Professor of English
East Carolina University
Greenville, NC 27834 ■

continued from page 58

```
9055 PRINT @ 470,"YOU USED ";F;" TURNS"
9056 IF F>350 THEN 9080
9057 IF F>175 THEN 9090
9060 PRINT @ 589,"EXCELLENT-I HEREBY KNIGHT YOU SIR ";Z$
9070 GOTO 9070
9080 PRINT @ 585,"POOR-";Z$;" SHOULD HAVE EATEN THE DUCKS
INSTEAD"
9081 GOTO 9070
9090 PRINT @ 585,"FAIR-BUT ";Z$;" DOESN'T GET TO KEEP THE
MAIDEN"
9091 GOTO 9070
9700 G=9 : GOTO 2050
```

Dave Trapasso
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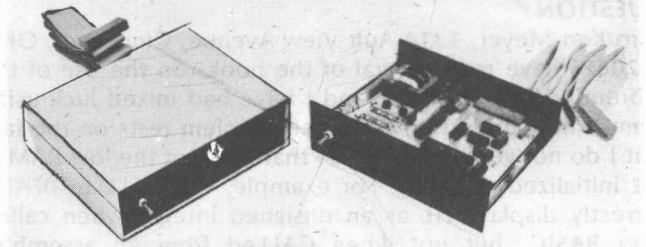

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QUESTIONS AND ANSWERS

Hubert S. Howe, Jr.

QUESTION

from Bill Rawls, Bill's TV Service, P.O. Box 114, Plymouth, FL 32768: Can you tell me where I can buy a BR1941M I.C. for the RS-232 board of my Model I TRS-80? I get vertical lines instead of a cursor in the upper left corner of the screen when I run the terminal program. Radio Shack won't sell me parts, and it's too far to the repair center. I checked the contacts. I get 5 volts on terminal 2 of the DC-DC converter on the RS-232 board, but no voltages on terminals 3 and 5. I tried replacing the DC-DC converter, but it didn't help. I get less leakage with an ohmmeter on 3 or 5 when I unplug the I. C. above, so I thought that might be pulling the voltages down. Can you help me or tell me where I can get help? Don't tell me to call Radio Shack in Texas. All they can ever say is, "take it to the repair center." They are never any help. They act like they don't have time for you. I think they are scared of competition.

ANSWER

Before you try replacing the I. C., get an RS-232 Connector Brace from Gunn Industries, 704 Franklin Blvd., Austin TX 78751. It costs only $5.00, and since installing them we have had no trouble with our RS-232 boards, which were nothing but trouble before then. In spite of the fact that you tried the connector test, it is probably the contacts that are bad. That may not be all, however, but you will need the brace even if the RS-232 board is good.

If the board itself is bad, I would suggest that you take it or send it to the repair center, as that may be the only practical solution to getting it fixed.

QUESTION

from Ken Meyer, 1314 Ault View Avenue, Cincinnati, Ohio 45208: I have read several of the books on the use of the subroutine calls in ROM, and I have had mixed luck using them. I now understand that the problem rests on the fact that I do not go into BASIC, so that some of the low RAM is not initialized correctly. For example, the CALL to 0FAFH correctly displays HL as an unsigned integer when called from BASIC, but not when CALLed from an assembler program. I have copied the division support routine found at 18F7H to 4080H, and this helps some. Now where I used to reboot, only an error message is displayed, and I get a warm return to TRSDOS. My question is simply, what else do I have to initialize, so that the various useful subroutines will work without BASIC. Since I am just learning assembler, I don't want to have to return to BASIC after each reboot. I'm sure all assembler programmers remember how often they had to reboot during the learning stage! I have a Model III with TRSDOS 1.3

ANSWER

There is no single answer that can cover all of the subroutines in ROM. You do not need to initialize RAM in order to use the input/output subroutines (which are documented this month in the Model 3 Corner), but you may need to initialize it to use the calls that are meant for BASIC programs. Most books will tell you what needs to be done for each specific subroutine. For example, James Farvour's *Microsoft Basic Decoded and Other Mysteries* specifically states that the subroutine you mentioned, 0FAFH ("HL to ASCII"), "can only be used after Disk BASIC has been initialized." When using the ROM subroutines, the best advice I can give is to follow the documentation very carefully, and even then some things will be wrong!

QUESTION

from Danny Cuzzart, 2427 Chattesworth Lane, Louisville, KY 40222: My hobbies are computers and printing, and I am using the TRS-80 Daisy Wheel Printer II as a typesetter.

Tandy has only five print wheels available, with two more coming out soon. Where can I get print wheels that are compatible with the TRS-80 Printer II and disk Scripsit? I would like to obtain several dozen different type faces if possible.

ANSWER

The Radio Shack Daisy Wheel printer is compatible with the Qume printers, and you should be able to use any of the typewheels for the Qume. These are advertised in many places, and many varieties are available. I doubt whether you will be able to obtain typewheels that will look good with the proportional spacing that you used in printing your letter, however. Most of them use the standard 10 or 12 characters to the inch.

QUESTION

from Warren Franz, 2623 Bermuda Dunes, Missouri City, TX 77459: I have a Model I 48K Level II machine, for which I plan to develop a fairly large interactive system for a particular application. However, the application will require considerable disk storage. To retain future compatibility with different systems, I would like to develop this system in Fortran. Radio Shack has a nice Fortran, I hear, for the Model I. However, because of the storage requirements of my application, I would like to have the flexibility of a double density system or even the ability to use 8-inch disks along with my 5-inch disks. Can Radio Shack's Fortran be run under NEWDOS/80 or some other DOS with double density and/or 8-inch disk drives? Also, will Radio Shack have a Fortran for its Model III? If not, I would have to transfer my application to some other machine, if I eventually wanted to replace it.

ANSWER

You have many questions here, so let's try to sort them out.

Radio Shack's Fortran was developed by Microsoft, and while I have no particular knowledge and may be quite wrong, it will probably be made available for the Model III eventually. I would not recommend that you develop your application in Fortran, however, especially if you are concerned about transporting it to another machine. Fortran is a language of the past, developed for maxicomputers and only rarely implemented on microcomputers. It has all but been replaced by Basic, and the two languages are so alike that there is little reason for using them both. If you are

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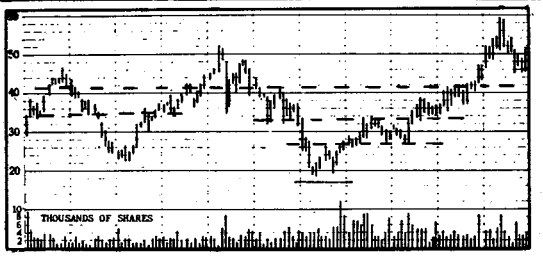

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concerned about future compatibility, I would recommend that you use either Basic or a structured language like Pascal or "C".

Storage requirements are certainly a problem for applications that need more than what you can get on 5-inch single density drives. I would not recommend that you get 8-inch disk drives, however. Instead, you can get more capacity by investigating double density, double-sided, and 80-track drives on 5-inch diskettes. For really a lot of storage, the best solution is a hard disk drive, and many of these are now appearing on the market at reasonable prices.

QUESTION

from Richard L. Davis, 3926 Bledsoe Avenue, Los Angeles CA 90066: I tried to use the Disk Drive Timing program listed in the June 1981 issue and didn't have much luck. First, the program bombed almost immediately with an "Out of Data in 8010" message. After some reflection, I decided it was easier to change the upper limit in line 8010 than to think up some additional data numbers, and I found that something like &H9022 "worked". I was then able to select a drive, but the system reboots shortly after the drives start.

For the record, I have a Model I Level II machine with 48K RAM, two Micropolis 77-track drives, Dataroyal 5000 printer, and I use TRSDOS 2.3 mostly. Two interesting tips:

I have modified FORMAT and BACKUP for 80-track operation. The Micropolis 77-track drives work just fine: all 80 tracks format and are usable.

I have been using Dr. Howe's "old" Word Processor for over two years now, with a few additional commands on the menu, and after compiling it with the Microsoft compiler, it's dynamite!

ANSWER

There were some errors in the Disk Drive Timing program, corrections for which were given in the July 1981 issue. Here they are again. Change lines 170, 180, and 200 as follows:

```
170 CT=PEEK(&H9092)+256*PEEK(&H9093)
180 RPM=60*1.774E6/(CT*35+112)
200 SBAR=SBAR*.9+RPM*.1
```

The program does run properly with these corrections, and although I have not tried the Micropolis drives, I see no reason why they would not work. I am sure other readers will be glad to read your information about the Micropolis drives.

* * * * *

Got a question about the TRS-80? Send it to **Questions, H & E Computronics, 50 North Pascack Road, Spring Valley NY 10977.** If you wish a personal reply, please enclose a self-addressed, stamped envelope. ■

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```
820 READ N$,B$,F$,M$   'name, birthday, father's, mother's
830 IF N$="OUT" THEN N$="":B$="":F$="":M$="":GOTO 860
840 IF B$ <> S$ THEN 820       'not the right one yet
850 LET B$=" ("+B$+")"
860 RETURN
870 REM Data are: Name, birthday, father's bday, mother's bday
880 DATA James Roosevelt,1760, ,
890 DATA Mary Eliza Walton,1769, ,
900 DATA Isaac Roosevelt,1790,1760,1769
910 DATA Rebecca Aspinwall,1809-1, ,
920 DATA James Roosevelt,4-16-1828,1790,1809-1
930 DATA Warren Delano,1779, ,
940 DATA Deborah Church,?-1, ,
950 DATA Warren Delano,1809-2,1779,?-1
960 DATA Joseph Lyman,?-2, ,
970 DATA Catherine Robbins Lyman,?-3,?-2,
980 DATA Sara Delano,9-21-1854,1809-2,?-3
990 DATA Franklin Delano Roosevelt,1-30-1882,4-16-1828,9-21-1854
1000 DATA OUT,OF,DA,TA
```

Gordon Speer
3304 Woodlawn Road
Sterling, IL 61081 ■

continued from page 56

```
370 B$=" "+CHR$(K)+CHR$(130)+CHR$(191)+CHR$(129)+CHR$(K)+STRING$
(5,CHR$(24))+CHR$(26)+" "+CHR$(135)+CHR$(181)+CHR$(144)+CHR$(K)
: GOTO 460
380 A$=" "+CHR$(128)+CHR$(168)+CHR$(188)+CHR$(148)+CHR$(128)
+STRING$(6,CHR$(24))+CHR$(26)+" "+CHR$(128)+CHR$(152)+CHR$(189)
+CHR$(164)+CHR$(128)
390 B$=" "+CHR$(128)+CHR$(131)+CHR$(191)+CHR$(178)+CHR$(129)
+STRING$(6,CHR$(24))+CHR$(26)+" "+CHR$(128)+CHR$(128)+CHR$(181)
+CHR$(144)+CHR$(141) : GOTO 460
400 A$=" "+CHR$(128)+CHR$(168)+CHR$(188)+CHR$(148)+CHR$(128)
+STRING$(6,CHR$(24))+CHR$(26)+" "+CHR$(128)+CHR$(152)+CHR$(189)
+CHR$(164)+CHR$(128)
410 B$=" "+CHR$(131)+CHR$(128)+CHR$(159)+CHR$(144)+CHR$(131)
+STRING$(6,CHR$(24))+CHR$(26)+" "+CHR$(160)+CHR$(182)+CHR$(128)
+CHR$(138)+CHR$(132) : GOTO 460
420 A$=" "+CHR$(128)+CHR$(168)+CHR$(188)+CHR$(148)+CHR$(128)
+STRING$(6,CHR$(24))+CHR$(26)+" "+CHR$(128)+CHR$(152)+CHR$(189)
+CHR$(164)+CHR$(128)
430 B$=" "+CHR$(131)+CHR$(128)+CHR$(159)+CHR$(144)+CHR$(131)
+STRING$(6,CHR$(24))+CHR$(26)+" "+CHR$(128)+CHR$(140)+CHR$(129)
+CHR$(181)+CHR$(128) : GOTO 460
440 A$=" "+CHR$(128)+CHR$(168)+CHR$(188)+CHR$(148)+CHR$(128)
+STRING$(6,CHR$(24))+CHR$(26)+" "+CHR$(128)+CHR$(160)+CHR$(189)
+CHR$(144)+CHR$(128)
450 B$=" "+CHR$(128)+CHR$(133)+CHR$(191)+CHR$(146)+CHR$(129)
+STRING$(6,CHR$(24))+CHR$(26)+" "+CHR$(128)+CHR$(140)+CHR$(129)
+CHR$(181)+CHR$(128) : GOTO 460
460 FOR L=1 TO 10 : NEXT : I=I+1 : PRINT @ I, A$; :
PRINT @ I+128, B$; : GOSUB 480 : J=J+1 : ON J GOTO
380,400,420,440,470
470 J=0 : GOTO 360
480 IF POINT(124,6) THEN 490 ELSE RETURN
490 PRINT @ 50, "GOODBYE"; : FOR J=1 TO 1000 : NEXT : CLS :
SS=1 : PRINT @ 340, "PRESS 'C' TO CONTINUE" : PRINT @ 405,
"PRESS 'F' TO FINISH"
500 Q$=INKEY$ : IF Q$ = "C" THEN SS=0 : GOTO 50 ELSE IF Q$
<> "F" THEN 500 ELSE CLS : FOR J=1 TO 2000 : NEXT : END
```

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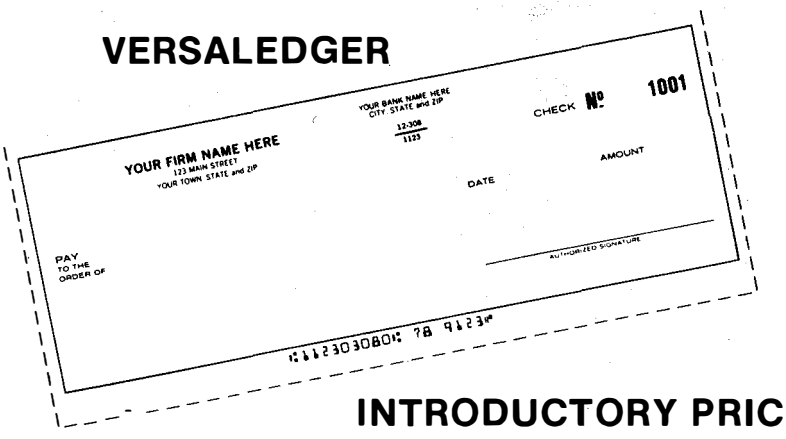

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GENERAL LEDGER

Processes

- ★ Flexible design allows system to be easily adapted to both small businesses and also to firms performing client writeup services.
- ★ Add, change or delete records within the Chart of Accounts (Master) File.
- ★ List the Chart of Accounts File.
- ★ Key in transactions into the Transactions (Journal Entries) File.
- ★ List the Transactions File.
- ★ If other Peachtree Software packages are present, pass summary transactions from these packages to the General Ledger at the end of the accounting period.
- ★ At the end of an accounting period, print out the major reports:
  - (1) Trial Balance (Detail Report)
  - (2) Transaction Registers
  - (3) Balance Sheet
  - (4) Prior Year Comparative Balance Sheet
  - (5) Income Statement
  - (6) Prior Year Comparative Income Statement
  - (7) Department Income Statements

File Information

There are two main computer files maintained within the General Ledger System.

(1) The of Accounts File
- Account Number
- Description
- Account Type
- Balance Sheet Column Code
- Current Amount
- Year-To-Date Amount
- Budget Amount
- Prior Year Monthly Amounts

(2) The Transactions File
- Account Number
- Description
- Source Code
- Reference
- Date
- Amount

ACCOUNTS RECEIVABLE

Processes

- ★ Add, change or delete records within the Customer File.
- ★ List the entire Customer File, or any Customer within the File.
- ★ Enter invoices, payments, credits and adjustments.
- ★ Prepare invoices and statements.
- ★ Produce the following reports:
  - (1) Aged Accounts Receivable
  - (2) Invoice Register
  - (3) Payment, Credit and Adjustment Register
  - (4) Customer Account Status Report
- ★ At the end of a month, post the following items to the General Ledger:
  - (1) Invoiced Sales
  - (2) Freight Charges
  - (3) Sales Tax
  - (4) Service Charge Income
  - (5) Cash Payments
  - (6) Discounts Allowed
  - (7) Returns/Credits
  - (8) Income Adjustments
  - (9) Accounts Receivable

File Information

There are three main computer files maintained within the Accounts Receivable System, the Customer File, the Invoice File, and the Transaction File.

CUSTOMER FILE
- Customer Account Number
- Customer Name
- Address
- Phone
- Type of Account
- Credit Terms
- Credit Limit
- Tax Rate
- Discount Rate
- Date of Last Credit
- Date of Last Debit
- Amount of Last Credit
- Amount of Last Debit
- Current Balance
- High Balance
- Year-To-Date Sales
- Year-To-Date Payments
- Automatic Billing Amount

INVOICE FILE
- Invoice Number
- Invoice Date
- Invoice Amount
- Credit Terms

TRANSACTION FILE
- Transaction Type
- Transaction Date
- Transaction Amount

ACCOUNTS PAYABLE

Processes

- ★ Add, change or delete records within the Vendor File.
- ★ List the Vendor File.
- ★ Enter vouchers.
- ★ Automatically determine which vouchers to pay.
- ★ Print checks and a Check Register.
- ★ Produce the following reports:
  - (1) Open Voucher Report.
  - (2) Accounts Payable Ageing Report.
  - (3) Cash Requirements.
- ★ At the end of a month, prepare the General Ledger Transfer File, passing the following information for each debit or credit transaction:
  - (1) Account Number
  - (2) Description
  - (3) Source Code
  - (4) Date
  - (5) Amount

File Information

There are two main computer files maintained within the Accounts Payable System, the Vendor File and the Voucher File.

VENDOR FILE
- Vendor Code
- Vendor Name
- Address
- Phone
- Year-To-Date Purchases
- Year-To-Date Payments
- Current Balance
- Last Payment
- Date of Last Payment
- Monthly Entry Flag
- Due Date of Month
- Debit Account Number
- Amount (Debit)
- Month Last Paid

This file may also contain information to enable generation of automatic vouchers for those items such as rent or bank payments that are paid every month.

VOUCHER FILE
- Voucher Code
- Voucher Date
- Amount Due
- Date Due
- Discount Percent
- Discount Amount
- Discount Date
- Invoice Number
- Invoice Date
- Status

Plus up to six account number-amount fields for General Ledger account numbers to which the amount due is to be distributed.

PAYROLL

Processes

- ★ Add, change or delete records within the Employee File.
- ★ List the Employee File.
- ★ Modify the Tax Information Files.
- ★ At the end of a pay period -
  - (1) Calculate Pay
  - (2) Print Checks
  - (3) Print Payroll Register
- ★ At the end of a month -
  - (1) Print the monthly summary
  - (2) Print the Unemployment Tax Report
  - (3) Prepare the General Ledger Transfer File, passing the following information:
    - Net Pay (Cash)
    - Employee FICA Withheld
    - Federal Tax Withheld
    - Insurance Deductions
    - Miscellaneous Dedutions
    - State Tax Withheld
    - Local Tax Withheld

  The gross pay for up to twenty payroll departments may also be passed to the General Ledger.
- ★ At the end of a quarter, print the 941A report information.
- ★ At the end of a year, print the W-2 forms.

File Information

There are two main computer files maintained within the Payroll System, the Employee Master File and the Tax File.

EMPLOYEE MASTER FILE
- Name
- Address
- Local Code
- State Code
- Marital Status
- Exemptions, Federal
- Exemptions, State
- Social Security Number
- Pay Period
- Pay Type
- Pay Rate
- Insurance Deduction
- Miscellaneous Deduction
- Date Employed
- Date Terminated
- Last Check Information

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- Miscellaneous Income
- FICA Deductions
- Federal Deductions
- State Deductions
- Local Deductions
- Insurance Deductions
- Miscellaneous Deductions

TAX FILE
- (for single and married persons)
- Federal Tax Information Tables
- State Tax Information Tables
- Local Withholding Tax Information Tables

An Overview of the Inventory System

Inventory is probably the most speculative of all of a company's assets. A true measure of the effectiveness of management is the ability with which it supervises the inventory control function.

The Peachtree Software™ Inventory Management System is designed to (1) give you better merchandise control, (2) allow you to lower your dollar investment in inventory, and (3) improve customer service and response.

The System maintains detailed information on each inventory item including the part number, description, unit of measure, vendor and reorder data, item activity, and complete information on current item costs, pricing, and sales. Transactions effecting inventory (sales, receipts, adjustments) may be applied at any time to insure the inventory data is always up to date and accurate.

As with all Peachtree products, the system is interactive, simple to operate, and provides reports that are up to date and comprehensive.

Particular features of the Peachtree Software™ Inventory Management System include:

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- Comprehensive management reporting
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- Sample data for demonstration and training

How the System is Designed

The Inventory Management System operates with an **Inventory Master File** which allows for the creation of each inventory item and for the recording of transactions (sales, receipts, returns, reserves, and adjustments) to each inventory item.

The Inventory Master File contains the item number, description and various other data on item costs, prices, reorder levels, vendor refereence, and activity. The items within the Master File are entered, changed, deleted, and queried through the **Inventory Master File Maintenance** program. All data on all items may be listed by using the **Detail Inventory Report** program.

Transactions may be applied at any time to the Master File through the **Enter Inventory Transactions** program. An **Update Report** automatically prints during this entry process to provide an audit trail of all inventory acitivity.

Several reports are available for the maintaining of stock, analysis, and forecasting. These reports include the **Physical Inventory Worksheet, Inventory Price List, Departmental Summary Report, Inventory Status Report,** the **Reorder Report** and the **Period-to-Date** and **Year-to-Date** reports.

At the end of an accounting period (usually a month), and then again at the end of a year, the **End of Period Processing** program is run to update current balances and clear previous balances.

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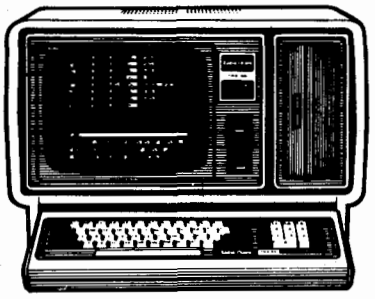

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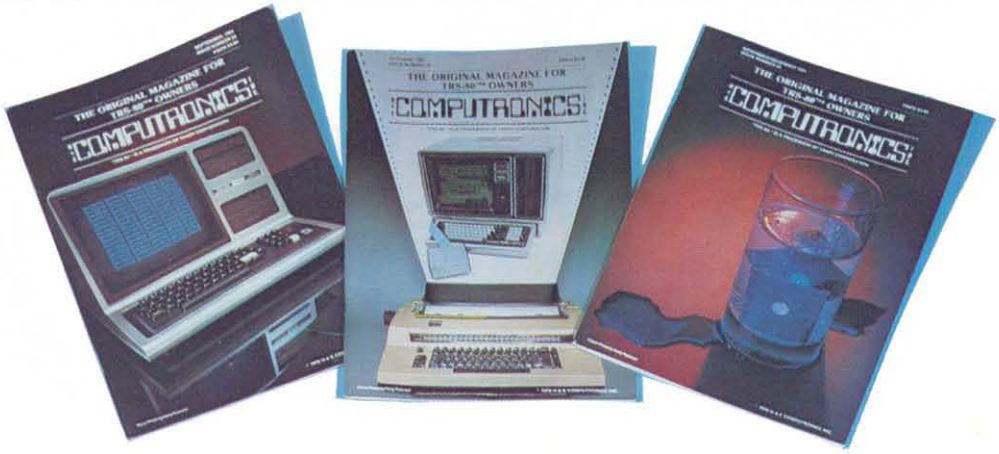

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