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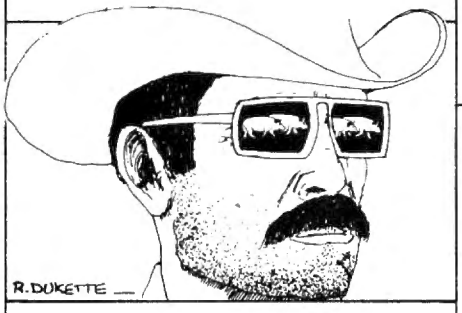

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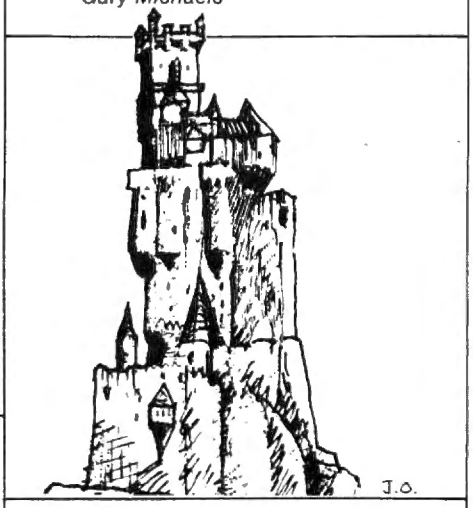

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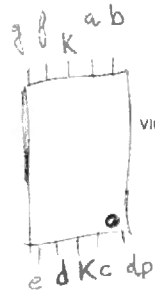

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80 Micro (ISSN 0744-7868) is published 12 times a year by 1001001 Inc., 80 Pine St., Peterborough, NH 03458. Phone: 603-924-9471. Second class postage paid at Peterborough, NH, and additional mailing offices. Subscription rates in U.S. are $25 for one year and $53 for three years. In Canada and Mexico $27.97 – one year only. U.S. funds drawn on a U.S. bank. Canadian distributor: Micro Distributing, 409 Queen St. West, Toronto, Ontario, Canada M5V 2A. BC Canadian Distributor: Graymar Data Services, Ltd., #4 258 E. 1st Ave., Vancouver, BC V5T 1A6. Foreign subscriptions (surface mail), $44.97 – one year only, U.S. funds drawn on a U.S. bank. Foreign subscriptions (air mail), please inquire. In South Africa contact *80 Micro*, P.O. Box 782815, Sandton, South Africa 2146. All U.S. and Canadian subscription correspondence should be addressed to *80 Micro*, Subscription Department, P.O. Box 981, Farmingdale, NY 11737. Please include your address label with any correspondence. Postmaster: Send form 3579 to *80 Micro*, Subscription Services, P.O. Box 981, Farmingdale, NY 11737.

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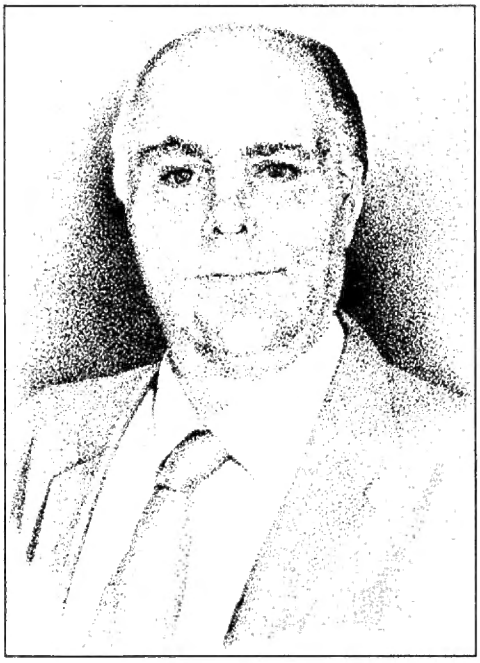
REMARKS

by Wayne Green



Mini makers can't sell their micros

About a year ago there was a rash of new computer product introductions. Within a few days I managed to get to the introduction of a Sony micro, two from Wang, and four from Digital Electronics Corp. (DEC). Each expressed extravagant ideas about their expected market share, yet when I tried to discuss marketing plans with their marketing people I found them surprisingly vague. Well, here we are a good deal later and not very much has happened.

The DEC people, when asked why they were so late with their personal computers, said (1) they weren't late and (2) they'd been too busy with other things. The president went on to say that half of the home computers were in the closet unused. Hmmm. DEC was thinking in terms of quickly producing 100,000 of their personal computers and said they expected to get 20 percent of the market. They were very enthusiastic about getting distribution through the Computerland stores, Hamilton Avnet, and the DEC stores.

All of these computers, introduced with considerable hoopla, and all with high hopes on the part of the manufacturers, have remained almost invisible in the desktop computer field. I doubt if any of them have even come close to 1 percent of the market, much less 20 percent. Now what kind of an industry are we in where giant firms such as Sony, Wang, and DEC are unable to make a dent after a year?

Well, with all due respect to both the desktop industry and to these large firms, the main problem, I suspect, was one of marketing. These big firms had good, experienced marketing people... but *not* people with experience in the desktop field. Adam Osborne, who grew up with the micro industry, understood the marketing of micros and quickly got his sales into the millions of dollars. If the marketing managers of these firms had brought in a consultant familiar with the micro field, they might have made an impression. But instead they tried to go ahead with marketing systems geared to minicomputers, not micros.

When these large, well-endowed firms brought out their microcomputers, I suspect there was a good deal of dung around the halls of the Tandy Towers, shaking off of alarmed cowboy boots. It was bad enough when IBM threw their Stetson into the ring, but with DEC in there too...and with a rapidly growing rash of DEC stores in malls...can little ole $2B-sales Tandy keep afloat?

Fortunately for Tandy...and the rest of the microcomputer industry...the moguls at DEC, Wang, and Sony (among a lot of others) stuck firmly to traditional marketing strategies—traditional for the minicomputer field in the case of DEC and Wang, which meant lots of advertising in the magazines being read by data processing professionals. Talk about wasting money! Running ads where they are going to be glimpsed and avoided like the plague by the group most fighting micros has to come under the heading of self-destruction. For the most part, DP managers have thought of micros as toys and have held them in disdain, refusing to give them more than a lip curl and sneer. The more adventurous executives have been sneaking their micros onto their desks at work, but they're not tied in with the company data-processing network.

The DP-oriented magazines have been getting the brunt of the ad campaign, with the rest going to *Business Week* and so on. Yet when we look at surveys of this new industry, we find that DP professionals are not the big buyers of micros. What we find is that most people who go out and buy a micro have checked with a friend who has one first, not with their MIS manager.

And where do these friends get their information that they pass along to help guide purchases? You know as well as I that micro users are reading the micro magazines, not *Computerworld, Computer Decisions*, and so on. They're reading *Personal Computing*, *Creative Computing*, *Microcomputing*, *80 Micro*, and *inCider* (to name a few.) So, while Apple and Tandy have been racking up ever-growing sales, DEC has been closing its stores and looking sadly at Hamilton Avnet to see what went wrong.

You're a micro user. Tell me, does a day go by when someone doesn't ask you for *your* advice on what micro they should buy? I know I'm asked a dozen times a day. Having never touched a DEC micro, it is unlikely that I am going to be an enthusiastic booster. And having read virtually nothing about the DEC systems in the micro magazines, I'm likely to pass any thoughts about getting DEC micros off as a serious judgment error. Aren't these systems really just intelligent terminals designed to augment the larger DEC computers? No offense DEC, but your products are as invisible to me as they are to most of the readers of my magazines.

When you multiply the expected 100,000 computer sales times the cost per system, you're looking at some $500 million in lost sales. With those kinds of numbers at stake, one would think that DEC could have eked out just a tad for a consultant to help them enter this new field. It isn't as if they hadn't seen what happened to the mainframe firms when they ignored the minicomputer firms a few years ago. Ah, history repeated.

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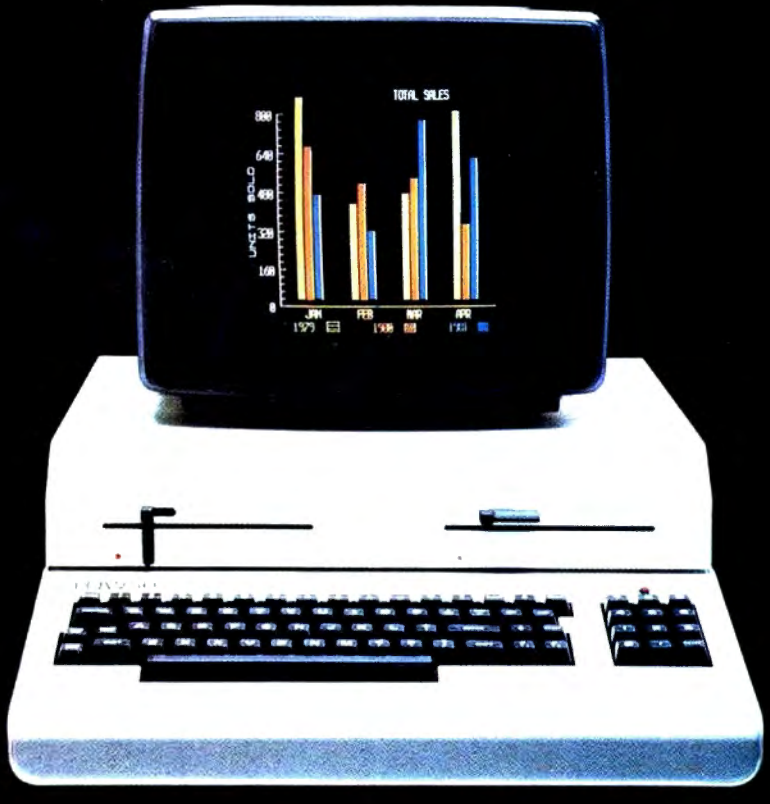

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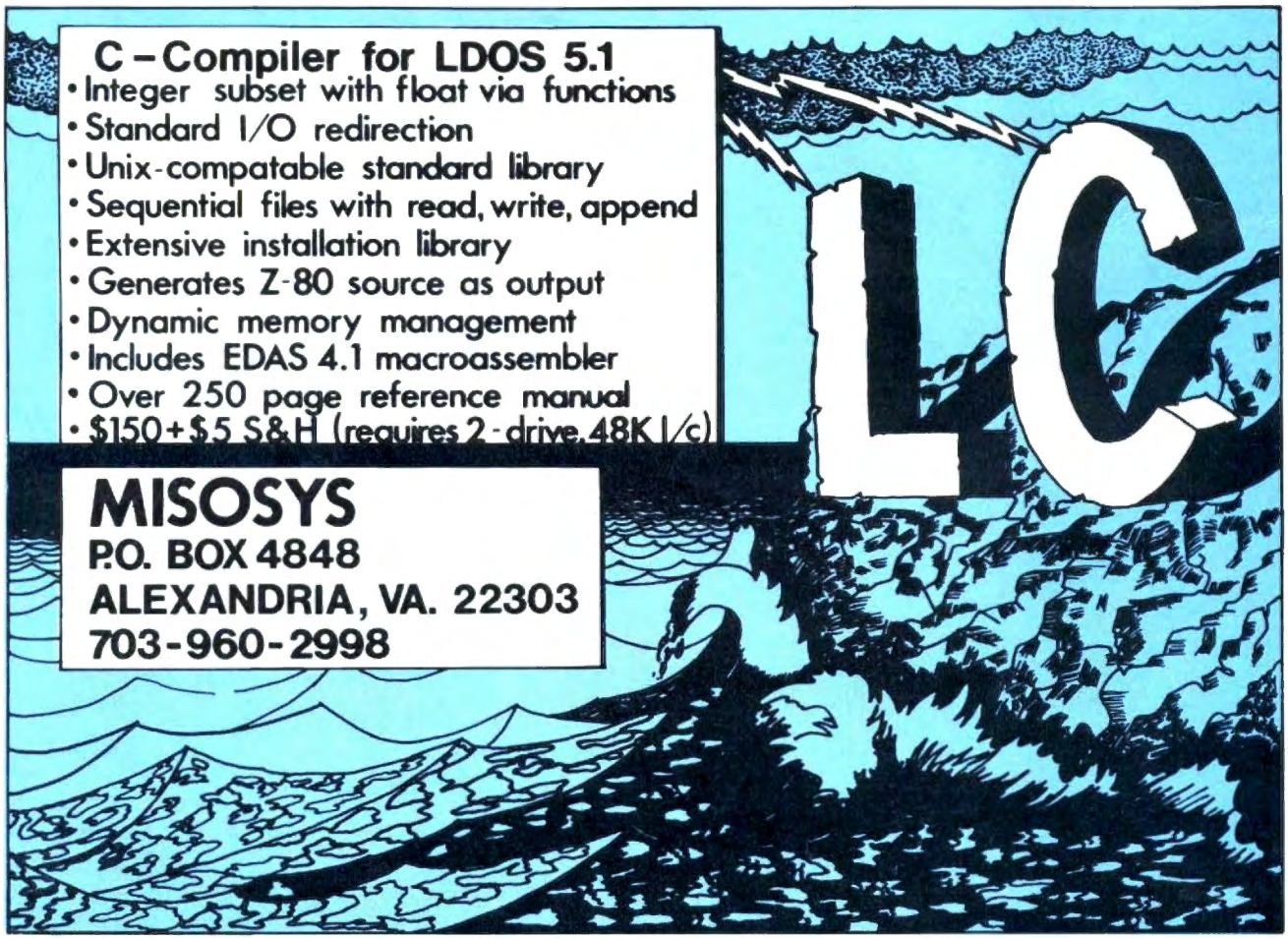
REMARKS

result in a tiny fraction of the sales), the businessman who makes a computer-buying decision on the basis of an ad in *Time* is an idiot . . . and there is a shortage of idiots with enough money to buy computers.

Not that minicomputer firms have a patent on throwing advertising money into the wrong corners. Old timers in the field may remember the wild advertising attack by something called The Last One. This was a program that was heralded as the last *program* one would ever have to buy. The outfit said they had $1 million to invest in ads . . . and judging from the splash in *Time*, *Newsweek*, and so on, they probably did indeed spend their $1 million. I wonder if they had any more success than Bridge Computer, who spent $50,000 in *Byte* and, as a result, sold three computers? One would guess that they didn't, if one were to judge from the visibility of the firm today . . . two years later. It would appear that the only winner there was the advertising agency that orchestrated the media attack. ■



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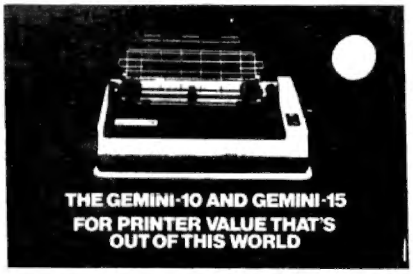

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I got pretty excited when *80 Micro* asked me to write Proof Notes, since Rodney and Mercedes hog the Gamer's Cafe. Then I found out that it was for the games issue. Hey—I know something about serious stuff, too. I even won a prize in high school for my paper, "The Cicada—Nature's Little Time Capsule."

Of course, games can be pretty serious business. Who among us has not felt the massive wave of depression that comes from missing a scoreboard by 10 points, the blind rage from a sneak attack by some sleazy little alien with no sense of morals or even etiquette? And what about when you shoot a ship swooping down on you and it *doesn't die*? AND WHAT ABOUT WHEN THE MACHINE LOCKS UP JUST AS—

Well. Suffice it to say that games are not all fun and games.

But let's get philosophical for a moment. What's so great about TRS-80 games anyway? I mean, why would anyone want to play some stupid space shoot-em-up on a dinky black-and-white monitor with lousy graphics to boot when he could be cruising along on a sleek new Apple IIe or Atari 800?

Yes, I wondered that myself once, when all my friends sneered at me and I only dared to play Galaxy Invasion in the bathroom after 3 a.m. But no more! I'm proud to be a TRS-80 gamer!! AND I'LL TAKE ON ANY MAN WHO—

But no point in getting worked up here. I've made peace with my games. No longer am I ashamed of them. For in TRS-80 games I have found simplicity, and in that simplicity I have found the essence of computer gaming.

Who needs all those splashy colors? What's so great about realistic high-resolution graphics? Why bother with state-of-the-art voice synthesis? These are but frilly trappings that obfuscate the basic (some might even say primordial) confrontation between man and machine.

Mad Max on the meaning of games

No matter what we call those objects on the screen, no matter what planet we're on or mythical foe we're fighting, are we doing anything more than trying to zap a bunch of phosphor blobs the computer is tossing at us? Isn't that what it's really all about?

The TRS-80 gamer is a minimalist and a purist. He lets his imagination fill the blanks between the few broad strokes the computer paints with its luminescent brush. And in doing so, he becomes one with the game; in fact, he *becomes* the game, another ball on a binary billiard table that sits in an ephemeral pool hall on an ephemeral side street somewhere in a city that lies next to a river of dreams on a vibrational plane that cuts sharply through a region of time known only to—

Hmmm. I've probably said enough (Mercedes thinks I've said enough when I say "Good morning"). Except to add that the games in this issue have been given the Gamer's Cafe Seal of Approval, and we highly recommend them to you. (And not simply because the editors at *80 Micro* have threatened to ax the Cafe if we don't.) Just remember the words of John Godfrey Saxe:

In battle or business, whatever the game,
In law or in love, it is ever the same;
In the struggle for power, or the scramble for pelf,
Let this be your motto—Rely on yourself!
For, whether the prize be a ribbon or throne,
The victor is he who can go it alone!
Whatever pelf is. ■

—Mad Max

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* As compared to MTC AIDS-III, Version 1.0

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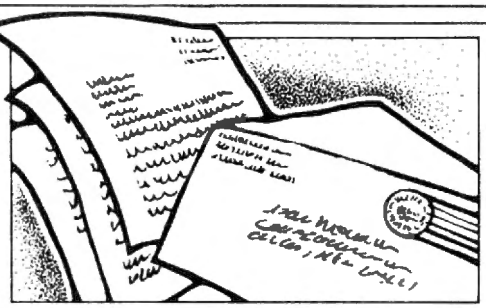
Corvus Absolved

NEWDOS80 2.0 for the Model III does work in concert with the Corvus hard disk environment and the Radio Shack accounting software (*80 Micro*, May 1983, p. 18).

Model III accounting packages are written in Basic. When you load and list the programs, you see that the authors have assigned drive numbers to the various file names used throughout each program disk.



Simply edit and change the drive numbers to the slot number on which you plan to mount the program and data files. Then save the programs with the correct file names.

```
640 I=1:ML=0:CL=32:CH=LU
1260 Q=578+LEN(NF$(SF)):FL=FNLF(SF):ML=1:FV$="":RJ=(FL(SF)>0):NE
=NOT RJ: FD=FD(SF):CL=32:CH=LU:GOSUB120:SV=FV$
1930 ' CHECK MODEL TYPE & DO SETUP FOR LOWERCASE USE
1935 IF PEEK(4)=48 THEN POKE 16412,1: POKE 16419,95: LU=122 ELSE
 LU=PEEK(15360): POKE 15360,120: IF PEEK(15360)<>120 THEN POKE 1
5360,LU: LU=90 ELSE POKE 15360,LU: LU=122
```

Program Listing 1. AIDS-III

```
3840 Q=578+LEN(NF$(SF)):FL=FNLF(SF):ML=1:FV$="":RJ=(FL(SF)>0):NE
=NOT RJ:FD=FD(SF):CL=32:CH=LU:GOSUB800:SV$=FV$
9515 Q=768:FL=HS-1:ML=0:FV$="":CL=32:CH=LU:GOSUB800
13500 ' CHECK MODEL TYPE & DO SETUP FOR LOWERCASE USE
13510 IF PEEK(4)=48 THEN POKE 16412,1: POKE 16419,95: LU=122 ELS
E LU=PEEK(15360): POKE 15360,120: IF PEEK(15360)<>120 THEN POKE
15360,LU: LU=90 ELSE POKE 15360,LU: LU=122
```

Program Listing 2. MAPS-III

```
13500 ' CHECK MODEL TYPE & DO SETUP FOR LOWERCASE USE
13510 IF PEEK(4)=48 THEN POKE 16412,1: POKE 16419,95: LU=122 ELS
E LU=PEEK(15360): POKE 15360,120: IF PEEK(15360)<>120 THEN POKE
15360,LU: LU=90 ELSE POKE 15360,LU: LU=122
15272 Q=659:FL=NS+5:ML=0:CL=32:CH=LU:FV$=NF$(24):GOSUB800: ON IC
 GOTO 15200,15275,14500,16000,15200
15282 Q=723:FL=NS+5:ML=0:CL=32:CH=LU:FV$=NF$(25):GOSUB800: ON IC
 GOTO 15270,15285,14500,16000,15200
15292 Q=787:FL=NS+5:ML=0:CL=32:CH=LU:FV$=NF$(26):GOSUB800: ON IC
 GOTO 15280,15295,14500,16000,15200
15310 Q=896:FL=HS-1:ML=0:FV$=LEFT$(PT$,FL):CL=32:CH=LU:GOSUB800
56140 Q=578+LEN(NF$(SF)):FL=FNSZ(SF):ML=1:FV$="":RJ=(FL(SF)>0:NE
=NOT RJ:FD=FD(SF):CL=32:CH=LU:GOSUB800:SV$=FV$
```

Program Listing 3. CALCS-III

```
10072 ' CHECK MODEL TYPE & DO SETUP
10074 IF PEEK(4)=48 THEN POKE 16412,1: POKE 16419,95:' =MOD 3
```

Program Listing 4. MERGE-III

In addition, the programs and data files seem to fit on one formatted 40-track double-density volume. If you use slot 1 solely for each program and its accompanying data files, you can FCOPY >:1 :1 for easy back-up.

Albert A. Livingstone II
Consultant
8001 West Belmont Ave.
River Grove, IL 60171

Better AIDS-III

Program Listings 1, 2, 3, and 4 are modifications to my AIDS-III articles (*80 Micro*, March 1983 and April 1983, pp. 136 and 168). The listings include modified and additional lines.

The changes provide automatic recognition of model number (I or III), and the detection and use of lowercase support.

Robert A. Fiorelli
SofTrends Inc.
26111 Brush Ave.
Euclid, OH 44132

FLEX Information

You can obtain further information about FLEX for the Color Computer (*80 Micro*, April 1983, p. 144) from Data-Comp Inc., 5900 Cassandra Smith Road, Hixson, TN 37343, 615-842-4600.

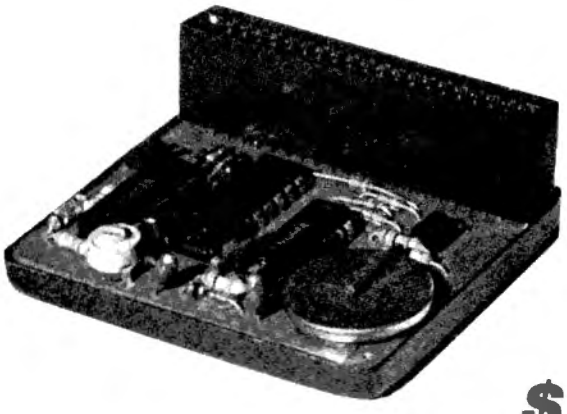
Source code text files are available for the following utilities: high-resolution video routines, a program to set user-defined keyboard characters, a program to set disk-drive stepping rates, a single-disk copy program, FLEX printer drivers, and disk and memory display/change utilities.

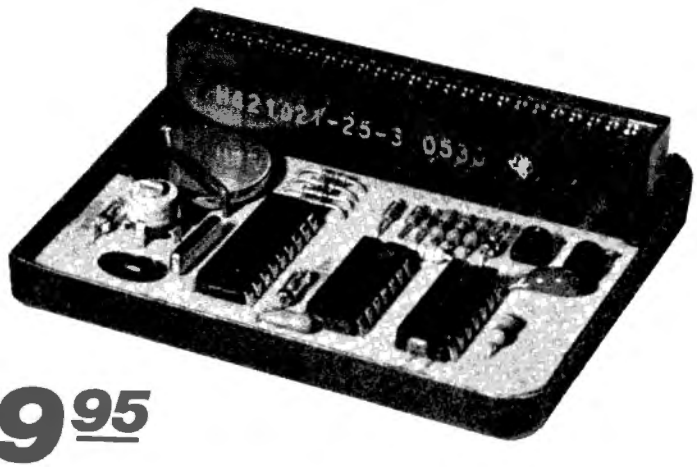
My article described a version of FLEX that has since been replaced by version 2.1. Additional FLEX utilities perform several new functions: copy Disk Basic format files to FLEX format files (includes ASCII and binary files), copy FLEX format fields to Disk Basic format files (includes ASCII and binary files), and convert binary files to standard FLEX-loadable program data files.

Manufacturers are introducing several new software packages for FLEX

NEWCLOCK-80

MODEL I **MODEL III**





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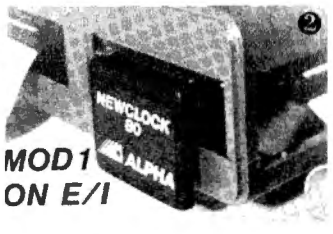

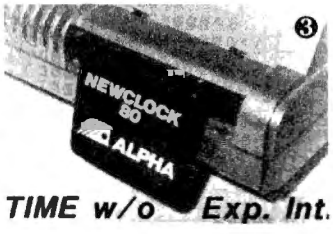

Wouldn't it be nice if your computer could always boot up with the right time and date and then stay accurate. Newclock-80 will enhance your Model I or III system with powerful clock/calendar/timer functions.

Using LSI (large scale integration) and custom circuits, Newclock-80 provides MO/DATE/YR, HR:MN:SEC plus AM/PM and day of week and even takes care of leap years! It continues to keep time and date with quartz accuracy when the computer is turned off or experiences a power failure. A single battery lasts over 2 years.

Compatibility: Newclock-80 is compatible with any operating system, including DOSPLUS, NEWDOS, LDOS. With its fully decoded circuitry it will work with any other hardware you may own. Bus expanders are available.

Installation is very simple, no tools, no disassembly, no soldering. Just plug it in, that's all. There is no power supply or messy cable. Newclock-80 plugs into the rear of the keyboard ❸ or side of the Exp. Int. ❷. Model III Newclock fits the 50 pin card edge (underneath) ❶

The Software: Newclock-80 is as easy to use as it is to install. -"SET", a Basic program, is used only once to set the time and date and select 12 or 24 hour format. -"TIMESTR", also in Basic, patches your computer "TIME$" function to read Newclock-80. It also adds "TIME$" to keyboard-only systems, a short routine is simply "poked" into low memory.

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Steve Odneal
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PowerSoft Support

Hooray for PowerSoft. They said it all. They said it well. And it needed to be said (*80 Micro*, April 1983, p. 24).

The freeloaders of the world deny creative people their right to make a buck. PowerSoft's superb defense of copy protection should put this matter to rest once and for all.

Frank J. Rosato
12 Blueberry Lane
Lexington, MA 02173

VCMOD Mod

Arne Rohde's VCMOD program (*80 Micro*, April 1983, p. 210) contains one bug that occurs if you use the exponential function (shifted @) in an equation.

The correction requires adding three lines to the Assembly-language program before assembling (or, if you're a byte zapper, adding 6 bytes to the object code in the middle of the program, which could mean retyping the last half). Between lines 1850 and 1860 of the original program, add:

```
1852   CP    5BH
1854   JR    NZ,$+4
1856   ADD   A,05H
```

If you must work at the byte level, add the bytes starting at address FF5C hexadecimal (hex) using Mr. Rohde's ORG location of FE00 hex for a 48K Model I machine:

Location	Bytes
FF5C	FE5B
FF5E	2002
FF60	C605

You must increase all subsequent locations by six.

To run VCMOD, assemble it and name it VCMOD/CMD. Then save it on the same disk that contains VC/CMD. To run VisiCalc, type in VCMOD/CMD or VCMOD (or use autostart with AUTO VCMOD) rather than entering VC/CMD or VC (or AUTO VC).

The VCMOD program starts by loading in VC/CMD (or whatever you've named the original VisiCalc program—don't forget to modify line 0480 if you change the name), then modifies the VisiCalc code and runs it.

L.S. Wilkins
4000 Capitol Drive
Fort Collins, CO 80526

Copyrights and Conversions

We are in the software business and have gone to great lengths to copyright our programs. Admittedly, the copyright only stops honest people from stealing a program, but comments like yours (*80 Micro*, April 1983, p. 16) give thousands of people the idea that they are honest if they use a copyrighted program for their "personal use."

I'm sure you meant well by your comments, but the term "personal use" is simply too broad. Too many well-meaning readers will take this as a subtle license to copy any and all programs. We provide our source code at no extra cost to our customers, but we do not want them to give it to their friends for "personal use."

Eddie Waren, President
The Software Terminal
223 Fairway Drive
Fayetteville, NC 28305

You're right—"personal use" is a bit vague. What we meant is that the consumer has a right to duplicate or modify commercial software as long as he or she doesn't sell or give away copies of that software to other users.—Eds.

WittSoft and Copy Protection

I'd like to respond to some of PowerSoft's statements directed at WittSoft (*80 Micro*, April 1983, p. 24).

PowerSoft says, "...due to the fact that some magazines, companies, and individuals are making it possible for nonregistered users (read pirates) to use our software, supporting registered owners has been hampered."

The Super Utility Plus manual says registration has always been a requirement for support; section 3.2 states, "We will do our best to assist and support all REGISTERED OWNERS, so be sure and include your SERIAL number."

The card that customers sign and return to PowerSoft to receive support is a legal agreement that binds the user to conditions not revealed prior to the purchase. Refusing to sign and return such an agreement doesn't make one a pirate.

On SU+ as a CMD file, PowerSoft says, "...if you are using single density, you don't have much room left for anything else. This makes it impractical to have SU+ as a CMD file." There's no reason the CMD file can't be kept on a data disk when space is a problem, and many users have double-density, double-sided, or 80-track drives.

When the program is in CMD format, users can store it on any medium they like. PowerSoft distributes the $500 Special Edition in CMD format on a single-density data disk, and makes that the number one selling point in their S/E ad (*80 Micro*, Anniversary Issue 1983, p. 153).

The PowerSoft response might lead one to think that Super Duper is a "1-byte patch (with directions)." It is not. It is a 500-plus byte machine-language program provided on disk with a 16-page manual.

Regarding Scripsit back-up patch authors, PowerSoft says, "...they are looking to make a quick buck and deny good programmers the royalties they are due.... The guy who wrote Scripsit deserves to be paid for every copy out there that is being used...."

Apparently the concern for the author of Scripsit is newly acquired. The PowerSoft ad for Scriplus (*80 Micro*, January 1983, p. 249) says, "Allows MOD III versions to be BACKED UP for your protection."

Concerning utilities to back up SU+ 2.2z, PowerSoft says, "If you bought one, send it back. Only these pirates have a need for it now." Only after WittSoft released a utility to back up version 2.2z did PowerSoft find enough concern for their customers to release CMD back-up instructions.

Those who buy Super Duper receive a program that performs as advertised. PowerSoft specifically exempts version 3.0 from their offer, whereas we've agreed to provide an upgrade when the new version is available.

Regarding the back-up disk included with the program, PowerSoft says, "...it is doubtful that you will be without SU+. Of course, that wasn't good enough for WittSoft...."

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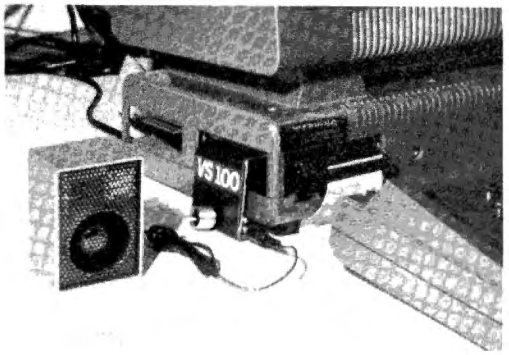

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We feel that every program requires at least four copies (original, virgin back-up, working version, and working version back-up). When any of these crashes, the user should have a way to generate a replacement. The issue is not whether one would be without SU+; it's having to pay for back-up disks over and over again.

About WittSoft, PowerSoft says, "Perhaps they should be made aware that every back-up and/or CMD file of SU+ contains the serial number of the purchaser." We do know about it and could have erased it if we'd wanted to. Like PowerSoft, we don't want to be included in categories where we don't belong.

Our letter in the February 1983 issue of *80 Micro* (p. 14) was an edited version of the introduction to the Super Duper manual. One passage removed read, "Use Super Duper only to back up your legally obtained copy of SU+. . . Kim Watt deserves to be paid for his work."

PowerSoft says, "We challenge you to show us one ad that brags about backing up protected disks." The January 1982 issue of *80 Micro* (p. 153) contains a full-page ad for SU+. Under the heading "Disk Copy" appears, "The Special Disk Copy enables the user to make a back-up of most TRS-80 readable disks that are presently on the market, regardless of any efforts that have been made to protect them."

The response also says, "It was intended to copy garbled disks. . . . It was not designed to be a game-disk copier. . . although you perhaps bought it for that purpose." The same ad continues with "This program's only intended use is for you to make back-ups of your legally purchased programs."

PowerSoft says, "We have never highlighted our special copy function in SU+." However, similar text appears on the back cover and in section 1.3 of the version 2.2z manual.

Last, PowerSoft says, "Magazines must take a stand somewhere and stick to it." Magazines (and all forms of media) have a responsibility to serve the public in article, editorial, and advertising content. If they limit any copy utility, they should limit all copy utilities—including Super Utility Plus.

80 Micro raised an important issue and gave all parties a chance to air their opinions. This isn't an indication of "ambivalence," but evidence of the magazine allowing a free exchange of ideas and an unbiased marketplace for computer products.

Jean Witt
WittSoft
1302-41st St.
Orlando, FL 32805

Page Program

In "Moving Window" (*80 Micro*, April 1983, p. 296), Ken M. Williams resorts to a complicated string manipulation procedure to extract the pattern of bits corresponding to the binary equivalent of the page number.

A simpler technique for displaying a desired page takes advantage of the logical AND operation to extract bits. To extract the ith-order bit from an integer X, use the statement B=SGN(N AND X), where N equals the ith power of two. The subroutine in Program Listing 5 illustrates the technique; the desired page number (zero to 127) stored in the variable PG calls the routine.

The display for PG>31 is hardware dependent. If you have a 16K machine, or 32K via piggybacking 16K chips, pages 32–63, corresponding to addresses 4000–7FFF hexadecimal (hex), will not produce a stable display without special hardware modifications. RAM does not go higher than 3FFF hex in a 16K machine in any case. Pages 64–127 will be a repeat of pageszero to 63.

If you have a stock 32K machine containing 64K chips that are only half used, pages zero to 127 will be stable and distinct.

Arthur J. Flexser
11111 N. Kendall Drive
Miami, FL 33176

```
100 'Subroutine to display a memory page (0-127) given by
PG
110 N = 1                              N will equal
                                       1,2,4,8,16,32,64 for bits
                                       0-6
120 FOR M=&HFFC6 to &HFFD2 STEP 2      7 address pairs in
                                       page-select register
130 B = SGN(N AND PG)                  Extract a bit from PG
140 POKE M+B,0                         Poke it into page-select
                                       register
150 N = 2 * N                          Get ready for next higher
                                       bit
160 NEXT M
170 RETURN
```

Program Listing 5

Tandy Technology

As an advocate of computer technology, I cringe every time I enter a Radio Shack store. I fail to understand why Tandy is trying to sell computer technology at one end of their store, while they use a manual cash register.

It seems worthwhile for Tandy to use their computers in their check-out process, if for no other reason than to exhibit a working computer.

The stores I've visited would turn off any small-business owner that might be interested in using a computer when he sees that Tandy cannot even develop a system for its own use.

Charles E. Austin
Route One, Box 105 B
Flat Rock, AL 35966

Scripsit for LDOS

To patch Scripsit for use under LDOS Double Density, implement the following patches:

```
PATCH SCRIPSIT/LC (D13,E5=2D 40)
PATCH SCRIPSIT/LC (D06,4F="LDOS")
```

The first patch changes the exit address from a reset causing a reboot to the LDOS Ready mode. The second patch changes the version from "VER 1.0" to "VER.LDOS". This is an optional cosmetic change.

Do not use high-memory routines with Scripsit under LDOS.

Terry I. Major
7614 N. 48th Ave.
Glendale, AZ 85301

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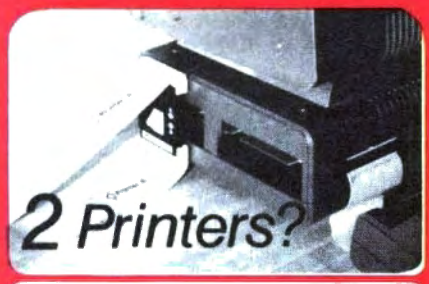

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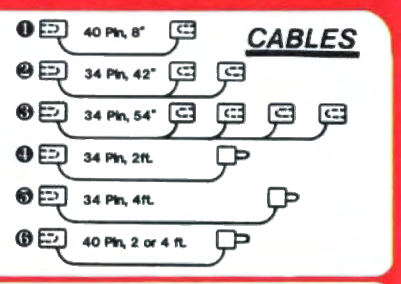

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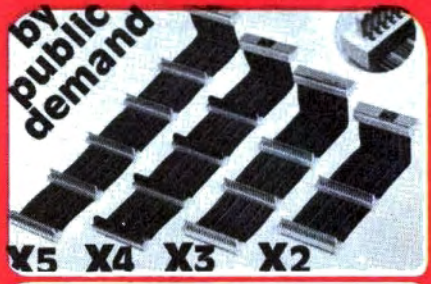

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GREEN SCREEN WARNING

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

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

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

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

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

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

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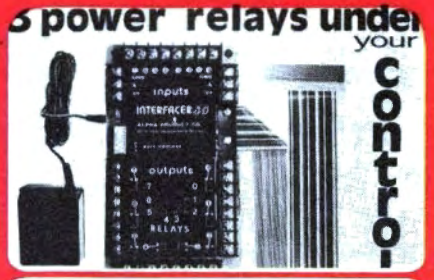

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Xenix and the Model 16

In reply to your request for information on the latest applications for the Model 16, Delker Electronics Inc. has been keeping on top of the Model 16/Xenix system. We have accounting, inventory, and language development software from Radio Shack available and currently installed at several customer sites.

With the aid of the Model 16 Multi-User Cobol Development System and MBasic, we have converted Model II programs to the Model 16 with relative ease.

One of the best applications we have found for the Xenix system is the flexibility to upload and download files generated on other systems, such as the new Model 100.

We encourage your increased support for articles involving the Xenix operating system and information on non-Radio Shack software compatible with it.

Thomas M. Delker, President
Delker Electronics Inc.
Sam Davis Road
Smyrna, TN 37167

Model III Jet Bomber

I typed in Thomas H. Rogers' great screen scrolling game, "Jet Bomber" (*80 Micro*, May 1983, p. 298). On my Model III, the Model I graphics looked strange, indeed.

To take advantage of the special character set on the Model III, and even provide rockets to bomb, you must make three changes. At the end of line 400, change 91 to 255. In line 470, change OR PEEK(PP)=91 to OR PEEK(PP)=255, and change POKE PP,94 to POKE PP,27. (Or experiment with the special character set until you get a jet you like.)

Finally, change IF PEEK(PP)=91 in line 500 to IF PEEK(PP)=255.

Errol Ford
P.O. Box 397
Bridgeport, NE 69336

More on PowerSoft

In a recent letter concerning copy protection, I asked why software vendors do not mention such protection in their ads. I am certainly not alone in thinking that they should be required to do so.

PowerSoft's lengthy reply did not once address my simple and relevant question. Instead, they raised a storm of falsehoods and misdirection, culminating in a personal attack on me. This is the standard vendor response on this subject. Allow me to correct a few of PowerSoft's statements.

They say that Super Utility has not been promoted for its ability to copy protected disks. Here's a quotation from an early ad (*80 Micro*, December 1980, p. 115): "The special disk copy allows the user to make a backup of ANY (that's right, I said ANY) TRS-80 readable disk...regardless of any efforts that have been made to protect the disk...."

A later ad backed off from the "any" claim (*80 Micro*, September 1981, p. 248): "Special copy (to back up most protected disks...)...go to the heart of your protected disks and read and/or modify data...."

The current SU+ manual goes on in a similar vein. Perhaps this is how people got the idea that SU+ would copy protected disks! More subtle deception is in many of PowerSoft's other arguments. For example, they explain in great detail why a CMD file format is impractical. OK, but that doesn't mean the disk has to be protected.

Also, they attribute to me the desire to give my software away, and then criticize me for expecting the same from them. I never said either of these things!

I have attempted to offer my software on a "share the cost" basis, where the original purchaser is allowed to make a fixed number of copies for others—thus bringing the individual cost to an affordable level. This makes a lot more sales than it loses, and is better for everyone. A new market might need new marketing ideas.

Finally, I am a villain, apparently because my Trakcess program will, among other things, copy some protected disks, as will SU+. I am not embarrassed by this fact. PowerSoft is, but they'll still take the sales and have for years now.

In fact, Mr. Watt told me that he had learned a lot about special copy from Trakcess, and subsequently improved the abilities of his own routine. He approved my publishing a copy procedure for SU, saying that all controversy over their protected disk was a publicity bonanza, as it is. Now he pretends to be upset, for more publicity.

I would happily see all protection disappear, and many of the sales of Trakcess with it. Every customer could back up, move around, examine, and modify the code he bought, just the way it used to be. This might even happen before my "one-man crusade" (for what?) "wins" (how?) "by forcing away every good programmer we have left."

Obviously, PowerSoft is doing OK. So are Med Systems, Sublogic, Acorn, SFINKS, and all the others to whom I repeat my original, simple question: Is there any reason other than a desire to make every possible sale in any manner that you do not mention your software protection in those big, fancy ads?

Before the industry collapses completely (as vendors like these have predicted since Day One), thanks to *80 Micro* for allowing a second point of view, and for allowing those of us who hold it to advertise, too.

To the many, many people who have written me with questions and comments on disk protection, I can't reply to them all, but I think you'll see some detailed information published on this subject. Send your thoughts in to *80 Micro* instead, where they can have a real effect.

Roxton Baker
Box 8272
APO San Francisco, CA 96555

TRS-80 in Business

If you look at Radio Shack's recent market introductions, such as the Model 12, the Xenix packages for multi-user capability, and the portable computer, I think you'll agree that Radio Shack is going the small business computer route and getting away from the fun-and-games home market.

As the owner of two Model IIs, both with hard disks, I have only the highest praise for Radio Shack, their software packages for small businesses, and their entire attitude.

Their computer centers are a place where a businessman can get a serious discussion about what he needs in com-

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puter equipment and software for his business.

Lauren R. Januz
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Model III at Bat

I've received a number of letters from readers who want to know why "Batter Up!" (*80 Micro*, April 1983, p. 130) will not run on their disk-based Model III.

Their operating system takes up space in memory needed for the program. This is true even if the system is larger than 16K because the program restricts memory size and blocks automatic expansion in a larger system.

Program Listing 6 allows the program to run on a Model III with 48K.

Harold A. Kime
252 East Clay St.
Lancaster, PA 17602

Supply and Demand

The many letters about software protection and piracy have interested and amused me. An important element is missing in the remarks of those who present production and marketing costs as justification for software protection and high selling prices.

A long-standing free market axiom states that the cost to produce an item does not determine its value; the utility (no pun intended) provided to the consumer establishes value.

I purchase those products that meet my needs at the lowest possible cost. My needs are simple—good documentation and support services, the right to protect my investment with back-up procedures, and a program that meets my objectives.

I will not purchase a program sight unseen, but will purchase one even though I have a free copy if I'm convinced that good support services are available.

R. Keith Richard
7608 Stoneridge Place
New Orleans, LA 70126

More Graphics Software

The Graphics Software Buyer's Guide (*80 Micro*, May 1983, p. 146) omitted our Auto-Graph, a 16K Level II program on cassette for the Models I and III.

It graphs equations on the screen and printer, automatically scales axes for the highest resolution, and is menu driven. It sells for $24.95.

N.J. Modney, President
Modtec, Software Division
4144 N. Via Villas
Tucson, AZ 85719
602-293-5186

Editor/Assembler NODOS

I've received many inquiries from readers about keying in my program NODOS 80 (*80 Micro*, Anniversary Issue 1983, p. 96) using the new Radio Shack Series 1 Editor/Assembler for cassette.

Although Program Listing 3, the renumbering utility in the article, loads into memory using this new assembler, 16K is insufficient room to assemble the program.

Radio Shack's newer Editor/Assembler for cassette takes about 1500 more bytes of memory than the original version. I programmed NODOS 80 using the original version with a modification for the Model III.

Other than to increase memory, the only solution is to split Listing 3 into two parts with the same technique used in the article to split the program into its four listings. Use Equates to refer to Labels that must pass between the two parts. You will now have to load NODOS 80 as five programs.

Thomas L. Quindry
6237 Windward Drive
Burke, VA 22015

```
1 CLS: MS!=64334:POKE 16562,MS!/256:POKE 16561,MS!-INT(MS!/256)*
256
50 FOR I=0 TO 173:READ X:POKE -1200+I,X:NEXTI
220 FOR I=0 TO 1023:POKE -1026+I,32:NEXTI
230 READ X,Y:IF X=0 THEN 240 ELSE POKE -1386+X,Y:GOTO 230
1041 POKE -1148,100:POKE -1147,170:POKE -1146,100:POKE -1145,200
:POKE -1144,0:GOSUB 33100:POKE -1148,150:POKE -1147,254:POKE -11
46,108:POKE -1145,126:POKE -1144,102
1066 POKE -1148,50:POKE -1147,100:POKE -1146,50:POKE -1145,200:P
OKE -1144,0:GOSUB 33100
1070 POKE -1148,150:POKE -1147,254:POKE -1146,108:POKE -1145,126
:-1144,102
1608 POKE -1148,40:POKE -1147,100:POKE -1146,0:GOSUB 33100
1609 POKE -1148,150:POKE -1147,254:POKE -1146,108
1701 POKE -1148,25:POKE -1147,200:POKE -1146,0:GOSUB 33100:POKE
-1148,150:POKE -1147,254:POKE -1146,108
1893 MS!=65535:POKE 16562,MS!/256:POKE 16561, MS!-INT(MS!/256)*2
56:POKE 16396,201:CLEAR 50:END
2020 POKE -1148,25:POKE -1147,150:POKE -1146,0:GOSUB33100
2030 POKE -1148,150:POKE -1147,254:POKE -1146,108
2200 PRINT @ 960, "LONG DRIVE";:GOSUB 30002:PRINT @ 990," HOME R
UN!";:POKE -1122,0:GOSUB 33100:POKE -1122,102
32140 IF F=3 THEN POKE 16223,253:POKE 16154,160:POKE -1148,25:PO
KE -1146,0:GOSUB 33100:POKE -1148,150:POKE -1146,108
33100 DEFUSR0=64336:J=USR0(0):RETURN
40200 US(5)=1023:US(6)=-20243:IF A$="S" THEN US(1)=15360:US(3)=-
1026 ELSE US(1)=-1026:US(3)=15360
40201 DEFUSR1=VARPTR(US(0)):J=USR1(0):RETURN
49001 DATA 221,33,132,251,221,78,0,121,183,194,93,251,201,221,70
,1,62,1,211,255,16,254,221,70,1,62,2,211,255,16,254,13,194,93,25
1,221,35,221,35,1,255,255,33,48,0,9,218,125,251,195,84,251
```

Program Listing 6

User's Group Update

80 Micro *frequently receives information about user's groups from all parts of the country. The list below contains current information about the groups; it is arranged in alphabetical order by state.*

Dust Byter's User's Group
c/o Burt Haberman
6557-A East Calle La Paz
Tucson, AZ 85715
602-298-7888 or 297-2179

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P.O. Box 60116
Sunnyvale, CA 94088
Please describe your equipment and send a SASE for membership information.

Solano Microcomputer User's Group—TRS-80
c/o Tom Burnett
840 Bollard Court
Vacaville, CA 95688
707-448-6702

Tandy Business Computer User's Group
c/o Ira O. Tolmich
The Coca-Cola Co.
P.O. Box 1734
Atlanta, GA 30301

Central Illinois TRS-80 Computer Club
1418 So. Douglas Ave.
Springfield, IL 62704

New England Color Computer User's Group
c/o Chris Sweet
P.O. Box 255
Harvard, MA 01451
617-456-8291

Central Oregon Color Computer Club
c/o Paul Bellemore, President
3947 N.W. 21st
Redmond, OR 97756

MCTRUG or **DALTRUG**
c/o D.D. Freeman
334 Fieldside Drive
Garland, TX 75043
214-270-0625 or 637-4510

CoCo-MUG
c/o Tom Fandre
2420 Misty Lane
Waukesha, WI 53186
414-542-0600

Error Trap

In "40K Color Basic" (*80 Micro*, May 1983, p. 212), a line of text is missing between p. 212 and p. 214. The transitional sentence should read, "You could install a switch in line with diode CR2."

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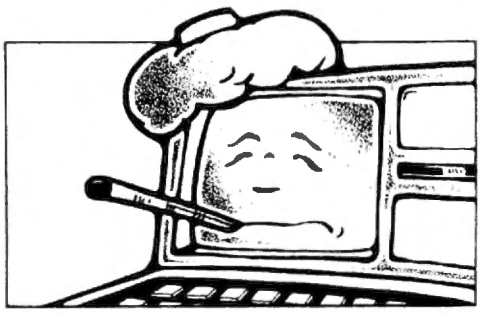

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Phillip Walsh
Holy Family School
410 Pacific Highway
Lindfield, 2070
Australia

Fiji and the Genie

Is there a CP/M program available for the Genie 3 that can mix and read different drive formats, such as the PDRIVE command on NEWDOS80? Also, is there an incremental-spacing, letter-quality printer on the market that I can use with Electric Pencil to make a typesetting unit? I would like to hear from other Genie 3 and Color Genie 4 owners.

E. John Handley
Box 2280
Suva, Fiji Islands

Character I.D.

I've written a program that analyzes our business bills. The only problem with it is that it takes too long to manually enter all the information from each month's bills. Is there any type of character recognition system or device that will work with my Model III?

Thomas R. Andrews
Box 422
Angola, IN 46703

Model I Stereo System

I would like to use my Model I as an audio frequency analyzer for my stereo system. Does anyone know where I can obtain the necessary hardware and software to do this? Also, is it possible to run CP/M on the Model I without any hardware modifications?

Ronald Hughes
PSC Box 3893
APO NY 09057

Foreign Language

A potential use for our school's computers is to teach the students Ukrainian. Is there any way to get the Ukrainian alphabet for the TRS-80?

Grant Lederhouse
Box 1288
Roblin, Manitoba R0L 1P0
Canada

Invoicing Help

Does anyone know of a software patch for the Model II that will print invoice totals at the bottom of a form?

Charles Trovato
278 Bay Ridge Parkway
Brooklyn, NY 11209

Semi-Log Graph

Does anyone have a modification for Micro Software System's Datagraph program to allow it to graph semi-log and log-log graphs?

James Greenlee
1024 NW 24th St.
Moore, OK 73160

At Wit's End

Help! I'm at my wit's end. I'm looking for Model II software specifically designed for jewelry inventory control. The program must feature automatic repricing of inventory and inventory label printing. Can someone come to my rescue?

George Veazey, III
11622 North Nebraska Ave.
Tampa, FL 33612

Lowercase Help

Our library was recently given an RS Centronics 779 printer to use for catalog card production. Can someone help us find a lowercase modification kit compatible with this printer?

Rick Richmond
Sublette County Library
Pinedale, WY 82941

Printer Driver Needed

I need an Epson MX-80 printer driver for Radio Shack's Model III Business Graphics Analysis Pack. Does anyone have any suggestions?

Lee C. Rice
Philosophy Department
Marquette University
Milwaukee, WI 53233

Checkbook Subroutine

Does anyone know if there's a Basic subroutine for the Model III that automatically updates the running balance in a checkbook program after current withdrawals and deposits are entered?

Gladys Crede
1812 Hickman Road
Des Moines, IA 50314

Screen Display Problem

The display on my Model I has moved up so that it's difficult to read the top line. The Langley-St. Clair Soft View CRT I bought doesn't correct this problem. Does anyone have a solution?

Frank Deignan
44 Old Mill Road
Shrewsbury, MA 01545

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Lynn Miner
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Program Addition

There is a problem with my "Mini-Micro Text Editor" program listing as published in the May 1983 issue (p. 290). To make the program work add the following two lines:

```
1000  PRINT "SINGLE OR DOUBLE
SPACING? (1 OR 2)";
1010  INPUT X: X=X-1: IF X<>0 AND
X<>1 THEN 1010 ELSE POKE 17210, X:
X=USR(0)
```

Jasper Kump
Box 108
Pyatt, AR 72672

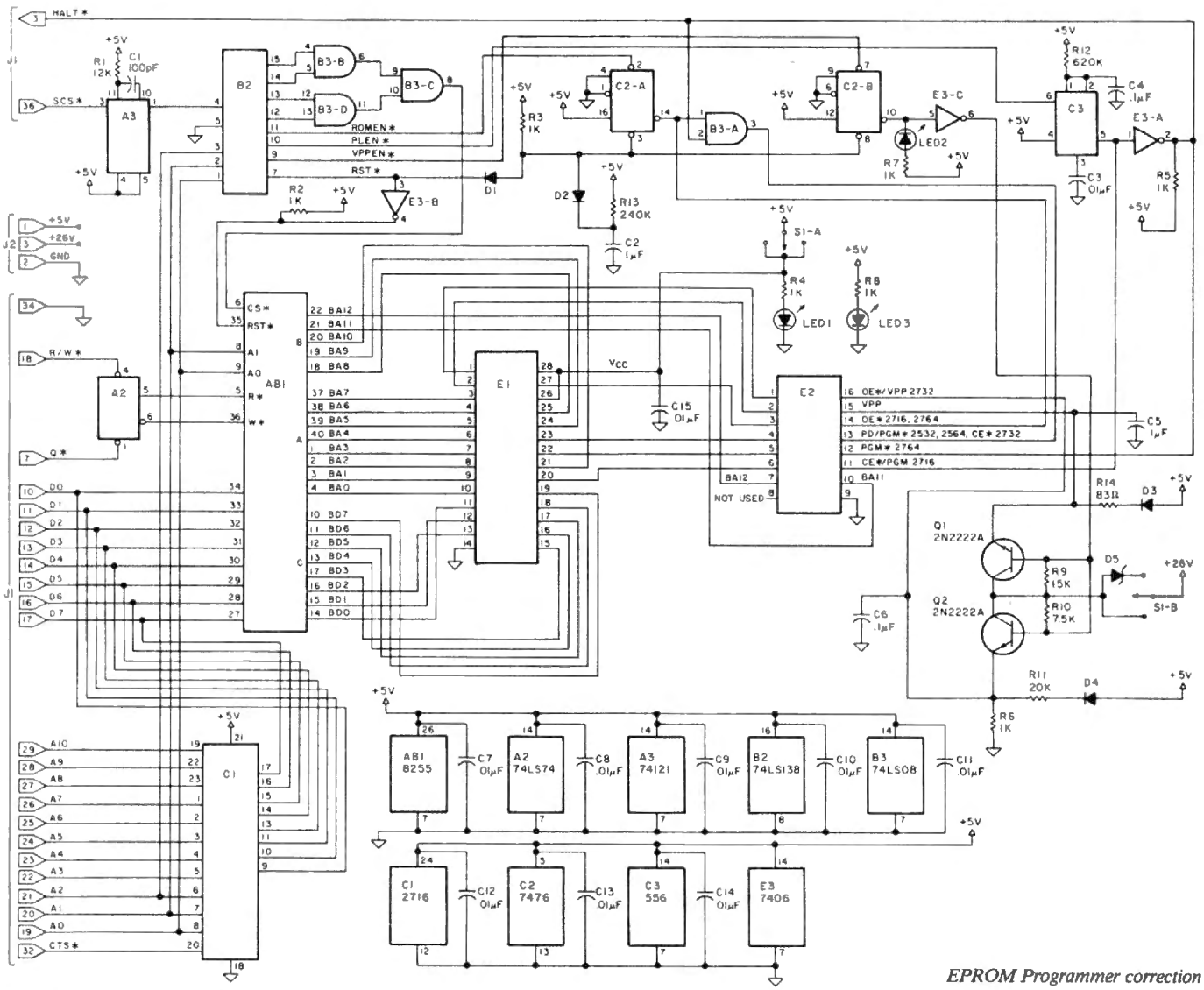
Frustrations Resolved

In "Build an EPROM Programmer" by William Mahoney (June 1983, p. 200), Photo 1 incorrectly showed the EPROM being programmed. Socket pins 1, 2, 27, and 28 should have been empty. On p. 220, the last line of the middle column mentions address 05AD. This should be changed to 05B7. Also, Fig. 7 was incorrectly drawn. The proper schematic is shown below. Our apologies for these frustrating mistakes.—*Eds.*

A Bomber Mistake

I found a rather simple mistake in Thomas Rogers' "Jet Bomber" program (May 1983, p. 298). On p. 303 in the text concerning the Model II Debug program, you need to change DUMP HSCROLL?CMD[START=H000,END=F054] to DUMP HSCROLL/CMD START=F000, END=F054.

Pat Palmer
510 10th St. SE
Hampton, IA 50441



EPROM Programmer correction

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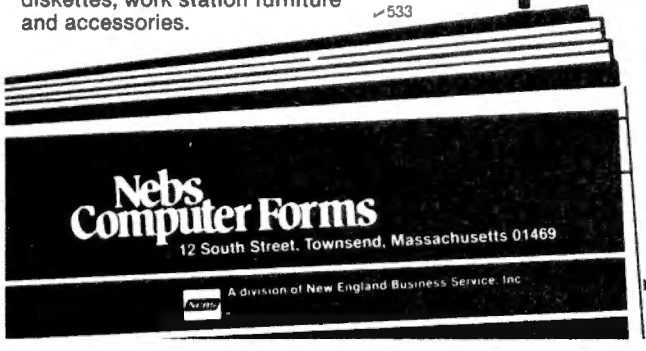

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✓See List of Advertisers on Page 323

Sailplane Flies Again

There are several errors in my "Fly Like an Eagle" program listing (1983 Anniversary Issue, p. 306). Make the following changes to correct the bugs.

● Change line 150 to:

```
150  Z=VARPTR(V$):Z=Z+65536*(Z>32767):Y=PEEK(Z+1)+PEEK(Z+2)*X:Z>INT(Y/X):POKE16527,Z:POKE16526,Y-Z*X:Y=Y+65536*(Y>32767):FC=INT(1E4/L):DC=L/29:POKEY+6,FC/X:POKEY+5,FC-INT(FC/X)*X:POKEY+3,DC/X:POKEY+2,DC-INT(DC/X)*X:Z=USR(0):RETURN
```

● Change line 590 to:

```
590 V(NA+1)=0:D(NA+1)=0:D(NA)=DS-D:T(NA)=T:H(NA)=H GOSUB 1900:PRINT "COMMAND?";
```

● Insert line 1495:

```
1495 CN$=NA$(NA)
```

● Change line 1780 to:

```
1780 IF CC$="A" THEN FOR Z=0 TO NA:CN=Z:Z=Z-(NA-Z)*(CN$=NA$(Z)):NEXT Z:NA$(CN)=NA$(NA):D(CN)=D(NA):T(CN)=T(NA):H(CN)=H(NA):V(CN)=V(NA):NA$(NA)=CN$:GOSUB 1880:GOTO 1500
```

Ian Cohn
1 Manor St.
Brighton, 3186
Victoria, Australia

Program Listing

```
10 REM MASTER DISK DIRECTORY
20 CLEAR 5000
30 DIM L(70),P1$(30),N1$(30),M1$(30),F1$(30),L1$(30),PP$(250),V(250)
40 AA$="   %%  %      %   % %      % %        %  %"
50 AB$="%% %      %% %   % %     %  %"
60 CLS:PRINT" MASTER DISK DIRECTORY":PRINT
70 PRINT"FOLLOWING OPTIONS ARE AVAILABLE:  <A>DD DIRECTORY FOR A DISK"
80 PRINT"  <D>ELETE DIRECTORY FOR DISK     <F>IND SPECIFIC PROGRAM"
90 PRINT"  <P>RINT MASTER DIRECTORY        <U>PDATE DIRECTORY FOR DISK"
100 PRINT"  <E>XIT PROGRAM":PRINT
110 PRINT"PLEASE KEY IN YOUR OPTION"
120 X$=INKEY$:IFX$="" THEN 120
130 ON INSTR("FADPUE",X$) GOTO 160,280,500,620,780,150
140 GOTO 60
150 END
160 CLS:PRINT"TO FIND A SPECFIC PROGRAM ENTER NAME":PRINT
170 LINE INPUT" PROGRAM NAME ";Y$:Y=LEN(Y$)
180 IF Y>8 THEN PRINT"TOO LONG, ONLY ENTER 8 LETTERS":GOTO 170
190 GOSUB 1000
200 K=1:J=1
210 CLS:PRINT"DISK NAME  EXT FORMAT GRANULES"
220 IF K>LOF(1) THEN CLOSE#1:GOTO 270
230 GET#1,K:GOSUB 1040:NN$=LEFT$(N1$,Y)
240 IF Y$<>NN$ THEN K=K+1:GOTO 220
250 PRINT USING AB$;P1$;N1$;M1$;F1$;L1$:J=J+1:IF J<14 THEN K=K+1:GOTO 220
260 LINE INPUT"KEY <ENTER> TO CONTINUE";Z$:K=K+1:J=1:CLS:GOTO 210
270 LINE INPUT"TASK COMPLETE, KEY <ENTER> TO   RETURN";Z$:GOTO 60
280 CLS:PRINT"TO ADD THE DIRECTORY FOR A DISK THE PROGRAM WILL PROMPT WHEN TO"
290 PRINT"INSERT THE DISK":PRINT:SOUND128,10
300 PRINT"REMOVE MASTER DISK AND INSERT   SUBJECT DISK"
310 LINE INPUT"KEY <ENTER> TO CONTINUE";Z$:IF X$="U" THEN 340
320 LINE INPUT"INPUT DISK NAME, USE CODE LIKE  A0,A1,ETC.";P2$
330 IF LEN(P2$)<>2 THEN PRINT" JUST TWO CHARACTERS, REENTER":GOTO 320
340 GOSUB 1080:PRINT"REMOVE DISK AND PUT IN MASTER   DISK":SOUND128,10
350 LINE INPUT"KEY <ENTER> WHEN DONE";Z$:GOSUB 1000:N=LOF(1)
360 FOR K=1 TO M
370 GOSUB 1060:PUT#1,K+N:NEXTK
380 CLOSE#1:GOSUB 1000:K=1
390 IF K>LOF(1) THEN CLOSE#1:GOTO 410
400 GET#1,K:PP$(K)=N$+P$:V(K)=K:K=K+1:GOTO 390
410 FOR P=1 TO K-2
420 J=P
430 IF PP$(V(J))<=PP$(V(J+1)) THEN 450
440 T=V(J):V(J)=V(J+1):V(J+1)=T:J=J-1:IF J<>0 THEN 430
450 NEXTP
460 GOSUB1000:GOSUB1020
470 FOR J=1 TO LOF(1)
480 GET#1,V(J):GOSUB 1040:GOSUB 1050:PUT#2,J
490 NEXTJ:CLOSE:KILL"DIR/DAT"RENAME "TEMP/DAT" TO "DIR/DAT":GOTO 60
500 CLS:PRINT"TO DELETE A DISK DIRECTORY FROM MASTER FILE ENTER DISK CODE"
```

Listing continues

!'s Revealed

When printing the program for Gerald Sprouse's "Color Disk Directory" (April 1983, p. 285) we inadvertently left out the color disk commands. The accompanying program listing is correct and complete. We apologize for any inconvenience this may have caused you.—*Eds.*

A Model III Update

As is, the program listing for my "Graphics on the Line Printer VII" article (April 1983, p. 306) will not work on the Model III. To update the program, change line 8370 to: OUT (0F8H),A ;PRINT. To enter the object code, use the following patch on the same line: B2B7 D3F8C9 8370.

Tom Tinsley
1721 Horton Drive
Orange Park, FL 32073

For Once, No Problem!

The correction to Richard Ramella's "Dreidel" program (May 1983, p. 26) lets the game continue when a player is broke. The program is correct as published in our December 1982 Fun House column (p. 421).—*Eds.*

No More LISP Problems

There is a typographical error in Randy Beer's "LISP: Basically Speaking—Part II" article (April 1983, p. 254). The description of a recursive way to look at finding the factorial as found on p. 258 should be changed as follows:

if n=0: factorial(n)=1
if n> 0: factorial(n)=n*factorial(n-1)

—*Eds.*

Listing continued

```
510 INPUTP3$
520 IF LEN(P3$)<>2 THEN PRINT"REENTER WITH JUST TWO CHARACTERS":
GOTO 510
530 GOSUB 1000:GOSUB 1020:I=1
540 FOR J=1 TO LOF(1)
550 GET#1,J:GOSUB 1040:IF P3$<>P1$ THEN 570
560 GOTO 580
570 GOSUB 1050:PUT#2,I:I=I+1
580 NEXTJ
590 CLOSE:KILL"DIR/DAT"RENAME!"TEMP/DAT" TO "DIR/DAT"
600 IF X$="U" THEN 800
610 GOTO 60
620 CLS:PRINT"TO PRINT A DIRECTORY TWO OPTIONSARE AVAILABLE:"
630 PRINT:PRINT"  <A>LL ENTRIES IN MASTER          DIRECTORY"
640 PRINT"  <S>PECIFIC DISK ONLY":PRINT:PRINT"KEY IN CHOICE"
650 W$=INKEY$:IFW$="" THEN 650
660 IF W$="A" THEN P6$="XX":GOTO 690
670 IFW$="S" THEN LINE INPUT"DISK CODE?";P6$
680 IF LEN(P6$)<>2 THEN PRINT"JUST TWO LETTERS":GOTO 670
690 PRINT#-2,"       MASTER DIRECTORY":PRINT#-2,""
700 PRINT#-2,"  DISK  NAME   EXTENSION  FORMAT   GRANULES":GOSUB
 1000
710 FOR K=1 TO LOF(1)
720 GET#1,K:GOSUB 1040
730 IF P6$="XX" THEN 750
740 IF P1$<>P6$ THEN 760
750 PRINT#-2,USING AA$;P1$;N1$;M1$;F1$;L1$
760 NEXTK
770 CLOSE:GOTO 60
780 CLS:PRINT"TO UPDATE DIRECTORY FOR DISK    FIRST ENTER DISK C
ODE"
790 GOTO 510
800 P2$=P3$:GOTO 290
1000 OPEN"D",#1,"DIR/DAT",20
1010 FIELD#1,2ASP$,8ASN$,3ASM$,3ASF$,4ASL$:RETURN
1020 OPEN"D",#2,"TEMP/DAT",20
1030 FIELD#2,2ASP2$,8ASN2$,3ASM2$,3ASF2$,4ASL2$:RETURN
1040 P1$=P$:N1$=N$:M1$=M$:F1$=F$:L1$=L$:RETURN
1050 LSETP2$=P1$:LSETN2$=N1$:LSETM2$=M1$:LSETF2$=F1$:LSETL2$=L1$
:RETURN
1060 LSETP$=P1$(K):LSETN$=N1$(K):LSETM$=M1$(K):LSETF$=F1$(K):LSE
TL$=L1$(K)
1070 RETURN
1080 DSKI$ 0,17,2,A$,B$
1090 FOR I=1 TO 68
1100 L2$=MID$(A$,I,1):L(I-1)=ASC(L2$):NEXTI
1110 M=0
1120 FOR X=3 TO 11
1130 DSKI$ 0,17,X,C$,D$
1140 E$=C$+LEFT$(D$,127):N$(0)=LEFT$(E$,8)
1150 M$(0)=MID$(E$,9,3):F$(0)=MID$(E$,13,1)
1160 L$(0)=MID$(E$,14,1):L1(0)=ASC(L$(0))
1170 FOR K=1 TO 7
1180 N$(K)=MID$(E$,1+K*32,8):M$(K)=MID$(E$,9+K*32,3)
```


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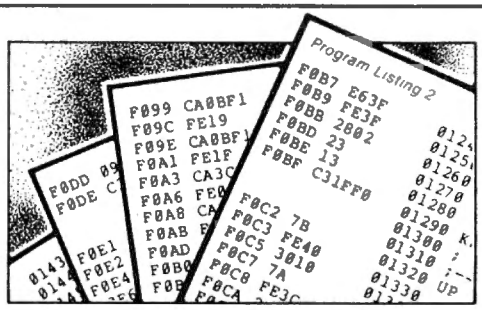

Programming the keyboard

The earliest microcomputers had a single input device: a row of toggle switches on the front of a cabinet. They had no cassette ports, no disk drives, no modem, and no keyboard. To input data, you had to set a series of switches representing the individual bits of a single byte or address.

On the TRS-80, the keyboard is the most important input device, but it is still nothing more than a collection of on/off switches. Many computers have an ASCII-encoded keyboard. Whenever a key is pressed, the ASCII value of that key is sent to the computer for processing.

However, the TRS-80 keyboard is not encoded. It is merely a matrix of switches that operate like the keyboard of an inexpensive calculator. Each time you press a key, a connection is made between one of eight columns and one of eight rows. Though the Model III keyboard has only 53 keys (52 on a Model I), it is mapped to 1K of memory between 3800H and 3BFFH.

To see the keyboard in action, run Program Listing 1. Experiment by pushing different keys and combinations of keys. With every keystroke, half the keyboard memory changes value. Listing 1 merely transfers the keyboard memory to the video memory while adding 30H (48D) to each position to show a blank keyboard as all zeros (the source code is shown in Program Listing 2).

After experimenting with the keyboard-to-video program, you should notice that:

- the upper-left position (equivalent to 3800H) never changes; it remains a zero.
- when you press a key, the lower right position (38FFH) has a non-zero value.
- different keys affect different portions of the screen, but several keys affect the same portions.
- different keys produce different values, but several keys produce the same values.
- pressing more than one key creates new values and new patterns of positions.

Most keyboard maps look something like Fig. 1. The address for each row is the lowest memory address the keys in that row affect, and it is the one address without interference from keys in other rows. If you wish to write a program that checks for a combination of two keys, you can either have the program check both rows (the most common method) or check a position that both keys will change.

In Basic, the INKEY$ function is a slow way of checking for a particular keystroke. Your program reacts to the keyboard much more quickly by PEEKing the key's address and then acting appropriately. As an example, use the arrow keys to sketch a picture on the screen with Program Listing 3. The same technique speeds up many Basic games.

If you are a hardware hacker, you probably noticed some holes in the ma-

	Line	Disk System	Tape System
	160	DEFUSR=&H7FE1	POKE 16526,225: POKE 16527,127
16K	190	DEFUSR=&H7B9F	POKE 16526,159: POKE 16527,123
	270	DEFUSR=&H7BB0	POKE 16526,176: POKE 16527,123
	160	DEFUSR=&HBFE1	POKE 16526,225: POKE 16527,191
32K	190	DEFUSR=&HBB9F	POKE 16526,159: POKE 16527,187
	270	DEFUSR=&HBBB0	POKE 16526,176: POKE 16527,187
	160	DEFUSR=&HFFE1	POKE 16526,225: POKE 16527,255
64K	190	DEFUSR=&HFB9F	POKE 16526,159: POKE 16527,251
	270	DEFUSR=&HFBB0	POKE 16526,176: POKE 16527,251

Table 1. Changes to Program Listing 4 for Various Systems

```
10 '*************************************
20 '*                                   *
30 '*       KEY-VIEW ROUTINE            *
40 '*    Displays the keyboard memory   *
50 '*    from 3800H to 38FFH            *
60 '*    on video screen.               *
70 '*                                   *
80 '*************************************
90 '
100 FOR I = 32512 TO 32539
110     READ D
120     POKE I,D
130 NEXT I
140 DEFUSR=32512          'For tape systems, this line should be
                          POKE 16526,0: POKE 16527,177

150 CLS: PRINT "PRESS KEYS 1-7 SIMULTANEOUSLY TO ESCAPE DISPLAY"
160 FOR I = 1 TO 500 : NEXT I
170 A = USR(0)
180 END
190 DATA 33, 0, 56, 17, 0, 60, 1, 0, 4, 126
200 DATA 198, 48, 18, 35, 19, 11, 120, 177
210 DATA 32, 245, 58, 16, 56, 254, 254, 32
220 DATA 229, 201
```

Program Listing 1

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```
                00100 ;*********************************
                00110 ;*                               *
                00120 ;*    KEY-VIEW  Routine          *
                00130 ;*      Transfers keyboard       *
                00140 ;*      memory to screen         *
                00150 ;*      for viewing --           *
                00160 ;*      Depress 1 - 7 simul-     *
                00170 ;*      taneously to escape      *
                00180 ;*                               *
                00190 ;*********************************
                00200 ;
                00210 ;
7F00            00220          ORG     7F00H           ;ROUTINE IS RELOCATABLE
7F00 210038     00230 KEYVU    LD      HL,3800H        ;HL==> KEYBOARD MEMORY
7F03 11003C     00240          LD      DE,3C00H        ;DE==> SCREEN MEMORY
7F06 010004     00250          LD      BC,400H         ;BC = 1K LENGTH OF BOTH
7F09 7E         00260 K10      LD      A,(HL)          ;GET A BYTE
7F0A C630       00270          ADD     A,30H           ; 0 = "0"
7F0C 12         00280          LD      (DE),A          ; STORE TO SCREEN
7F0D 23         00290          INC     HL              ;BUMP
7F0E 13         00300          INC     DE              ;  ALL
7F0F 0B         00310          DEC     BC              ;  POINTERS
7F10 78         00320          LD      A,B             ;TEST FOR DONE
7F11 B1         00330          OR      C               ;MERGE LSB OF BYTE COUNT
7F12 20F5       00340          JR      NZ,K10          ;REPEAT WHOLE SCREEN
7F14 3A3840     00350          LD      A,(3810H)       ;NUMBER ROW
7F17 FEFE       00360          CP      0FEH            ;CHECK FOR 1 - 7
7F19 20E5       00370          JR      NZ,KEYVU        ;GO UNTIL DONE
7F1B C9         00380          RET                     ;RETURN TO BASIC
                00390 ;
0000            00400          END
00000 TOTAL ERRORS
```

Program Listing 2

```
10 CLS
20 K%=PEEK(14400)   'REM 14400 = 3840H
30 IF K% AND 8 PRINT CHR$(27);
40 IF K% AND 16 PRINT CHR$(26);
50 IF K% AND 32 PRINT CHR$(24);
60 IF K% AND 64 PRINT CHR$(25);
70 PRINT CHR$(191);CHR$(24);: GOTO 20
```

Program Listing 3

trix in Fig. 1. You can easily add 11 or 12 more keys to your TRS-80, and give special functions to each. In fact, the control key required for Electric Pencil 1.0 was simply a key added to the matrix in the Shift row. To add extra keys, wire each to the appropriate row and column of your keyboard. You can also add a second, remote keyboard in the same manner. (See *The Custom TRS-80 and Other Mysteries* by Dennis Bathory Kitsz, IJG Inc., Upland, CA, 1982, for detailed instructions.)

Because the TRS-80 keyboard is not encoded, the meaning of each key must be determined by software. If you wish to change key definitions for a few keys or the entire keyboard, all you need do is write new software. The Model I and Model III store the address of the keyboard driver—the routine that scans and decodes the keyboard—at 4016H and 4017H. If you put the address of a different routine in those bytes, that new routine becomes the keyboard driver.

Basic calls the keyboard driver at the end of every instruction, looking for either a Break command or a SHIFT@ command. Because the driver is called so often, newly defined key combinations react instantly (except when Basic enters its string space garbage collection routine).

The keyboard driver is allowed to use registers AF, BC, DE, and HL and must return the value of the key pressed in the A register. If no key is pressed, the driver loads the A register with zero and sets the Z flag. With these restrictions in mind, you can write a short program to modify the normal driver flow and define any new keys or key combinations you wish.

For example, Program Listing 4 runs with any long and involved program. You might want a page of instructions available at all times. Although you could implement a screen swap routine by continually checking with INKEY$, defining a new key combination streamlines the program's design.

For this implementation, pressing the shift and clear keys halts all other program operations and displays a Help screen. The original screen and the program in progress continue after another

	Bits: 7	6	5	4	3	2	1	0
3801H	G	F	E	D	C	B	A	@
3802H	O	N	M	L	K	J	I	H
3804H	W	V	U	T	S	R	Q	P
3808H						Z	Y	X
3810H	7	6	5	4	3	2	1	0
3820H	/	.	-	,	;	:	9	8
3840H	SPACE	RT ARW	LT ARW	DN ARW	UP ARW	BREAK	CLEAR	ENTER
3880H							*	SHIFT*

*NOTE—On the Model III, bit 0 is the left shift key and bit 1 is the right shift key. On the Model I, bit 0 is both shift keys.

Fig. 1. Map of the Keyboard

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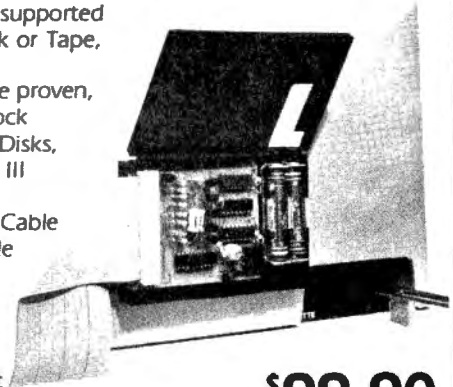

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keystroke.

This driver routine has to stay in a specific place in memory after the pointer at 4016H is set—if it were relocatable and moved around, Basic would never be able to find it and the computer would hang up or reset. Therefore, don't load the routine into a string or integer array.

Instead, pick a spot for it in memory (high or low) and assemble it to that location. Be sure to record three addresses from the symbol table; you will later need to know the location of Setup, Unset, and Swap to use the routine from Basic.

```
                00100 ;*********************************
                00110 ;*                               *
                00120 ;*  <shift> <clear> Screen-Swap  *
                00130 ;*    allows operator to get     *
                00140 ;*    a full page of instruc-    *
                00150 ;*    tions, etc, at any time    *
                00160 ;*                               *
                00170 ;*********************************
                00180 ;
                00190 ;Note -- see text for set-up instructions
                00200 ;
7B9F            00210          ORG     7B9FH           ;NOT RELOCATABLE --
                00220                                  ;ASSEMBLE TO ANY ADDRESS
                00230                                  ;YOU WISH
                00240 ; ORG of 7B9FH puts routine at top of 16K memory. Use
                00250 ;  0BB9FH for top of 32K memory, 0FB9FH for top of 48K.
                00260 ;
7B9F 2A1640     00270 SETUP    LD      HL,(4016H)      ;GET CURRENT DRIVER ADDR.
7BA2 11B77B     00280          LD      DE,TEST         ;GET ROUTINE ADDR.
7BA5 DF         00290          RST     18H             ;COMPARE DE & HL
7BA6 2807       00300          JR      Z,SET10         ;GO IF ALREADY SET
7BA8 22C37B     00310          LD      (RETURN+1),HL   ;SET RETURN ADDR.
7BAB ED531640   00320          LD      (4016H),DE      ;SET 'TEST' AS DRIVER
7BAF C9         00330 SET10    RET                     ;RETURN TO BASIC
                00340 ;
7BB0 2AC37B     00350 UNSET    LD      HL,(RETURN+1)   ;GET OLD ADDR.
7BB3 221640     00360          LD      (4016H),HL      ;SET DCB TO ORIG. ADDR.
7BB6 C9         00370          RET                     ;RETURN TO BASIC
                00380 ;
7BB7 3A8038     00390 TEST     LD      A,(3880H)       ;GET SHIFT ROW
7BBA B7         00400          OR      A               ;IS SHIFT PRESSED?
7BBB 2805       00410          JR      Z,RETURN        ;GO IF NOT
7BBD 3A4038     00420          LD      A,(3840H)       ;GET <CLEAR> ROW
7BC0 E602       00430          AND     2               ;TEST FOR CLEAR
7BC2 CA0000     00440 RETURN   JP      Z,0000H         ;SETUP PUTS VALUE HERE
                00450 ;
                00460 ;<Shift> and <Clear> are pressed, so SWAP
                00470 ;
7BC5 CDE17F     00480          CALL    SWAP            ;SWAP SCREENS
7BC8 CDF47F     00490 L10      CALL    KEY             ;CHECK FOR KEY DOWN
7BCB 20FB       00500          JR      NZ,L10          ;WAIT FOR RELEASE
7BCD CDF97F     00510          CALL    DELAY           ;WAIT TO AVOID BOUNCE
7BD0 CDF47F     00520 L20      CALL    KEY             ;CHECK FOR ANY KEY DOWN
7BD3 28FB       00530          JR      Z,L20           ;WAIT FOR KEY PRESS
7BD5 CDE17F     00540          CALL    SWAP            ;RESTORE SCREEN
7BD8 CDF47F     00550 L30      CALL    KEY             ;CHECK FOR ANY KEY DOWN
7BDB 20FB       00560          JR      NZ,L30          ;WAIT UNTIL RELEASED
7BDD CDF97F     00570          CALL    DELAY           ;WAIT TO AVOID BOUNCE
7BE0 C9         00580          RET                     ;RETURN TO REG. PROGRAM
                00590 ;
                00600 ;NOTE -- A will be loaded with 0 and the Z flag set when
                00610 ;        L30  falls through.
                00620 ;        Basic will think no key has been pressed.
                00630 ;
0400            00640 SWPBUF   DEFS    400H            ;1K FOR BUFFER
                00650 ;
                00660 ;Actual SWAP done below
                00670 ;
7FE1 11E17B     00680 SWAP     LD      DE,SWPBUF       ;DE==> SWAP BUFFER
7FE4 21003C     00690          LD      HL,3C00H        ;HL==> SCREEN
7FE7 46         00700 SW10     LD      B,(HL)          ;SAVE SCREEN BYTE
7FE8 1A         00710          LD      A,(DE)          ;GET BUFFER BYTE
7FE9 77         00720          LD      (HL),A          ;BUFFER BYTE TO SCREEN
7FEA 78         00730          LD      A,B             ;GET SCREEN BYTE
7FEB 12         00740          LD      (DE),A          ;PUT IN BUFFER
7FEC 13         00750          INC     DE              ;BUMP
7FED 23         00760          INC     HL              ;  POINTERS
7FEE 7C         00770          LD      A,H             ;GET MSB OF SCREEN PTR.
7FEF FE40       00780          CP      40H             ;OFF SCREEN YET?
7FF1 38F4       00790          JR      C,SW10          ;GO UNTIL DONE
7FF3 C9         00800          RET                     ;ELSE RETURN
                00810 ;
7FF4 3AFF3B     00820 KEY      LD      A,(3BFFH)       ;CHECK FOR ANY KEY
7FF7 B7         00830          OR      A               ;SET FLAGS
7FF8 C9         00840          RET                     ;AND RETURN
                00850 ;
7FF9 01A486     00860 DELAY    LD      BC,1700D        ;VALUE FOR DELAY ROUTINE
7FFC CD6000     00870          CALL    60H             ;ROM'S DELAY ROUTINE
7FFF C9         00880          RET                     ;DELAY ABOUT 100 mS.
                00890 ;
0000            00900          END
00000 TOTAL ERRORS
```

Program Listing 4

Listing 4 contains many interesting features. First, the Setup routine, which saves the current driver address and puts the address of Test in its place, checks to be sure the routine is not initialized. Without this check, a second call to Setup causes the keyboard driver to enter an endless loop because the Return address would be set to Test.

Also, note that a machine-language routine must call Setup, not Basic. Changing the driver address from Basic requires two POKEs. However, Basic scans the keyboard for a Break command or a SHIFT @ command after the first POKE, and uses the current (just changed) keyboard driver address. But the driver address is incorrect until after the second POKE, which probably won't be executed because the computer is lost in RAM, looking for a nonexistent driver.

The Unset routine restores the original keyboard driver to the system. It is wise to include the routine before the end of the Basic program, or else the new driver routine remains active until a reset. If you should later load a new program over the driver, you face another potential hair-pulling disaster.

The third section, Test, checks for the necessary Shift-Clear command that invokes the swap routine. The program checks for a Shift command first, then a Clear command. Notice that the check for a Shift command only considers a non-zero value in that row, ignoring the difference between the two Model III shift keys. If you have other special keys wired into the shift row, the check must be made more particular. If the shift and clear keys aren't pressed, control passes to the original driver through the address stored at Return.

The fourth section of the routine, starting with line 480, is the screen swap driver. This routine is only reached when the shift and clear keys are pressed. First, the Swap routine is called (Swap is written as a subroutine so you can also call it from Basic during initialization). Then continuous calls are made to the Key routine until all keys are released. Third, a time delay routine is called to avoid key bounce during the key release.

Next, the Key routine is again called continuously until you press any key to signal that you want to return to Basic. The screen is swapped back to its original state, and, as soon as you release

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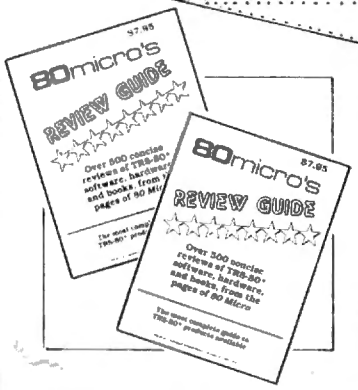

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ACT I
Scene One:
(Lights up. JOHN DOE sits in front of his computer reading a thick book. A sledge hammer is embedded in the 34-column printer to his left. PETE SMITH enters STAGE RIGHT.)

PETE: Hi, John, what's new?
JOHN: (Without looking) Hi, Pete. Just choosing a new printer.
PETE: What's wrong with the old one?
JOHN: Can't seem to get the daisy wheel past the sledge hammer.
PETE: Sledge hammer? What's that, some new computer term?
JOHN: (Looking at Pete for the first time) Put your glasses on, Pete. (Pete does so and sees the sledge hammer)
PETE: Wow!... (Crosses to printer) Boy, your figure did a number on it! How many swings did it take?
JOHN: Just one.
PETE: One?! That's pretty impressive.
JOHN: Yeah, well I've had a lot of practice. Took me two or three swings to get the others.
PETE: Others? How many have there been?
JOHN: (Staring off into space) Let's see... two printers, three modems, one joystick and a couple of cassettes.
PETE: That's a lot of money down the tubes.
JOHN: I know. That's why I'm making sure I get my money's worth this time.
PETE: How?
JOHN: With this. (He holds up the book)
PETE: (Reading cover) The 80 MICRO Review Guide?
JOHN: Brand new. Over 500 reviews of hardware, software and books. All encapsulated from the pages of 80 MICRO, and all with this quick-comparison 5-star rating system. I can compare printers, modems, joysticks, games, word processing programs, business programs, books on language and programming—
PETE: Must have cost you a pretty penny.
JOHN: Nope. Just $7.95.
PETE: That's all? How can I get one?
JOHN: You got the latest issue of 80 MICRO? (PETE nods) Just use the order card or the coupon in there. Or call toll free 1-800-258-5473 and use your MasterCard, VISA, or American Express.
PETE: Sounds easy enough.
JOHN: It is. And this Review Guide is great. I already saved more than the cost of the book when I used it to get that disk drive unit over there. Hey, where are you going?
PETE: To order my 80 MICRO Review Guide.
JOHN: But, Pete—
PETE: Don't worry. I'll bring the sledge hammer back as soon as I'm done with it.
(Lights fade as Pete exits STAGE RIGHT)

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the key, control returns to Basic.

The key checks could call the ROM routine at 002BH, which scans the keyboard and returns the value of any pressed key in the A register; pressing the shift and clear keys a second time, however, makes the program double back on itself because it's still in the keyboard driver line. Therefore, the program checks the keyboard by scanning byte 3BFFH, the only byte that is always non-zero with a key pressed. The final delay routine sets the A register to zero and triggers the Z flag. No other manipulation of these two registers is necessary to notify Basic that no key is pressed. Basic continues on its way without knowing the routine was invoked.

Though the machine language portion of the routine uses only 97 bytes, the entire routine requires 1,121 bytes because of the necessary buffer for the save screen. Despite its relatively large memory requirement, such a routine probably saves memory space compared to other forms of self-documentation.

The process for using the swap driver in a program is straightforward if you record the three addresses from the symbol table during assembly. First, print the Help screen and then, with the USR command, call the Swap section of the routine. This stores your Help screen in the buffer and also transfers whatever garbage happens to be in the buffer to the video screen. Clear the screen and call Setup to initialize the Help feature. Sometime before the program ends, call Unset to clear Test from the keyboard driver chain. Program Listing 5 shows how to use the program.

You could invent many other types of auxiliary keyboard drivers for special purposes. For some applications, you might want to call the regular keyboard scan first and have your program take some action if a certain key or group of keys is pressed. For example, you could easily develop a routine that allows direct input of graphics or special characters from the keyboard.

Also, you could redefine some of the unused control code characters. Pressing the shift key, the down-arrow key, and any key from A-Z simultaneously produces the ASCII codes from 1-26. At least half of these codes have no effect during telecommunications. A program could call the regular driver and take various actions based on which control code is pressed.

If you write an unusual auxiliary driver you think others might enjoy, send it to me. If I consider it to be of general interest, and if it works on the Model I and III, I'll include it in a future article so we can all experiment with it. ■

Write to Hardin Brothers at 280 North Campus Ave., Upland, CA 91786, or contact him through CompuServe. His e-mail address is 72165,735.

```
10 '*************************************
20 '*                                   *
30 '*    SWAP Demonstration Program     *
40 '*                                   *
50 '*************************************
60 '
70 ' NOTES -- Load SWAP routine before running this program.
80 '          See Table 1 to modify lines 160, 190, and 270
              for your system.
90 '
100 CLS
110 FOR I= 1 TO 10
120    PRINT TAB(I*3);"This is the Help Screen"
130 NEXT I
140 FOR I=1 TO 200: NEXT
150 PRINT: PRINT TAB(36);"Press any key to return."
160 DEFUSR=&H7FE1     'Call SWAP routine
170 A=USR(0)
180 CLS
190 DEFUSR=&H7B9F     'Call SETUP routine
200 A=USR(0)
210 FOR I=1 TO 100
220    K=K+2
230    IF K>30 THEN K=0
240    PRINT TAB(K),"Press <SHIFT> <CLEAR> for help."
250    FOR J=1 TO 50: NEXT J
260 NEXT I
270 DEFUSR=&H7BB0     'Call UNSET routine
280 A=USR(0)
```

Program Listing 5

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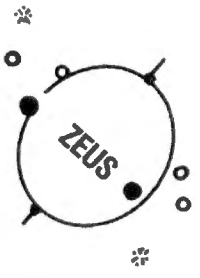

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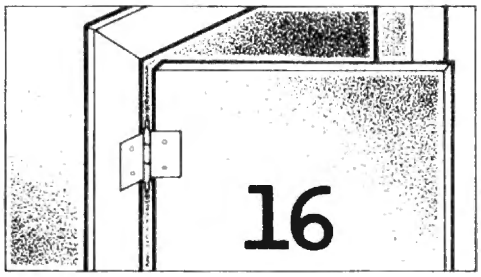

Versions of TRSDOS

Are you confused by all the versions of TRSDOS? Should you use version 1.0, 1.1, 1.2, 1.3, 2.0a, 2.0b, II, HD, 4.1, 4.2, or 16?

The original Model II TRSDOS was version 1.0. Later improvements and fixes yielded versions 1.1, 1.2, and 1.3. The only time you'll see these versions is if you purchase software originally designed for the Model II. Should you buy a program on such a disk, leave it there. The program was written and debugged on that version and you can be sure it functions correctly.

The newest Model II version is TRSDOS 2.0. A letter suffix indicates whether it will run on the Model II, 12, or 16. TRSDOS 2.0a is for the Model II, although 2.0b also runs on it. But 2.0b must be in control if the disk is used on the Model 12 or 16.

To convert a 2.0a disk into a 2.0b, simply type DO THINLINE from the TRSDOS Ready mode. Then reset and the version number changes right on the screen.

Model 12 and 16 disk drives shut off if they are not addressed within 20 seconds of the last access. The idea is to save wear and tear on the disk and the drive mechanism. However, if disk input or output is required, the motor turns on and the disks must be brought up to speed before the system accesses them.

TRSDOS 2.0b instructs the computer to wait 8/10 second. If operating time is a factor on your Model II, though, you should use version 2.0a. This speeds up disk I/O since there is no delay in accessing the disk. To convert 2.0b to 2.0a, type DO UNTHIN from the TRSDOS Ready mode.

One final note: Version 2.0 does not support double-sided disks.

When Radio Shack brought their first hard disk out on the market, they needed an operating system to control it. Thus, TRSDOS HD was born.

The latest Model 12 and 16 disk operating system is version 4.2. TRSDOS HD is extinct. The hard-disk operating system is built into version 4.2. As you might have guessed, version 4.2 replaces version 4.1, which made its debut when the Model 16 came out last year. The Model 16 owner's manual sometimes refers to TRSDOS 4.2 as TRSDOS II.

Version 4.2 uses disk space most efficiently of any TRSDOS to date. It supports double-sided disks.

You cannot use just any disk to record data on both of its sides. The indexing sector hole on the disk appears at different locations on single- and double-sided disks. If the computer detects a double-sided disk, it automatically writes to the other side when side 1 is full.

TRSDOS 16, which is part of the version 4.2 disk, controls the MC68000 microprocessor in the Model 16, II/16, and 12/16 machines.

In summary, if you have a Model II, you should be using TRSDOS 2.0a. If you have a Model 12 or 16, use version 4.2 (TRSDOS II). Versions 2.0 and 4.2 address the Z80 microprocessor. Use TRSDOS 16 when dealing with the MC68000.

TRSDOS 2.0 and 4.2 format disks differently—version 4.2 uses disk space more efficiently. However, you can transfer programs and files between the two with the command FCOPY. ■

Continues on p. 42

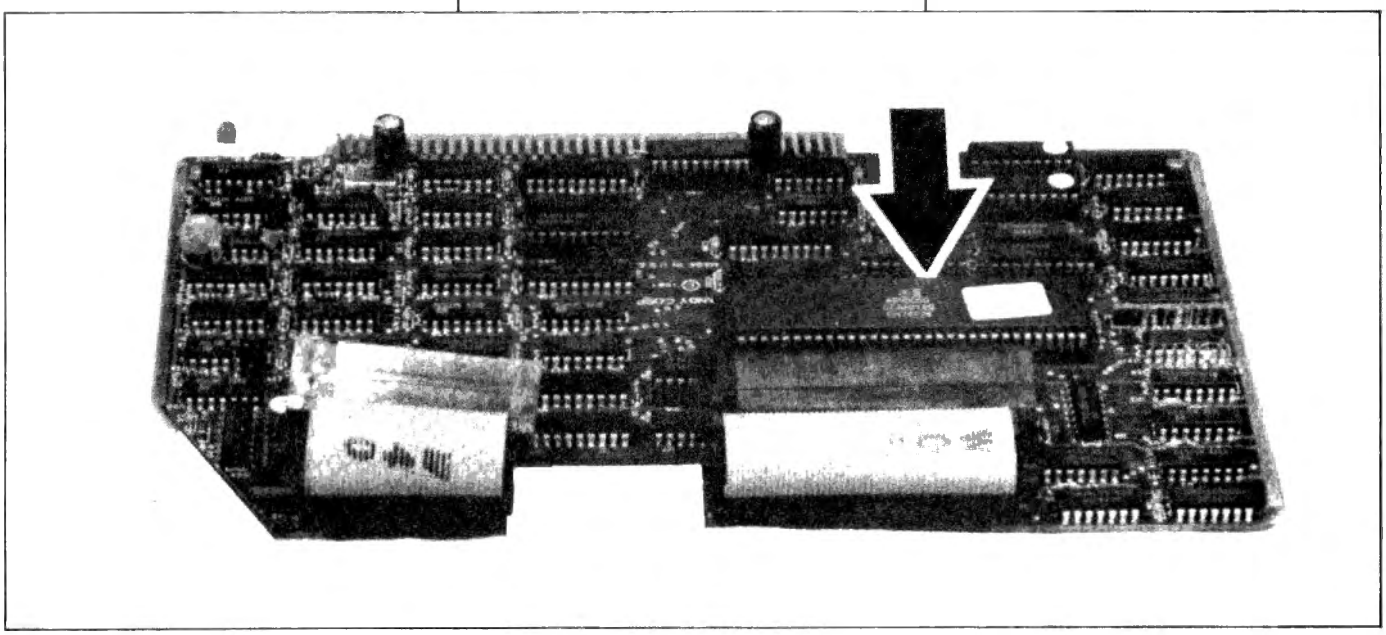

Photo 1. Model 16 CPU circuit board. Arrow indicates MC68000. (Photo by George M. Keen.)

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Continued from p. 40

Assembly-Language Corner

Photo 1 shows the MC68000 board used in the Model 16, II/16, and 12/16. The arrow points out the microprocessor. Physically, it is a very big chip compared to typical integrated circuits. The sheer number of input and output connections accounts for its large size.

The 68000 offers an abundance of general-purpose registers, named A0–A7 and D0–D7. Each register can store up to 4 bytes of data.

The term "addressing mode" refers to the microprocessor's instructions and the syntax needed to address the MPU (microprocessor unit) registers.

The MC68000 instruction set is similar to those of most other microprocessors. However, there is one new factor. Instructions need a suffix that tells the computer how many bytes of the register are to be acted upon. These suffixes are labeled B to represent a byte operation, W for 2 bytes (a word), and L for a long word or 4 bytes.

The statement LDW .A0,#5 acts on 2 bytes (a word). Address register A0 is loaded directly with the decimal number 5. Since the suffix is W, the upper byte of the word is filled with a zero. You cannot be sure of the values stored in the other 2 bytes of the register, however. If you want to be certain that the register's 4 bytes contain only a value of 5, specify LDL instead of LDW.

In keeping with Z80 load format, the operand of the LD statement contains the destination register and source value (or source register) separated by a comma. The source appears to the right of the comma in parallel with Z80 programming. This is true for all MC68000 op codes with one exception, STore. Like the load instruction, it places values in registers. The syntax for STore is ST source,destination. You must use B, W, or L to indicate the number of bytes affected by the operation.

In the LD example, a pound sign (#) tells the processor to treat the following entity as a number. Otherwise, it is a memory location.

Finally, the period in front of register A0 indicates direct register addressing while an @ sign denotes direct addressing. Direct addressing means to place the value from the source directly into the register specified in the destination position of the operand.

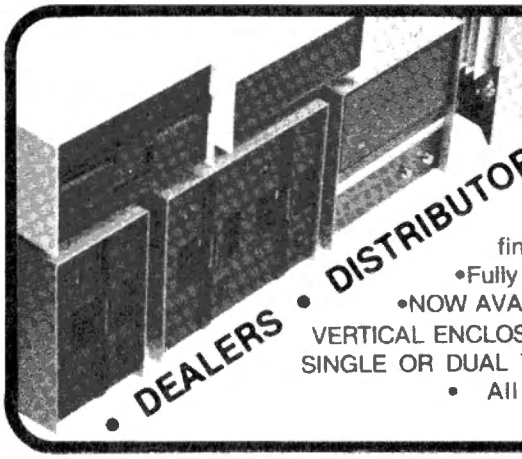
LD is used for direct register addressing, and the op code MOV (for MOVe) is for indirect operations. For instance, LDA .A0,STORAGE AREA loads the memory address location of this section of the program given the identifying label STORAGE AREA. LDA is a complete instruction to load an address location into a register. Since memory addresses are 4 bytes long, the instruction always works on the entire register and requires no B, W, or L suffix.

Let's go one step further and load the decimal number 5 into the memory address whose location was defined with the label STORAGE AREA. The address was loaded into register A0 using the instruction LDA .A0,STORAGE AREA. Now the program must load the number 5 into the memory location to the address indicated by the value stored in A0. In other words, A0 points to the destination. The register itself is not to receive the 5. Because the @ sign represents the indirect addressing mode, the routine might look like this:

```
LDA     .A0,STORAGE AREA
MOVW    @A0,#5
```

It is standard practice to use the suffix W on loads and moves even when you are loading only 1 byte. A W forces a zero into the second upper byte of the register. Most op codes work on a word, in contrast to 8-bit MPU's which handle 1-byte instructions.

The MC68000 places all instructions in even memory address locations. A good reason for defining a word instead of a byte when setting aside memory as storage areas for text or numeric data is to ensure even placement of instructions that appear later. ■



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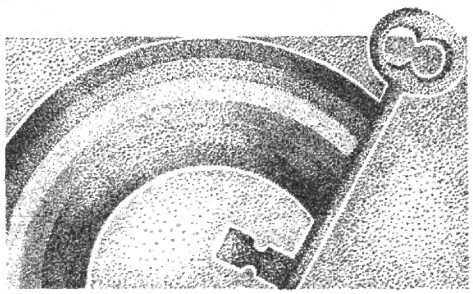
THE COLOR KEY

by Scott Norman



Graphics, games, and the Color Computer

I'd like to tie this edition of The Color Key into the games theme of the August issue. This presents certain problems: I'm not much of a game player.

I do have a soft spot for Pac Attack and Doodle Bug. I've even taken on Zaxxon or Defense to satisfy some primitive blood lust, but I yield to the kids where any claim to dexterity is concerned.

And forget adventure games. I've already spent too long stumbling around one isolated sector of Aardvark's Circleworld, and that's my most successful encounter with the type! I have a tough time getting interested in screen after screen of text when I know what else the CoCo can do.

All of which gives me the structure for this column: a little on games, much more on the graphics that give them their appeal.

A Radar Routine

I might not be too big on games, but simulations are for grownups. My lifelong enthusiasm for aircraft, and so for flight simulators of all types, sets me to thinking about CoCo graphics as applied to war games (I mean tactical and strategic simulations).

I've been flirting with the idea of writing a complex simulation of the Battle of Britain. The setting of Batlbrit (I already have the file name) will be the RAF (Royal Air Force) War Room, with the computer providing a real-time radar display of the battle area: much of England's southern Channel coast, including cities and airfields.

British radar picks up the incoming Luftwaffe formations, and the player has to allocate fighter resources to intercept them. This provides possibilities for strategic considerations and the use of historical data.

I plan to use the short routine in the Program Listing as the basis of the radar display. It needs some polishing; the array that stores the formation could be defined more efficiently, that's clearly not the English coast on the screen, and eventually I'll have multiple aircraft formations present at any given time.

Perhaps the game writers among you can see other uses for the routine even now. It's based on combining Extended Color Basic's Get and Put commands for simulating motion with periodic screen clearing to provide a satisfactory radar effect. A given return stays fixed on the screen until the next sweep of the beam, then you see its new position.

The listing defines the fictitious coastline as a string variable, CL$, so you can use it in multiple Draw statements without a lot of retyping.

The M, or Move, subcommand within the definition of CL$ allows you to draw lines at practically any angle; otherwise, oblique lines would be restricted to the 45-degree positions of the E, F, G, and H subcommands.

The little routine between lines 130 and 160 is useful for constructing a fuzzy radar return for the incoming aircraft. Line 150 defines the fuzziness. Use numbers less than 0.9 to fill more of the array.

Line 240 sets the speed and direction for the radar signal's movement across the screen. I included the random term in the expression for DY to make it harder to predict where the incoming formation would cross the coast.

At this stage of the full-blown game, computer-generated Luftwaffe strategy inserts predefined course changes for the bomber fleets.

Lines 240–320 draw successive radar scans. The PCLS blink in line 250 adds realism. If you find it bothersome, you can delete lines 250 and 260, and blank out the old radar return by putting a blank rectangle on top of it before writing the updated signal onto the screen.

Line 270 allows the coastline to show up before the aircraft do; I now think the display looks better without this effect, and might get rid of the line in future work. Line 500 is an endless loop to freeze the final display.

It's taken longer to describe the routine than to write it. If these techniques still leave you cold, I recommend a couple of good references.

Color Computer Graphics, by William Barden, Jr., is available for $5.95 at Radio Shack Computer Centers. The book is for the Basic programmer. Barden's usual style comes through; he might succeed in making Video Display Generator (VDG) and Synchronous Address Multiplexer (SAM) programming comprehensible.

Assembly Language Graphics for the TRS-80 Color Computer, by Don and Kurt Inman, is from Reston Publishing Co., Reston, VA, for $14.95. It's much headier stuff. The Inmans use sound and graphics as the most attractive vehicles for teaching Assembly language. Much of the book discusses putting text on the screen when using a graphics display mode, which leads me neatly to my next topic.

Using the Keyboard with Graphics

In many games, the player wants to enter keyboard commands while retaining a high-resolution graphics display. That's how the RAF commander will direct his forces in my Battle of Britain simulation. A normal input command won't work, since it causes the machine to revert to the text display mode.

In last month's column, I discussed Arizin Inc.'s Colorkit utility (P.O. Box 8825, Scottsdale, AZ 85252). The .TXOF command defeats the reversion to text display when an input is encountered.

To use this in Batlbrit, I could have the display freeze as a signal for keyboard input. Hitting enter restarts the display, while the program parses the input string and takes appropriate action.

Handy as these utilities are, it's unrealistic to expect prospective game players to rush out and buy Colorkit; besides, it takes up about 5K of RAM that might not be available. Finally, you'd have to make the keyboard en-

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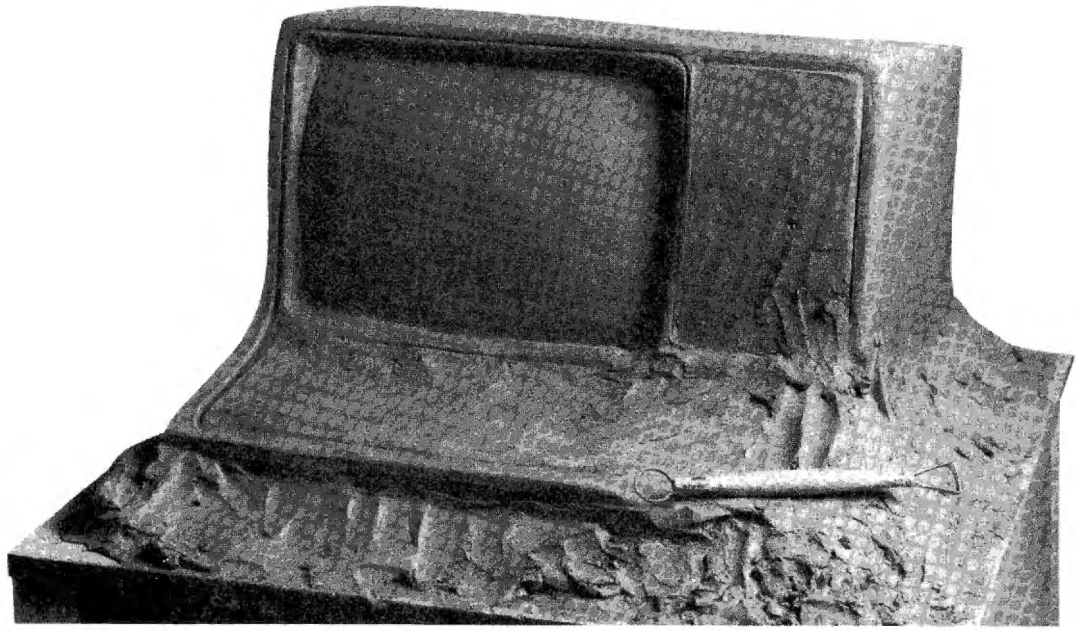

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tries blind; Colorkit doesn't have a way of echoing them to the high-resolution screen.

However, you can still use the INKEY$ function to interpret keyboard input one character at a time, even when a graphics display is up. A screen echo is also easy to arrange. Have the program draw a high-resolution graphics representation of the character whose key you just pressed. I've published one such character set (*80 Micro*, Anniversary Issue 1983, p. 469).

You can also retain use of the enter key for command termination. If PEEK(338)=191, that's enter. If PEEK(339)=191, you've pressed clear. That might be handy to rectify a typing error; if the machine detects a clear, it should ignore everything entered up to that point and start over.

Information of this sort is readily available from the many CoCo keyboard maps produced over the past few years. The first one in my files appeared in "The Color Computer" by Philip Martel and Robert Nicholas (*80 Microcomputing*, June 1981, p. 206).

```
10 ' "RADAR SCREEN" ROUTINE
20 '
30 '
40 ' SETUP & DRAW "COASTLINE"
50 PMODE 4,1: PCLS: SCREEN 1,0
60 CL$="D41F10D5M-15,35L13D25G12U4M+6,-8U4L23M-40,79"
70 DRAW "BM128,0;XCL$;"
80 '
90 '
100 ' RESERVE ARRAY, CONSTRUCT
110 ' RANDOM "RADAR SIGNAL"
120 DIM R(10,10)
130 FOR X=246 TO 255
140 FOR Y=0 TO 9
150 IF RND(0)>0.9 THEN PSET(X,Y,1)
160 NEXT Y,X
180 '
190 '
200 ' MOVE "RADAR SIGNAL" ACROSS
210 ' SCREEN
220 GET (246,0)-(255,9),R,G
230 X=246: Y=0
240 DX=2: DY=1+RND(0)
250 PCLS
260 DRAW "BM128,0;XCL$;"
270 FOR T=1 TO 100: NEXT T
280 X=X-DX: Y=Y+DY
290 IF X<=0 OR Y>=181 THEN 500
300 PUT(X,Y)-(X+9,Y+9),R,PSET
310 FOR T=1 TO 750:NEXT T
320 GOTO 240
500 GOTO 500
```

Program Listing. Routine to Simulate a Radar Screen

Some Graphics Editors

One of my first projects after adding joysticks to my computer was writing a paintbrush program to create low-resolution graphics without squinting at graph paper or sweating out a mass of Pset commands. I even added a routine to save the video RAM data as an ASCII tape file.

However, it's possible to do much more, and nowadays most software vendors have some sort of graphics editor in their portfolio. These vary from programs that let you create individual figures for incorporation into a game, to full-screen editors that do for graphics what a good word processor does for text.

Larry Ashmun's Color Graphics Editor (CGE) from Soft Sector Marketing (6250 Middlebelt, Garden City, MI 48135) gives you a small screen area in which to build a figure for use in a larger program.

The disk version stores the graphics data as an ASCII file of Basic data statements, or as a file of Form Double Byte (FDB) directives for an Assembly language program. You even have a limited capability to check out animation effects before committing your creation to disk.

A powerful feature of most graphics editors is the ability to program the VDG and SAM chips in nonstandard ways. If you've delved into CoCo graphics programming at the Assembly language level, you know that the Microsoft interpreter accesses only certain setups, the four PMODEs of Extended Color Basic.

Other graphics and semigraphics modes exist, and some nice effects are possible if you're willing to get involved with some of the details. How about the equivalent of PMODE 4 with three colors on a black background?

CGE gets you started in the right direction, although the Basic programmer still has a lot of work to do.

After loading the program, you have a choice of four modes, each with two color sets. In resolution, these correspond to PMODEs 1, 3, and 4, plus a 128-by-64-element mode designated as 2C. You then enter the edit mode, in which you create a shape for later use.

The display gives you a rectangular graphics work area, plus a table of four two-digit columns. Each digit will later contain the hexadecimal (hex) representation of the data stored in 1 byte, or four dots, of video memory. Each pair of bits controls the color of one dot. Thus, the first line of digits represents the first video line, and so on.

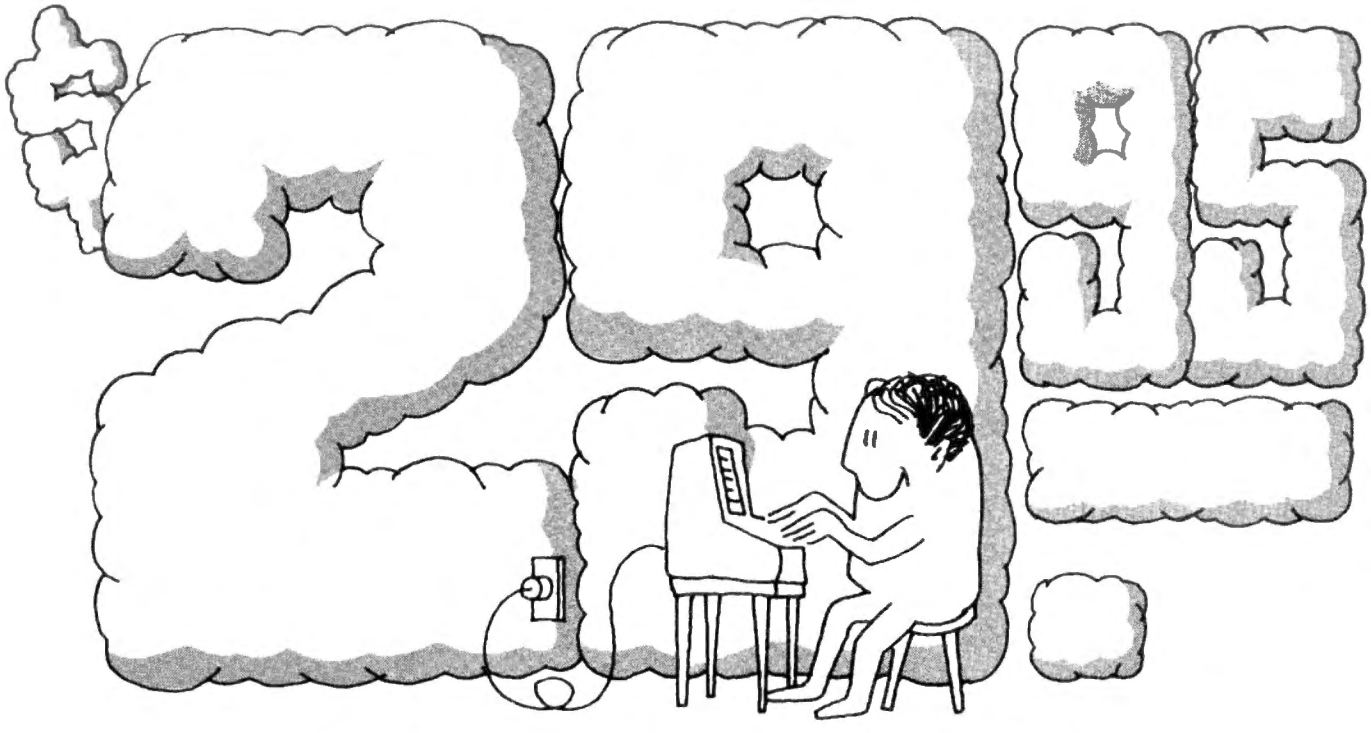
There are two shape creation modes. In Dot/Draw, you move a flashing cursor within the work area and press number keys to create color dots. (I could use it to create the aircraft formations in Batlbrit, for instance.) The numbers in the table change as you lay down dots.

Hex/Direct Entry lets you write hex numbers directly into the table. This can be faster if you know the hex representations of the colored dot patterns you want.

However, I've found an effect similar to keybounce that limits the speed with which I can enter data in this mode. I suspect that this results from an insufficient delay time in the keyboard scanning routine, and should be amenable to a software fix.

CGE gives the programmer tools for filling the work area box with a solid background color, Exclusive ORing the box's contents with another color to change background and figure, and moving the figure within the box.

You can use this to simulate animation when combined with the four buf-



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fers CGE sets aside for storing the current contents of the box. You can sequentially rotate the buffers' contents in and out of the work area, so you can see the effects of storing slightly different versions in each.

Unfortunately, while CGE does make shape creation simple, incorporating the shapes into a Basic program is awkward. The Basic output option of disk CGE generates an ASCII file of data statements (line numbers 100, 110, and so on) that you must renumber and merge with the rest of your program.

Then it's up to you to read the data into an array and use POKE or Get/Put to get it onto the screen. The tape version of the program can't even generate the file for you; you have to copy the data table by hand.

There is no easy road to arcade-quality animation for Basic programmers. If you want high speed, you have to use Assembly language.

CGE author Ashmun doesn't duck this issue; he does provide an Assembly format option. I just think it's important to keep your expectations within bounds when considering the purchase of a software tool.

Bob Crispen's Foxygraf (Computerware, Box 668, 4403 Manchester Ave., Encinitas, CA 92024; $29.95 tape, $34.95 disk) takes another tack. This is quite a comprehensive package, with a manual that features an excellent treatment of graphics in general and CoCo programming in particular.

Few people have done a better job of describing the interactions between the three determinants of a CoCo display: page, the address of the top left corner of the screen; VDG mode, the vertical size of the screen and the vertical separation between bytes; and color set, which controls page width and pixels per byte.

With Foxygraf, you can create images on part or all of the screen, using the arrow keys and space bar to control a cursor of variable size. You can save the images to tape (with the cassette version of the program, anyway) and subsequently recall them. You can also interface them to Extended Color Basic programs.

Foxygraf gives the user an unusual degree of control over VDG and SAM programming. It has its own shorthand commands for drawing lines and ellipses, and for painting rectangular portions of a screen.

You can define the cursor as a graphics block or any alphanumeric character received from the keyboard. This makes it possible to mix text with graphics in semigraphics modes. With practice you can get unusual effects, although it might not be possible to maintain them when recalling an image with Basic.

Foxygraf also supplies complete real-time information about the parameters of the mode and screen in use. A query command lets you leave the graphics screen to examine and possibly change parameters without destroying your work.

The program also keeps track of the cursor's position in two coordinate systems: graphics screen rows and columns, and RAM addresses. This is handy for defining the portion of the screen you want to record.

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retrievable with CLOADM commands. They are not exactly the same as the files that Color Basic's CSAVEM produces—there are extra bits in the header to set the graphics parameters—but they are readable.

The task isn't completely trivial, since you must note and clear the required part of memory to avoid clobbering a program with the imagery. Foxygraf's thorough record-keeping seems to give the programmer the best possible chance of getting things right.

The manual includes a tutorial and command summary, details of memory utilization, subroutine addresses, and other miscellany of interest to the experimenter.

I've recently been using Computerware's other graphics editor, 3-D Drawing Board (16K tape, $24.95; 32K disk, $29.95). This is a very different animal: a tool for constructing wire frame drawings of three-dimensional objects, with the ability to view an object from different points in space.

This amounts to a hands-on introduction to the world of computer-aided design, and it's a marvelous demonstration of the Color Computer's powers. Of course, it's important to keep the program's limitations in mind (I almost said in the proper perspective).

An object's shape is defined by a series of cross sections, called z-cuts because they are taken perpendicular to the z-axis of a Cartesian coordinate system. You must make each z-cut up of straight line segments.

The computer's limited memory results in limitations on the complexity of objects. In a 32K system, you can have no more than nine z-cuts, and the outline on each z-cut can have no more than 20 nodes (corners, to be imprecise).

The program, which I'll call 3-D from now on, is capable of connecting corresponding nodes on different z-cuts to give the finished image its wire frame appearance. Again, memory size rears its ugly head; you can have no more than 300 connections in a figure.

You also have a limit on the number of nonprismatic connections, i.e., linkages between dissimilar shapes. An example of a nonprismatic connection is that between the eaves of a house (a rectangular shape) and the ridge of the roof (a straight line). 3-D is limited to ten connecting lines in each such connection.

Within these limitations, it's a terrific program. If you have the data, you can specify z-cut outlines by the coordinates of their nodes. If you don't have the data, you can draw the z-cuts with a joystick-controlled cursor in what looks like PMODE 4.

". . . the subsequent use of files is a weak spot for many graphics editors."

You can also mix the two input modes. If your object has a constant cross section, you can replicate z-cuts with a few keystrokes instead of redrawing the figure.

3-D shines in its ability to create different views of an imaginary object. Once you've defined an object by z-cuts, you can use the CoCo's joysticks to conduct an imaginary flyaround.

The right stick controls your viewpoint's horizontal and vertical position, while the left governs viewing distance and object rotation about the line of sight (equivalent to cocking your head to one side).

You don't see continuous motion on the screen. In practice, you generate one view of your object, move the joysticks by a likely amount, and press the right stick's button to command a drawing from your new vantage point. If only the CoCo could use high-resolution light pen techniques. . .

You can store objects constructed with 3D on tape or disk as ASCII files. In principle, other programs can read and manipulate these, although your math had better be good to do so. In fact, the subsequent use of files is a weak spot for many graphics editors.

3-D still puts on quite a show. You wouldn't use it to design a space shuttle, or even next year's Chevy, but it can do wonders for a mind jaded by too many alien invaders. It's marvelous what you can do with a little trigonometry. ■

Scott Norman welcomes reader response to The Color Key. Write c/o 80 Micro, *80 Pine St., Peterborough, NH 03458.*

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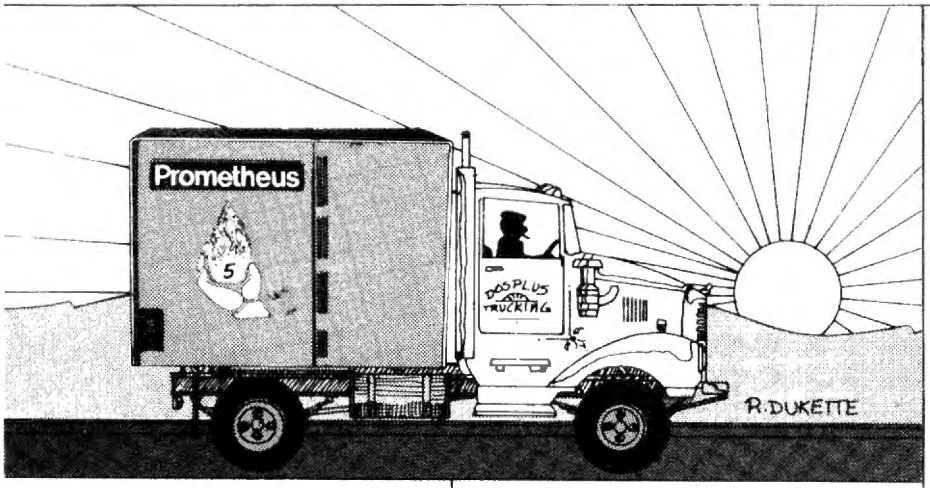
edited by Lynne M. Patnode



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Our reviewers use a five-star rating system. One star represents the low end of this spectrum, while five stars represent the spectacular and high end of the spectrum.

★ ★ ★ ½

Prometheus 5 Hard Disk System
Computex, division of
World Wide Data Systems Inc.
17321 El Camino Real
Houston, TX 77058
Model III
$1,495

DOSPLUS 4.0 Hard Disk Operating System
Micro-Systems Software Inc.
4301-18 Oak Circle
Boca Raton, FL 33431
Models I and III
$299.95 (included with Prometheus at no extra charge)

by John Ratzlaff

The Prometheus 5 Hard Disk System is a relatively low-cost, mass-storage Model III system based on Winchester technology. Its manufacturer, World Wide Data Systems Inc., is the parent company of Computex, which has been selling disk drive kits and other Model III add-ons for several years.

I purchased a Prometheus 5, a 5-megabyte drive, for my Model III. The drive included DOSPLUS 4.0, the hard-drive operating system by Micro-Systems Software. Fortunately, DOSPLUS is my top choice among all available TRS-80 operating systems.

Preparing the System

Installing the Prometheus drive is simple. Plug a ribbon cable into the back of the drive and into the input/output (I/O) connector on the bottom of the Model III. Then plug the power cord into the wall.

The manual accompanying the hard disk (mine was a preliminary version) did not indicate which way to plug the cable into the drive (exiting to the left or right). I was wrong the first time, but when the computer didn't work, I reversed the cable and it worked properly.

The cable should exit to the right when viewed from the back. The manual indicates no harm is done if you plug it in backward.

Installing the operating system is not so simple. First, use the CONFIG command to set the various parameters for the hard drive, then format the drive using the HFORMAT utility. Transfer the system files using SYSGEN, then the rest of the files using Transfer. Finally, use CONFIG again to signal DOSPLUS that the system now resides on the hard disk.

Once you format the hard drive, it is ready to store files, even before you transfer the system files. Since I was so excited to use my new hard drive, I saved a Basic program onto the newly formatted drive to see if it worked. And it *did* work!

Unfortunately, when I proceeded with SYSGEN, it aborted with an error message. Figuring that I should use SYSGEN without any files on the drive, I killed the file I had saved and tried it again.

This time it seemed to work, but when everything was finished I couldn't boot up from the hard drive. An "unknown error code" message appeared and the program booted from the floppy disk.

Neither the Prometheus nor the DOSPLUS manual provided pertinent suggestions, so I called Micro-Systems for advice. They suggested I reformat the disk and try again, because even a killed file can cause problems with SYSGEN.

It makes sense to me now: The system expects system files to occupy certain places in the directory. Since a killed file still occupies a directory slot, one of the system files is forced to an improper slot. Anyway, everything worked fine after that.

The Prometheus manual describes all the settings you use in configuring and formatting the hard drive. However, DOSPLUS 4.0 has tremendous flexibility: You can configure the hard drive any way you want, within some limitations.

The Prometheus 5 hard drive has one platter with 32 sectors per track, and 320 cylinders on that platter. Other models in the Prometheus series have the same specifications, but they have more platters. The Prometheus 10 has two platters, for instance.

The manual directs you to specify 32 sectors per granule, or two granules per cylinder. Since the platter has two sides, each cylinder has two tracks, or 64 sectors.

If you recall that a granule is the smallest unit of disk space you can allocate to a file, you will realize that it's a very large minimum file size. If you store a small Basic program on the disk,

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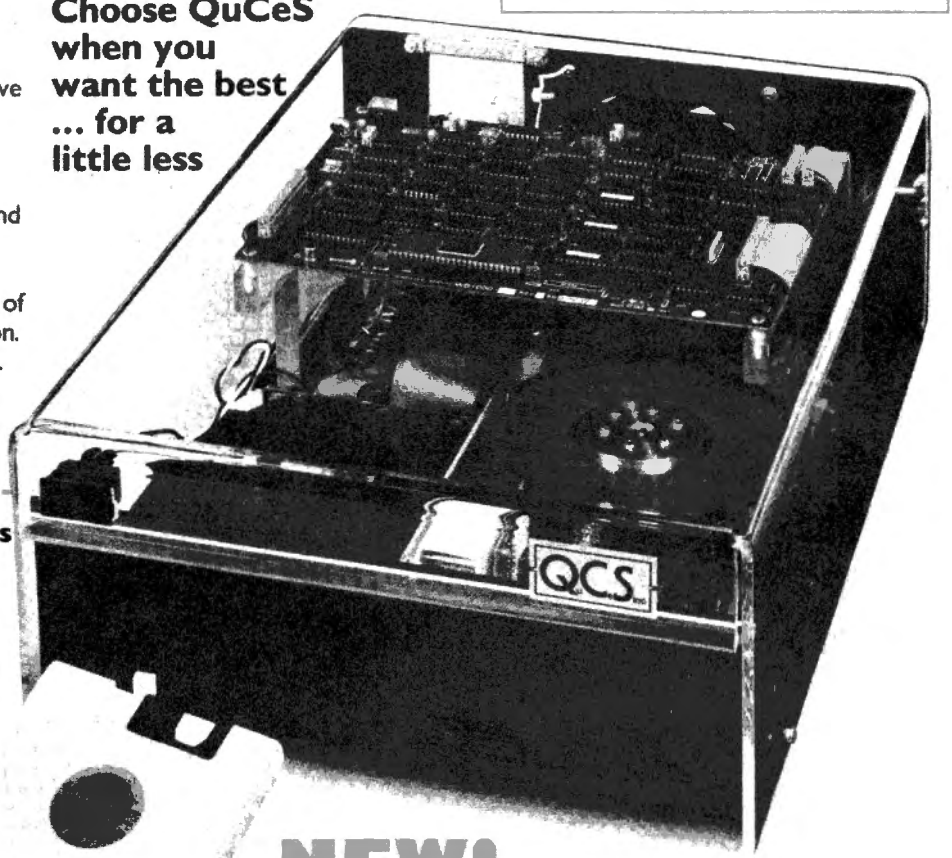

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After some calculations, I decided that I wanted my granule size to be eight sectors, so I set GS=8. This makes the minimum file size 2K. However, a smaller minimum file size allows more files on the disk, so I set the directory size to 32 sectors (22 sectors was the suggested size). This allows a maximum of 240 files in the directory.

DOSPLUS imposes several minor limitations. You can have no more than eight granules per cylinder, so my granule size had to be eight or more. The directory cannot exceed the length of one track, which limits it to 32 sectors on the Prometheus.

Incidentally, the DOSPLUS manual stresses that ideally the directory size should be one granule. I could find no reason for that, and allocating four granules for the directory has worked fine for me.

Another important feature of DOSPLUS is the ability to partition the hard drive into two or more pseudo drives. The Prometheus has 320 cylinders, so you must partition DOSPLUS because it accommodates no more than 200 cylinders per drive.

I decided to have my first drive (drive 4) contain 120 cylinders, and the second drive contain 200 cylinders. I could create as many as three drives, as long as each drive had 100–200 cylinders.

You partition the drive by specifying the base address in the CONFIG command. The base address refers to the cylinder on which the pseudo drive begins. In my configuration, drive 4 has a base address of zero, while drive 5 has a base address of 120.

When you've formatted the drive, specify how many cylinders to format for that drive. It is possible to create overlapping pseudo drives by using improper values with CONFIG and HFORMAT. The DOSPLUS manual warns you against such actions.

The New World of Hard Drives

Once you configure, format, and SYSGEN the hard drive, it's ready to act as the system drive. The Model III still tries to boot from the floppy disk in drive zero, so you must have a system disk in drive zero when you turn on the computer.

When the operating system has read in enough of the system files from the floppy disk, its base of operations transfers to the hard drive (if so configured). All subsequent actions originate from the hard drive, so library commands and utilities execute much faster, and you can remove the system disk from drive zero.

Using the Master parameter in CONFIG, you can also specify that all disk searches must begin with the hard drive or any drive you want. You can have the system consider drive 4 the default drive for DIR and other commands, and the starting point when searching for a file with an unspecified drive number.

This speeds searches considerably, since the hard drive's response time is much shorter than that of floppy disk drives. However, if a search starts at drive 4, the system searches only the hard drives. If you want a file from drive zero or 1, you must specify the drive number.

The hard disk's speed is impressive for two reasons. The disk is always rotating, eliminating the delay while it gets up to speed, and the disk rotates at 3,600 revolutions per minute (rpm), allowing a much faster data transfer rate.

However, track-to-track access time is not that much faster (3 milliseconds), so a lot of head travel results in a noticeable delay. For instance, during the search for a file, the head moves from the drive 4 directory (cylinder 60) to the drive 5 directory (cylinder 220). This travel over 160 tracks (and back again, if necessary) causes a delay of between one and two seconds.

Such a delay also occurs during access to files on drive 5. The operating system usually consults one of the system files on drive 4 near the directory track, so the head travels back and forth between pseudo drives 4 and 5.

This takes a bit longer than it does on floppy drives since the operating system would simply access another drive, reducing the necessary head travel.

As the DOSPLUS manual states, "the name of the game" is minimizing head travel. A hard drive with more platters and fewer cylinders is faster than a drive with one platter and many cylinders (such as the Prometheus), all other things being equal.

A hard drive with two platters and 160 cylinders has the same capacity as the Prometheus drive, with only half the head travel. The difference is quite small, however, and is insignificant under most circumstances.

Head travel aside, the fact is that a file loads from a hard disk much faster than from a floppy disk, typically in 40–50 percent less time. It's not instantaneous, but it is quicker.

Space is the other main advantage of hard disks. Even after transferring nearly all my files to the hard drive, I still have over 4 megabytes of available memory.

The drive accepts huge files as well as many files. It easily accommodates a monstrous data-base file that you would have to break into several parts and place on several disks with a floppy disk system. This makes the data base much easier to use.

Back-up of the hard drive has traditionally been a problem. Although the hard drive is much more reliable and not subject to the same physical abuses as floppy disks, it is still wise to back up your files periodically.

DOSPLUS 4.0 does not provide a means of backing up the entire contents of the hard disk to floppy disks in one step. Two utilities, Transfer and HCOPY, back up files on the hard drives.

Transfer copies all the files from one drive to another. Since the destination disk (a floppy) is obviously too small to hold them all, it lets you specify a class of files using wildcard file specs.

For instance, "TRANSFER/BAS:4 :1" transfers all the files ending with BAS (assuming they would all fit on the destination disk). If you can break down the set of files on the hard drive into subsets small enough to fit on floppy drives, you can back them all up.

Since the hard drive handles large files that wouldn't fit on a single floppy disk, the HCOPY utility breaks a file into pieces and saves each portion on a separate disk. It also reads those pieces back onto the hard drive and reassembles them into the original file.

The floppy disks must be formatted and ready before HCOPY is run. When using HCOPY to read the file back in from floppy disks, enter the disk containing the last portion of the file last. Otherwise, you can present the disks to HCOPY in any order.

The HZAP utility duplicates the functions of DISKZAP, a useful DOSPLUS disk-view-and-modify utility, except that it operates on the hard drive. Because of the many different hard drive systems available, you must use hard drive parameters that HZAP uses. It does not go by the settings in CON-

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FIG. Tell it the number of platters, number of cylinders, sectors per track, track access time, and write pre-comp track each time you use it.

That latter parameter is not adequately explained in either manual, so I use the default setting. It would be nice to change the defaults so you would not have to specify the settings each time, but no provision is made for that.

A more serious problem with HZAP is that it does not go higher than cylinder 255, so you can't use it on the top 64 cylinders of the Prometheus drive. Other drive brands that don't have more than 255 cylinders present no problem.

DOSPLUS 4.0 provides a new directory command, ACAT, for alphabetical file catalog. DOSPLUS 3.4 and 4.0 are otherwise identical except for the hard disk support. ACAT has an alphabetically sorted catalog that makes it easier to find a specific file among the hundreds that could be in the directory.

ACAT also accepts wildcard specifications, displaying only the files that meet specified criteria. "ACAT A?/DAT" alphabetically displays all the files on the default drive that have file names beginning with A and ending with the extension DAT.

• The sort is extremely quick, with practically no delay while sorting. This is an extremely useful function, although you cannot reliably call it from Basic because of the room required to do the sort.

When the hard drive is turned on, the LED on the front panel flashes until the drive is up to speed and ready. Wait until the hard drive is ready before attempting to boot from it. This usually takes less than 15 seconds.

The hard drive case has a small cooling fan which, along with the constantly rotating disk, produces a low whir. You can easily adjust to the noise and to the barely audible click as the head steps from track to track. The hard drive's overall sound is preferable to the intermittent whirring and clicking of a floppy drive.

Round-up

The Prometheus 5 hard drive and DOSPLUS 4.0 make an excellent team, with only a few minor drawbacks. DOSPLUS is slightly harder to install than other hard-disk operating systems, precisely because it is more flexible.

The Prometheus hard drive might be better off with two platters and fewer cylinders, but it is a terrific value considering that it includes an excellent operating system at no extra cost, and it is priced much lower than most hard disk systems.

Several competing hard-disk systems cost as much as $1,000 more and have no significant additional features. The Prometheus 10, with twice the capacity, costs only $200 more—an even better value!

The only serious deficiency of DOSPLUS 4.0 is the need for a true back-up utility to copy all the files on the hard drive onto as many floppy disks as necessary.

Micro-Systems has recently announced their latest operating system, DOSPLUS 3.5, which should be available by the time you read this. They will no longer have a separate version for hard drives, but will provide add-on drivers to DOSPLUS 3.5 for hard-drive support.

One important change is Micro-Systems' merging HZAP into DISKZAP, so the same program operates on both floppies and hard disks. ■

★★★★½

Color Caterpillar
Soft Sector Marketing Inc.
P.O. Box 340
Garden City, MI 48135
Color Computer
$21.95 cassette

by Carlos Calle

Color Caterpillar is an entertaining and fairly complicated game written in machine language for a Color Computer with at least 16K.

The program begins with a short introductory display of the title characters, accompanied by sound effects that add to the overall pleasant presentation of the game. Armed with a gun controlled by the right joystick, you become the sole defendant of a valley under attack from menacing insects with uncanny reproductive abilities.

You must shoot and destroy an advancing caterpillar through the surrounding mushrooms. If you succeed,

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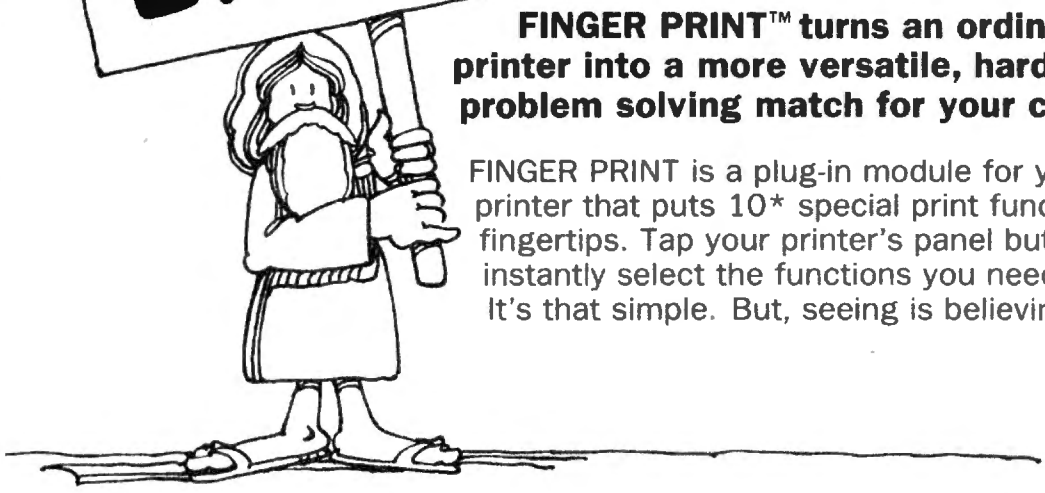

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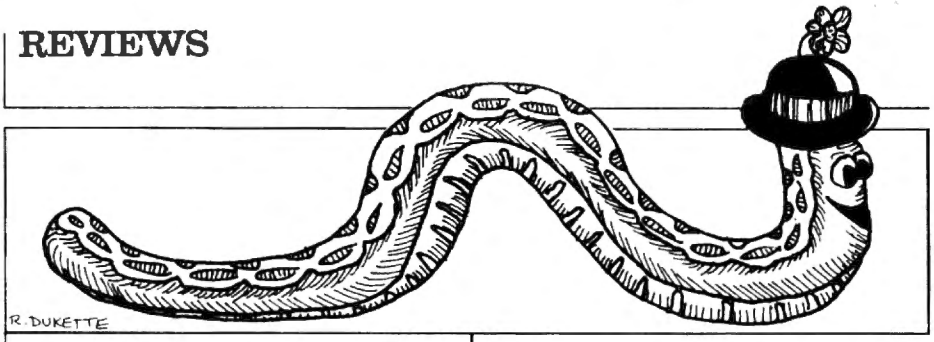

the insect's remaining parts continue living and advance towards you.

If you kill the monster before it gets to you, another one advances rapidly. The second caterpillar has a nasty assistant, a deadly beetle, that attacks you from unexpected directions. While you're busy staying alive, a tarantula joins your enemies in an attempt to devour you.

Two players can use different joysticks to take turns for each round of a game. You score points by completely destroying a mushroom or by hitting a caterpillar segment, a beetle, or the tarantula. After you reach a score of 10,000, you receive a bonus of one extra round.

Magic mushrooms allow the caterpillar to quickly dive towards you. Killer mushrooms break the caterpillar into segments that head down the screen. Regular mushrooms cause the caterpillar to turn away in the opposite direction.

This is one of the most entertaining Color Computer games available. It combines exciting play, attractive graphics, and realistic sound effects in a professional product. ■

★★★★★

POWER! (Version 3.03, erroneously advertised as 3.3)
COMPUTING!
2519 Greenwich St.
San Francisco, CA 94123
$149

by Charles R. Perelman

POWER! is pure joy. It tames your CP/M until it's downright friendly, speeds up CP/M operations, reduces file name entry errors, and gives you a bushel of worthwhile utilities at a reasonable price.

You'll put this 16K of software on all your system disks and wonder how you got along without it. Its flexibility and 50 separate routines are a bargain. POWER!'s new version 3.03 improves an already fine package with greater finesse, more features, and enhanced documentation.

Using POWER! as a wraparound for CP/M gives added protection from nasty BDOS errors, even permitting removal of the system disk after booting. If you change disks and forget to hit control-C before writing to a disk, POWER! politely informs you to mend your ways without crashing the system.

Commands

POWER! supports most CP/M commands. Copy is a notable substitution for the inscrutable Pip. You can use normal CP/M format, but POWER! syntax is usually shorter and faster.

You'll feel comfortable with POWER! in no time at all, but to get maximum performance you must carefully review the manual and work with it, which is a pleasure compared to bare-bones CP/M. Wildcards are similar to CP/M usage but easier, friendlier, quicker, and more talented. Escape or control-C returns to POWER!, not CP/M.

POWER! does most of the things you've always yearned for with CP/M. Individual utilities available from CP-MUG can't compare to the convenience of this error-trapped, documented, and coordinated composite system.

For openers, DIR alphabetizes your files, shows all system and read-only files appropriately marked, and pauses to let you review a portion of the screen when the directory exceeds your terminal display area.

Convenient wildcard functions display directories by type or with the same initial letters. You can list all user areas or show directories for drives you've previously accessed, or for all user areas on all drives in your system.

Sort lets you change the display so that DIR and other commands involving file lists show system files last, sorted by file extension and alphabetically; by file type, with system files last;

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or unsorted. Such flexibility forces you to consider which alternative best serves your purposes.

POWER! shines in day-to-day repetitive operations. To Copy, Erase, Type, SETSYS (make a system file), or SETRO (make file read only), start with a menu of files sorted alphabetically with assigned sequential numbers. Choose the numbers or ranges you want, press the enter key, and you get multiple processing of all selected files. This adds tremendous speed to your operations.

You can choose whether to review each file in turn or continue automatically. You can even abort the operation in the middle of a file since the program keeps you informed of the file on which it's working.

When you copy a file and a second file with the same name exists, you must decide whether to overwrite, skip, or make the destination disk file a BAK file.

Other commands in which you select a file for operation use the numbered directory approach as well. You work more rapidly and make fewer mistakes when you type a number and not the entire file name.

Like its CP/M counterpart, Type reviews files on the screen, but it stops to let you read each screen of text rather than testing your reflexes in hitting the hold key as the data flies by. Set Type for continuous scroll and you can increase or decrease scrolling speed by pressing a number.

But wait, there's more. Press the space bar to scroll a line at a time, or to pause and use control-P for printing a specific section of a file. Besides standard Type, TypeA lists text files without formatting commands in 16-character lines, TypeH displays COM files in hexadecimal (hex), and TypeX is DDT (dynamic debugging tool) style with printable ASCII characters at the right side.

If you're not sure which of several files has the data you need, select a group of likely candidates. Start reviewing the first file with Type. As soon as you know you haven't found the right file, break out with control-K to immediately call up the next file in the queue.

Erase a file by mistake? Reclaim displays names of erased files and offers you the chance to revive them if you haven't written over the sectors. Recovered files are set to read-only status; you must reset to read/write to alter the contents.

Help is only a question mark away when entered from the command prompt. It saves flipping through the manual for proper entry if you forget a command name or mnemonic and get syntax errors. Help doesn't give you any clues to function operation, however.

Run by itself produces a numbered menu of all executable COM files on a disk. You then choose any program. Follow Run with the program name or other parameters, and it works fine with WordStar or a spelling program. Ignore the $$$.SUB file in the WordStar directory; POWER! created it to return to the program shell after you finish editing.

When going back to POWER!, don't hit any keys until the sign-on prompt appears or you'll abort the submit file and wind up in CP/M. The alternative form can also directly call CBasic or MBasic and a user program, even if they are on another disk.

POWER! segregates bad blocks with Test, generates checksums with Check to see if two files are exactly the same, and provides file size information in sectors and kilobytes with Size. Log controls a host of display and other options and tells you where POWER! is located in memory.

User and Xuser commands access user areas other than zero. Added capabilities include 32 user areas instead of 16, file copy and move capabilities from one user area to another, and restricted access to programs in user areas 16–31 with the Password command.

Another practical tidbit is a unique customizing command: Pwretool. With a few keystrokes, you can change the name of any command. More important, you can delete or password-protect any command from your customized version of POWER!. This helps prevent hitting the wrong keys and inadvertently making file changes or getting into a file-altering mode.

Pwretool and Pass are separate from Power.COM. They run as COM files rather than within POWER!, and take up an additional 2K each. Excluding these programs from a protected disk prevents a snoopy user from altering protection levels.

The Assembly language monitor routines are a hacker's delight. Rather than struggle with DDT, use CM to compare two Assembly language programs and list the bytes that differ. DS displays one memory address at a time in both hex and decimal, and lets you change any byte within approximately 120 locations before or after your entry point.

Search, which has wildcard functions, lists addresses of ASCII, hex, or combination groups of characters that match your key. POWER! lets you read from or write to any memory location, fill blocks of memory, move programs around in memory, duplicate blocks, and more.

Do you want to add a few favorite routines of your own? User functions (UR1 to UR4) allow you to jump within POWER! to your own utilities.

Documentation

The new spiral binding on the 8½-by-11-inch manual makes it easy to read from a typing stand. Generous margins and spacing make it easy to scan or study. Besides a table of contents and an index titled "Function Index," the manual has an additional alphabetized summary of all commands.

Following a helpful introduction covering manual organization, backing up, and similar start-up information, the manual has a general outline of program function, format, syntax, and scroll controls.

Except for Password and Pwretool, each POWER! command is listed in alphabetical order. Explanations include sample screens, descriptions of function use and syntax, and step by step instructions. Some of the Assembly language commentary is a little terse and needs some expanding, but generally the information is sufficiently detailed.

A couple of pages contain suggestions for correcting problems that cause common error messages. You'll appreciate hints on applying POWER! to save crashed programs, glitched directories, and files with bad blocks. You'll also have customization details for altering keyboard, video, and program operation, commands, and responses.

The manual contains a wealth of information in plain English, particularly for the more advanced programmer. This is truly exceptional documentation for such a program.

I'm enthusiastic about POWER! and recommend it to any CP/M user without reservation. COMPUTING! guarantees to refund your money if you're unhappy with the software. I think their money is safe. ■

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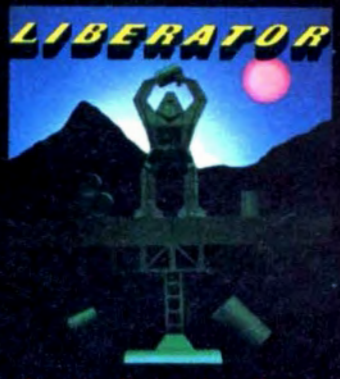

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Microcomputers in Large Organizations
by Thomas Madron
Prentice-Hall Inc.
Englewood Cliffs, NJ 07362
Softcover, 181 pp.
$12.95

by Timothy Daniel

A friend of mine who handles the care and feeding of a large company's mainframe computer used to note gleefully that the managers in his organization had to sneak microcomputers in the back door. Otherwise, they might incur the wrath of higher-ups for bringing toys to work.

Times have changed; big business and government are taking the micro seriously. *Microcomputers in Large Organizations*, by Thomas Madron, builds on this new legitimacy.

This book should have a special place in the hearts of TRS-80 owners. The author makes a strong case for using Model IIIs as executive work stations. He even includes a lengthy Basic program that acts as a master menu and appointments calendar. Great stuff for the home hacker, but not necessarily the direction of tomorrow's automated office!

Microcomputers in Large Organizations seems to be based on thorough but somewhat dated research in hobby and trade literature. In his introduction, the author highlights the problems encountered when micros supplement or replace traditional work methods. Topics include planning for change, networking, and micro-mainframe communication.

Once you get beyond the "Gee, aren't micros great" section, the book's lack of substance might disappoint you. Madron presents only two real-life cases. Each takes about two pages and neither is truly representative of micro integration into a large organization.

The strongest selling point of this book is its unintentional but effective humor. I didn't know whether I should laugh or cry over the following statement about the IBM PC: "Although IBM announced some software for the system, substantial amounts of off-the-shelf software is not expected until the mid 1980's...." You can get information of equal integrity from a fortune cookie or Ouija board.

The publisher's back-cover claim that *Microcomputers in Large Organizations* is "the book that explains everything you need to know to use microcomputers in your business..." is one more rib tickler. But the joke's on you if you spend $12.95 to find out the punch line. ■

★★★

Sneak Thief
Soft Sector Marketing Inc.
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Garden City, MI 48135
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$19.95 16K cassette
$21.95 32K disk

by Thomas L. Quindry

If you're the thrifty type who relishes rescuing your riches from inflation or evil-doers, Sneak Thief is the game for you. In Sneak Thief, each player is a guard whose duty is to protect his gold from the thief.

You can choose a one- or two-player format. The disk version has a talking voice and saves high scores. Both disk and cassette versions have sound effects and the option of keyboard or joystick control.

You start the game with three guards, and gain an additional guard with every 10,000 points. The game ends when you lose all your gold (around 18 pieces) or all your guards.

The gold is in a box in the center of a room. The thief enters from one of three doors. The guard shoots the thief or captures him by running into him. You earn more points by capturing the thief, who then goes to the brig.

If the thief succeeds in stealing a piece of gold, he turns into a fugitive and tries to escape through one of the doors. The fugitive seems to move aimlessly around the room until he goes through a door by chance.

"In Sneak Thief, each player is a guard whose duty is to protect his gold from the thief."

If the guard shoots the fugitive, your gold returns and you score points. You cannot capture the fugitive, and running into him brings fatal results.

Sometimes a protector appears who tries to keep you from shooting or capturing the thieves and fugitives. You score points by shooting the protector, but he destroys you if he runs into you.

Another function of the protector is to attempt a jailbreak. If he gets to the brig, the protector removes one prisoner at a time and each one becomes a thief. For his own protection, it's imperative that the guard shoot the protector as soon as possible.

When the total number of intruders (thieves, fugitives, and protectors) captured or shot equals 20, you've completed a so-called wave. You receive bonus points for all captured thieves, who then disappear from the brig. For each successive wave, the number of bonus points increases for each captured thief.

After ten waves, the bonus points have doubled and you will receive no more increases in the bonus value. You can still score bonus points, however.

If you complete a wave without shooting any intruders (by capturing 20 thieves), you get back all your stolen gold. That's quite a feat, since protectors are releasing prisoners as you capture them. I doubt that a released prisoner is deducted from your 20 count.

As in most arcade games, Sneak Thief's complications increase as you score more points. More intruders enter at once, and protectors try to release prisoners or attack the guard more frequently. The guard has his hands full.

One feature I like is that you must press any key to resume action after you've lost one of your guards. This avoids marathon playing and allows you to leave the game for dinner or whatever.

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The disk version is unique in that it boots on a 40- or 80-track Model I or III. It should also boot in a 35-track disk.

My main objection to the disk medium is that it's practically impossible to save as a command file on a system disk, even with the proper utility program. I used a utility program to examine the disk and learned that the disk input/output (I/O) routines are not file oriented but are track and sector oriented.

The program saves the scores on a single-density track 16, sector zero that would conflict with TRSDOS 1.3 and other Model III DOSes, because it requires single-density tracks and conflicts with some of the DOS as it is stored. The data for the talking voice is also stored in single-density format. All this makes the program unavailable as a command file.

In spite of this inconvenience in the disk version, Sneak Thief is an entertaining game sure to be popular with arcade fans. ■

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Early Games
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by Don Stauffer

Early Games is a delightful disk of nine educational games for preschool children.

Although the program is essentially self-documenting, a brief but well-written manual accompanies the disk or cassette to explain loading procedures and present a one-paragraph summary of each game. The instructions do not mention the games' sound feature, but it is important.

The menu is educational and appealing in itself. It flashes a typical scene from each game on the screen for a few seconds, in a repeating pattern. The child depresses any key while the frame indicating the game he wants to play is on screen and the game loads. Your child does not need to read to operate the menu.

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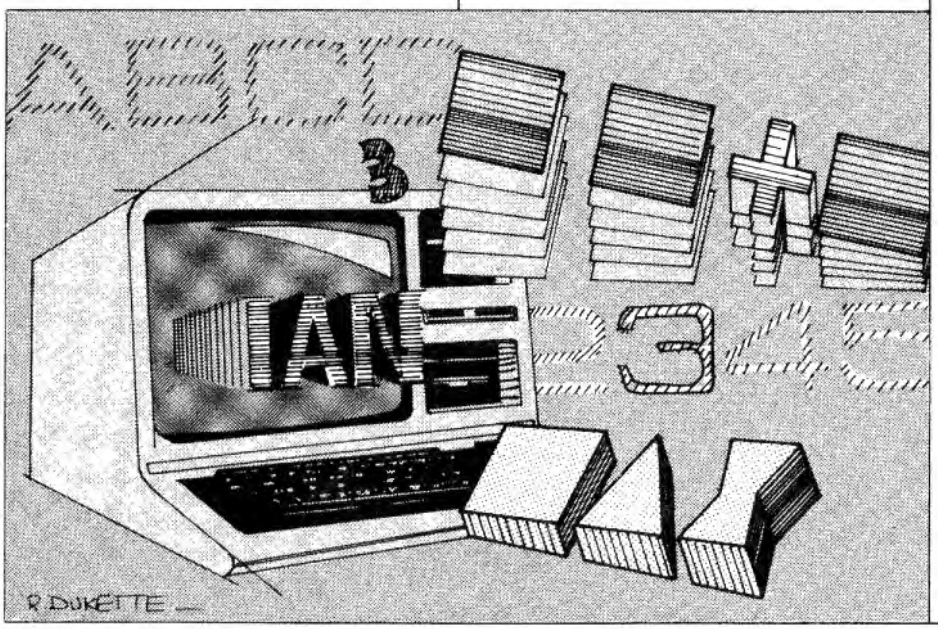
At any time, the child can return to the menu by pressing enter. He can operate the system by himself once the program is running.

Each game might not hold a child's attention for long. However, the variety of games and the menu's friendliness allow him to operate the program for a long time without help.

The first program is a matching numbers game. A single, large numeral appears on the screen, and the child must press the corresponding key. If he presses the correct key, a happy tune plays and a new letter appears.



Pressing the wrong key results in a sad pair of notes; the character remains for another try. Since the screen display doesn't change until after the happy tune, the positive audio feedback is important to the child. Sound should accompany this game whenever possible.

Next is a counting game. Anywhere from one to five blocks appear on the screen, and the child must press the correct number key. Again, the sound provides immediate feedback for a correct choice. The use of numbers between one and five is important for the preschool audience.

An addition game follows. Two groups of blocks appear with a plus sign between them. The child must choose the key corresponding to the sum of the numbers in the blocks. Again, the total does not exceed five.

A subtraction game has the same for-

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mat. A minus sign separates the two groups, and the child must respond with the difference. This game is much harder, since subtraction is a more difficult concept than addition. However, I was impressed with how quickly a child who had never been exposed to subtraction could grasp the concept using this game.

Two alphabet games are similar to the number games. The first is a recognition game, except it displays large alphabetical characters. The second teaches the order of the alphabet. The child presses the key for the letter that follows the one displayed on the screen.

Names is a simple spelling game using the child's name, which the parent enters. The cursor advances after the child types in each correct letter. As in the previous games, sound provides immediate feedback.

The shape comparison game is the highlight of the program. Four shapes appear on the screen, three identical and one different. The shapes are simple ones: blocks with markings, triangles, and hourglasses. This discrimination between like and unlike forms is crucial to the intellectual skills a young child must master for reading and math readiness.

The last game, a drawing program, is a favorite of children who tried this collection. The child moves the dot with keys, but not the normal arrow key arrangement. Keys on the keyboard's left move the cursor left, keys on the top center move it up, keys on the upper left move it diagonally left and up, and so on.

Even with experience, you might not be sure which key does what. I'm not convinced that this is better than using the arrow keys, and it's the main criticism I have of the program. However, children do not seem to mind the inconvenience of the dot occasionally going where they don't want it to.

Another slight problem is that the cursor always draws a line behind it or erases a previously drawn line. This makes the game easier to handle without a separate menu, but it also creates some frustration.

Aside from math and reading skills, this program teaches computer literacy by increasing the child's familiarity with key positions and with the computer itself.

Other than the criticisms I mentioned in the drawing game, I found few flaws in the program. I'd suggest that a change in the screen display following a correct choice would provide more immediate feedback for models without sound.

This is the most effective educational program I've seen for preschoolers. Three-year-olds could handle many of the games with some adult help, while four- and five-year-olds can spend hours alone with the games.

The ease of operation is truly impressive. Model I and III disk versions are even auto run, so the child can bring up the system by himself if you trust operation of the disk drive to him. If you bought your system with the idea of using educational software to help your children, this is one program you don't want to miss. ■

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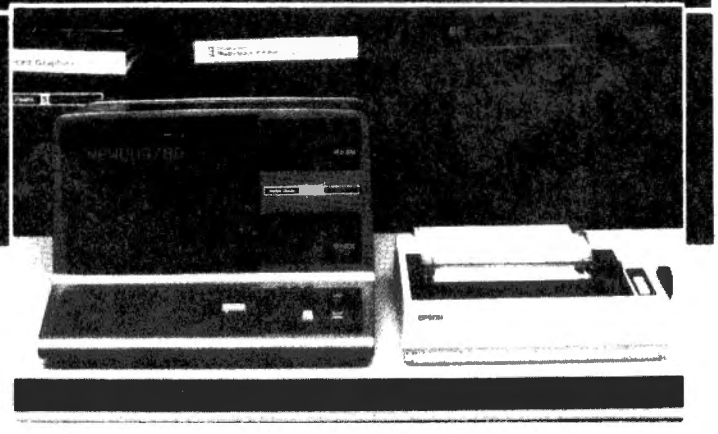

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★★★

Standard Pascal
User Reference Manual
Doug Cooper
W.W. Norton & Company
500 Fifth Ave.
New York, NY 10110
Softcover, 176 pp.
$12.95

by John B. Harrell, III

Since its inception by Kathleen Jensen and Niklaus Wirth, Pascal has been one of the most controversial of languages. Doug Cooper has written a concise and clear manual to explain all aspects of Pascal as the International Standards Organization (ISO) has defined them.

This is truly a reference document. *Standard Pascal User Reference Manual* attempts to clarify the stilted, terse language definitions in the ISO standard.

Mr. Cooper's *Standard Pascal* is easy to read. He develops the notation of Backus-Naur Formalism (BNF) to describe the productions that precisely specify the language's syntax.

He also develops and uses syntax charts (railroad charts) to amplify his explanation of the constructions. This provides clear, visual representation of the BNF forms, which might be confusing even to the experienced reader. Syntax charts are somewhat simplified and the language's complete definition still comes from the BNF productions.

Standard Pascal User Reference Manual has 12 chapters that fully describe the ISO standard definition's implementation of the language. In addition, several appendices address a quick introduction to Pascal, a cross-reference of the BNF forms to the textual material, and syntax charts for the BNF descriptions.

After explaining the notation and defining the basic element of programs as tokens, Mr. Cooper thoroughly discusses the groups of tokens allowed in Pascal. He discusses each group of tokens using the BNF form to describe allowed syntax and gives examples of proper and improper constructions.

Next, he presents each statement that the ISO standard recognizes. Mr. Cooper discusses each Pascal control statement. Here lies the strength of Pascal: The richness of the control statements allows complete structuring and proper control of programs without the confusing GOTO statement so prevalent in Basic and similar programming languages.

Mr. Cooper describes each valid construction allowed for Pascal statements by giving the BNF production that governs it and a syntax chart to explain the BNF form. Myriad examples illustrate the constructions.

The following chapter launches into a discussion of the ordinary data representations in Pascal and the required functions. The initial discussion centers around the simple types the Standard requires.

The BNF description and several examples of right and wrong constructions explicate each simple type. Data type operators (such as addition and multiplication) are first described with their respective ordinary types.

"Pascal is a strongly typed language; you must define items prior to use."

Next, Mr. Cooper presents the required functions of the language. These have four types: arithmetic functions, transfer functions, ordinal functions, and Boolean functions.

Arithmetic functions provide certain mathematic functions expected in each language. Transfer functions don't have common mathematical analogies. These transfer type real data to and from integer data types. The ordinal functions allow manipulation of the ordering relationships.

After the discussion of the language's simple types, operators, and functions, you are ready for the syntax descriptions of simple expressions. Mr. Cooper presents the operations needed in these expressions with a complete discussion of their function on the operands and the precedence of evaluation. Charts provide a complete understanding of each operator's symbol, the operation performed, the operands' data type, and the result's data type.

A program is worthless if the programmer cannot communicate with it via some form of input and output. This is often the most difficult part of the program's definition: specifying input and output format so the data makes sense to the user. The simplest form of communication with a program written in Pascal is text.

To allow a reader to understand the program segments more clearly, Mr. Cooper provides an early introductory section on text file input and output. This gives you a basic understanding of input and output in Pascal programs, but by no means presents the intricacies of file manipulation (one of Pascal's strong features).

Pascal is a strongly typed language; you must define items prior to use. This definition creates a data item and a data type that remains associated with the item throughout the activation of the block containing each item. You can think of activation as the execution of a particular block of code.

For example, the procedure block "carddeal" defines several variables for use during its execution, but these variables do not exist outside this procedure and have no space in the computer's memory until it executes this procedure.

The last part of the book discusses the complex data typing that sets Pascal off from other languages and makes it strong. As described before, several ways to represent data exist in Pascal programs. You can combine these data types into very complex and powerful data structures by using Pascal's language features.

In addition to the simple data types, the book describes several other types. The enumerated ordinal type allows the programmer to name values to use as constants. For example,

```
TYPE cardtype = (spade, heart, diamond, club);
```

might be the definition of type for the variable "card." Then you can assign card any of the four alternatives specified, and test for any of these selections.

To accomplish this in Basic, you would have to use integer values to represent the cards and then make the assignments. Constants of this type (spade, heart, and so on) do not have any external representation. They are self-sufficient as written and you cannot transmit them to text files for input and output.

Subrange types allow the definition of a variable or type over a preselected

Continues on p. 68

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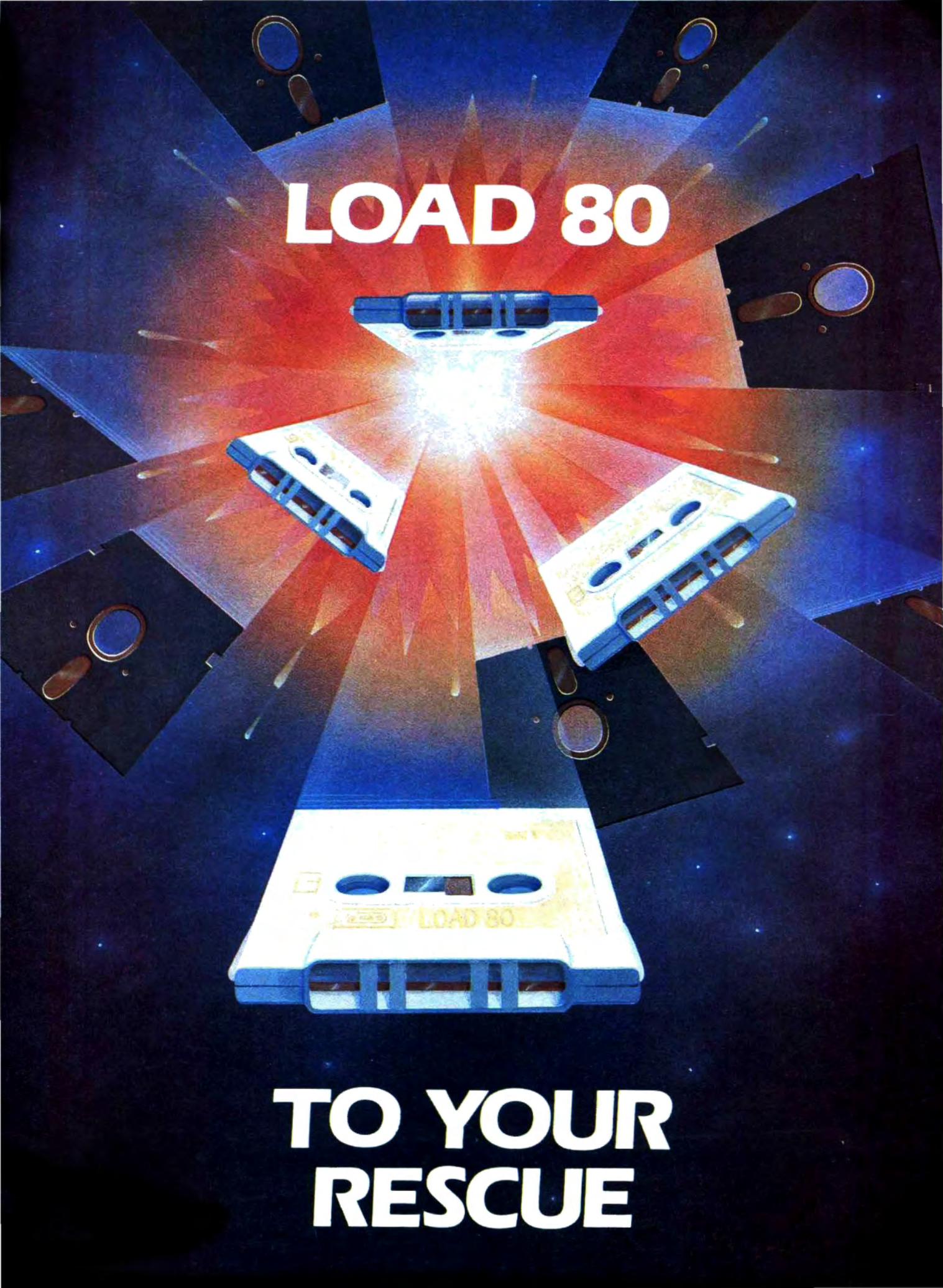
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Continued from p. 64

subrange of the spectrum of allowed values. Both types aid Pascal programs in self-documentation. They cause the information that must otherwise appear in comments to become an integral part of the programs.

The next chapter describes structuring these data types into complex types you can use to store more than one value in a single variable. These are the building blocks used in Pascal to form complex data structures. Mr. Cooper thoroughly describes the major constructions: record and array.

The remainder of this chapter discusses file type. All previously discussed data types are limited to the working size of the computer's store, while type file is limited only to the external storage device's capacity.

The last chapter describes the use of pointer variables. You allocate memory space for all the variables in a procedure block each time you activate it, and deallocate memory space on termination of the procedure. Once defined, however, the variable structure (activation record) is fixed during the procedure's execution.

Pointers allow truly dynamic data structures that you can create and alter during execution of the program or any procedure contained in it. These structures can remain active even though the procedure that created them has terminated.

Mr. Cooper has provided a valuable tool to programmers using Pascal and those attempting to establish a working Pascal system on computers. He presents a difficult topic—the standard definition of the language—in clear, concise terms.

His many examples are extremely helpful in understanding the concepts of BNF productions as a tool to language description. You don't need an education in computer science to read Mr. Cooper's reference text.

The material in *Standard Pascal User Reference Manual* is beneficial to anyone who wishes to increase his working knowledge of Pascal. Due to the complexity of the language description, I do not recommend this as a text for the beginner.

It's a text for the Pascal programmer to enhance his fluency in the language and I heartily recommend this book to him.■

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by Bruce Powel Douglass

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SALC also supports unstructured Assembly language so you needn't rewrite all the routines and programs you've already written. SALC allows you to create multiple relocatable Assembly-language modules larger than your computer's memory.

The linker links these separately compiled pieces together into a complete program. The programmer can build subroutine libraries with external declarations to use from other Assembly-language routines.

The assembler is not field sensitive; it recognizes a label or an instruction no matter where it occurs. Thus, you can indent your programs to more clearly show control construct nesting (as is common in Pascal and other structured high-level languages).

SALC allows long labels, and the first 16 characters are significant. Labels can include upper- and lowercase letters, and three special characters: the underline, the at sign, and the colon.

```
IF CharacterInput,EQ,'X' THEN
    ...
    ...
END
WHILE B,NZERO DO
    ...
    ...
END
REPEAT
    ...
    ...
UNTIL H,OR,L,ZERO
IF C, AND, 080H, ZERO THEN
    ...
    ...
END
```

Program Listing 1

```
    CP    A,'X'
    JP    NZ
          ...
          ...
    LD    A,B
    CP    0
    JP    NZ
LOOP EQU $
          ...
          ...
    LD    A,H
    OR    L
    JR    Z,LOOP
    LD    A,C
    OR    80H
    JR    NZ
          ...
          ...
END
```

Program Listing 2

Constructs and Options

The use of structured constructs makes Assembly-language programming much easier to read and write. Consider Program Listing 1. Normally, this takes the form of Program Listing 2.

Which is easier to read? Which do you think is easier to write? The closer the language is to how people think, the higher its level. Defined this way, SALC is a middle-level language. You're still speaking the computer's language, but its IQ is a little higher.

Consider a routine that performs different tasks on the basis of a returned result. In Z80 mnemonics, this involves a series of tests (CP) followed by jumps (JP). SALC simply performs the routine with the Case construct (see Program Listing 3).

The assembled program contains the CP and JP instructions necessary to implement the Case statement, since Case

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is not a Z80 command. However, it takes care of some of the details that make Assembly-language programming a chore.

SALC minimally supports Procedure and Function constructs, used as subroutines in high-level languages. No parameters are explicitly passed in either of these constructs. This means no local variables and no recursion. Well, you do have recursion in your subprogram, but you must manipulate the stack yourself.

It would be nice to specify the registers to save on stack directly in the procedure or function statements. The program could then assemble the procedure calls as a set of Pushes followed by a Call.

The Procedure and Function constructs improve reading the source code. They are essentially ignored except they provide a label for the subprogram. If your procedure is the one in Program Listing 4, you would execute it with a Call statement, such as:

```
CALL DivideHLby8
```

The Procedure and Function constructs are assembled identically. Nor-

```
CALL GetInputChar
CASE
    A,EQ,'1' THEN
        . . . ;THIS CODE EXECUTED ONLY IF
        . . . ;THE A REGISTER HOLDS A '1'
    END
    A,EQ,'2' THEN
        . . . ;THIS CODE EXECUTED ONLY IF
        . . . ;THE A REGISTER HOLDS A '2'
    END
    A,EQ,'3' THEN
        . . . ;THIS CODE EXECUTED ONLY IF
        . . . ;THE A REGISTER HOLDS A '3'
    END
END          ;END CASE STATEMENT
```

Program Listing 3

```
PROCEDURE DivideHLby8
        LD    B,3
        XOR   A        ;clear carry and zero A
        WHILE B,NZERO DO
          SRL   H      ;shift right logic into carry
          RR    L      ;rotate carry into L
          RR    A      ;rotate carry into A
          DEC   B      ;three times
        END ; end WHILE
        ; NOW HL IS DIVIDED BY 8
        ; AND A HAS THE REMAINDER
END     ; end DivideHLby8
```

Program Listing 4

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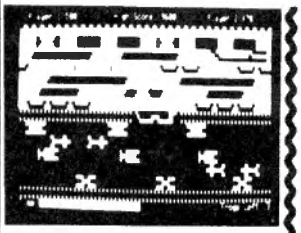

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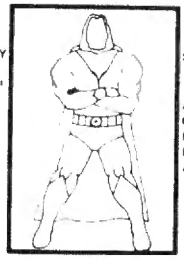

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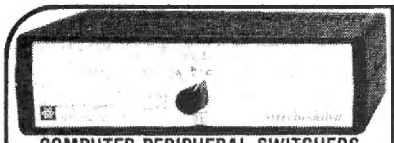

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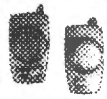
210830	**Intel Memory Components Handbook (1983)** (798 pages) Contains all Application Notes, Article Reprints, Data Sheets, and other design information on Intel's RAMs, EPROMs, E²PROMs & Bubble Memories.	$14.95
210844	**Intel Microprocessor & Peripheral Handbook (1983)** (1027 pages) Contains Data Sheets on all of Intel's Microprocessors and Peripherals.	$14.95

ATARI

ATARI PADDLES



JSP (2) . . . . . $4.95 pair

ATARI DRIVER

JSD(1) . . . . . $2.95 ea.

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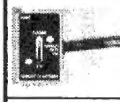

Used on Atari. Cosmetically blemished. 100% functional.

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JE300 . . . . . $39.95

Universal Computer Keyboard Enclosures

"DTE" Blank Desk-Top Enclosures are designed for easy modification. High strength epoxy molded end pieces in mocha brown finish. Sliding rear/bottom panel for service/component access. Top/bott. panels .060" thick alum. sliding type (200 finish (gold tint color) for best paint adhesion after modification. Vented top & bottom panels for cooling efficiency. Rigid construction provides unlimited applications. Assembly instructions included.

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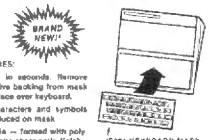
Printer paper - 3 rolls (4.3 in. x 82 ft.) . . . TPP-3 **$5.95**

Keyboard Mask for Your ZX81/1000* Computer



FEATURES:
- Install in seconds. Remove adhesive backing from mask and place over keyboard.
- All characters and symbols reproduced on mask.
- Durable — formed with poly carbonate sheet satin finish.

JE681 KEYBOARD MASK

The JE681 Keyboard Mask provides users of the ZX81/1000 series computer the individual feel of each keypad on the keyboard. The mask has a raised outline around each keypad allowing the user to feel and correctly position their fingers onto the keyboard.

JE681 KEYBOARD MASK . . . . $8.95 each

Jameco ELECTRONICS ZX81/1000* Keyboard Conversion Kit

JE682-AK KEYBOARD KIT MOUNTED IN DTE-AK ENCLOSURE. LIGHT TAN PANELS WITH MOLDED DARK BROWN END PIECES. SIZE: 14¾"W x 3½"D x 3¼"H

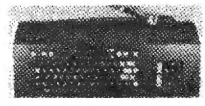
The JE682 Kit provides users of the ZX81/1000 series computers a full-size industrial keyboard hook-up to their computer. The JE682 Kit allows the use of either the full-size keyboard or the Sinclair/Timex Keyboard. The Kit also permits the simple disconnection of the Sinclair/Timex Keyboard for portable use. The JE682 Kit consists of a full-size industrial grade keyboard with 62 keys, 2 p.c. boards, 24" ribbon cable, DIP socket and 4 rubber feet. The keyboard conversion kit can easily be mounted into the DTE-AK enclosure. This enclosure is large enough to contain the ZX81/1000 computer and the full-size keyboard together. A handy label representing the ZX81/1000 keyboard layout is placed on the enclosure.

JE682-AK Keyboard Conversion Kit . . . . . $99.95 ea.
(WITH DTE-AK CASE - AS PICTURED)

JE682 Keyboard Conversion Kit . . . . . $59.95 ea.
(WITHOUT DTE-AK CASE)

*ZX81/1000 is a trademark of Sinclair/Timex

80-Key Keyboard



CA150C $69.95

95-Key Keyboard

CA154A $79.95

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- ★ 128 Character ASCII
- ★ Non-Slip, Non-Glare Keycaps
- ★ CDC752 Terminal Keyboards
- ★ Attractive Case

Limited Quantities!

These Control Data Keyboards consist of a base, cover, the keyboard assembly, and an interface cable. Color (case): Harvest gold and black. Color (keycaps): Black, blue, and red. Electrical requirements: +5V @ 600mA, -12V @ 50mA. Size: 21½"W x 9"D x 3½"H. Weight: 6 lbs. All units brand new in original boxes, specifications included.

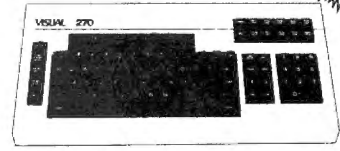
Keytronics 90-Key Soft-Programmable Keyboard

WITH SECURITY KEYLOCK SWITCH

350 Available!

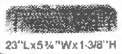
- RFI shielded
- Cursor controls
- Numeric keyboard
- 8-bit Parallel
- Capacitance keys
- 10 user-programmable keys
- Positive TTL Logic
- Size: 17"L x 8¼"W x 2¼"H

BRAND NEW!!



Made for Visual Technology, this keyboard features: a security keylock (includes two keys) to guard against unauthorized use; an 11-key numeric keypad; cursor controls, and 10 user-programmable keys. Electrical requirements: +5VDC. Color (case): White. Color (keycaps): Black. Complete with case, keyboard assembly, 40-inch interface cable, and schematics. Weight: 7 lbs.

Part No. KB270 . . . . . $79.95 each



23"Lx5¾"Wx1-3/8"H

MICRO SWITCH 85-KEY KEYBOARD
Word Processing Keyboard. 26 Pin Edge Card Connection. Supply Voltage +5VDC. Main Keyboard is DWERTY. Additional Key Pads for Cursor and word processing functions.
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3"L x 3"W x 1½"H

HI-TEK 14-KEY NUMERIC KEYPAD
SPST switching. Charcoal grey keycaps. Mounted on printed circuit board.
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POWER SUPPLY +5VDC @ 1 AMP REGULATED *Transaction Tech*
Output +5VDC @ 1A (also +30VDC) reg. Input 115VAC 60Hz. 2-tone (black/beige) self-enclosed case. 6 ft., 3 cond. black power cord. 6⅛"W x 7"D x 2¾"H. Wt. 3 lbs. Data sheet incl.
Part No. PS51194S . . . . . $14.95 each

POWER SUPPLY +5VDC @ 3 AMP REGULATED *Deltron*
Input: 115VAC, 47-440Hz. Output: 5VDC Adjustable @ 3 amp. 6VDC @ 2.5 amp. Adjustable current limit, Ripple & Noise: 1MV rms, 5MV p-p — 2 mounting surfaces. UL recognized. Size: 4"W x 4½"L x 2-7/16"H - wt 2 lbs. Data sheet included.
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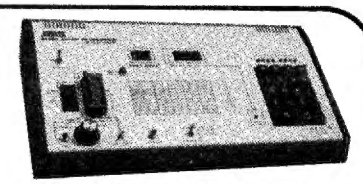

2708,2716,2732 & 2764 EPROM Programmer

JE664 EPROM PROGRAMMER

8K TO 64K EPROMS — 24 AND 28 PIN PACKAGES

— PROGRAMS 2716's IN 16 SECONDS —
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• Programs, validates, and checks for properly erased EPROMs • Emulates PROMs or EPROMs • RS232C Computer interface for editing/program loading • Loads data into RAM by keyboard • Changes data in RAM by keyboard • Loads RAM from an EPROM • Compares EPROMs for content differences • Copies EPROMs • Power Input: 115VAC, 60Hz, -or 10W power consumption • Enclosure: Color-coordinated, light tan panels w/molded mocha brown end pieces • Size: 15-5/8"L x 8¾"D x 3½"H • Wt.: 5¼ lbs.

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Assembled & Tested (Includes JM16A Module)

JE665 — RS232C INTERFACE OPTION — The JE665 RS232C Interface Option implements computer access to the JE664's RAM. Sample software written in BASIC provided for TRS-80® Model I - Level II Computer. Baud rate: 9600. Word Lgth.: 8 bits - odd parity. Stop bits: 2. Option may be adapted to other computers.

JE664-ARS EPROM Prog. w/JE665 Option $1195.00
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EPROM JUMPER MODULES — The JE664's JUMPER MODULE (Personality Module) is a plug-in Module that pre-sets JE664 for proper programming pulses to the EPROM & configures EPROM socket connections for that particular EPROM.

Part No.	EPROM	EPROM MANUFACTURER	PRICE
JM08A	2708	AMD, Moforola, National, Intel, TI	$14.95
JM16A	2716,TMS2516	Intel, Motorola, National, NEC, TI	$14.95
JM16B	TMS2716	Motorola, TI (+5,-12, + 12)	$14.95
JM32A	TMS2532	Motorola, TI	$14.95
JM32B	2732	AMD, Fujitsu, NEC, Hitachi, Intel	$14.95
JM32C	2732A(21V)	Fujitsu, Intel	$14.95
JM64A	MCM68764, MCM68L764	Motorola	$14.95
JM64B	2764	Intel	$14.95
JM64C	TMS2564	TI	$14.95
JM64D	HN482764G-4	Hitachi (21V)	$14.95

Jil's Black Hole EPROM Eraser

8 Chips — 6 Minutes

The Black Hole EPROM Eraser will completely and safely erase 8 EPROMs in less than 6 minutes. The Black Hole is a fully automatic cassette loading eraser featuring U-shaped 4000 hr. UV lamps mounted in a special ALZAK (UV reflectivity of .9) parabolic light tunnel. In operation, the user slips in an anti-static Bug Box (3 ea. incl.) containing the EPROMs to be erased into the loading slot on the front panel of Black Hole. The rest is fully automatic. The Black Hole latches the Bug Box into place, turns on the UV lamps and starts its fully solid state (CMOS) UV Integration dose timer. The percentage erasure time is monitored and displayed on a front panel LED readout. At the end of the erase cycle, the Black Hole ejects the Bug Box containing the 8 erased EPROMs and turns off power.

PART NO.		PRICE
ULV-008	Replacement Lamp for ERS-008	$29.95
ERS-008	Eraser, Auto Eject & LED Readout	$249.95

IBM MEMORY EXPANSION KIT

SAVE HUNDREDS OF $$$ BY UPGRADING MEMORY BOARDS YOURSELF!

Most of the popular memory boards allow you to add an additional 64K, 128K, 192K, or 256K. The IBM64K Kit will populate these boards in 64K byte increments. The kit is simple to install — just insert the nine 64K RAM chips in the provided sockets and set the two groups of switches. Directions are included.

IBM64K (Nine 200ns 64K RAMs) $59.95

EXPAND YOUR MEMORY

TRS-80 to 16K, 32K, or 48K

****Model 1 = From 4K to 16K Requires (1) One Kit**
Model 3 = From 4K to 48K Requires (3) Three Kits
Color = From 4K to 16K Requires (1) One Kit

****Model 1 equipped with Expansion Board up to 48K Two Kits Required — One Kit Required for each 16K of Expansion —**

TRS-16K3 *200ns for Color & Model III $12.95
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TRS-80 Color 32K or 64K Conversion Kit

Easy to install kit comes complete with 8 ea. 4164-2 (200ns) 64K dynamic RAMs & conversion documentation. Converts TRS-80 color computers with 8 circuit boards, & all new color computers to 32K. Minor modifications of 32K memory will allow the use of all the 64K of the dynamic RAM providing you have a FLEX DOS operating system.

TRS-64K2 . . . . . $54.95

5¼" Mini-Floppy Disk Drive

FOR TRS-80 MODEL I - COLOR COMPUTER

Features single or double density. Recording mode: FM single, MFM double density. Seek time: 25msec. track to track. Power: +12VDC (±0.6V) 1.6A max.; +5VDC (±0.25V) 0.8A max. Unit as pic. at right does not incl. case, power supply, cables). 30-pg. data book incl. Wt. 3½ lbs. Size: 5¾"W x 8"D x 3¼"H

Pertec Computer Corp.

Part No.	Limited Quantity!	Price
FD200	Single-sided, 40 tracks, 250K bytes capacity	$179.95
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8" FLOPPY DISK DRIVE

Siemens

- Shugart 801R compatible
- Single-Sided
- 77 Tracks
- 400/800K Bytes Capacity
- Industry Standard

The **FDD100-8 8" Floppy Disk Drive** (Industry Standard) features single or double density. Recording mode: FM single, MFM double density. Transfer rate: 250K bits/sec. single density; 500K bits/sec. double density. The FDD100-8 is designed to work with the single-sided soft sectored IBM Diskette I, or eq. disk cartridge. Power: 115VAC @ 50-60Hz. +24VDC @ 1.7 amps max., +5VDC @ 1.2 amps max. Unit as pictured above (does not include case, power supply, or cables). Size: 8.56"W x 14"L x 4.5"H. Weighs 12 lbs. Incl. 96-pg. manual.

Part No.	Price
FDD100-8 . .	**$169.95 ea.**

✓See List of Advertisers on Page 323

mally, a function is a subprogram that returns a simple value, but this is not a high-level language so no difference exists between them. Their function is to better document the programs. You can call the subprograms that return values (called functions) as well as those that do not (called procedures).

Besides the structured Assembly-language constructs, SALC supports a number of options, including assembler directives. Some assembler directives include a title for your assembly listing, page ejection, and the Include directive.

The Include directive lets you insert another source assembly file anywhere within a source program being assembled. When the program reads the Include statement, it loads and assembles the specified file name. You cannot nest Included files. This allows a method of linking program segments together besides using the linking loader.

SALC has a multipass assembler. You have several options available during assembly and linking. You specify these with a /X (where X is a letter denoting an option) on the command line.

Options include outputting an indented source file, specifying whether or not to be case-blind (a is the same as A), outputting the error messages to a log file or the screen, and waiting for disk change.

Another useful option is creating a Microsoft compatible relocatable object file. You can link these files with the Microsoft linking loader to compiled Basic, Fortran, or any M80-compatible compiled language.

Summary

On the negative side, SALC does not provide an editor. It takes standard ASCII file format. I use my NewScript word processor to create my SALC files.

A more serious problem is that currently SALC only runs with TRSDOS and LDOS. Programmers who prefer MULTIDOS, NEWDOS80, or DOSPLUS must sit this one out. SALC might work with some of these operating systems, but it doesn't specifically support any besides TRSDOS and LDOS.

The manual is a bit terse for my tastes. It describes all the structured constructs, and presents some brief examples to show syntax. The end of the manual contains a rather large calculator program (provided on disk as well). The manual could use some middle-level examples.

SALC comes with assemblers and linkers for both Z80 code and 8080 code. The 8080 version is primarily for CP/M folks, I suspect. But if you prefer 8080 programming to Z80, it has a separate assembler. The calculator program is in source, absolute object, and relocatable object code format, in both 8080 and Z80 mnemonics.

My opinion of SALC is quite high. There are a few drawbacks, but the only serious one is that the assembler does not support all DOSes. It works well, but you'll take a while to get used to the structured language constructs. However, considering the time and effort using them saves, the work is insignificant compared to the benefits. ■

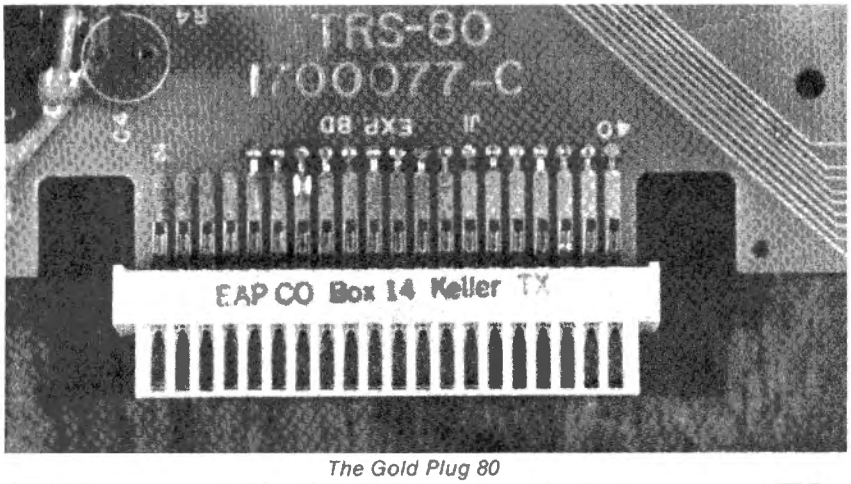
Gold Plug - 80

TRS - 80+MOD I, MOD III, COCO

Ahhhh, instant relief! At last there is a permanent cure for contact oxidation on Model I edge connectors. Many TRS-80 users are familiar with the symptoms: untimely resets, spontaneous reboots, or the inability to get the computer started at all without a frustrating session with a pink eraser.

The Gold Plug 80 is a well made device consisting of an edge-card plug with gold plated contacts, available with either 34 or 40 contacts. The rear of the plug has terminal tabs which fit exactly over the existing foil fingers on the TRS-80's connectors. After installation, the original plugs have been extended about a half inch, meaning that the plastic door covers no longer fit. This did not trouble me, but you should take it into consideration. E.A.P.'s advertising leaflet, by the way, cautions you about the doors, which is refreshing. They also have the excellent policy of permitting you to return any plugs ordered for a refund if after seeing them you are unwilling to undertake the installation.

An excellent set of instructions accompany the plugs, and they are shipped promptly. I ordered mine by mail on a Monday and received my set of plugs by first class mail on Tuesday of the next week.



The Gold Plug 80

Installation

Installation requires a soldering iron (I use a 40-watt Weller), Rosin-core solder, a Phillips screwdriver, and your last Pink Pearl. The keyboard and Expansion Interface have to be disassembled to get at the connectors, which are then cleaned—the eraser's last fling. The Gold Plug 80 is fitted over the existing plug with the contacts centered, and then soldered to the board. I have some soldering experience, but it proved to be an easy, safe job. The contact is heated, a very small amount of solder applied, and then you go on to the next contact. It took about an hour to do all six plugs.

GOLD PLUG 80 Mod I (6)	$ 54.95
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★★★★

Lazy Writer Extensions
AlphaBit Communications Inc.
13349 Michigan Ave.
Dearborn, MI 48126

by Dan Robinson

Lazy Writer has grown a bit in recent months. AlphaBit Communications, the original manufacturer of Lazy Writer, has added a number of extensions to the popular word processing program.

Various extensions display text format, align tables by decimal point and produce totals, incorporate illustrations in your documents, and construct Do files to set up your word processing session. Another extension provides fill-in-the-blank capability.

A "quick" version of Lazy Writer is also available, as well as Electric Webster's new option for automatic hyphenation.

Formatter

Formatter displays the location of line and page breaks as an aid to hyphenation, header changes, and footnoting. When you press the clear and enter keys, the Formatter module searches through the text and clears the screen to present the word, byte, and character count, as well as the number of the last page.

If you return to edit from this point, you'll see a large bar across the screen at page breaks, and centered text is indeed centered on the screen. The text does not appear indented or justified, but the lines terminate at exactly the character displayed. The module does not show headers and footers, but it accounts for them.

The Formatter enhancement is particularly valuable in making certain that a heading isn't cut off from its text, or that tables aren't broken in the middle. Knowing the page breaks, you can insert footnotes in the proper place or change headers and footers.

Another option from the Formatter menu is hyphenation. You select the minimum number of characters to add to each line, and your text appears line by line. The cursor blinks at the last opportunity to hyphenate, and you can move it to the word break.

When you press the hyphen key, Formatter breaks the word, inserts a hyphen, and adjusts line lengths. Lazy Writer moves on to the next hyphenation opportunity. If you want, you can put soft hyphens in the text rather than hard ones, so printed text breaks at that point only if necessary.

Formatter also error-checks for any goofs you might have made with control codes. It flashes an error message and places the cursor over your mistake. You must deformat text prior to printing.

Formatter is now standard on new copies of Lazy Writer, and is a $25 upgrade for current owners.

"Formatter. . . is particularly valuable in making certain that a heading isn't cut off from its text. . ."

Lazy Calc

Lazy Calc performs the four basic math functions on figures in your text file and inserts the result in printed copy.

It specifies the number of columns to be used in a nonprinting comment line, and identifies the location of the answer using # signs equal to the number of its digits.

Addition is the default function, so the standard mathematical sign (−, *, or /) must precede the number if you want other functions. Then the program places block move markers from the first number to be calculated to the last digit in the total. You call Lazy Calc from the Lazy Writer directory to perform the math and insert the answers in the text file.

You can pass information to Lazy Calc in comment lines, and mark numerical data (such as dates or check numbers) so it does not become a part of the result. Lazy Calc also functions with alternating credit/debit columns like those used in a balance sheet.

The printed result will be much like Basic's Print Using statement, with a specified number of digits behind the decimal point, and commas and dollar signs in place. If you make an error, the program returns to your text with the cursor over the mistake.

The program doesn't pretend to compete with spreadsheets, and you'll find that totaling short columns is faster if done manually. Longer columns make the formatting worthwhile, but any number-editing requires repeating the whole process.

The price of Lazy Calc is $29.95.

Lazy Tab

Lazy Tab lets you set or reset tab positions. Place the location of desired tab settings in a nonprinting comment line, and call Lazy Tab from the Lazy Writer directory. All tabs change to the new specifications.

Lazy Tab also includes a decimal align command to neatly stack your figures one above another, and is compatible with Lazy Calc. Lazy Tab sells for $15.

Lazy Draw and Lazy Do

Lazy Draw is a separate command file that lets you create illustrations. You can include these in your text file and print them as TRS-80 block graphics.

Draw pictures with the arrow keys, and erase errors by holding the clear key while moving the cursor. You can type text into the picture, and save the result to disk. The screen is saved in ASCII code with an optional offset for printers like the MX-80.

You can load the completed file together with text files and print it as you would any other document. It might require a bit of experimentation to get the desired result, since the Lazy Draw could misinterpret the graphics codes and alter format counters.

The program works only with printers that respond to ASCII codes to print block graphics. The MX-80, for example, prints block graphics as it does with Graftrax 80, but it doesn't function with Graftrax Plus.

Lazy Do is very similar to a DOS Do command or chain file. The program holds a series of instructions to load Lazy Writer, bring up a given document, call a menu, set desired parameters, or perform a given task.

Lazy Draw and Lazy Do come as a pair for $19.95, or you can order the

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For the TRS-80 Models I, III (48K, 2 drives, lower case required). Data-Writer is available from software dealers or direct from Software Options, Inc., 19 Rector Street, New York, NY 10006, (212)785-8285. Toll-free order line: (800)221-1624. Price $145 (plus $3 shipping and handling). NY State residents add sales tax. Visa/Mastercard accepted.

Canada: For the name of a local dealer, contact J&J Electronics Ltd, 310 Notre Dame Avenue, Winnipeg R3B 1P4; (204)942-0963.

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Dealer inquiries invited.

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SOFTWARE OPTIONS INC™

↵See List of Advertisers on Page 323

Lazy Stuff quartet (Lazy Calc, Lazy Tab, Lazy Draw, and Lazy Do) as a package for $39.95.

Lazy Doc

Lazy Doc is a utility that permits keyboard input to replace data in a coded text file. When Lazy Doc reaches a fill-in-the-blank location, a request for the data appears on the screen and all references to that data are replaced in the file.

Name, address, and the like can come from the operator to match a lengthy standard file without manually editing the text. Line lengths adjust as necessary to fit the variable input length.

Lazy Doc also supports standard or boilerplate paragraphs that you can call from disk and insert in the current text file.

Lazy Doc takes most of the work out of repetitive typing for similar documents. Lazy Doc takes Lazy Writer out of the home and puts it in the office where it can compete with higher priced business software.

Lazy Doc costs $59.95.

Q Version

David Welsh prepared a quick version of Lazy Writer with the print module in memory. This edition offers greater speed since you don't need to load the print and edit modules; it ends the thumb twiddling users once endured.

Q Version is useful for those who must process a number of short letters, but the code's presence is at the expense of the text buffer. Use the standard version for longer documents or chain them for printing.

Unless you're writing the great American novel, you'll find plenty of space to accommodate your text, and the added speed is a definite plus. The Q version is available to registered owners for $20.

In the mill are Lazy Merge, which inserts material from a data file into text to produce form letters, and Lazy Font, which supports customized fonts for printers such as the MX-80 with Graftrax.

Lazy Writer has long been highly regarded, and it started with more features than any other TRS-80 word processing program. Its author continues to add features, printer drivers, data sheets, and newsletters that make it the best supported word processing program available for the TRS-80. ■

★★★★★

Legal Care For Your Software
A Step-by-Step Guide for Computer Software Writers
Daniel Remer
Nolo Press
Berkeley, CA 94710
1982
Softcover, 256 pp.
$19.95

★ ½

Solving the Computer Contract Dilemma—A How-To Book for Decision Makers
Bruce K. Brickman
Hayden Book Co.
Rochelle Park, NJ 07662
First Printing, 1982
Softcover, 166 pp.
$20

by Carl Oppedahl, J.D.

Daniel Remer's *Legal Care For Your Software*, though geared for software authors, is fine reading for anyone who expects to be on the giving or receiving end of a large sum of money involving software. Remer successfully explains the elementary legal principles that govern the relationships between the software writer, publisher, and consumer.

Further, he illustrates the various financial and business interests of writers and publishers, and anticipates some of the conflicts that arise between them. Finally, he shows how, with a bit of thoughtful bargaining, they can resolve some apparent conflicts through properly drawn contracts. The book generally gives good advice and is easy to read.

Thousands of people write software for home computers and profit from it. Some set up their own firms to market the programs, but most choose to contract with a publisher who sells the software through an established organization.

Most of them have two things in common—they cannot find a lawyer skilled in computer law, and couldn't afford his advice anyway. *Legal Care For Your Software* is for them.

The first few chapters of the book contain detailed discussions of the two common ways to protect software: trade secret and copyright.

Basically, you accomplish trade secret protection by making sure everyone who gets your program has signed a contract promising not to give it to anyone else. Remer provides tear-out forms to use for this purpose, and lucidly explains the advantages and disadvantages of relying on trade secret protection.

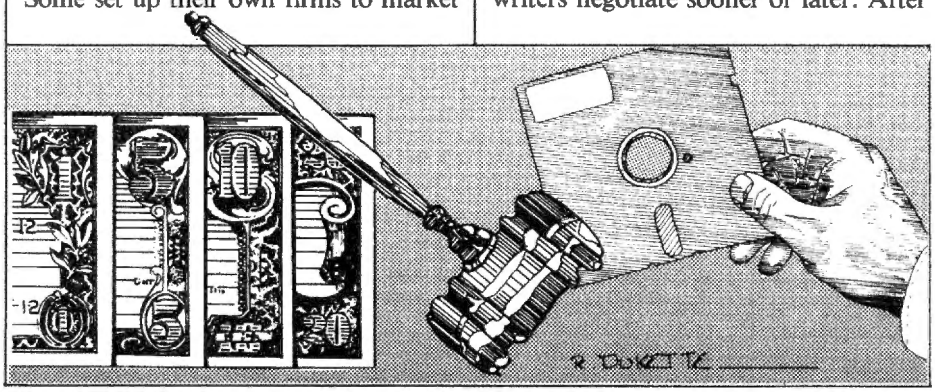
For example, if you absent-mindedly leave a copy of your program lying in the street, someone who has not signed your contract might pick it up and use it. You will be powerless to stop them.

Copyright protection, as Remer describes, is easy to get and easy to keep under the 1976 Copyright Act and 1980 revision. He explains the copyright office forms line by line, and tells how and where on the program to put a proper copyright notice.

The new act and its revision brought computer software securely under the wing of copyright protection, and removed most of the pitfalls for the unwary. Before 1976, for example, if you released even a copy or two of your program to the public without a copyright notice, you ran the risk of losing all rights to the program.

Under the new law, you can often save most of your rights, as long as you don't take too long to affix notices to all the copies.

Remer devotes five well-written chapters to the contracts all software writers negotiate sooner or later. After



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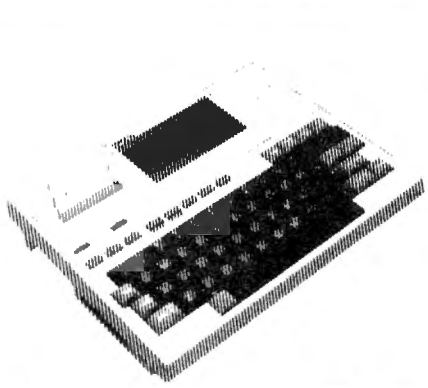

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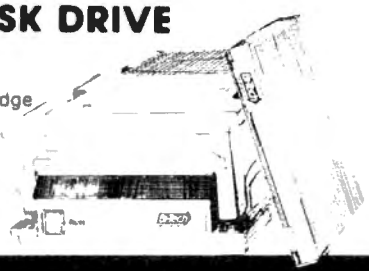

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spelling out what is and what isn't required in a valid agreement, he discusses the many issues likely to come up, gives suggestions on how to negotiate them, and points out the areas where a lawyer's help is useful or necessary.

In these chapters, *Legal Care* stands out from many other books in the field. Chapter eight, for instance, discusses areas where the programmer and publisher are likely to clash during negotiation. For example, the parties must decide the term of the contract and arrive at a formula to divide up the sales proceeds.

The natural tendency is to find a particular percentage-of-sales royalty rate and a fixed term. Assuming the publisher offers what seems like a low royalty rate, the programmer might want a short term of license. He assumes that if the program is a success he can renegotiate a higher royalty rate later.

Yet the publisher might not promote the software vigorously unless assured of a long-term agreement within which the promotional investment might be repaid. An impasse follows.

To quote Remer: "...instead of limiting the length of the license, allow the publisher as much time as he wants to sell the program. Then you can motivate him to really push your program by including a clause in the royalties section (of the contract) that guarantees you a minimum royalty level. A publisher who doesn't quite manage to meet an agreed-upon sales quota is faced with the choice of making up the monetary difference (in the hope of selling more programs next quarter) or returning the license to the programmer."

Through examples like this, Remer points out ways in which situations that appear to be adversarial can become cooperative. These range from a variety of negotiation methods to imaginative contract terms decribed in the text and appearing in the pull-out licenses at the end of the book.

Patent and trademark are the next subjects. As Remer explains, the United States patent laws are of little help to programmers, at least given recent court interpretations.

While copyright registration usually does not require the assistance of a lawyer, applying for a patent almost always does. When you seek a software patent, the patent office is likely to reject the application. Even if they grant the patent, a court will probably find it invalid if it later becomes the subject of litigation.

Since all granted patents are public records (the word patent means open for all to see), a patented program cannot be kept as a trade secret. Anyone who wants to learn about the program can order a copy from the patent office.

Trademarks, like patents, generally require the help of a lawyer. Fortunately, it is not essential that a program have a trademark. The chapter on trademark discusses the many steps you have to take to get one, as well as the benefits gained.

"Remer spells out the relatively few areas requiring a lawyer's advice, and discusses the remaining topics in plain language..."

Even if you have no trademarks, you must avoid infringing the trademarks and service marks of others. Remer explains the footnotes that should appear in any advertisement or manual that refers to someone else's trademark.

No book on software publishing law is complete without a chapter on warranties, and Remer's thorough discussion is recommended reading for everyone, including end users. If a program is published with no mention of a warranty, for example, state and federal laws provide one.

The various pull-out forms let a publisher tailor the warranty for the level of coverage, ranging from lifetime support to Radio Shack's "as is" non-warranty.

A complete index also serves as a glossary by pointing to definitions within the text.

Legal Care For Your Software gives sound, understandable legal advice. Remer spells out the relatively few areas requiring a lawyer's advice, and discusses the remaining topics in plain language with a minimum of legalese.

Clear examples supplement the important concepts, and humorous, explanatory cartoons occasionally break up the text.

The Dilemma

Bruce Brickman's *Solving the Computer Contract Dilemma—A How-To Book for Decision Makers* is hard reading, and is more likely to put you to sleep than teach you anything about computer contracts.

The cover claims that *Computer Contract Dilemma* is for "business executives, data processing managers, and lawyers," but even lawyers specializing in commercial contract law will find the book difficult to understand.

Furthermore, a majority of the court cases discussed are from New Jersey, and have only limited applicability to the rest of the United States. A partial explanation for this lies in the book's apparent origin—the New Jersey Institute for Continuing Legal Education.

Only the first two and final chapters are accessible to laymen. They introduce the book's subject, negotiation of contracts for computer acquisition and leasing, and discuss a variety of bargaining techniques.

None of the negotiation methods—good guy/bad guy, controlled anger, and bargaining solely with the ultimate decisionmaker—is unique to the computer field, but they deserve repetition if only because your opponents will eventually use them all.

Some chapters appear to be transcriptions of lectures. For example, the third chapter, "Computer Contract Basics," starts out: "Litigation with its coincident evidentiary issues forms the prism through which the attorney perceives his client's situation in order to prepare a document able to survive the ultimate litmus of drafting skill."

The punctuation and spelling errors that crop up about every fourth page are what you'd expect from unedited lecture transcripts.

Six of the eleven chapters contain extremely dry top-to-bottom coverage of the Uniform Commercial Code, a body of law that has been enacted, more or less, in each of the fifty states. The chapters discuss sections of the code and actual court cases interpreting them.

Lawyers who read these chapters will be disappointed to find that, despite the 1982 press date, none of the cases cited is more recent than 1979. Also, the case citations are often sloppy in form, and sometimes incorrect.

These chapters are hard going for laymen, partly because they use

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technical legal terms, such as "parol evidence" and "tolling a statute of limitations," yet define them nowhere in the text. Neither a glossary nor an index helps the reader or indicates definitions that do appear in the text.

The analysis of court cases, though usually legally sound, is often cloaked in impenetrable prose. However, the clarity of writing style varies greatly over the many chapters.

It's also regrettable that only nine pages consider the fast-growing subjects of copyrightability and patentability of software.

As a final comment on the book, the use of the word dilemma in the title is somewhat misleading. The reader who gets through all eleven chapters finds that no particular dilemma (a difficult choice between two equally distasteful alternatives) is ever identified, let alone solved. ■

★★★½

ProTrade—The Professional Tool for Stock and Option Trading
Nevins Microsystems Inc.
210 Fifth Ave.
New York, NY 10010
Model I or III
$350
$35 for manual and demonstration disk

by Frederic S. Goldstein

ProTrade is designed specifically for an investor familiar with the securities markets in general and the listed option market in particular. It provides two types of information: realized and unrealized profit and loss on groups of transactions, and theoretical values of options based on the Black-Scholes model.

To calculate an option's correct theoretical values, you must provide the program with specific, up-to-date information concerning both the stock and the option. You need to know the underlying stock's volatility, the anticipated amounts of the next several dividends along with their ex-dividend dates and the risk-free interest rate for alternate investments. You also need the option's strike price, conversion ratio, and its expiration date or dates.

The program is menu-driven and the 98-page manual explains each of the 12 menu items. However, the documentation does not contain a good system overview, so I had to work with it awhile.

You execute the program by typing PROTRADE. A message asks if you want to change the usual start-up. If you hit the enter key, or type N and then hit the enter key, the system uses its regular data files. Otherwise, enter the file names you wish to use. This feature allows you to use the same set of disks to work with different data files.

Next, enter the date in the MM/DD/YY format. If you don't, the system rejects your input.

The main menu gives you 12 choices in two categories. Items 1–4 are called Information Displays and items 5–12 are called Data Bank Changes.

To run any of the information displays, first enter data through the data bank changes. Your first choice should be number 5: Add or Change Security. This lets you enter or correct relevant data on a security.

For stocks, ProTrade prompts you for volatility and the next four ex-dividend dates along with the appropriate amounts. For options, it prompts you for the underlying security, the option strike price, its expiration date, and the conversion ratio. Menu item 6 allows you to delete a security. You must enter every security, stock, or option with which you work.

"ProTrade evaluates completed trades based on their closing prices and marks open trades to market. . ."

Item 8, Buy or Sell, lets you accumulate a series of trades into a strategy. The program as a whole allows up to ten different strategies. Item 7 allows you to set a current market price for a security subsequent to its entry into a strategy.

Menu item 1 calculates a net realized and unrealized profit or loss based on an analysis of all the trades in a strategy. ProTrade evaluates completed trades based on their closing prices and marks open trades to market using item 7.

For example, suppose you purchase stock in a company and write a call against that position. Then you close the position by buying back the call and write a new call against the position. The program calculates the realized gain or loss on the position you just closed, an unrealized gain or loss on positions that are still open, and a net of the two.

Item 11 sets the cost of money. The profit and loss routine uses this figure to indicate how much it would cost if you had borrowed the entire amount of funds committed to the strategy. The bottom line of the profit and loss screen reflects the strategy's daily cost.

It's interesting to see a strategy's gross trading profits reduced by a theoretical amount allocated as an interest charge. Unfortunately, the program does not take into account any dividends you might have earned over the period the position was open. The program developers indicated to me that they would correct this oversight in the program's next version.

ProTrade's most valuable feature is its ability to calculate theoretical values for options. You invoke this procedure by selecting item 2. However, you first must select item 10 and enter the interest rate for risk-free money.

If you forget, the option valuation routine tells you to hit the enter key to continue. At this point you'll probably realize that you forgot to enter the necessary number.

The program calculates theoretical option prices in two ways. If you ask for a stock's option prices, the program calculates theoretical values and hedge ratios for calls and puts for the nearest strike below the current price, as well as the next two above the current price.

Unfortunately, since the computations are complex they are also time-consuming. It takes about five minutes to complete the analysis for one company. Furthermore, the break key is disabled. If you want to abandon a set of computations before the program is complete, you either have to reboot or wait until the program finishes.

Also, the routine assumes that op-

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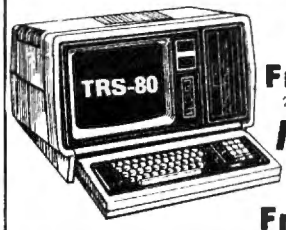

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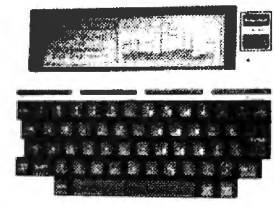

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tions expire on the fifteenth of the month. In reality, options expire at noon on the Saturday following the third Friday of the month.

You can also ask the program for a specific option's valuation. This approach is much faster because ProTrade makes only one set of computations. This approach is also more accurate because you provide the computer with the exact expiration date back in item 5.

Other menu items let you display transactions in a strategy or securities in the data bank. You also can cancel a trade or security by using a special program called Propurge.

To check for accuracy, I made a series of runs that compared ProTrade with one of the services providing data to option market makers on the floor of the stock exchange. For calls and hedge ratios, the numbers were in complete agreement to at least two places of accuracy.

However, there were significant differences with respect to puts. The system is high by about ¼ to ½ point. This was not particularly surprising, since there are a number of ways to evaluate puts and the investment community itself is not in agreement on this subject.

Is this program useful for an investor? The answer is a qualified yes. Although the call prices agreed with my other model, both were different from the prices published in the newspaper. Unless you can get accurate volatility readings and an appropriate interest rate, you will have trouble getting meaningful numbers out of the program.

However, it is helpful in spotting options that are greatly over or under priced. It also can help a call writer by indicating what kind of spread to expect when rolling an option from one period and series to another.

One of ProTrade's weaknesses is that it prints out only lists of securities or trades, but not a chart of the theoretical values for options. You can overcome this limitation on the Model III by using DUAL ON to route the screen display to the printer. Unfortunately, the Model I doesn't have a comparable feature and you must copy by hand any figures you wish to retain.

According to Nevins, all registered owners will receive complete software updates and enhancements for at least two years. Enhancements to the Model I/III versions are scheduled for later in the year. A CP/M version is also in process.

Remember that option trading can be risky. Should you decide to purchase this program, follow its results on paper before committing any funds based on its results. ■

★★★★★

TRS-80 Model I, III, and Color Computer Interfacing Projects
William Barden, Jr.
Howard W. Sams & Co. Inc.
4300 West 62nd St.
Indianapolis, IN 46268
Softcover, 272 pp.
$14.95

by Gary Shade

TRS-80 Model I, III, and Color Computer Interfacing Projects does an excellent job of demonstrating and explaining how you can interface custom circuitry to these Tandy computers.

For the most part, the circuitry is simple to implement. Most projects require three or fewer integrated circuits and a couple of resistors and capacitors. Design examples cover interfacing the circuitry to the Model I's and III's expansion or input/output (I/O) bus, cassette port, and RS-232 port.

The book presents similar designs for the Color Computer. Mr. Barden uses the CoCo's RS-232, joystick, and ROM cartridge ports to interface to his projects. Each computer receives equal treatment from the author.

This is what makes the book unique. It covers information on three of Tandy's computers in one publication.

Each chapter is devoted to different projects or concepts. The projects also provide the software required to test, calibrate, and drive each of the circuits. Most of the hardware projects require software drivers written in Assembly language.

"...you get information on three computers, the author's knowledge, and some nifty projects..."

You need not be an expert on Assembly language, or even own an editor/assembler, to get the programs to run. The author provides you with loader programs in Basic that POKE the required code into memory. This allows even the most inexperienced experimenter to get up and running with minimum difficulty.

The projects cover analog to digital (A/D) converters, a joystick interface for the Models I and III, and RS-232 communications. Mr. Barden includes an excellent description of the Western Digital TR1602B UART used in the Models I and III. He also describes how to sense and drive switches, transducers, and light-emitting diodes (LEDs) from each system.

One of the projects is a device to digitize a speaker's voice, store it in the CoCo, and play it back through the speaker in your television set. There are several other Color Computer projects in the book, including a half-year clock.

Mr. Barden discusses the circuitry contained in the three computers, and examines the Model III's I/O bus, the Model I's expansion interface bus, and the CoCo's ROM cartridge port in great detail. He also covers the differences between the Z80 and 6809E CPUs.

Mr. Barden wrote several articles for various publications on interface projects for these computers. Some of the information appears to be reprinted from these articles, although I could only verify one chapter as coming from a magazine.

This by no means detracts from the book's usefulness. The material is coherently organized and provides the reader with a valuable reference.

About the only complaint I have with the book is the length of its title! Considering you get information on three computers, the author's knowledge, and some nifty projects, the book is a bargain at $14.95.

I highly recommend it to the novice or to anyone interested in learning more about his Tandy computer. ■

REVIEW DIGEST

CHROMAtrs, South Shore Computer Concepts, 1590 Broadway, Hewlett, NY 11557, Model I or III, $99 kit, $169 assembled.

"CHROMAtrs is another attempt to add color to the uncolorful TRS-80 Models I and III.

"...CHROMAtrs does give a Model I or III an added 15-color display, assuming that you have a color TV or monitor attached.

"...it offers the devout hobbyist a new toy at an attractive price. I don't see it becoming popular enough to attract any high-level programmers. ...However, for users who like to roll their own, it offers an incredible price-to-performance ratio, especially if built from a kit." *80-U.S. Journal*, June, p. 103.

Word Processing Buyer's Guide, Arthur Naiman, McGraw-Hill Inc., New York, NY, 325 pp., $15.95.

"(The author) sets up a 100-point scale for his evaluation of word processors, and tells you why each of the points is awarded or, in some cases, deducted. ...whether you're a novice or a hacker, you'll find this book informative and fun. (The) style is conversational, yet clear and succinct. The book covers the word-processor field better than most works of this type..." *Personal Computing*, June, p. 148.

Milestone, Digital Marketing for Organic Software, 2670 Cherry Lane, Walnut Creek, CA 94596, Model I or III with CP/M and Model 4, $295.

"Milestone is a project management program...intended to complement critical-path analysis. Specifically, it provides information on project completion, project cost, schedule performance and rescheduling impact.

"Considering the complexity of the subject, it is convenient and even easy to use. This is the result of a well-thought-out, menu-driven program. ...This software does require a video-personalization package. The process of customization...can be difficult. ...You should check out the installation procedure in advance to make sure it serves your purposes." *InfoWorld*, May 30, p. 41.

Daisy, Med Systems Software, P.O. Box 3558, Chapel Hill, NC 27514, Model I or III, Model I Scripsit, $74.95.

"Daisy is a carefully written program that enhances Scripsit in many practical ways. ...If you have a need to prepare highly technical documents, or just long, nontechnical ones, Daisy supplies just about everything you could need. ...If you are looking for a program that will expand Scripsit...and you don't care about right-justified proportional print, then buy Daisy." *Creative Computing*, June, p. 86.

Writing in the Computer Age, Andrew Fluegelman and Jeremy Joan Hewes, Anchor Press/Doubleday & Co., Garden City, NY, 254 pp., $10.95.

"If you write at all, either professionally or as a casual correspondent, *Writing in the Computer Age* will be useful to you. ...If you have absolutely no experience with word processors, some chapters may be a little daunting, but they're worth reading and digesting before taking the plunge into electronic wordsmithing.

"...the authors discuss becoming comfortable with a word processor, the mechanics of editing on paper and on the screen, proofreading, producing elegant manuscripts, organizing research and files, and using computer communications." *Personal Computing*, June, p. 150.

The Works, Omikron Systems, Berkeley, CA, Model I or III, $299.

"...The Works...has been bundled with software such as WordStar, MBasic and CBasic that are individually worth a great deal more than the hardware modification alone.

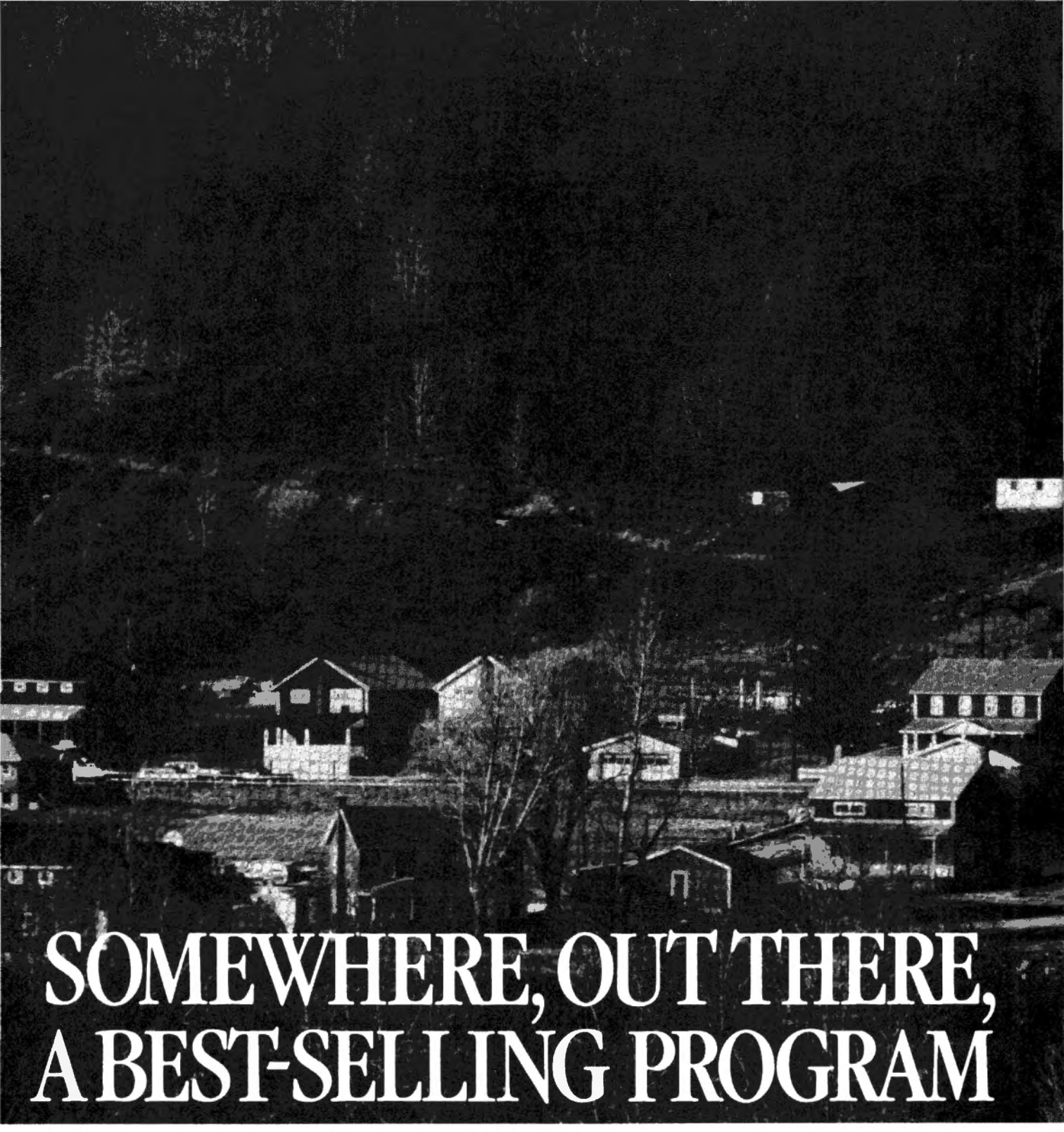
"...The Works can be installed by any neophyte following instructions included with the package. ...I have been using my CP/M conversion for six months. ...The Mapper I has never caused any problems, nor interfered with the normal non-CP/M functioning of the computer.

"...The Works *does* work, and represents an excellent value. The user must decide whether the tradeoffs involved in switching to CP/M are worth giving up some of the features of newer operating systems." *Interface Age*, June, p. 67.

Sprinter II, Holmes Engineering, 3555 South 3200 West, Salt Lake City, UT 84119, Model I or III, $99.

"Sprinter II...is the fastest speed-up modification for the TRS-80 Model I and III currently available. It is also the easiest to install and one of the least expensive. The Sprinter II gives you 16 different speeds from which to choose, all integer multiples or dividends of the standard 1.77 MHz clock speed.

"...I have used the modification without any problems whatsoever on any programs, including database management programs, compilers, statistical and other mathematical analysis programs, and programs to load neurological data from an external A/D converter connected to electrodes stuck in my pet leeches." *Creative Computing*, June, p. 161.



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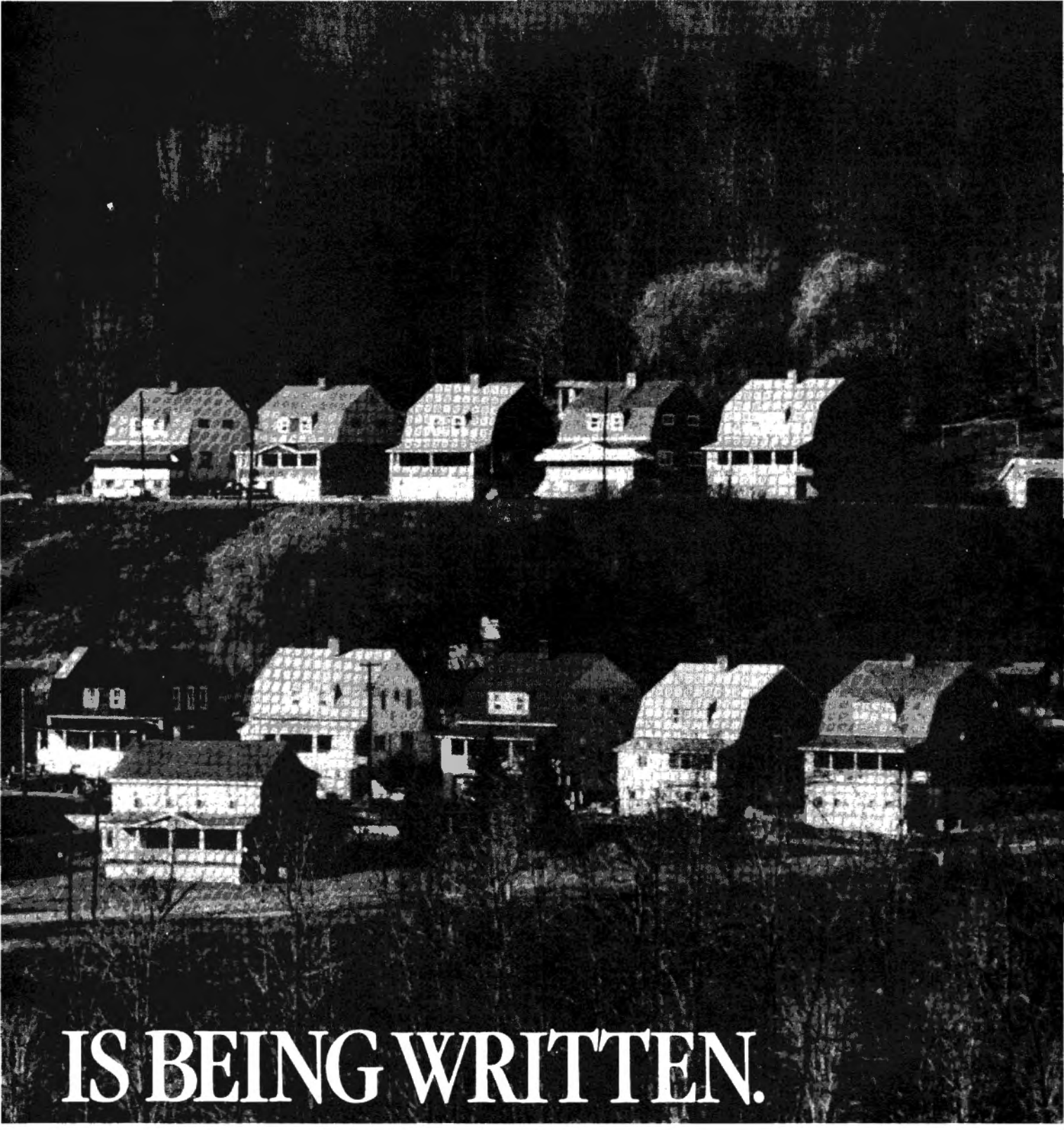

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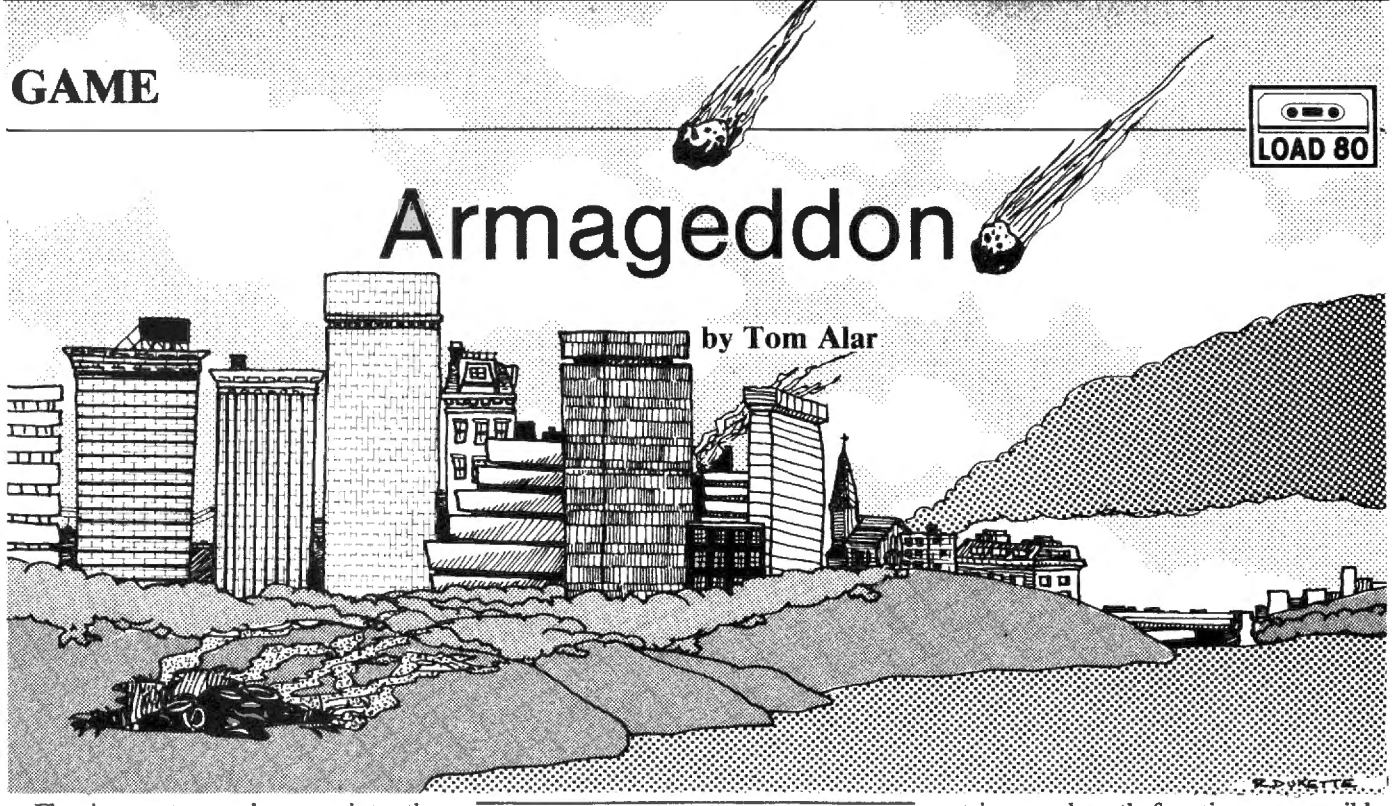
Armageddon

by Tom Alar



Flaming meteors plummet into the heart of Madison, WI, obliterating city blocks. Your mission is to man a missile-firing rocket and save the Fauerback brewery, the Capitol building, the Frank Lloyd Wright-designed Unitarian church, and the University of Wisconsin's Sterling Hall from destruction.

Your rocket has 10 missiles that you fire right or left. When your ammunition runs low, reload from the Sterling Hall rooftop deck before another meteorite smashes Madison. If ten meteorites reach the city, or if a meteor hits your rocket, you've failed your mission and the game is over.

You need speed and dexterity if you are to save Madison, WI, from certain destruction.

Playing Armageddon

The space bar shoots missiles singly or in rapid fire. Missiles are effective only at short range. Your rocket is controlled by either a joystick or by keys on the keypad. The number 4 key moves the rocket left, the 5 key moves it up, the 6 key moves it right, and the 2 key moves it down.

Armageddon has four skill levels, but you cannot advance to the next level unless you've earned it with spectacular bombing raids.

Armageddon's Program

The 16K Model III action is fast because the main control loop directs program action, and branches to other routines. Four loops perpetuate themselves whenever your rocket goes right, left, up, or down. As many character strings and math functions as possible perform outside the loops.

Program Changes

If you don't have a joystick, delete lines 2400–2555, 3090, 3140, and 3190. Change line 2260 to

```
2260 IF PEEK (14400) = 128 GOTO 2270 ELSE 2570
```

If skill level 4 proves too difficult, delete it by changing line 4030 to

```
4030  IF SC>9999 LS = 2:IF  SC>19999 LS = 3
```

and deleting lines 4040 and 4050. If you can't reach skill level 4 with bombing tactics, but want to try it, change line 110 so LS = 4, and delete line 4030.

Change the delay between meteorites by altering the reset value of H from H = 10. The higher the number you assign H, the faster the meteorite drops.

To fly around the sides of the screen, delete lines 10–90 and change lines 3210 and 3310 to:

```
3210 E = 225 – INP(0): IF B>828 THEN
B = B – 2
3310 E = 255 – INP(0): IF B<132 THEN
B = B + 2
```

NM$	Player's Name
SC	Score
SH	High Score
B	Location of Rocket
G	Location of Meteorite
J	Location of Missile
F	Location of Landscape
LS	Skill Level
DI$	Direction Missile Fires
WL	Location of Missiles (*) on Screen
W	Number of Missiles
H	Counter to Increment Frequency of Meteorites
U	Level of Flight (For The Array)

Table 1. Variables List

The Key Box

Model III
16K RAM
Cassette Basic
Joysticks Optional

While these program changes alter playing strategies, the big question remains—can you prevent Armageddon in Madison? ■

Tom Alar is employed by Hostess. You can write to him at 959 Lawrence St., Madison, WI 53715.

Program Listing

```
10 REM BUILD THE ARRAY
20 RGT=132:LFT=188:Y=1:DIM A(12,3):CLS:PRINT @404,"A R M A G E D
 D O N";
30 FOR X=1 TO 11
40 A(X,Y)=RGT
50 RGT=RGT+64
60 NEXT X
70 Y=2:FOR X=1 TO 11
80 A(X,Y)=LFT
85 LFT=LFT+64
90 NEXT X
100 REM INITIALIZE ARMAGEDDON SYMBOLS AND PREPARE GAME
110 B=784:U=11:F=831:C=20:G=196:H=0:I=0:L=5:T=0:SC=0:LS=1:G$=" "
:DI$="U":RUP$=CHR$(176)+CHR$(191)+CHR$(176):RRT$=CHR$(191)+CHR$(
140)+CHR$(140):M$=CHR$(153)+CHR$(166):WL=75:W=10
120 DEFDBL R-T:DEFINT E
130 CLS
140 GOSUB 910 'INSTRUCTIONS
150 CLS:GOSUB 1610 'DRAW LANDSCAPE
160 GOTO 2210 'GO TO THE MAIN LOOP
170 GOTO 5010 'CONCLUDE THE GAME
600 RESTORE:GOTO 110
900 REM INSTRUCTIONS
910 CLS
920 INPUT "DO YOU WANT INSTRUCTIONS (Y OR N)";G$
930 IF G$="Y" GOTO 1010
940 IF G$="N" RETURN
950 GOTO 920
1010 PRINT @86,"A R M A G E D D O N";
1020 PRINT @261,"FLAMING METEORITES ARE FALLING TO EARTH.  PROTE
CT THE CITY BY DISINTEGRATING THE METEORITES.  YOUR SHIP TAKES O
FF FROM A "
1030 PRINT @384,"ROOFTOP BASE.  YOU CAN RELOAD BY LANDING ON THE
 SAME BASE.  YOUR"
1040 PRINT @448,"FIRING RANGE IS LIMITED SO YOU MUST FLY TO BE W
ITHIN RANGE."
1050 PRINT @512,"PRESS SPACEBAR FOR INSTRUCTIONS."
1060 IF PEEK(14400)=128 GOTO 1100
1070 GOTO 1060
1100 CLS: PRINT @86,"A R M A G E D D O N";
1110 PRINT @261,"USE THE KEYPAD OR JOYSTICK TO FLY.  PRESSING '4
'MOVES LEFT.PRESSING  '5' MOVES UPWARDS.  PRESSING '6' MOVES RIG
HT.         PRESSING '2' MOVES DOWNWARD.  PRESSING THE SPACEBAR
FIRES THE   MISSILES."
1120 PRINT @458,"THE GAME CONTINUES UNTIL 10 METEORITES HAVE HIT
 THE   CITY,  UNLESS A METEORITE HITS THE ROCKET FIRST. GOOD LUC
K."
1130 PRINT @581,"(SUGGESTION: USE YOUR LEFT HAND ON THE SPACEBAR
 TO FIRE.   KEEP YOUR RIGHT HAND ON THE KEYPAD AND USE YOUR INDE
X FINGER    FOR LEFT, YOUR RING FINGER FOR RIGHT, AND YOUR MIDDL
E FINGER FORUP AND DOWN).
1140 PRINT @837,"PRESS SPACEBAR TO BEGIN PLAY";
1150 IF PEEK(14400)=128 RETURN ELSE 1150
1600 REM DRAW LANDSCAPE
1610 FOR X=1 TO 28:READ DTA:F=F+1:PRINT @F,CHR$(DTA);:NEXT
1620 DATA176,176,176,176,176,176,176,176,176,128,128,128,128,128
,128,128,128,128,128,128,128,128,160,128,128,128
1630 FOR X=1 TO 28:READ DTB:F=F+1:PRINT @F,CHR$(DTB);:NEXT
1640 DATA128,128,128,128,128,160,188,189,180,128,128,128,128,128
,128,128,128,128,128,128,128,128,128,128,149,149,149
1650 F=F+8
1660 FOR X=1 TO 31:READ DTC:F=F+1:PRINT @F,CHR$(DTC);:NEXT
1670 DATA191,191,191,191,191,191,191,159,129,128,128,128,128,191
,191,191,191,191,191,191,128,128,188,188,191,189,128,188,188,128
,128
1680 FOR X=1 TO 31:READ DTD:F=F+1:PRINT @F,CHR$(DTD);:NEXT
1690 DATA128,128,151,151,151,151,149,128,128,128,188,188,188,128
,128,170,128,128,128,128,128,128,149,149,149,128,128,128,176,128
,176
1700 F=F+2
1710 FOR X=1 TO 31:READ DTE:F=F+1:PRINT @F,CHR$(DTE);:NEXT
1720 DATA191,191,191,191,191,191,191,128,128,160,188,148,128,191
,191,191,191,191,191,191,168,188,191,191,191,191,191,191,191,128
,188
1730 FOR X=1 TO 31:READ DTF:F=F+1:PRINT @F,CHR$(DTF);:NEXT
1740 DATA188,191,191,191,191,191,191,191,189,188,148,191,191,191,191
,191,191,191,128,191,191,191,191,191,191,191,191,191,128,191,191
,191,191
1750 PRINT @B-1,RUP$;
```

Listing continues

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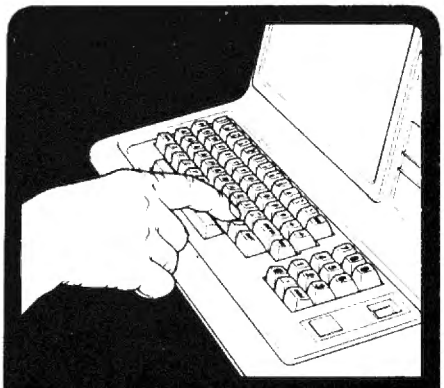

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Model I & III products of Tandy Corp

125

Listing continued

```
1800 PRINT @WL,"**********"
1810 PRINT @64,"MISSILES: "
1820 PRINT @54,"SKILL:";LS;
1830 PRINT @0,"SCORE:";SC;
1840 PRINT @22,"HIGH SCORE:";NM$;SH;
1850 PRINT @86,"A R M A G E D D O N";
1860 RETURN
2000 REM MAIN ACTION CONTROL LOOP
2200 REM KEYPAD COMPATABILITY
2210 IF PEEK(14352)=0 GOTO 2260
2220 IF PEEK(14352)=32 GOSUB 3010
2230 IF PEEK(14352)=4 GOSUB 3110
2240 IF PEEK(14352)=16 GOSUB 3310
2250 IF PEEK(14352)=64 GOSUB 3210
2260 IF PEEK(14400)=128 GOTO 2270 ELSE 2410
2270 IF DI$="U" GOSUB 3610
2280 IF DI$="R" GOSUB 3510
2290 IF DI$="L" GOSUB 3410
2400 REM JOYSTICK COMPATABILITY
2410 OUT 236,16
2420 E=255-INP(0)
2430 IF E=0 GOTO 2560
2500 IF E=1 THEN GOSUB 3010
2510 IF E=2 THEN GOSUB 3110
2520 IF E=4 GOSUB 3310
2530 IF E=8 GOSUB 3210
2540 IF E=16 GOTO 2545 ELSE 2560
2545 IF DI$="U" GOSUB 3610
2550 IF DI$="R" GOSUB 3510
2555 IF DI$="L" GOSUB 3410
2560 IF B=834 GOSUB 3910
2570 H=H+LS+I
2580 IF H>L GOSUB 3710
2590 GOTO 2210
3000 REM MOVE ROCKET UP SUBROUTINE
3010 E=255-INP(0):IF B<192 GOTO 3020 ELSE 3030
3020 B=B+64:U=U+1:GOTO 3060
3030 PRINT @B-1,RUP$;
3040 PRINT @B-1,STRING$(3,128);
3050 PRINT @B-1,STRING$(3,131);:PRINT @B-64,CHR$(188);
3060 PRINT @B-1,STRING$(3,128);:B=B-64:U=U-1
3070 PRINT @B-1,RUP$;
3080 H=H+LS+I:IF H>L GOSUB 3710
3085 DI$="U"
3090 IF E=1 GOTO 3010
3095 IF PEEK(14352)=32 GOTO 3010 ELSE RETURN
3100 REM MOVE ROCKET DOWN SUBROUTINE
3110 E=255-INP(0):IF B>766 GOTO 3120 ELSE 3150
3120 B=B-64:U=U-1:GOTO 3160
3150 PRINT @B+63,STRING$(3,131);:PRINT @B,CHR$(188);
3160 PRINT @B-1,STRING$(3,128);:B=B+64:U=U+1
3170 PRINT @B-1,RUP$;
3180 IF B=784 GOSUB 3910:H=H+LS:IF H>L GOSUB 3710
3185 DI$="U"
3187 H=H+LS+I:IF H>L GOSUB 3710
3190 IF E=2 GOTO 3110
3195 IF PEEK(14352)=4 GOTO 3110 ELSE RETURN
3200 REM MOVE ROCKET RIGHT SUBROUTINE
3210 E=255-INP(0):IF B>A(U,2) THEN B=B-2
3220 PRINT @B-1,STRING$(2,128);:B=B+2
3230 PRINT @B-1,RRT$;
3240 H=H+LS+I:IFH>LGOSUB3710
3250 IF B=784 GOTO 3260 ELSE 3270
3260 GOSUB 3910:PRINT @B-1,RRT$;
3270 DI$="R"
3280 IF E=8 GOTO 3210
3290 IF PEEK (14352)=64 GOTO 3210 ELSE RETURN
3300 REM MOVE ROCKET LEFT SUBROUTINE
3310 E=255-INP(0):IFB<A(U,1) THENB=B+2
3320 PRINT @B,STRING$(2,128);:B=B-2
3330 PRINT @B+1,CHR$(191);:PRINT @B-1,STRING$(2,140);
3340 H=H+LS+I:IFH>LGOSUB3710
3350 IF B=784 GOTO 3360 ELSE 3370
3360 GOSUB 3910:PRINT @B+1,CHR$(191);:PRINT @B-1,STRING$(2,140);
3370 DI$="L"
3380 IF E=4 GOTO 3310
3390 IF PEEK(14352)=16 GOTO 3310 ELSE RETURN
3400 REM FIRE MISSILES LEFT
3410 C=19:X=0:J=B-2:M=INT(J/64)
3420 W=W-1:PRINT @WL," ";:WL=WL+1:IF W<0 GOTO 3430 ELSE 3440
3430 WL=WL-1:RETURN
3440 K=J/64:A=INT((K-M)*64):IF A<C THEN C=A
3450 PRINT @J-C,STRING$(C,140);
3460 PRINT @J-C,STRING$(C,128);
3470 IF G<J GOTO 3480 ELSE 3485
3480 IF G>J-C GOTO 4010:IF G=J-C GOTO 4010
3485 C=20:H=H+LS+I:IF H>L GOTO 3710
3490 RETURN
```

Listing continues

Listing continued

```
3500 REM FIRE MISSILES RIGHT
3510 X=0:J=B+2:M=INT(J/64)
3520 W=W-1:PRINT @WL," ";:WL=WL+1:IF W<0 GOTO 3530 ELSE 3540
3530 WL=WL-1:RETURN
3540 K=J/64:D=INT((K-M)*64):A=64-D:IF A<C THEN C=A
3545 IF K=M RETURN
3550 PRINT @J,STRING$(C,140);
3560 PRINT @J,STRING$(C,128);
3565 C=20
3570 IF G>J-1 GOTO 3580 ELSE 3585
3580 IF G<J+C GOTO 4010:IF G=J+C GOTO 4010
3585 H=H+LS+I:IF H>L GOTO 3710
3590 RETURN
3600 REM FIRE MISSILES UP
3610 J=B-64:P=J:K=3
3620 W=W-1:PRINT @WL," ";:WL=WL+1:IF W<0 GOTO 3630 ELSE 3640
3630 WL=WL-1:RETURN
3640 IF J<192 GOTO 3690
3650 FOR X=3 TO U:P=P-64:PRINT @P,CHR$(191);:NEXT X
3660 FOR X=3 TO U:PRINT @P,CHR$(128);:P=P+64:NEXT X
3680 IF (J/64)-INT(J/64)=G/64-INT(G/64) THEN GOTO 4010
3685 H=H+LS+I:IF H>L GOTO 3710
3690 RETURN
3700 REM DROP METEORITES
3710 PRINT @G,STRING$(2,128);
3720 H=0:G=G+64:IF G=B GOTO 3810
3730 IF G=B-2 GOTO 3810
3740 PRINT @G,M$;
3750 IF G>958 GOTO 3760 ELSE 3790
3760 H=-10:T=T+1:IF T>9 GOTO 170
3770 G=RND(30):G=G*2:G=G+128:IF G=144 GOTO 3770
3780 IFG=142 GOTO 3770
3790 RETURN
3800 REM METEORITE HITS THE ROCKET
3810 X=0
3820 PRINT @B-1,STRING$(3,128);
3830 PRINT @B-1,STRING$(3,191);
3840 PRINT @B-1,STRING$(3,128);
3850 X=X+1:IF X<12 GOTO 3820
3860 G=G+64:GOSUB 3740
3870 FOR X=1 TO 100:NEXT X
3880 GOTO 5010
3900 REM ARM THE ROCKET
3910 PRINT @B+63,STRING$(3,131);:PRINT @B,CHR$(188);
3920 PRINT @B-1,STRING$(3,128);:B=B+64
3930 PRINT @B-1,RUP$;
3940 WL=75:PRINT @WL,"**********";
3950 W=10:FOR X=1 TO 25:NEXT X
3960 PRINT @B-1,STRING$(3,140);:PRINT @B,CHR$(143);:PRINT @B-64,
CHR$(176);
3970 PRINT @B-1,STRING$(3,131);:PRINT @B-64,CHR$(188);
3975 PRINT @B-1,STRING$(3,128);:B=B-64
3980 PRINT @B-1,RUP$;
3990 RETURN
4000 REM SCORING ROUTINE
4010 SC=SC+500
4020 PRINT @7,SC;
4030 IF SC>9999 LS=2:IF SC>19999 LS=3:IFSC>49999 GOTO 4050
4040 GOTO 4060
4050 I=6:LS=4
4060 PRINT @60,LS;
4100 REM METEORITE EXPLOSION
4105 M=1
4110 PRINT @G,STRING$(2,128);
4120 PRINT @G,STRING$(2,140);
4130 PRINT @G,STRING$(2,128);
4140 PRINT @G,STRING$(2,191);
4150 PRINT @G,STRING$(2,128);
4160 M=M+1:IF M<3 GOTO 4110
4170 G=RND(30):G=G*2:G=G+128:H=-10
4175 IF G=142 GOTO 4170
4180 IF G=144 GOTO 4170
4190 RETURN
5000 REM CONCLUDE THE GAME
5010 IF SH<SC THEN GOTO 5020 ELSE 5060
5020 CLS:PRINT @0,"SCORE: ";:PRINT @7,SC;
5030 PRINT @329,"C O N G R A T U L A T I O N S !!!"
5040 INPUT "YOUR SCORE IS THE HIGHEST SO FAR, ENTER YOUR INITIAL
S";NM$
5050 SH=SC:IF LEN(NM$) >4 GOTO 5020
5060 PRINT @960,"DO YOU WISH TO PLAY AGAIN (Y OR N)";:INPUT AN$
5070 IF AN$="Y" GOTO 6000
5075 IF AN$="N" GOTO 5090
5080 GOTO 5070
5090 END
6000 GOTO 600
6100 REM THIS IS AN ORIGINAL PROGRAM BY TOM ALAR
6110 REM 959 LAWRENCE MADISON, WISCONSIN,53715
6120 REM DATE WRITTEN: 12,19,1982
```


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I have just received one of your SOFT-VIEW CRT's and I wanted to write you to tell you that I am impressed. I ordered the CRT by phone on Wednesday afternoon, and I received it this morning (Friday) by UPS. When the UPS truck pulled up, I commented that it would be weird if that was the CRT, figuring that it would show up in about a week. That was the fastest shipment from a telephone order I've ever got!

I should also mention that I was pleased to find that the people I talked to on the phone were very nice and friendly, a quality lacking in many companies I have dealt with by phone....

I have installed RAM chips and two disk drives on my Model III and many times in doing so I could have used directions as good and adequate as I got with the CRT. I congratulate the writer of the instructions for doing a very good job. The directions were intelligent, well-written and described the operation very well without becoming dull or technical....

....By the way, this is the first letter I've written to a supplier of computer hardware that was in praise. I have told a few off by mail, but this is the first time I have been this pleased with a company supplying hardware for my computer. I only hope that your attitude is contagious.

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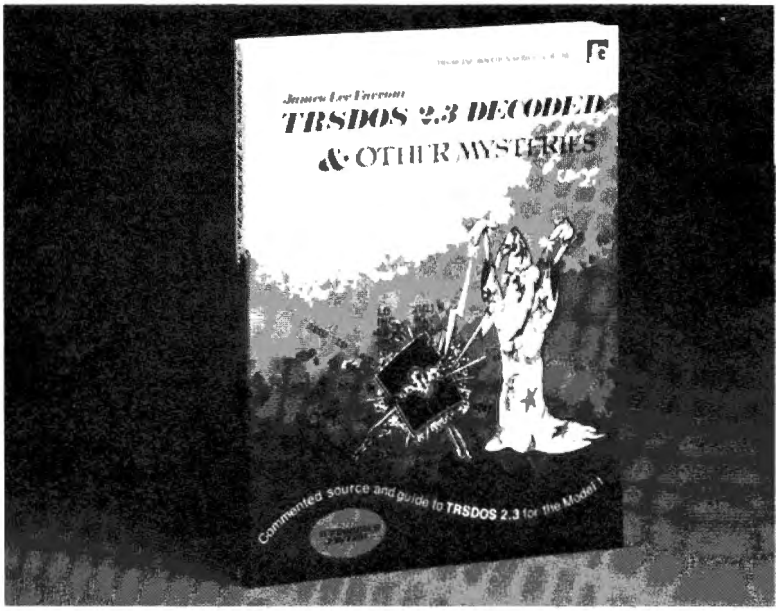

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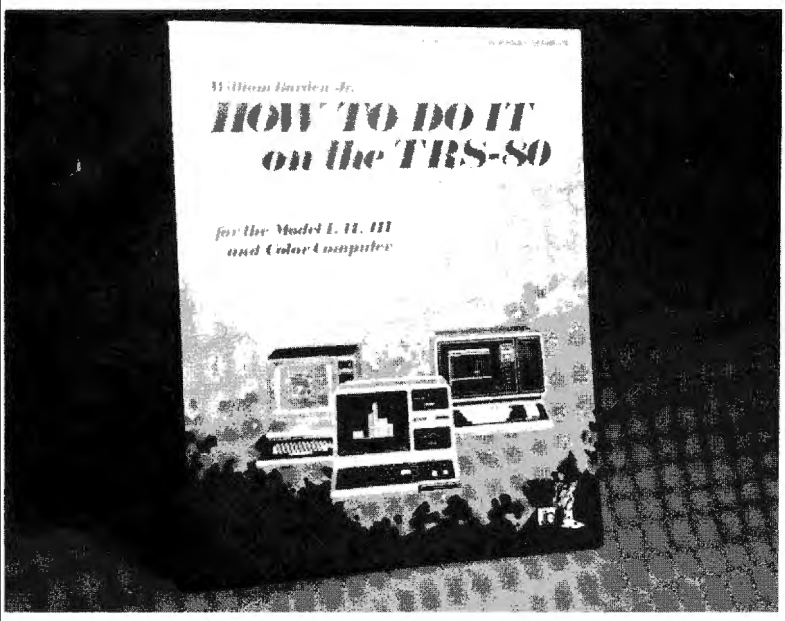

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LOAD 80

Lost On the Great Barrier Reef

by Tom Johnstone and Mike Matthews

Finally, the summer holidays! You decide to go fishing in your new speedboat. Leaving Australia's Sydney Harbour you head northeast across the Pacific Ocean to a well-known fishing spot off the Great Barrier Reef.

Arriving there, you start to lay down your nets around a deserted island when your engine suddenly fails. Hurriedly, you examine the fuel tank and find it empty. Before you drift too far, you drop your anchor and look at the isle before you. You are hopelessly stranded and your only hope lies in what might be on this seemingly desolate landscape.

You hop into your lifeboat and head for the island. Unfortunately, you have no survival equipment and must exist on what you can find on the island.

You must find fuel for your speedboat before dark so you can reach the safety of the Australian mainland. But many secrets and intriguing puzzles await you.

Move about the island and manipulate objects using two-word commands (a verb followed by a noun). Since the program recognizes over 50 words, you should have no problem finding the correct word for each situation.

One program feature lets you enter just the first three letters of each command. Also, the directions north, south, east, and west can stand alone and don't require the verb "go."

One aggravating aspect of many adventures is that they can't be logically mapped; Lost on the Great Barrier Reef can be mapped.

While fishing Down Under, your boat runs out of gas. How will you get back to the mainland?

The Program

This game was written for a TRS-80 Model I or III with at least 16K of memory (see Program Listing). The program is numbered in multiples of 10 to make it possible to use the Auto command when typing it in. Some features of the program, such as scroll protection, are apparent only on a Model III.

A main control loop at lines 250–500 branches off to the separate routines for different commands, located in lines 510–2560. The end of the program lists the instructions, descriptions of all the locations, and a number of data statements containing the different verbs and the island map.

The main control loop is an important part of the program since it identifies the different two-word commands. The computer automatically identifies the first three letters of the verb. It then searches the input for a space and, upon finding one, assumes the next three characters denote a noun.

Then the program processes the verb and noun and checks them against a number of flags. If they match, the program branches out to the separate routines that handle them. If they don't match, the computer scans through the data statements containing the different verbs and compares these with the input verb. If this verb doesn't match any of the program verbs, it prompts the user for another input. When a verb does match, the program branches out by means of an ON . . . GOTO statement to a separate routine that handles that verb.

The routines that process the different commands are set up so the program compares the input noun to a number of nouns that apply to the verb. If the noun doesn't apply to the situation, an appropriate message is displayed and the program prompts for another input. If the noun does apply, the correct process is performed.

The Key Box

Model I and III
16K RAM
Cassette or Disk Basic

On the data map, each location is represented by five numbers contained in a data statement. The first is the location number. The remaining four numbers correspond to the directions north, south, east, or west, respectively. A zero in any of these four numbers means that the player cannot go in that direction.

Before you run the game for a friend, we suggest that you type in the following lines:

```
5  POKE 16396,175:POKE16397,201
3320  NEW
```

The first change traps the break key, preventing him from looking at the listing. The second erases the program from memory when he is finished playing. ■

Tom Johnstone can be reached at 75 Buntine Road, Wembly Downs, Western Australia 6019, Australia.

Mike Matthews can be reached at 7 Benson Court, Bunbury, Western Australia 6230, Australia.

Program Listing

```
10 REM ------------------------------------------------------
20 REM ---------- LOST ON THE GREAT BARRIER REEF ------------
30 REM ----------          BY TOM JOHNSTONE          ----------
40 REM ----------        AND MIKE MATTHEWS           ----------
50 REM ------------------------------------------------------
60 CLEAR 1000:DIMOB$(30,10),IN$(6),NN$(30),DE$(28)
70 CLS:RANDOM
80 MH=0:CK=0:FC=0:CN=0:LF=0:SS=0:LC=1:TM=100
90 OB$(2,1)="SHELL":OB$(3,1)="TREE"
100 OB$(4,1)="CANNON":OB$(6,1)="KEY"
110 OB$(8,1)="LINE":OB$(9,1)="WATER"
120 OB$(10,1)="SIGN":OB$(11,1)="TRUCK"
130 OB$(13,1)="SIGN":OB$(15,1)="CROCODILE"
140 OB$(18,1)="DEAD FISH":OB$(20,1)="CHAIR"
150 OB$(25,1)="RUBBER DINGY":OB$(28,1)="DESTROYED LIFE RAFT"
160 OB$(28,2)="PLANK":OB$(16,1)="SKULL"
170 OB$(22,1)="LEECH":OB$(21,1)="ABORIGINE"
180 OB$(26,1)="SEA URCHIN":OB$(27,1)="JELLY FISH"
190 GOSUB 2800
200 POKE16419,196
210 POKE16916,0
220 CLS
230 PRINTDE$(LC);
240 GOSUB2580
250 REM ------- CHECK THE FLAGS -------
260 IFLC=1FORI=1TO10:IFOB$(1,I)<>"FUEL CAN"THENNEXTELSEGOTO3240
270 INPUT"YOUR COMMAND ";CM$
280 IFRND(20)<3THENPRINT"YOU HEAR A DRONING AS A PLANE FLIES OVE
R THE ISLAND.....AND RECEDES INTO THE DISTANCE."
290 IFLEN(CM$)=1ANDCM$="N"THENCM$="NOR"
300 IFLEN(CM$)=1ANDCM$="S"THENCM$="SOU"
310 IFLEN(CM$)=1ANDCM$="E"THENCM$="EAS"
320 IFLEN(CM$)=1ANDCM$="W"THENCM$="WES"
330 IFLEN(CM$)=1ANDCM$="I"THENCM$="INV"
340 IFLC=6THENFORI=1TO10:IFOB$(6,I)<>"PLANK"THENNEXTELSE370
350 IFLC=6SS=SS+1
360 IFSS>1PRINT"ARRGGHH! I'VE SUNK! I CAN'T BREATHE! ARRGGHH!":G
OTO3250
370 RESTORE
380 COM$=LEFT$(CM$,3)
390 FORI=1TOLEN(CM$)
400 IFMID$(CM$,I,1)<>" "THENNEXTELSENN$=MID$(CM$,I+1,3)
410 TM=TM-1:IFTM<=0THENPRINT"NIGHTFALL....OH DEAR! I HEAR A GROW
LING....IT'S GETTING CLOSER....ARRGGHH! A CROCODILE!      YOU AR
E RIPPED TO PIECES!":FORI=1TO1000:NEXTI:GOTO3250ELSEIFTM<30PRINT
"IT'S BEGINNING TO GET DARK!"
420 REM ---------- COMMAND SEARCH ----------
430 FOR I=1 TO 29
440 READ DAT$
450 IF DAT$=COM$ THEN ON I GOTO 520,650,830,830,830,830,980,1050
,1090,1200,1290,210,1340,1420,1740,1910,2030,2090,2120,2160,2200
,2260,2350,2370,1420,2470,520,650,2550
460 NEXT I
470 PRINT"I'M SORRY ,BUT THAT WORD IS NOT PART OF MY VOCABULARY
.PLEASE"
480 PRINT"ENTER A VALID COMMAND SO THAT I CAN UNDERSTAND WHAT YO
U ARE "
490 PRINT"SAYING ."
500  GOTO 270
510 REM ---------- GET ----------
520 FORD=1TO6
530 IFIN$(D)=""THEN560
540  NEXTD
550 PRINT"YOU ARE CARRYING TOO MUCH.":PRINT:GOTO270
560 FORE=1TO10
```

Listing continues

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Listing continued

```
570 IFLEFT$(OB$(LC,E),3)=NN$THEN610
580 NEXTE
590 IF NN$="LIF"THEN610
600 PRINT"I DON't SEE IT HERE .":GOTO270
610 IFNN$="CHA"ORNN$="SIG"ORNN$="TRE"ORNN$="WAT"ORNN$="CAN"ORNN$
="TRU"ORNN$="CRO"ORNN$="LIF"THENPRINT"I AM NOT STRONG ENOUGH":GO
TO270
620 IFNN$="KEY"ANDLC=6PRINT"I CAN'T REACH THE KEY":GOTO270
630 IN$(D)=OB$(LC,E):OB$(LC,E)="":PRINT:GOTO210
640 REM ---------- DROP ----------
650 FORD=1TO10
660 IFOB$(LC,D)=""THEN720
670 NEXTD
680 PRINT"THIS AREA IS PILED HIGH WITH JUNK AND I DON't HAVE ANY
 ROOM TO "
690 PRINT"PUT ANYTHING."
700 PRINT
710 GOTO270
720 FORE=1TO6
730 IFLEFT$(IN$(E),3)=NN$THEN780
740 NEXTE
750 PRINT"YOU AREN't CARRYING ANY ";NN$
760 PRINT
770 GOTO270
780 PRINT
790 OB$(LC,D)=IN$(E)
800 IN$(E)=""
810 GOTO210
820 REM ---------- MOVEMENT ----------
830 RESTORE
840 FORI=1TO29
850 READDT$
860 NEXTI
870 IFLC=6THENSS=0
880 IFLC=4ANDCN=0AND(DAT$="SOU"ORDAT$="WES")THENPRINT"BANG!!!! Y
OU ARE BLOWN TO SMITHERINES!!!":GOTO3250
890 FORI=1TOL
900 READKL,N,S,E,W
910 NEXTI
920 IFDAT$="NOR"ANDN>0THENLC=N:GOTO210
930 IFDAT$="SOU"ANDS>0THENLC=S:GOTO210
940 IFDAT$="EAS"ANDE>0THENLC=E:GOTO210
950 IFDAT$="WES"ANDW>0THENLC=W:GOTO210
960 PRINT"I CAN'T GO IN THAT DIRECTION.":GOTO270
970 REM --------- DRINK ---------
980 IFNN$<>"WAT"PRINT"IT IS NOT POSSIBLE TO DRINK THAT":GOTO270
990 IFLC=9PRINT"UGGHHH! THIS RIVER WATER IS TERRIBLE! I THINK I'
VE BEEN POISONED":GOTO3250
1000 IFLC=20PRINT"I CAN'T SEE ANY WATER HERE.":GOTO270
1010 IFLC=6ORLC=7ORLC=10ORLC=11ORLC=12ORLC=15ORLC=16ORLC=17ORLC=
21ORLC=22PRINT"UGGHHH! THIS SWAMP WATER IS STAGNANT! I THINK I'V
E BEEN POISONED":GOTO3250
1020 PRINT"IT TASTES RATHER SALTY."
1030 GOTO270
1040 REM --------- DIG ---------
1050 IFLC<>1ANDLC<>20PRINT:PRINT"I FOUND NOTHING.":GOTO270
1060 PRINT"THE GROUND HERE IS TOO HARD TO DIG IN."
1070 GOTO270
1080 REM ---------- CLIMB ----------
1090 IFLC<>11ANDLC<>16ANDLC<>3THENPRINT"THERE IS NOTHING HERE TO
 CLIMB":GOTO270
1100 IFNN$<>"TRI"ANDNN$<>"TRE"THENPRINT"I CANNOT CLIMB SUCH A TH
ING":GOTO270
1110 IFNN$="TRE"ANDLC<>3PRINT"I CANNOT SEE ANY TREE.":GOTO270
1120 IFNN$="TRE"THENPRINT"ARRGGHH!! A COCONUT HAS FALLEN ON MY H
EAD AND KNOCKED ME OUT!":TM=TM-50:FORI=1TO1000:NEXT:PRINT"TIME =
 ";TM:GOTO270
1130 IFLC=3THENPRINT"I CANNOT SEE ANY THICKET.":GOTO270
1140 PRINT"WHOOPS! I FELL."
1150 IFLC=11THENLC=16ELSELC=11
1160 FORI=1TO500
1170 NEXTI
1180 GOTO210
1190 REM ---------- EAT ----------
1200 IFNN$<>"DEA"ANDNN$<>"FIS"THENPRINT"IT IS NOT POSSIBLE TO EA
T SUCH A THING":GOTO270
1210 FORI=1TO6
1220 IFIN$(I)="DEAD FISH"THEN1260
1230 NEXTI
1240 PRINT"YOU DO NOT HAVE A DEAD FISH"
1250 GOTO270
1260 PRINT"UGGHHH! THE FISH WAS ROTTEN! I THINK I'VE BEEN POISON
ED."
1270 GOTO3250
1280 REM ---------- READ ----------
1290 IFLC<>10ANDLC<>13THENPRINT"THERE IS NOTHING HERE TO READ.":
GOTO270
1300 IFNN$<>"SIG"THENPRINT"I CAN'T READ THAT.":GOTO270
1310 IFLC=10PRINT"CARNIVORES DEVOUR MANY INTERESTING ITEMS!"ELSE
PRINT"TRY TO DIG UP AS MANY CLUES AS POSSIBLE!"
1320 GOTO270
1330 REM ---------- EXAMINE ----------
1340 IFNN$="CHA"ORNN$="TRU"ORNN$="LIN"ORNN$="CAN"THEN1350ELSEPRI
NT"I SEE NOTHING SPECIAL":GOTO270
1350 IFNN$="CHA"ANDLC=20PRINT"THERE IS A CRACK IN THE LUG":GOTO2
70
1360 IFNN$="TRU"ANDLC=11PRINT"INSIDE THERE IS A LARGE CAN OF GAS
OLINE":GOTO270
1370 IFNN$="LIN"THENFORI=1TO6:IFIN$(I)<>"LINE"THENNEXTELSEPRINT"
IT HAS A HOOK ON THE END":GOTO270
1380 IFNN$="CAN"ANDLC=4PRINT"IT IS A SWIVEL MOUNTED ARTILLERY GU
N":GOTO270
1390 PRINT"I CAN'T SEE THAT HERE"
1400 GOTO270
1410 REM ---------- GO ----------
1420 IFNN$="LIF"ORNN$="DIN"ORNN$="RUB"ORNN$="RAF"THEN1470
1430 IFNN$="EAS"ORNN$="WES"ORNN$="NOR"ORNN$="SOU"THENDAT$=NN$:GO
TO830
1440 IFNN$="BUI"ANDLC=15ANDMH=1THENLC=20:GOTO210ELSEIFNN$="BUI"T
HENPRINT"I FIND IT HARD TO DO THAT AT THE MOMENT":GOTO270
1450 PRINT"HOW IS IT POSSIBLE TO ENTER SUCH A THING!"
1460 GOTO270
1470 IFNN$="RUB"ORNN$="DIN"THEN1490
1480 GOTO1540
1490 FORI=1TO10
1500 IFOB$(LC,I)="RUBBER DINGY"THEN1600
1510 NEXTI
1520 PRINT"I CAN'T SEE A DINGY"
1530 GOTO270
1540 IF(NN$="RAF"ORNN$="LIF")ANDLF=0THEN1560
1550 GOTO1580
1560 IFLC=1THENLC=4:GOTO210
```

Listing continues

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Listing continued

```
1570 IFLC=4THENLC=1:GOTO210
1580 PRINT"THE LIFEBOAT WAS PREVIOUSLY DESTROYED"
1590 GOTO270
1600 IFLC=1THENLC=4:GOTO1620
1610 IFLC=4THENLC=1
1620 IFLC=1THENOB$(4,I)="":GOTO1640
1630 GOTO1700
1640 FORI=1TO10
1650 IFOB$(1,I)=""THEN1680
1660 NEXTI
1670 GOTO1700
1680 OB$(1,I)="RUBBER DINGY"
1690 GOTO210
1700 IFLC=4THENOB$(1,I)="":FORI=1TO10:IFOB$(4,I)<>""THENNEXTIELS
EOB$(4,I)="RUBBER DINGY"
1710 IFLC<>4ANDLC<>1THENPRINT"NOTHING HAPPENS":GOTO270
1720 GOTO210
1730 REM -------------- HELP! --------------
1740 ONRND(5)GOTO1750,1780,1810,1840,1870
1750 PRINT"OPEN YOUR EYES!"
1760 PRINT
1770 GOTO270
1780 PRINT"I'M SORRY, BUT I CANNOT HELP YOU HERE"
1790 PRINT
1800 GOTO270
1810 PRINT"I'M NOT IN A HELPFUL MOOD!"
1820 PRINT
1830 GOTO270
1840 PRINT"YOU COULD EXAMINE THE LISTING!"
1850 PRINT
1860 GOTO270
1870 PRINT"YOU'RE NOT GOING TO DIG ANY INFORMATION OUT OF ME!"
1880 PRINT
1890 GOTO270
1900 REM --------- OPEN ---------
1910 IFNN$="DOO"ANDMH<>1ANDLC=15ANDCK=1THENFORI=1TO6:IFIN$(I)<>"
KEY"THENNEXTELSE1980
1920 IFNN$="DOO"ANDLC=15ANDCK=0THENPRINT"THE CROCODILE TEARS YOU
 TO PIECES!":GOTO3250
1930 IFNN$="TRU"ANDLC=11ANDFC<>1THENFORI=1TO6:IFIN$(I)<>"HAIR PI
N"THENNEXTELSE2000
1940 IFNN$="DOO"ANDLC=15ANDMH=1PRINT"IT'S ALREADY OPENED":GOTO27
0
1950 IFNN$="TRU"ANDLC=11ANDFC=1PRINT"IT IS ALREADY OPENED":GOTO2
70
1960 PRINT"I CAN'T OPEN SUCH A THING"
1970 GOTO270
1980 MH=1
1990 GOTO210
2000 FORI=1TO10
2010 IFOB$(LC,I)<>""THENNEXTELSEOB$(LC,I)="FUEL CAN":FC=1:GOTO21
0
2020 REM ------------------- FEED --------------------
2030 IFNN$<>"CRO"PRINT"IT IS NOT POSSIBLE TO FEED A NON-LIVING T
HING":GOTO270
2040 IFLC<>15PRINT"I CAN'T SEE A CROCODILE":GOTO270
2050 FORI=1TO6:IFIN$(I)<>"DEAD FISH"THENNEXTIELSE2070
2060 PRINT"YOU AREN'T CARRYING ANTHING TO FEED IT WITH":GOTO270
2070 CK=1:IN$(I)="":PRINT"THE CROCODILE GORGES HIMSELF ON THE FI
SH":GOTO270
2080 REM --------- KILL ---------
2090 IFNN$<>"CRO"ORLC<>15PRINT"THAT ISN'T POSSIBLE":GOTO270
2100 PRINT"KILL A CROCODILE? IT RIPS YOU TO TINY SHREDS AND KNAW
S YOU TO   THE BONE":GOTO3250
2110 REM ------------ QUIT -------------
2120 POKE16916,0
2130 POKE16419,176
2140 END
2150 REM --------- BREAK ---------
2160 IFNN$<>"CHA"PRINT"I AM NOT ABLE TO DO THAT":GOTO270
2170 IFOB$(LC,1)="CHAIR"THEN2180ELSEPRINT"I CAN'T SEE ANY CHAIR"
:GOTO270
2180 PRINT"IT SPLITS APART AND SOMETHING FALLS OUT":OB$(20,1)="H
AIR PIN":FORI=1TO1000:NEXTI:GOTO210
2190 REM ------------ INVENTORY ------------
2200 PRINT "YOU ARE CARRYING THE FOLLOWING :-"
2210 FOR D=1 TO 6
2220 IFIN$(D)<>""THENPRINT "          ";IN$(D)
2230 NEXT D
2240 PRINT:GOTO 270
2250 REM ------------ HOOK ------------
2260 FORI=1TO10
2270 IFOB$(LC,I)=NN$THEN2300ELSENEXT
2280 PRINT"I CAN'T SEE THAT HERE"
2290 GOTO270
2300 IFNN$<>"KEY"THENPRINT"IT IS NOT POSSIBLE TO HOOK SUCH A THI
NG":GOTO270
2310 FORD=1TO6:IFIN$(D)<>"LINE"THENNEXTELSE2330
2320 PRINT"YOU HAVE NOTHING TO HOOK IT WITH":GOTO270
2330 OB$(LC,I)="":FORI=1TO6:IFIN$(I)<>""THENNEXTELSEIN$(I)="KEY"
:PRINT"OKAY":GOTO210
2340 PRINT"I AM CARRYING TOO MUCH":GOTO270
2350 PRINT:PRINTNN$:PRINT:GOTO270
2360 REM ------------ TURN ------------
2370 IFNN$<>"CAN"THENPRINT"I CANNOT TURN ONE OF THOSE":GOTO270
2380 IFLC<>4THENPRINT"I CANNOT SEE THAT HERE":GOTO270
2390 IFCN=1THENPRINT"NOTHING SEEMS TO HAPPEN":GOTO270
2400 CN=1
2410 PRINT:PRINT"OH NO! THE CANNON HAS BLOWN UP YOUR LIFEBOAT!"
2420 LF=1
2430 FORI=1TO1000
2440 NEXTI
2450 GOTO210
2460 REM ----------- LISTEN -----------
2470 FORI=1TO6
2480 IFLEFT$(IN$(I),3)<>NN$THENNEXTELSE2510
2490 PRINT"YOU AREN'T CARRYING IT"
2500 GOTO270
2510 IFNN$<>"SHE"PRINT"I CANNOT HERE A THING":GOTO270
2520 PRINT"THERE MAY BE MORE THAN ONE KEY TO SOLVING THIS ADVENT
URE"
2530 GOTO270
2540 REM --------- TIME ---------
2550 PRINTTM" TURNS LEFT UNTIL IT GETS DARK"
2560 GOTO270
2570 REM ----------- SCREEN SETUP ------------
2580 IFLF=0AND(LC=1ORLC=4)PRINT" THERE IS A LIFEBOAT HERE."ELSEP
RINT""
2590 PRINT"VISIBLE ITEMS :-"
2600 FORD=1TO10
```

Listing continues

TRS-80
MODEL I MODEL III MODEL 4

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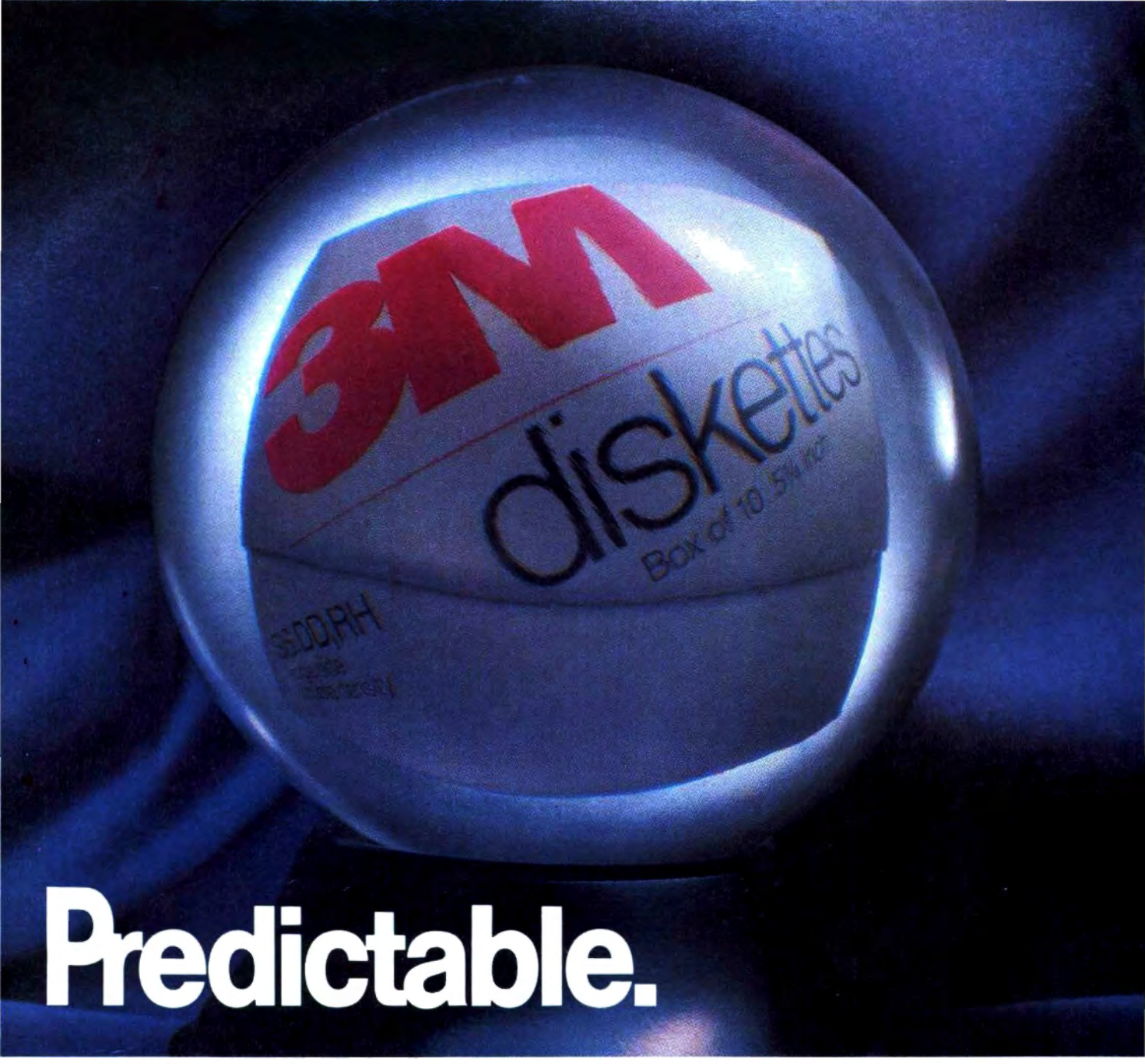
```
2610 IFOB$(LC,D)=""THEN2620DELSEPRINT OB$(LC,D);"  ";
2620 NEXT D
2630 PRINT:PRINT:PRINT"POSSIBLE EXITS:-   ";
2640 RESTORE
2650 FORI=1TO29
2660 READDT$
2670 NEXTI
2680 FORI=1TOLC
2690 READKL,N,S,E,W
2700 NEXTI
2710 IFMH=0ANDLC=15THENS=0
2720 IFN>0PRINT"NORTH ";
2730 IFS>0PRINT"SOUTH ";
2740 IFE>0PRINT"EAST ";
2750 IFW>0PRINT"WEST";
2760 PRINT@384,STRING$(64,140)
2770 POKE16916,7
2780 RETURN
2790 REM -------- INSTRUCTIONS --------
2800 PRINT"    WELCOME  TO  LOST  ISLAND,  A  MOST  CHALLENGING
 ADVENTURE"
2810 PRINT"WRITTEN BY TOM JOHNSTONE AND MIKE MATTHEWS .  IN THIS
 ADVENTURE"
2820 PRINT"YOU WILL TRAVEL THROUGH A MYSTERIOUS ,  ABANDONED WOR
LD WAR TWO"
2830 PRINT"NAVAL BASE ON A DESERTED TROPICAL ISLAND IN THE PACIF
IC  HOPING"
2840 PRINT"TO FIND A WAY TO GET OFF THE ISLAND AND BACK HOME SAF
ELY. WHILE"
2850 PRINT"PLAYING THIS GAME YOU MAY USE VARIOUS TWO-WORD COMMAN
DS TO MOVE"
2860 PRINT"AND PERFORM ACTIONS.  THESE COMMANDS MUST CONSIST OF
A VERB AND"
2870 PRINT"A NOUN ( IN THAT ORDER ). OVER FIFTY WORDS CAN BE USE
D TOGETHER"
2880 PRINT"IN ANY COMBINATION,  SO IF YOU GET STUCK FOR A WORD T
RY ANOTHER"
2890 PRINT"WITH A SIMILAR MEANING. SOME WORDS WHICH CAN BE USED
ARE DROP ,"
2900 PRINT"GET, ENTER AND INVENTORY. IT MAY ALSO BE A GOOD IDEA
TO MAKE  A"
2910 PRINT"MAP AS YOU GO ALONG.  REMEMBER , YOU ONLY HAVE A LIMI
TED AMOUNT""
2920 PRINT"OF TIME BEFORE IT GETS DARK, AND ALL SORTS OF CREATUR
ES ROAM IN"
2930 PRINT"THE DARK, DON'T THEY? ( TO FIND OUT HOW MUCH TIME IS
LEFT ENTER"
2940 PRINT"THE COMMAND 'TIME' )."
2950 INPUT"                                        PRESS <ENTE
R>";A$
2960 REM --------- DESCRIPTIONS ---------
2970 DE$(1)="YOU ARE IN A MOTOR BOAT ANCHORED OFF A PACIFIC ISLA
ND.":DE$(2)="YOU ARE STANDING ON A STRETCH OF DESOLATE, SANDY BE
ACH.":DE$(3)="YOU ARE ON A STRETCH OF COMPLETELY DESERTED BEACH
ON AN ATOLL."
2980 DE$(4)="THIS IS A LARGE AND ROTTING LANDING PLATFORM FOR LA
RGE SHIPS.":DE$(5)="A GRASSED AREA STRETCHES AWAY TO EITHER SIDE
 OF YOU ALONG THE   SEA.":DE$(6)="OH NO! YOU ARE SLOWLY SINKING
INTO SINKING SAND IN A LARGE BOG."
2990 DE$(7)="YOU ARE STANDING AT THE EDGE OF A SWAMP WITH LOW SC
RUB TO THE   NORTH.":DE$(8)="YOUR FEET SINK UP TO THEIR KNEES AS
 YOU STEP INTO A SHALLOW ROCKPOOL":DE$(9)="THIS AREA IS A SANDY
BEACH WITH A SMALL STREAM TRICKLING INTO   THE SEA."
3000 DE$(10)="YOU ARE AT THE EDGE OF A DAMP SWAMP, RUNNING DOWN
TO THE WEST.":DE$(11)="YOU ARE STANDING TO THE NORTH OF A THICKE
T IN THE SWAMP.":DE$(12)="YOU ARE AT THE RIM OF A LARGE BAD SMEL
LING SWAMP."
3010 DE$(13)="YOU ARE ON A LARGE STRETCH OF WHITE, SANDY BEACH O
N AN ISLAND.":DE$(14)="THIS AREA IS A GRASSED AREA BORDERING A L
ARGE TROPICAL OCEAN.":DE$(15)="YOU ARE STANDING IN A SWAMP, SOUT
H IS A BUILDING WITH A DOOR."
3020 DE$(16)="YOU ARE WADING IN THE STINKING HEART OF A SWAMP SU
RROUNDED BY   REEDS":DE$(17)=DE$(16):DE$(18)="YOU ARE STANDING O
N A WIDE EXPANSE OF WHITE SANDY BEACH.":DE$(20)="YOU ARE IN A RU
NDOWN, ABANDONNED, NAVAL MESS HALL."
3030 DE$(19)="YOU ARE STANDING ON A GRASSY BEACH TO THE WEST OF
A BUILDING.":DE$(21)="YOU ARE STANDING IN A DISMAL SWAMP TO THE
EAST OF A BUILDING."
3040 DE$(22)=DE$(16):DE$(23)=DE$(18):DE$(24)="YOU ARE STANDING O
N THE SOUTHWEST CORNER OF A TROPICAL ISLAND.":DE$(25)="YOU ARE S
TANDING ON A SANDY BEACH SOUTH OF A BUILDING.":DE$(26)=DE$(23):D
E$(27)=DE$(23)
3050 DE$(28)="YOU ARE STANDING ON AN EXPOSED REEF AT THE SOUTHEA
ST CORNER OF  THE ISLAND."
3060 RETURN
3070 REM ---------- VERBS ----------
3080 DATA"GET","DRO","SOU","WES","EAS","NOR","DRI","DIG","CLI","
EAT","REA","LOO","EXA","ENT","HEL","OPE","FEE","KIL","QUI","BRE"
,"INV","HOO","SAY","TUR","GO ","LIS","TAK","PUT","TIM"
3090 REM ---------- DATA MAP ----------
3100 DATA1,0,0,0,0,2,0,3,3,0
3110 DATA3,0,6,4,2,4,0,7,0,3
3120 DATA5,2,9,6,0,6,3,10,7,5
3130 DATA7,4,11,8,6,8,0,12,0,7
3140 DATA9,5,14,10,0,10,6,15,11,9
3150 DATA11,7,0,12,10,12,8,17,13,11
3160 DATA13,0,18,0,12,14,9,19,15,0
3170 DATA15,10,20,16,14,16,0,21,17,15
3180 DATA17,12,22,18,16,18,13,23,0,17
3190 DATA19,14,24,0,0,20,15,0,0,0
3200 DATA21,16,26,22,0,22,17,27,23,21
3210 DATA23,18,28,0,22,24,19,0,25,0
3220 DATA25,0,0,26,24,26,21,0,27,25
3230 DATA27,22,0,28,26,28,23,0,0,27
3240 PRINT:PRINT"CONGRATULATIONS! YOU WERE ABLE TO ESCAPE FROM T
HE DESERTED      ISLAND!"
3250 FORI=1TO1250
3260 NEXTI
3270 POKE16916,0
3280 CLS
3290 INPUT"DO YOU WANT TO TRY THIS ADVENTURE AGAIN ";TR$
3300 IFLEFT$(TR$,1)="Y"THEN3330
3310 POKE16916,0
3320 END
3330 CLEAR0:GOTO60
```



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Once More, With Feeling

by G. Michael Vose

Tandy has come a long way since the days of the Model I. Just look at the Model 4, with 64K, 4 MHz, and CP/M potential, for only $1,999.

★★★★★

Model 4
Tandy/Radio Shack
Fort Worth, TX 76102
$1,999

In the microcomputer game, the byword of late seems to be, "Anything you can do, I can do better." If it's not a price reduction or a smaller disk drive, it's a computer with a lower chip count.

Denser VLSI chips with low power consumption not only bring us exciting new products like Tandy's portable Model 100, they also make possible second- and third-generation spinoffs of existing machines.

For Apple, new chip technology provided the Apple IIe earlier this year. Similar advances now bring us the TRS-80 Model 4, an improved version of the computer that started life as the Model I.

If you own a Radio Shack computer, your mailbox brought the news of this new computer in late April. You probably remember the basics—4 MHz Z80 CPU, 64K of memory expandable to 128K, and an 80-column screen display, plus a new version of TRSDOS and the prospect of CP/M. Now it's time to find out what all the hoopla is about.

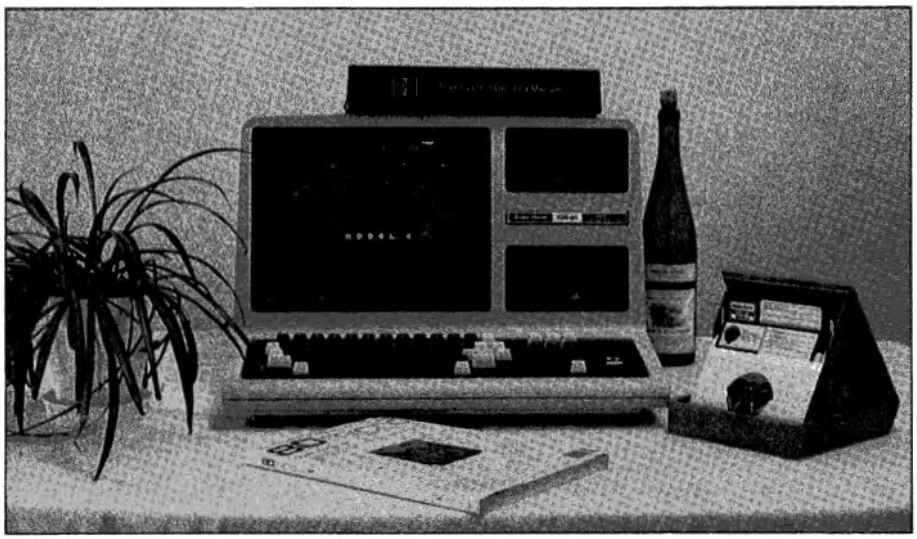


Photo 1. The Model 4. (All photographs in this article by Jeff DeTray.)

A Wolf in Sheep's Clothing

The Model 4 comes in three standard configurations: a 16K cassette-based system selling for $999, a 64K one-drive system without an RS-232 communications port for $1,699, and a 64K two-drive system with RS-232 port for $1,999. All this is packaged in a textured, off-white cabinet similar to that on the Model III.

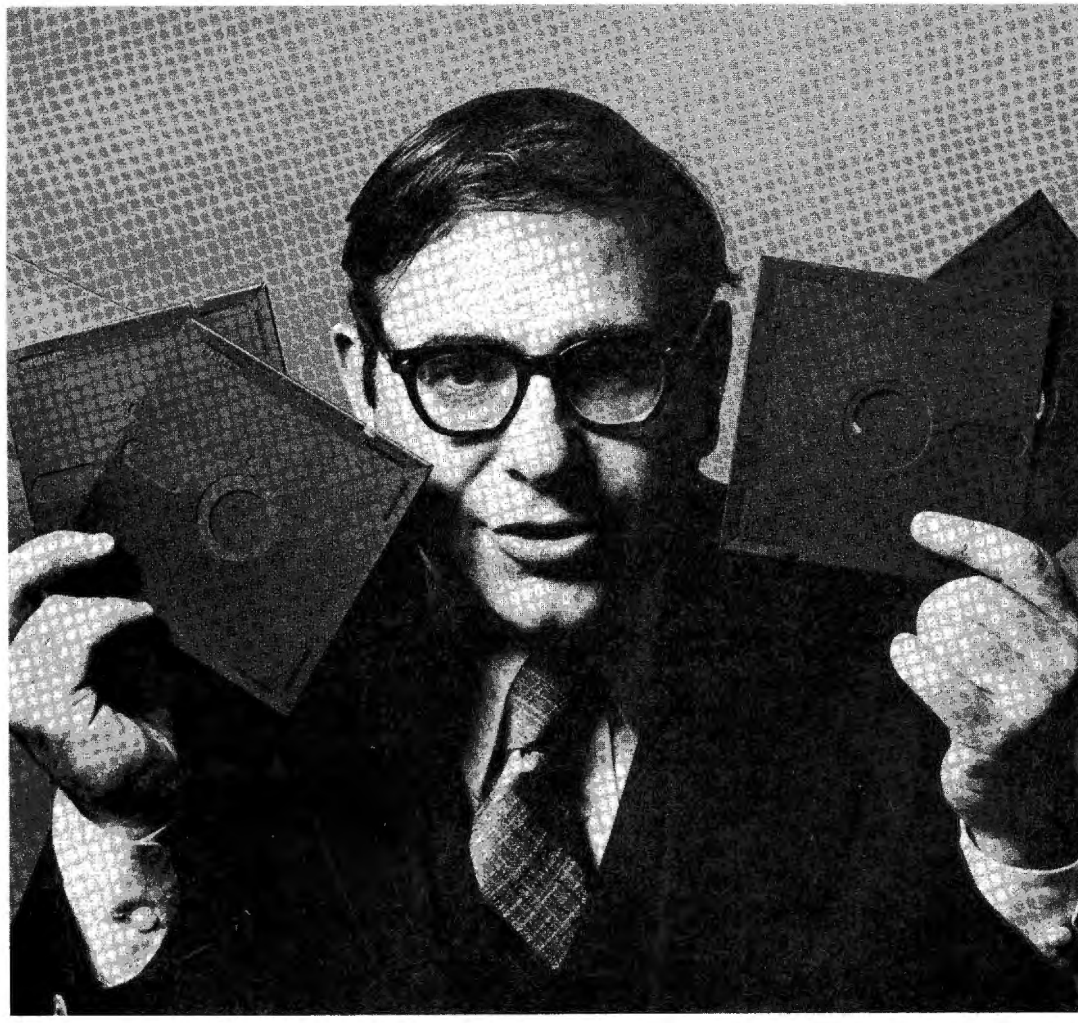
Like the Apple IIe, however, it's what's inside that makes the Model 4 different. Using advances in chip design and packaging, Radio Shack reduced the number of components required to build the Model 4's circuits.

This component reduction provides increased computing power *and* lower cost. Radio Shack passed these savings along to consumers and simultaneously beefed up the Model 4 with additional features in a machine priced less than a 1982 Model III.

For example, using new video circuitry, the Model 4 provides an 80-column by 24-line high-resolution video display of excellent quality. An on-board speaker generates sound, and a reworked keyboard is easier to use.

I'll examine these features in detail below and tell you how Radio Shack put it all together. I think the Model 4's new hardware makes this machine as powerful as any Z80 computer available today, particularly at its price.

With computers, however, "hardware doth not a workable solution make," as the Bard might have quipped. The $64,000 question is always, "What



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software will it run?" Let's first look at the Model 4 from the software angle.

The Software

Earlier, Radio Shack tried to maintain software compatibility between the Model I and III; they followed this tradition with the Model 4. The machine has a Model III mode—much like the Model 16 has a Model II mode—so it runs Model III software.

". . . you can run virtually any Radio Shack software that runs on a Model III. . ."

In the Model III mode, however, you only get a 64 by 16 display and 2 MHz CPU operation, and you can only use a Model III operating system and Basic. It's a bit like putting a Volkswagen engine in a Cadillac.

In this Model III mode, you can run virtually any Radio Shack software that runs on a Model III—including Model I software that runs on a Model III. Model III software manufactured by companies other than Radio Shack might *not* run on the Model 4, however.

For example, certain game programs that feature special loaders (designed to foil attempts to copy the disks the games are shipped on) might fool the Model 4's bootstrap loader, since this loader is different from the Model III's; these programs can't be loaded so they can't be run in either mode.

Some people will be uncomfortable with the Model 4 in Model III mode because the video display looks slightly squashed. The letters appear to have the same width as they do on a Model III screen, but they look more squat. The Model 4's characters in Model III mode actually have better resolution than the characters on a Model III screen but they take a while to get used to.

What software does the Model 4 run as a Model 4? For the time being, the only Model 4 software available is an operating system, TRSDOS 6.0, and the latest version of Microsoft Basic, version 5.0. In the next few months, Radio Shack is expected to announce SuperScripsit, VisiCalc, and other applications packages for the Model 4.

At the official debut of the Model 4—the general meeting of the prestigious Boston Computer Society on April 27, chosen partly to commemorate the 20th anniversary of Tandy's acquisition of Radio Shack—Jon Shirley claimed that "lots of software never offered for the Model III will be available for the Model 4, taking advantage of its 80-column display and 128K memory."

The biggest news is that CP/M 3.0 will be available for the Model 4 in midsummer, opening up another dimension of software possibilities from WordStar to Supercalc, dBASEII to PerfectWriter. You can expect to see dozens of ads from companies selling CP/M software converted to the Model 4's disk format in these pages in the near future.

While there have been no official announcements, you can also expect the Model 4 to support the UCSD p-system, along with several good Pascal compilers. Eventually, you might be able to run C and Ada compilers on the Model 4.

A New Version of Basic

For now, however, you must be content with TRSDOS 6.0 and Basic. This certainly poses no limitation as both these software constructs are as powerful as any Radio Shack has ever offered.

Microsoft Basic 5.0 (identified on the Model 4 screen as "BASIC 01.00.00 for TRSDOS Version 6" and in the manual as "TRSDOS 6 Basic") is the same Basic that runs on the IBM Personal Computer, the NEC PC8000, the Victor 9000, and several other major microcomputers.

This version of Basic supports all Level II Basic commands except CSAVE, CLOAD, Clock, CMD, POSn, Rename, and Verify. The Model 4 does not support cassette-based operations from Basic.

Basic 5.0 adds these new keywords: Chain, Common, ERR$, OCT$, Option Base, RENUM, Row, SPACE$, SPC, Swap, Wait, While. . . Wend, and WRITE#. Table 1 summarizes the functions of these new keywords.

There are some significant differences in the new Basic and Level II Basic. One that takes some getting used to is the new Basic's requirement that all reserved words be delimited by spaces. You cannot write FORX = 1TO10, for example, or DEFUSR. Instead, you must write FOR X = 1 TO 10 and DEF USR.

This is no small task when you start converting Level II Basic programs to run on the Model 4. Since you can copy Level II programs onto Model 4 disks and subsequently load them into TRSDOS 6.0 Basic, you will have to convert programs before you run them.

A feature of TRSDOS 6.0 Basic that

is easy to get used to is its ability to use variable names of up to 40 characters in length—with all 40 characters significant. This lets you use descriptive variable names, including multiple word names like *first.counter*. Meaningful variable names enhance program readability.

TRSDOS 6.0 Basic rounds numbers rather than truncates them in converting real numbers to integers. Since the Model 4 uses an 80-column display, its internal print zones are 20 spaces apart rather than the 16 spaces in the Model I and III. As discussed under hardware, the Model 4 is a RAM-based machine, so there are no ROM routines to access from Basic.

TRSDOS 6.0 Basic dynamically allocates string space, making Clear statements unnecessary. Division-by-zero errors are not fatal and Then is optional in If...Then...Else statements.

These features make TRSDOS 6.0 Basic a more powerful language, but there are a few "gotcha's."

The first gotcha is the amount of memory available for Basic programs. With the operating system and the entire Basic interpreter residing in user memory, only 29,424 bytes of program space are available. The Model III, with much of the interpreter in ROM, gives you 38,202.

Second, with spaces necessary to delimit key words and with long variable names possible, TRSDOS 6.0 Basic programs eat up memory more quickly.

Conspicuous by its absence in TRSDOS 6.0 Basic are the key words Sound and Play, used by other computers to access the machine's sound capability. In fact, the Model 4 manual says very little about the unit's sound capability.

TRSDOS 6.0

The Model 4 operating system is called TRSDOS 6.0, and is an upgrade of Logical Systems Inc.'s LDOS 5.x.x. It was christened version number 6.0 to distinguish it from previous versions of TRSDOS and from previous versions of LDOS.

LDOS has been reviewed extensively in these pages; it is a powerful operating system offering job control language, device control, software filters, and numerous utilities. I call LDOS a programmer's operating system, due both to its power *and* (another gotcha) its complexity.

The main criticism I'll level at Radio Shack regarding the Model 4 is this operating system—not because it lacks power, but because it is hard to use.

I've used LDOS extensively and know my way around it pretty well. I've also used DOSPLUS and MULTIDOS extensively, in addition to TRSDOS 2.x and 1.x. Of all these operating systems, LDOS is the most difficult to use. TRSDOS 6.0, unfortunately, features all of LDOS's obscurity.

For experienced computerists or semiprofessional and professional programmers writing applications software for the Model 4, LDOS presents no problems. But many newcomers to computing, buying a Model 4 as their first machine, might find TRSDOS 6.0 a difficult introduction.

Radio Shack would better serve the vast new audience the Model 4 will attract (since it can double as a CP/M computer) by writing a shell to insulate the average user from the operating system. This shell could present a menu offering major choices such as formatting and backing up a disk, loading a program, copying a program, and exiting to the operating system. Such a shell could make operating system blues a thing of the past.

Part of the problem with LDOS and TRSDOS 6.0 is the documentation.

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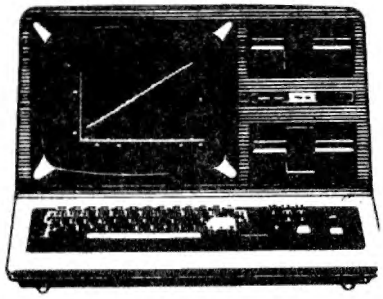

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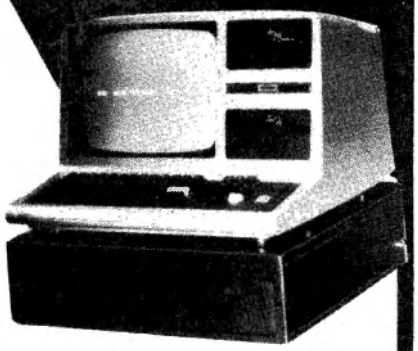

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While the manual is well organized and reasonably well-written, it seldom tells you all you need to know to accomplish a task.

For example, TRSDOS 6.0 comes with a filter file called CLICK/FLT. This software filter is used to produce an audible click when you strike the Model 4's keys. To engage the filter, you must set the keyboard.

In Appendix A, where you are directed by looking in the index for the entry CLICK/FLT, the manual offers this syntax for engaging the filter:

```
SET devspec CLICK/FLT
FILTER *KI devspec
```

The accompanying text states, "In order to use the click filter, you must SET it to this filter program, and activate it with the FILTER command." If you follow these instructions an error message appears stating that the device (the keyboard) is already set.

A lot of additional reading indicates that you must first set the physical device equal to a phantom device before you activate the filter. The information is there, but *not in one place*, a drawback typical of the manual.

When you're working with a complex program, it's impossible to provide concise instructions. But I believe that it can be done more effectively than it has been with the Model 4 TRSDOS manual.

(By the way, here is the syntax needed for the CLICK/FLT filter:

```
SET *PD TO CLICK/FLT
FILTER *KI *PD
```

This sequence sets a phantom device (PD) to the filter file and then filters the keyboard through the phantom device, which in turn invokes the filter file. All this to make your keys click!)

In spite of its complexity and inadequate documentation, TRSDOS 6.0 is the best operating system offered by Radio Shack for one of its computers (Xenix and CP/M 3.0 were not available for inspection at this writing).

Of major importance is the conversion (CONV) utility, which lets you copy files from TRSDOS 1.2- and 1.3-formatted disks to TRSDOS 6.0. Therefore, Model III owners who buy the Model 4 upgrade kit (see Hardware, below) can easily convert Basic programs to the Model 4, as can anyone with Model III programs on disk.

The only Model III disk the Model 4 won't copy is a copy-protected Scripsit or VisiCalc disk, or a disk with a nonstandard format.

You can even convert machine-language programs. But they might not run on the Model 4 (remember, there are no ROM routines). I immediately copied Scripsit and VisiCalc from an LDOS 5.1 disk to a TRSDOS 6.0 disk (TRSDOS 6.0 reads LDOS disks without the need for CONV) only to discover that the programs did not execute in the Model 4 environment.

Another major utility is the communications (COMM) program, a terminal program that lets you use your Model 4 to talk to other computers via the RS-232 communications line. COMM even allows you to obtain information from another computer and send it directly to a printer attached to your machine.

Two other interesting utilities are the TAPE100/CMD file, which allows the Model 4 to read Model 100 tapes, and the MEMDISK/DCT file, which allows a disk drive to be simulated in RAM if you have a full 128K. (*80 Micro* will present separate articles about these capabilities of the Model 4 in upcoming issues.)

TRSDOS 6.0 supports hard-disk

Chain	Chains one program to another and initiates a run of the last program chained.
Common	Reserves space for variables so they can be passed to a chained program.
ERR$	Returns a system error number and message.
OCT$	Converts a decimal number to octal.
Option Base	Resets the minimum value for an array subscript.
RENUM	Renumbers a program.
Row	Returns the row position of the cursor.
SPACE$	Prints a string with zero-255 spaces.
SPC	Prints a line with between zero-255 spaces.
Swap	Exchanges the values of two variables.
Wait	Suspends program execution until an input/output port receives a value.
While...Wend	Executes a loop as long as the entry condition is true.
WRITE#	Writes data to a sequential-access disk file (replaces PRINT#).

Table 1. New TRSDOS 6.0 Basic keywords

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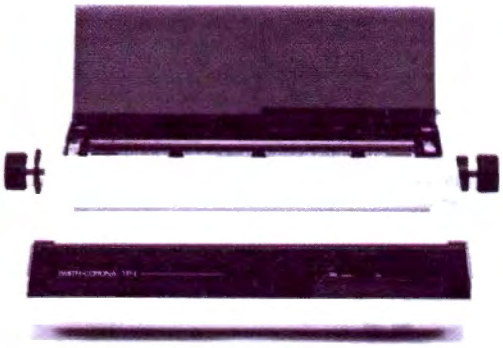

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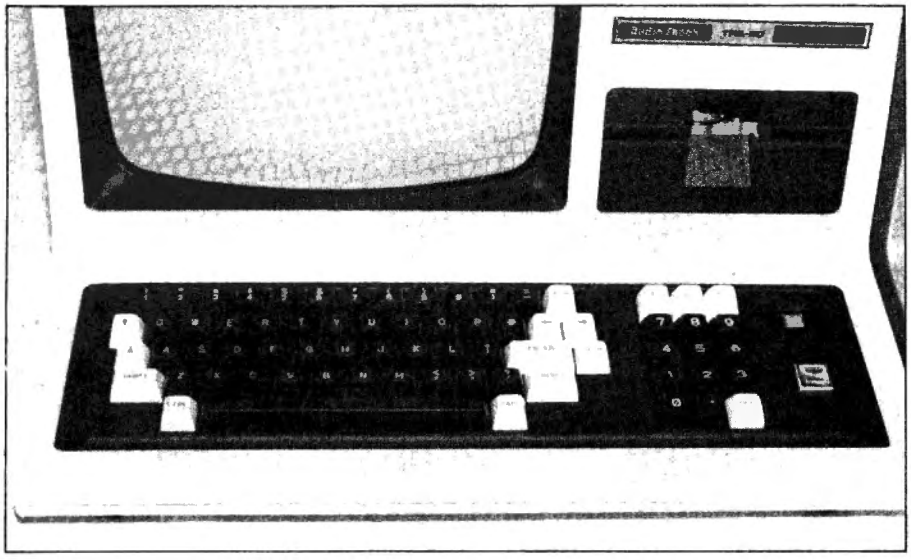

Photo 2. The Model 4's Keyboard.

operation, although the Model 4 manual contains virtually no information about this. The occasional reference to hard disks refers the reader to the Radio Shack hard-disk manual for information.

The Hardware

Now that you have an idea of what the Model 4 can and cannot do from a software standpoint, let's look inside the cabinet to discover what hardware goodies make up this affordable new machine.

But before we go inside, let's look at the outside. The primary difference is a new paint job and a modified keyboard. There isn't much to say about the paint—it's off-white—but the keyboard has some nice new keys (see Photo 2).

The first thing you notice is that where the Model III has three white keys, the Model 4 has 15. In addition to the enter keys, the four cursor control keys, the shift keys, and the break and clear keys are white. Also white are five new keys—control, caps, and three function keys (labelled F1, F2, and F3).

Besides the keyboard and cabinet color, you'll find that only the nameplate and the RAM-size emblem differ from those on the Model III.

The Model 4 uses the same disk drives as the Model III—single-sided, double-density drives with 160K capacity—and supports a maximum of four drives.

Disk operation is a bit different with the Model 4. A small, on-board ROM turns on the disk drive when you first turn on or reset the machine. This ROM reads the first track on the disk in drive zero and determines whether the disk is a Model III or Model 4 (or, ultimately, a CP/M) disk.

If the disk is for a Model III, a hardware multiplexer switches out the first 16K of RAM and switches in 14K of ROM, plus 2K of system RAM, and emulates a Model III. When a Model 4 (or CP/M) disk is decoded, the full 64K of RAM is used and the entire operating system loads into RAM from the disk.

The CPU Board

The main reason for the Model 4's increased processing power and lower cost is a lower chip count. Overall, the 64K Model 4, with 84 chips, has 23 fewer chips than a 48K Model III (with 107 chips).

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Semi-Custom Logic Circuits

The Model 4 makes use of new, VLSI (very large-scale integration—over 1,000 transistors on a chip) semi-custom logic chips. These chips are also called programmable gate array logic chips.

Essentially, a semi-custom logic chip contains a large number of standard circuits, called gates, for hardware implementation of Boolean logic functions—ANDs, ORs, NORs, and NANDs. These circuits are not connected to each other until the chip is programmed, a process similar to encoding ROM chips.

A gate is simply a circuit with two or more inputs and one output. A gate array is a geometric pattern of gates that can be combined during manufacture (or when programmed, as in the newest generation of programmable gate arrays) to perform a complex function.

The logic circuits on the chip are combined to produce multiplexing circuits, flip-flops, address decoding circuits, bus control logic, and the like. Once the design of the circuits is fixed, many chips (in Tandy's case, hundreds of thousands) are programmed.

Semi-custom chips have several advantages. Because they are already fabricated, economies of scale keep their cost down. They allow circuit designers to build boards with empty sockets while all the other circuits on the board are built—the designer can design around this "hole" and come back later to install the customized IC once the overall design is complete. ■

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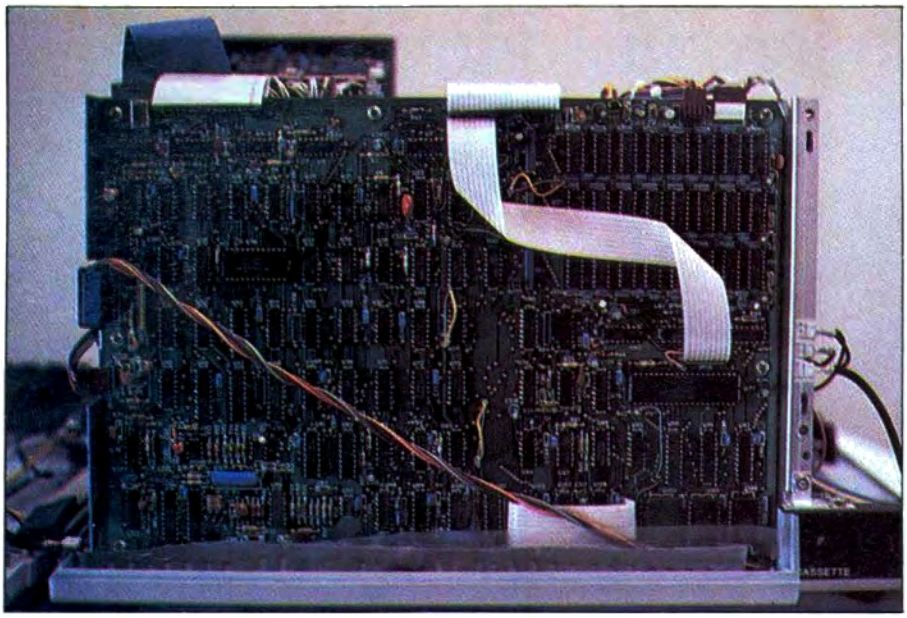

Photo 3. Model III CPU Board.

namic RAM chips rated at 100 nanoseconds versus the Model III's 16K x 1's. This alone reduces the chip count for 64K from 24 to eight chips.

Much of the bus control logic circuitry and address decoding circuitry is consolidated onto programmable gate array logic chips (see accompanying box), further reducing the chip count.

Finally, the video control circuitry is replaced by a custom video chip to reduce the chip count even further, while providing better resolution plus two character sets—one for the 64 by 16 (Model III mode) display, the other for the 80 by 24 or 40 by 24 display.

The microprocessor is the workhorse Z80A running at a fast 4 MHz. The increased speed of the processor accommodates the extra decoding hardware and software necessary to bank-select an extra 64K of RAM. (It'll also sort your mailing list faster.)

The Model 4's power supply is consolidated onto one board, replacing the two-board power supply in the Model III, giving the machine a much cleaner look (see Photos 3 and 4). The disk drive housing is better shielded than the Model III's.

The Model 4 I reviewed carried the serial number 0026691 (the model number is 26-1069). This machine's CPU board has a substantial number of reworked and rewired circuits; in fact, one IC has a pin bent up away from the socket it normally occupies and an attached wire leading to another circuit.

It thus appears that some early models were altered in the latter stages of production. (An American folk tale says never buy a new model car until they've made a few thousand; does this wisdom apply to computers, too?)

The Model 4 video display offers substantially higher resolution than the Model III. It looks like the Model II/12/16 display, with the same 80-column character set. Preproduction rumors claimed the Model 4's display would be green—they were wrong; it's white-on-black. The display does support reverse video, however, and a high-resolution graphics board is offered as a $249.95 option.

Model III owners can upgrade their machine to a Model 4 for $799. The upgrade includes a new CPU board and keyboard installed in your existing Model III cabinet (installation charges are extra). A Model 4 upgrade also provides the new operating system and Basic.

The 64K memory expansion for the Model 4 costs $149. The CPU board has eight empty sockets for the extra chips needed for this upgrade.

The 50-pin expansion bus on the Model 4 is identical to that of the Model III, as is the RS-232 circuitry.

Little information is available at this time about the machine's sound capability. As mentioned previously, Basic does not offer any sound commands (in spite of advertising claims) and the only sound I generated in my review was a faint clicking noise from a tiny speaker under the keyboard. *80 Micro* will hasten to uncover more about this mysterious sound facility.

Evaluation

My opinion of the Model 4 is positive. With the exception of the new Osborne Executive and one or two other portable computers, the Model 4 is the least expensive Z80 machine on the market today.

With CP/M and TRSDOS capability, it has the potential to address a massive market. A big market means outstanding software support, new peripherals, and hundreds of great articles in *80 Micro* about a powerful machine.

The recent shift by Tandy away from proprietary system software bodes well for the future of the TRS-80 line. If you're like me, you'll applaud this trend and look forward to other new computer products both from Radio Shack and the companies that support the TRS-80s. ■

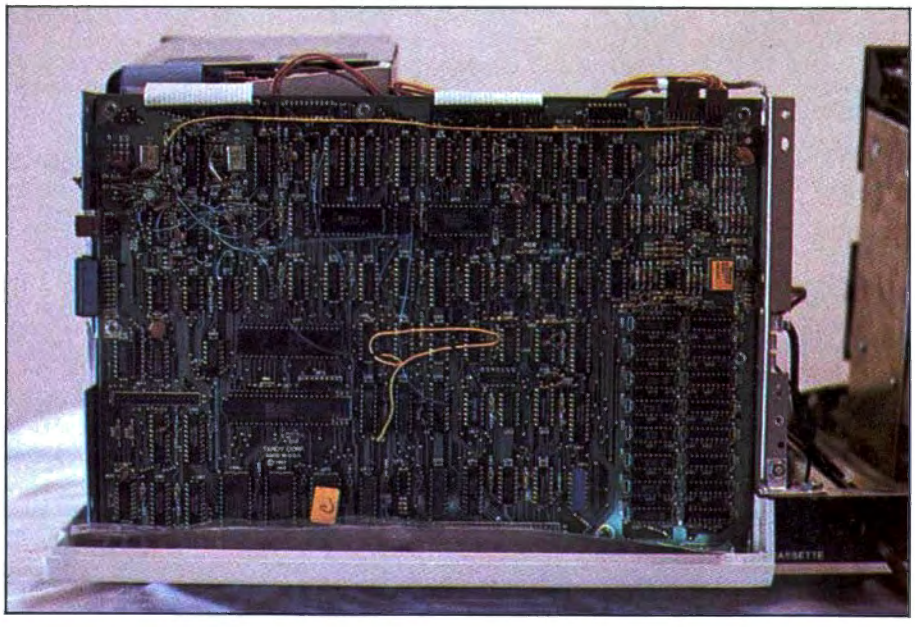

Photo 4. Model 4 CPU Board.

THE CUTTING EDGE

THE CONCEPT

A series of computer games in which players become characters of their own design, characters who must grow in skill and wisdom to survive the challenges presented them. Characters developed in the simpler of the games would be transferrable to the more difficult as their abilities increase. Rather than offering one fixed goal in one set maze, the software would have to contain thousands of potential goals and thousands of possible pitfalls, for thousands of hours of amusement. The concept, in short, was for the creation of a series of games unlike any available in the microcomputer market.

THE GAMES

demanded by such a concept would be unlike common software. They would require machine-language speed, and dungeon-master complexity. Graphics would have to be an integral part of the adventure, rather than pretty but static pictures with no real-time connection to action. They would have both a game-save and character-save feature. And, on whatever machine they were implemented, the software would have to have the same great graphics, the same speed of command interpretation, the same complexity and mind-bending challenge.

A stiff challenge. But ScreenPlay™ found an author up to it.

THE SERIES

Called The Warrior of RAS. The programs in the series are **DUNZHIN**, **WYLDE**, **KAIV** and **ZIGGURAT**. **DUNZHIN** is the simplest of the series, and gives the beginning warrior a chance to learn the techniques necessary for success in the others. **DUNZHIN** is set in a massive dungeon. **WYLDE** takes place in a trackless wilderness. Subterranean adventures are presented in **KAIV**, and **ZIGGURAT** takes place in a giant pyramid, with an adventure so complex and challenging even the author wonders if he can ever complete it.

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KAIV	*$29.95*
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Available in diskette versions for Atari 400/800, Radio Shack Model I/III, Apple II+/IIe, IBM Personal Computer, and Commodore 64.

All versions require 48K.

THE AUTHOR

Randall Don Masteller. Well-known within the close-knit fraternity of non-computer fantasy role-players, Masteller combines years of professional programming experience with an awe-inspiring imagination and dedication to fantasy gaming. No other fantasy role-playing game author has skills comparable to Masteller's. And Masteller's software demonstrates that skill.

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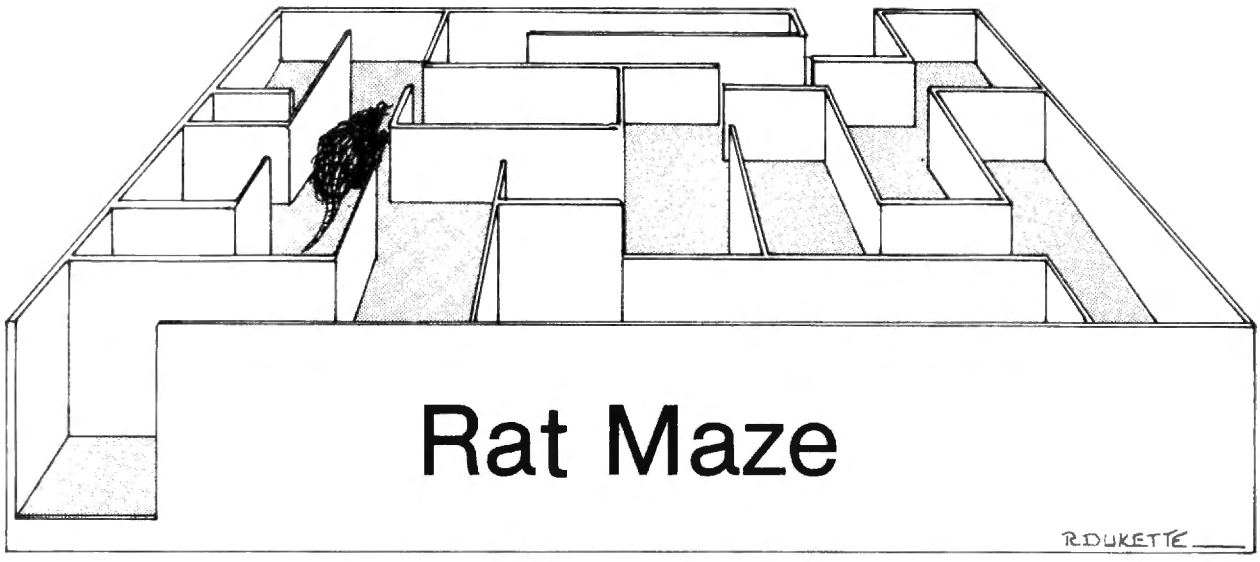

Rat Maze

by Richard Uglum

You're a slimy rat. And you're stuck—in a 3-D Color Computer maze straight out of the twilight zone. Escape if you can!

Have you ever wondered what it's like to be a laboratory rat? Consuming mass quantities of cancer-causing food and drink, being injected, dissected, and molested? And those crazy mazes!

This Color Computer game simulates the life of an experimental rat. It gives you a rat's-eye view of a maze you must successfully negotiate. The game is based on a two-dimensional maze, but gives you a three-dimensional view as you travel through it.

The Maze

The maze comprises a 20- by 20-element array (DIM A(20,20)) of ones and zeros. The ones represent the walls, the zeros corridors. The maze's starting location is the value two, and the exit is the value three. The walls form the boundaries and cannot be traversed.

The screen display is divided in half to create the rat's-eye view. Each half is divided into three ranges: the current location of the rat and the two locations immediately in front of the rat.

There are four possible corridor combinations for each area on each side of the screen. For example, at range zero (the rat's current coordinates), the following combinations of corridors and walls exist for the left side of the screen:

- corridor to the left, corridor to the front.
- corridor to the left, wall to the front.
- wall to the left, corridor to the front.
- wall to the left, wall to the front.

This scheme produces 24 combinations that have to be checked to print the entire screen. The program keeps track of your direction and accordingly

A(20,20)	array that holds the maze
X,Y	the current coordinates of the rat
XS,YS	the starting coordinates of the maze
XE,YE	the exit coordinates of the maze
XT,YT	temporary coordinates for the rat's position
XF,YF	position immediately in front of the temporary rat position
XR,YR	position immediately right of the temporary rat position
XL,YL	position immediately left of the temporary rat position
XA,YA	values used to increment the range of view
F	value of array in front of rat (F = A(XF,YF))
L	value of array to the left of the rat
R	value of array to the right of the rat
D	direction the rat is facing
A$	command input variable

Table 1. Variables List

The Key Box

Color Computer
32K RAM
Extended Color Basic

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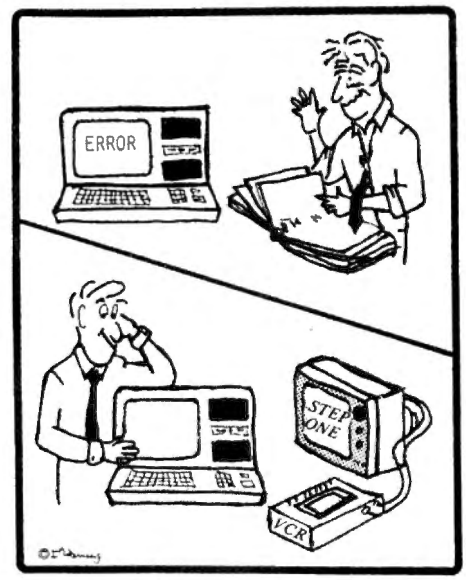

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115

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prints N, S, E, or W at the top of the screen. Use the appropriate letter keys to change the rat's direction during play. The L and R keys change the way the rat faces. The F key moves the rat forward. See Table 1 for a complete list of program variables.

The Program

Before running the game, use the POKE 65495,0 command to increase program execution speed unless it

Table 2. Line description

10–30	Program comment header.
40–210	Print header and command options.
220–560	Set up graphics mode and array that holds the maze. A value of one is a wall and a value of zero is an open passage. A value of two is the starting location and a value of three is the exit location.
570–590	Set initial direction and start accepting commands.
600–640	Check quit condition and output of location at end.
650–800	Set direction to desired value.
810–900	If command is an "F" then check for open space and update coordinates.
910–980	Check for termination condition. If not at end of maze then print view from current location and continue.
990–1010	Start of view subroutine. This subroutine prints the view from the current location and direction by determining the locations to the left, front, and right of the current location. This is repeated for two locations beyond the current location.
1020–1080	Determine L, R, and F based upon direction. Begin range zero.
1090–1140	Left open, front open.
1150–1170	Left open, front closed.

Table 2 continues

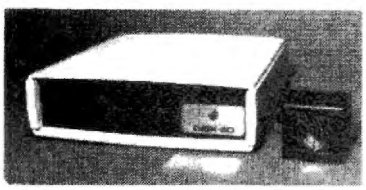
Program Listing 1

```
10 REM THIS PROGRAM SIMULATES A
20 REM RAT MAZE AT EYE LEVEL
30 REM BY R.D. UGLUM 6/82
40 CLS
50 PRINT "THIS IS THE RAT MAZE"
60 PRINT "YOU HAVE THE FOLLOWING"
70 PRINT "OPTION KEYS ... GOOD LUCK"
80 PRINT
90 PRINT "   N = NORTH"
100 PRINT "   S = SOUTH"
110 PRINT "   W = WEST"
120 PRINT "   E = EAST"
130 PRINT "   F = FORWARD"
140 PRINT "   L = LEFT"
150 PRINT "   R = RIGHT"
160 PRINT "   Q = QUIT"
170 PRINT
180 PRINT "ENTER 'C' TO CONTINUE"
190 PRINT "(WAIT 15 SEC)"
200 Z$=INKEY$
210 IF Z$<>"C" THEN 200
220 PCLEAR 4
230 DIM A(20,20)
240 PMODE 4,1
250 PCLS
260 DATA 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
270 DATA 1,0,0,0,0,0,1,0,1,0,1,0,0,0,1,0,1,0,1,2,1
280 DATA 1,1,1,1,0,1,0,0,0,0,0,0,1,0,0,0,0,0,0,0,1
290 DATA 1,0,1,0,0,0,1,1,0,1,1,1,0,1,1,1,0,1,1,1,1
300 DATA 1,0,1,0,1,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,1
310 DATA 1,0,0,0,0,0,0,1,1,0,1,0,1,1,1,0,1,1,0,1,1
320 DATA 1,0,1,0,1,0,1,0,1,0,0,0,0,1,0,1,0,1,0,0,0,1
330 DATA 1,1,1,0,1,0,1,1,1,1,1,0,1,0,1,0,1,0,1,1,1,1
```

Listing 1 continues on p. 114

TRS-80 Model I is alive and well at the Micromint. We still have the expansion interfaces you need!

Disk-80 Expansion Interface



As featured in Ciarcia's Circuit Cellar
Byte Magazine, March 1981

Reviewed in March '82 "80 Microcomputing"

DSK01	Disk-80 Expansion Interface with 32k RAM A & T	$330.00
DSK02	Disk-80 Expansion Interface with 32k RAM & Printer Port A & T	380.00
DSK03	Disk-80 Complete Kit with 32k RAM & Printer Port	275.00
DSK04	Disk-80 Bare Printed Circuit Board	48.00
DSK05	Printer/Power Supply Circuit Board	16.00

The Disk-80 Expansion Interface is the perfect peripheral for converting your TRS-80 Model I into a professional computer system. The Disk-80 controls up to four 35 to 77 track mini-disk drives, and contains a hardware data separator which substantially increases the reliability of data transfers. Attaches to the CPU/Keyboard connector and comes complete with mini-disk controller, 32K expansion memory, power supply, optional Centronics compatible printer port, real time clock and buffered bus expansion connector.

"Reviewing Disk-80 is almost incongruous, because any comments can be summarized with the sentence, "It works." Dennis Bathory Kitsz, 80 Microcomputing, March 1982.

All interfaces are Radio Shack hardware and software compatible and carry a 60 day warrantee including parts and labor
All units include user's manual, power supply & auxiliary TRS-BUS connector for future expansion.

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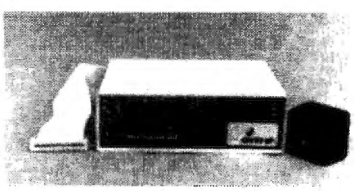
Comm-80



As featured in Ciarcia's Circuit Cellar
Byte Magazine, May and June 1980

The COMM-80 is the only interface you need to turn your TRS-80 Model I into a time sharing terminal with provisions for a printer. The COMM-80 combines the most used features of the RS expansion interface in a low cost unit containing a built-in RS-232-C interface, a full 8-bit parallel port and a 40 pin bus connector for future expanstion. Terminal software is included at no extra cost.

- RS-232-C Serial output port (50-19200 baud) with standard DB25 connector.
- Centronics compatible parallel printer port (34 pin)
- 40 pin card edge connector for bus expansion
- Connects directly to CRT terminals, modems, printers, other computers.
- Includes case, power supply & interconnecting cable.

CM01 COMM-80 Serial/Parallel I/O Interface A&T $150.00

TRS-80 is a trademark of Tandy Corp. 117

Table 2 continued

1180–1200	Left closed, front open.
1210–1260	Left closed, front closed.
1270–1320	Right open, front open.
1330–1350	Right open, front closed.
1360–1380	Right closed, front open.
1390–1440	Right closed, front closed.
1450–1490	Check for termination of view at wall. If no termination then extend range forward one. Redetermine L, R, and F.
1500–1560	Left open, front open.
1570–1600	Left open, front closed.
1610–1630	Left closed, front open.
1640–1690	Left closed, front closed.
1700–1760	Right open, front open.
1770–1800	Right open, front closed.
1810–1830	Right closed, front open.
1840–1890	Right closed, front closed.
1900–1940	Check for termination of view at wall. If no termination then extend range forward one. Redetermine L, R, and F.
1950–2010	Left open, front open.
2020–2050	Left open, front closed.
2060–2080	Left closed, front open.
2090–2140	Left closed, front closed.
2150–2210	Right open, front open.
2220–2250	Right open, front closed.
2260–2280	Right closed, front open.
2290–2350	Right closed, front closed. End of routine.
2360–2390	This routine prints the letter "N".
2400–2450	This routine prints the letter "S".
2460–2500	This routine prints the letter "E".
2510–2550	This routine prints the letter "W".

causes problems.

The line commands in the program (see Table 2) draw the maze so that the line-end coordinates are obvious for converting this program to other machines. Try converting the program to draw commands; it requires some extra effort, but it might make the program execute faster.

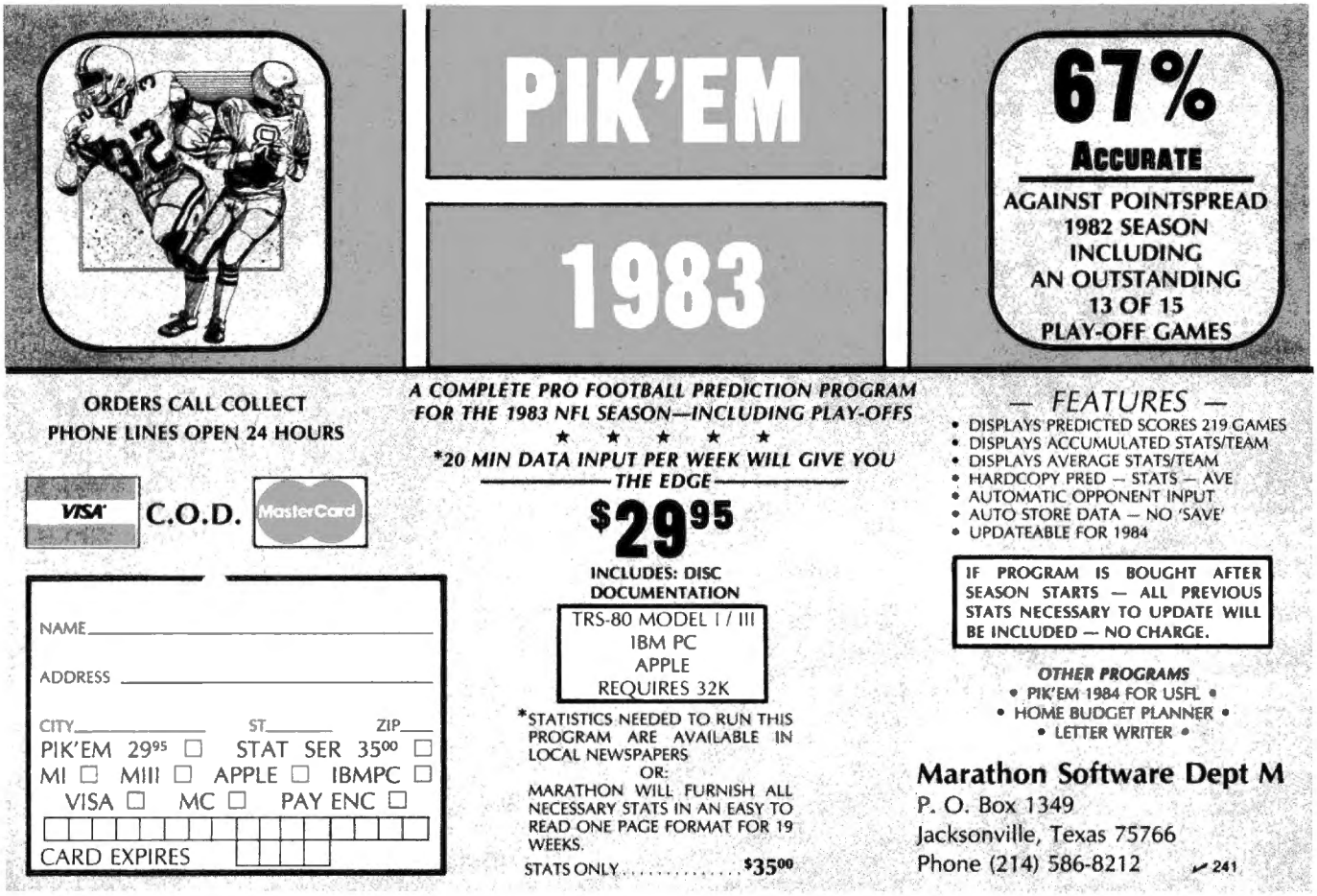
Version Two

The object of the second version of Rat Maze is similar to the first, but the maze is smaller and the rat slower. In addition, an invisible exit is included in the maze at a randomly chosen juncture. A tone increases in pitch as the rat nears this exit.

The most significant change, however, is the addition of five rat-eating cats to the maze. The cats, represented by circles, try to corner the rat. Three of the cats produce increasingly shrill noises as they get near the rat. The other two cats are silent. If you try to avoid the cats, you'll never find the exit.

Use POKE 65495,0 to make this version playable. ■

Write to Richard Uglum at 1117A E. Potter Ave., Milwaukee, WI 53207.



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Listing 1 continued from p. 112

```
340 DATA 1,0,1,0,0,0,0,0,1,0,0,0,0,1,0,1,0,0,0,1
350 DATA 1,0,1,1,1,1,0,1,0,1,1,0,1,0,0,0,0,0,0,1
360 DATA 1,0,1,0,0,0,1,0,1,0,0,1,0,1,1,0,1,1,0,1
370 DATA 1,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,1
380 DATA 1,1,1,1,0,0,0,1,1,1,1,1,1,0,1,0,1,1,1,1
390 DATA 1,0,0,0,0,0,1,0,1,0,0,0,0,0,1,0,0,0,0,1
400 DATA 1,1,0,1,0,1,0,1,0,1,0,1,1,1,1,1,1,1,0,1
410 DATA 1,0,0,1,0,0,0,0,0,0,0,1,0,0,0,1,0,0,0,1
420 DATA 1,0,1,1,1,0,1,0,0,1,0,1,0,1,0,1,0,1,0,1
430 DATA 1,0,0,0,0,0,0,0,1,0,1,0,0,0,0,0,0,1,0,1
440 DATA 1,1,1,1,3,1,0,0,0,0,1,1,0,1,0,1,0,1,0,1
450 DATA 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
460 FOR J=1 TO 20
470 FOR I=1 TO 20
480 READ A(I,J)
490 IF A(I,J)<>2 THEN 520
500 XS=I: YS=J: X=I: Y=J
510 A(I,J)=0
520 IF A(I,J)<>3 THEN 550
530 XE=I: YE=J:
540 A(I,J)=0
550 NEXT I
560 NEXT J
570 D=1: GOSUB 990
580 A$=INKEY$
590 IF A$="" THEN 580
600 IF A$<>"Q" THEN 650
610 CLS
620 PRINT "RATS FOILED AGAIN"
630 PRINT "X = ";X" Y = ";Y
640 STOP
650 IF A$="N" THEN D=1
660 IF A$="S" THEN D=2
670 IF A$="E" THEN D=3
680 IF A$="W" THEN D=4
690 IF A$<>"L" THEN 750
700 ON D GOTO 710,720,730,740
710 D=4: GOTO 750
720 D=3: GOTO 750
730 D=1: GOTO 750
740 D=2: GOTO 750
750 IF A$<>"R" THEN GOTO 810
760 ON D GOTO 770,780,790,800
770 D=3: GOTO 810
780 D=4: GOTO 810
790 D=2: GOTO 810
800 D=1: GOTO 810
810 IF A$<>"F" THEN 910
820 ON D GOTO 830,850,870,890
830 IF A(X,Y-1)=0 THEN Y=Y-1
840 GOTO 910
850 IF A(X,Y+1)=0 THEN Y=Y+1
860 GOTO 910
870 IF A(X+1,Y)=0 THEN X=X+1
880 GOTO 910
890 IF A(X-1,Y)=0 THEN X=X-1
900 GOTO 910
910 IF X=XE AND Y=YE THEN 940
920 GOSUB 990
930 GOTO 580
940 CLS
950 SCREEN 0,1
960 PRINT "CONG'RATS' YOU HAVE"
970 PRINT "FOUND THE EXIT"
980 END
990 XT=X: YT=Y:
1000 PCLS
1010 SCREEN 1,1
1020 ON D GOTO 1030,1050,1060,1070
1030 YA=-1: YL=YT: YR=YT: YF=YT-1: XA=0: XL=XT-1: XR=XT+1: XF=XT
:
1040 GOSUB 2360: GOTO 1080
1050 YA=1: YL=YT: YR=YT: YF=YT+1: XA=0: XL=XT+1: XR=XT-1: XF=XT:
 GOSUB 2400: GOTO 1080
1060 YA=0: YL=YT-1: YR=YT+1: YF=YT: XA=1: XL=XT: XR=XT: XF=XT+1:
 GOSUB 2460: GOTO 1080
1070 YA=0: YL=YT+1: YR=YT-1: YF=YT: XA=-1: XL=XT: XR=XT: XF=XT-1
: GOSUB 2510: GOTO 1080
1080 L=A(XL,YL): R=A(XR,YR): F=A(XF,YF)
1090 IF L<>0 OR F<>0 THEN 1150
1100 LINE(4,24)-(36,24),PSET
1110 LINE -(36,184),PSET
1120 LINE -(4,184),PSET
1130 LINE(36,24)-(68,56),PSET
1140 LINE(36,184)-(68,152),PSET
1150 IF L<>0 OR F<>1 THEN 1180
1160 LINE(4,24)-(116,24),PSET
1170 LINE(4,184)-(116,184),PSET
1180 IF L<>1 OR F<>0 THEN 1210
1190 LINE(20,8)-(68,56),PSET
1200 LINE(28,191)-(68,152),PSET
1210 IF L<>1 OR F<>1 THEN 1270
1220 LINE(20,8)-(32,24),PSET
1230 LINE -(32,184),PSET
1240 LINE -(28,191),PSET
1250 LINE(32,24)-(116,24),PSET
1260 LINE(32,184)-(116,184),PSET
1270 IF R<>0 OR F<>0 THEN 1330
1280 LINE(228,24)-(196,24),PSET
1290 LINE -(196,184),PSET
1300 LINE -(228,184),PSET
1310 LINE(196,24)-(164,56),PSET
1320 LINE(196,184)-(164,152),PSET
1330 IF R<>0 OR F<>1 THEN 1360
1340 LINE(116,24)-(228,24),PSET
1350 LINE(116,184)-(228,184),PSET
1360 IF R<>1 OR F<>0 THEN 1390
1370 LINE(212,8)-(164,56),PSET
1380 LINE(204,191)-(164,152),PSET
1390 IF R<>1 OR F<>1 THEN 1450
1400 LINE(212,8)-(200,24),PSET
1410 LINE -(200,184),PSET
1420 LINE -(206,191),PSET
1430 LINE(116,24)-(200,24),PSET
1440 LINE(116,184)-(200,184),PSET
1450 IF F=1 THEN 2350
1460 XF=XF+XA: YF=YF+YA
1470 XR=XR+XA: YR=YR+YA
1480 XL=XL+XA: YL=YL+YA
1490 L=A(XL,YL): R=A(XR,YR): F=A(XF,YF)
1500 IF L<>0 OR F<>0 THEN 1570
1510 LINE(68,56)-(68,152),PSET
1520 LINE(68,72)-(84,72),PSET
1530 LINE -(84,136),PSET
1540 LINE -(68,136),PSET
1550 LINE(84,72)-(100,88),PSET
1560 LINE(84,136)-(100,120),PSET
1570 IF L<>0 OR F<>1 THEN 1610
1580 LINE(68,56)-(68,152),PSET
1590 LINE(68,72)-(116,72),PSET
1600 LINE(68,136)-(116,136),PSET
1610 IF L<>1 OR F<>0 THEN 1640
1620 LINE(68,56)-(100,88),PSET
1630 LINE(68,152)-(100,120),PSET
1640 IF L<>1 OR F<>1 THEN 1700
1650 LINE(68,56)-(84,72),PSET
1660 LINE -(84,136),PSET
1670 LINE -(68,152),PSET
1680 LINE(84,72)-(116,72),PSET
1690 LINE(84,136)-(116,136),PSET
1700 IF R<>0 OR F<>0 THEN 1770
1710 LINE(164,56)-(164,152),PSET
1720 LINE(164,72)-(148,72),PSET
1730 LINE -(148,136),PSET
1740 LINE -(164,136),PSET
1750 LINE(148,72)-(132,88),PSET
1760 LINE(148,136)-(132,120),PSET
1770 IF R<>0 OR F<>1 THEN 1810
1780 LINE(164,56)-(164,152),PSET
1790 LINE(96,72)-(164,72),PSET
1800 LINE(96,136)-(164,136),PSET
1810 IF R<>1 OR F<>0 THEN 1840
1820 LINE(164,56)-(132,88),PSET
1830 LINE(164,152)-(132,120),PSET
1840 IF R<>1 OR F<>1 THEN 1900
1850 LINE(164,56)-(148,72),PSET
1860 LINE -(148,136),PSET
1870 LINE -(164,152),PSET
1880 LINE(148,72)-(116,72),PSET
1890 LINE(148,136)-(116,136),PSET
1900 IF F=1 THEN 2350
1910 XF=XF+XA: YF=YF+YA
1920 XR=XR+XA: YR=YR+YA
1930 XL=XL+XA: YL=YL+YA
1940 L=A(XL,YL): R=A(XR,YR): F=A(XF,YF)
1950 IF L<>0 OR F<>0 THEN 2020
1960 LINE(100,88)-(100,120),PSET
1970 LINE(100,96)-(108,96),PSET
1980 LINE -(108,112),PSET
1990 LINE -(100,112),PSET
2000 LINE(108,96)-(116,104),PSET
2010 LINE(108,112)-(116,104),PSET
2020 IF L<>0 OR F<>1 THEN 2060
2030 LINE(100,88)-(100,120),PSET
2040 LINE(100,96)-(116,96),PSET
2050 LINE(100,112)-(116,112),PSET
```

Listing 1 continues

USE YOUR RADIO SHACK§ COMPUTER TO WRITE SOFTWARE FOR ALL THE REST

• IBM • DIGITAL EQUIPMENT • NEC • HEWLETT-PACKARD • SAGE • TEXAS INSTRUMENTS • APPLE • RADIO SHACK • XEROX • COMMODORE • TERAK • OLIVETTI • ALTOS • ZENITH • CORVUS • COMPAQ • VICTOR

If you have been writing programs on microcomputers for any length of time, you've discovered that nearly all operating systems lock you into one family of microprocessors (or worse, into one brand of computer). That leaves you some hard choices about your software development. Whether you are writing programs at home for personal use, or in the corporate environment, or for national distribution, the question about portability to other machines now and in the future is the same. Should you go after the 8-bit or the 16-bit market? Would it be better to target IBM, Apple, Radio Shack, Commodore, or Osborne? How will you move your programs to Digital Equipment machines, or the Texas Instruments market? And what about next year's crop of microcomputers?

The UCSD p-System "Universal Operating System"* has the answer.

Compare Market Coverage (Microprocessors)											
O.S.	8080	Z-80	8085	6509	6502	8086	HP-87	LSI-11	68000	9900	VAX
p-System	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CP/M	✓	✓	✓								
CP/M-86						✓					
MSDOS						✓					
TRSDOS		✓									
	8-bit							16-bit			32-bit

While some operating systems **claim** to be universal, only one is, in fact. And with the UOS, the entire operating system — editors, linkers, assemblers, compilers and all applications written under the UOS are designed for portability which means that a program written and compiled on one computer under the UOS can be ported to any other supporting the UOS and run without change. **No** other operating system can beat that degree of portability. Not only that, but the system features complete and integrated programmer productivity tools to conserve your software investment. The p-System "virtual" operating system characteristics make it possible to run very large applications in only 64K of RAM, yet allows you to take advantage of the additional speed and memory of the 16 and 32 bit computers.

Here is what we have for the Radio Shack line of micros:

UOS includes screen editor, bios, file manager, disk format, utilities, library for:

Model 16 (68000)	$475
Model 12 (Z-80)	$375
Model 4 (Z-80)	$375
Model II (Z-80)	$375

New Release - Model III upgrade board (Holmes) with 16K RAM (for 64K total) 80 x 24 video **and** the **UOS** $595

Add-On's (Run on all)

Pascal Compiler	$375
FORTRAN-77 Compiler	$350
BASIC Compiler	$225

File Conversions:

TRSDOS to p-System	$100
CP/M to p-System	$100
IBM 3741 to p-System	$285

Plus a complete line of high performance software including spreadsheet, data base, mailing list, word processing, accounting, medical and mathematical applications programs from some of the best names in the software business. Applications have been selected for sale and national distribution by IBM, Texas Instruments, DEC, and others.

Write or call for our free newsletter and listing of applications software for these computers and the Apple, IBM-PC, IBM Displaywriter, DEC Pro 350, DEC 11/03 & 11/23, Altos 8000 series, Terak & Sage.

PCD Systems, Inc.
P. O. Box 143
Penn Yan, N.Y. 14527
(315) 536-7428 ↵433

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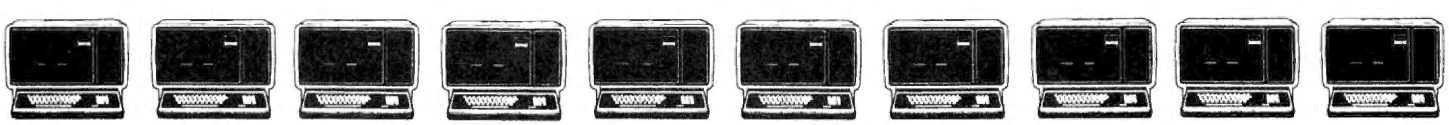
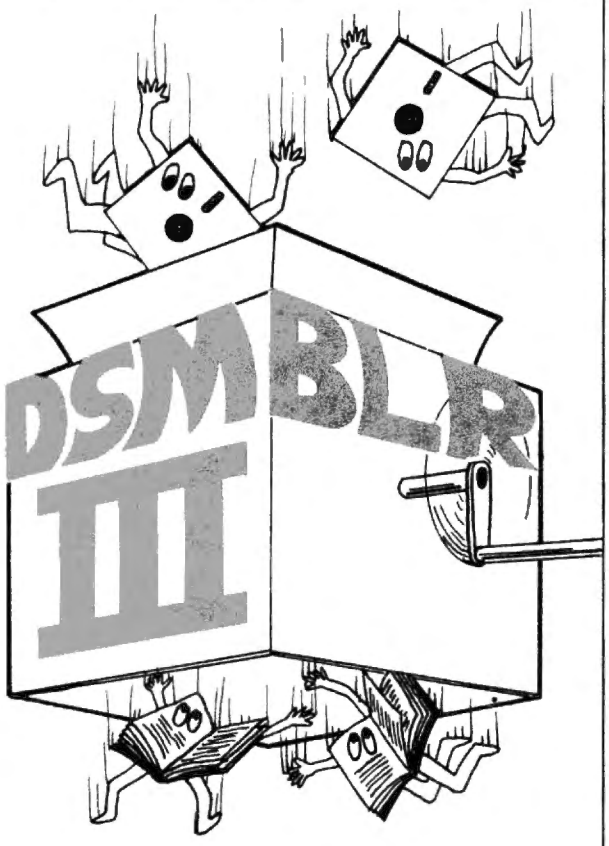
†PCD Supports Systems Software on DEC LSI-11, Radio Shack Models II, III, 4 12 & 16, Altos, Terak, IBM PC, Apple II ±, & Sage.
*UOS is a trademark of SofTech Microsystems, UCSD p-System is a trademark of the University of California.
IBM is a trademark of International Business Machines.



MISOSYS ANNOUNCES!



- Disassemble from disk / memory
- Disassemble to disk/printer/video
- Automatic output partitioning
- Full label generation
- Data area screening - generates DB, DW

- $40 + $2 S&H

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Listing 1 continued

```
2060 IF L<>1 OR F<>0 THEN 2090
2070 LINE(100,88)-(116,104),PSET
2080 LINE(100,120)-(116,104),PSET
2090 IF L<>1 OR F<>1 THEN 2150
2100 LINE(100,88)-(108,96),PSET
2110 LINE -(108,112),PSET
2120 LINE -(100,120),PSET
2130 LINE(108,96)-(116,96),PSET
2140 LINE(108,112)-(116,112),PSET
2150 IF R<>0 OR F<>0 THEN 2220
2160 LINE(132,88)-(132,120),PSET
2170 LINE(132,96)-(124,96),PSET
2180 LINE -(124,112),PSET
2190 LINE -(132,112),PSET
2200 LINE(124,96)-(116,104),PSET
2210 LINE -(124,112),PSET
2220 IF R<>0 OR F<>1 THEN 2260
2230 LINE(132,88)-(132,120),PSET
2240 LINE(116,96)-(132,96),PSET
2250 LINE(116,112)-(132,112),PSET
2260 IF R<>1 OR F<>0 THEN 2290
2270 LINE(132,88)-(116,104),PSET
2280 LINE(132,120)-(116,104),PSET
2290 IF R<>1 OR F<>1 THEN 2350
2300 LINE(132,88)-(124,96),PSET
2310 LINE -(124,112),PSET
2320 LINE -(132,120),PSET
2330 LINE(124,96)-(116,96),PSET
2340 LINE(124,112)-(116,112),PSET
2350 RETURN
2360 LINE(112,16)-(112,10),PSET
2370 LINE -(120,16),PSET
2380 LINE -(120,10),PSET
2390 RETURN
2400 LINE(112,16)-(120,16),PSET
2410 LINE -(120,13),PSET
2420 LINE -(112,13),PSET
2430 LINE -(112,10),PSET
2440 LINE -(120,10),PSET
2450 RETURN
2460 LINE(120,16)-(112,16),PSET
2470 LINE -(112,10),PSET
2480 LINE -(120,10),PSET
2490 LINE(112,13)-(120,13),PSET
2500 RETURN
2510 LINE(112,10)-(112,16),PSET
2520 LINE -(120,16),PSET
2530 LINE -(120,10),PSET
2540 LINE(116,10)-(116,16),PSET
2550 RETURN
```

Program Listing 2

```
10 REM THIS PROGRAM SIMULATES A
20 REM RAT MAZE AT EYE LEVEL
30 REM BY R.D. UGLUM 6/82
40 CLS
50 PRINT "THIS IS THE RAT MAZE"
60 PRINT "YOU HAVE THE FOLLOWING"
70 PRINT "OPTION KEYS ... GOOD LUCK"
80 PRINT
90 PRINT "   N = NORTH"
100 PRINT "   S = SOUTH"
110 PRINT "   W = WEST"
120 PRINT "   E = EAST"
130 PRINT "   F = FORWARD"
140 PRINT "   L = LEFT"
150 PRINT "   R = RIGHT"
160 PRINT "   Q = QUIT"
170 PRINT
180 PRINT "ENTER 'C' TO CONTINUE"
190 PRINT "(WAIT 15 SEC)"
200 Z$=INKEY$
210 IF Z$<>"C" THEN 200
220 PCLEAR 4
230 DIM A(15,15),XC(5),YC(5),S2(5)
240 PMODE 4,1
250 PCLS
260 REM SCORE
270 SC=100
280 DATA 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
290 DATA 1,0,1,0,0,0,0,0,0,0,0,0,1,0,1
300 DATA 1,0,1,1,0,1,1,0,1,1,0,1,1,0,1
```

Listing 2 continues

Listing 2 continued

```
310 DATA 1,0,0,1,0,1,0,0,0,1,0,1,0,0,1
320 DATA 1,0,1,1,0,1,0,1,0,1,0,1,1,0,1
330 DATA 1,0,1,0,0,0,0,0,0,0,0,0,1,0,1
340 DATA 1,0,1,1,0,1,1,0,1,1,0,1,1,0,1
350 DATA 1,0,0,0,0,0,0,0,0,0,0,0,0,0,1
360 DATA 1,0,1,1,0,1,1,0,1,1,0,1,1,0,1
370 DATA 1,0,1,0,0,0,0,0,0,0,0,0,1,0,1
380 DATA 1,0,1,1,0,1,0,1,0,1,0,1,1,0,1
390 DATA 1,0,0,1,0,1,0,0,0,1,0,1,0,0,1
400 DATA 1,0,1,1,0,1,1,0,1,1,0,1,1,0,1
410 DATA 1,0,1,0,0,0,0,0,0,0,0,0,1,0,1
420 DATA 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
430 DATA 1,0,1,1,1,0,1,0,0,1,0,1,0,1,0,1,0,1,2,1
440 FOR J=1 TO 15
450 FOR I=1 TO 15
460 READ A(I,J)
470 NEXT I
480 NEXT J
490 XS=8: YS=2
500 X=XS: Y=YS
510 XE=RND(15): YE=RND(15): IF A(XE,YE)=1 THEN 510
520 FOR I=1 TO 5
530 XC(I)=RND(15): YC(I)=RND(15)
540 IF A(XC(I),YC(I))=1 THEN 530
550 NEXT I
560 D=1: GOSUB 1240
570 A$=INKEY$
575 IF A$="" THEN 570
580 FOR I=1 TO 5
590 CX=RND(3): CY=RND(3)
600 CX=CX-2: CY=CY-2
610 CX=CX+XC(I): CY=CY+YC(I)
620 IF A(CX,CY)=1 THEN 640
630 YC(I)=CY: XC(I)=CX
640 NEXT I
650 REM GOTO HERE
670 IF A$<>"Q" THEN 720
680 CLS
690 PRINT "RATS FOILED AGAIN"
700 PRINT "X = ";X" Y = ";Y
710 STOP
720 IF A$="N" THEN D=1
730 IF A$="S" THEN D=2
740 IF A$="E" THEN D=3
750 IF A$="W" THEN D=4
760 IF A$<>"L" THEN 820
770 ON D GOTO 780,790,800,810
780 D=4: GOTO 820
790 D=3: GOTO 820
800 D=1: GOTO 820
810 D=2: GOTO 820
820 IF A$<>"R" THEN GOTO 880
830 ON D GOTO 840,850,860,870
840 D=3: GOTO 880
850 D=4: GOTO 880
860 D=2: GOTO 880
870 D=1: GOTO 880
880 IF A$<>"F" THEN 980
890 ON D GOTO 900,920,940,960
900 IF A(X,Y-1)=0 THEN Y=Y-1
910 GOTO 980
920 IF A(X,Y+1)=0 THEN Y=Y+1
930 GOTO 980
940 IF A(X+1,Y)=0 THEN X=X+1
950 GOTO 980
960 IF A(X-1,Y)=0 THEN X=X-1
970 GOTO 980
980 S1=SQR((XE-X)^2+(YE-Y)^2)
990 S1=255-S1*15
1000 FOR I=1 TO 5
1010 S2(I)=SQR((XC(I)-X)^2+(YC(I)-Y)^2)
1020 S2(I)=255-S2(I)*15
1030 NEXT I
1040 IF S2(1)>=S2(2) AND S2(1)>=S2(3) THEN S4=S2(1)
1050 IF S2(2)>S2(1) AND S2(2)>=S2(3) THEN S4=S2(2)
1060 IF S2(3)>S2(1) AND S2(3)>S2(2) THEN S4=S2(3)
1070 IF S4<S1 THEN S4=S1
1080 SOUND S4,1
1090 SC=SC-1
1100 FOR I=1 TO 5
1110 IF X<>XC(I) OR Y<>YC(I) THEN 1140
1120 CLS: PRINT"TO BAD, THE CAT GOT YOU"
1130 GOTO 1130
1140 NEXT I
1150 IF X=XE AND Y=YE THEN 1180
1160 GOSUB 1240
1170 GOTO 570
1180 CLS
```

Listing 2 continues

INNOVATION QUALITY SUPPORT

PIONEER COMPUTER

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PIONEER tm

160

SCRIPTR

VERSION makes SCRIPSIT a REAL SYSTEM
Special Custom Versions Support All Popular Printers

MX-80 version allows for Underlining Emphasized, Sub + Super Scripting, Double and ITALICS. MID-LINE even on Justified text lines without disturbing the formatting. SCRIPTR supports EVERY programmable feature of the GRAPHTRAX 80 and PLUS roms. No other MOD does as much!

STANDARD FEATURES INCLUDE

OUTPUT any code or string of codes to your printer.
Write FORM LETTERS by inserting data during printing.
Print any page DIRECT with correct headers / footers.
Reenter SCRIPSIT to get use of ALL DOS FUNCTIONS.
See where PAGES start and end without printed copy.
Edit mode for errors, changes or GRAPHICS entry.
(7) TEACHING PROGRAMS fully explain every function.
66 page manual-bound - CASS-DISK Ver. Model I/III for
- CUSTOM VERS FOR FOLLOWING -
Centronics 737 + 739 / LP-8 + LP-4 - Daisy Wheel II.
Microline 80 + 82A - Prowriter + Cioth 8510A + F-10
SCM-TP-1 - DMP-200 + 400 + 410 - Gemini 10 + 15 MORE

LDOS COMPATIBLE

SYSTEM REQ TRS-80 MOD I/III. 32k, lower case.
Disk ver. requires SCRIPSIT/LC on both Model's I/III.
PRICE $40.00 on DISK / CASS. 5.5K. program.
FREE BROCHURE Demonstrates all features.
Customer support by phone or letter after the sale makes Scriptr a pleasure to own and use. 1,500 fully satisfied customers in over 14 countries. CALL / WRITE FOR INFO.

PLEASE INCLUDE THIS INFORMATION WHEN ORDERING
Name | MODEL 1/3 | Cass/Disk
Address - Phone -Zip | Printer Type | MEM SIZE

CHECKS - MONEY ORDERS - COD'S

CRAYON DELUXE

FULL SUPPORT FOR: PROWRITER
MX-80 / 100 + NEW GEMINI 10 +15
NEW CIOTH 8510A + NEC-8023A

DONT LET THIS SIMPLE NAME FOOL YOU CRAYON DELUXE is not a toy but a COMPLETE WORD/GRAPHICS PROCESSOR which offers complete versatility in creating custom letter-sets and graphics. Written in Z-80 Assembler it is fast, flexible and very easy to use. No program of this kind written in BASIC can compare to it. Computing the bit patterns for 760,320 bits per page of printing demands Z-80 Assembler. COMPARE + you won't get G.E.A. Ped

STANDARD FEATURES INCLUDE

1. Programmable Underlining, even create lined paper
2. Mix WIDE and regular sizes MID-LINE.
3. INVERT any part of the text even MID-LINE.
4. SHORT LINE SEEKING for maximum speed. NO WAITING!!
5. Reversed Block Capitals Character Set.
6. CONTROLLER - A 15k. Machine Language program which enables you to create your own custom fonts, STORE, RETRIEVE AND PRINT letters INSTANTANEOUSLY. Allows 3 1/2 coresident character sets in memory. PLUS a fast easy way to print sample LETTERS and SETS
7. Repeat printing capability without carriage advance even on graphic lines gives *Typewriter Quality* print.
8. Create 100, or any number of copies of High-Res MAIL LABELS or LETTERHEADS with easy *hands off* operation.
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10. The *sharpest* dot matrix print you've ever seen!!
11. Variable DOT Linespacing control for text documents.
12. Bit Masking allows creation of graphs and the *graph paper* simultaneously. Superimpose any background!!!
13. CREATE Block Graphics in any size and with every set.
14. *Fine Line Drawing* for creating real business forms.
15. Character sets may contain letters up to 40H x 127W.
16. Continuous WIDE printing in any font or style. Even allows for partial EXPANDED from this mode.

FREE BROCHURES!!

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CRAYON DELUXE - DISK MOD 1/3 $80.00 w/7 SETS

ADDITIONAL FONTS AVAILABLE

HERITAGE = AMERICAN TEXT + OLD ENGLISH $15.00
ELITE = 4 Variations on disk for $15.00
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PRINT SAMPLES - AVAILABLE ON REQUEST.

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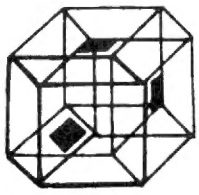
WE ARE NOW CARRYING A 25 MEG. HARD DISK SYSTEM FOR THE TRS-80 MODEL III. PRICE = $3300 COMPLETE WITH DOSPLUS 4.0 ASSEMBLED - FORMATTED - SYSTEM SEES IT AS 4 DRIVES. CALL! JUST BOOT-UP AND YOU ARE UP AND LOADING WITH HARD DISK

See List of Advertisers on Page 323

Listing 2 continued

```
1190 SCREEN 0,1
1200 PRINT "CONG'RATS' YOU HAVE"
1210 PRINT "FOUND THE EXIT"
1220 PRINT "YOUR SCORE = ";SC
1230 END
1240 XT=X: YT=Y:
1250 PCLS
1260 SCREEN 1,1
1270 ON D GOTO 1280,1300,1310,1320
1280 YA=-1: YL=YT: YR=YT: YF=YT-1: XA=0: XL=XT-1: XR=XT+1: XF=XT
:
1290 GOSUB 2700: GOTO 1330
1300 YA=1: YL=YT: YR=YT: YF=YT+1: XA=0: XL=XT+1: XR=XT-1: XF=XT:
 GOSUB 2740: GOTO 1330
1310 YA=0: YL=YT-1: YR=YT+1: YF=YT: XA=1: XL=XT: XR=XT: XF=XT+1:
 GOSUB 2800: GOTO 1330
1320 YA=0: YL=YT+1: YR=YT-1: YF=YT: XA=-1: XL=XT: XR=XT: XF=XT-1
: GOSUB 2850: GOTO 1330
1330 L=A(XL,YL): R=A(XR,YR): F=A(XF,YF)
1340 FOR I=1 TO 5
1350 IF XF=XC(I) AND YF=YC(I) THEN CIRCLE(116,104),28
1360 NEXT I
1370 IF L<>0 OR F<>0 THEN 1430
1380 LINE(4,24)-(36,24),PSET
1390 LINE -(36,184),PSET
1400 LINE -(4,184),PSET
1410 LINE(36,24)-(68,56),PSET
1420 LINE(36,184)-(68,152),PSET
1430 IF L<>0 OR F<>1 THEN 1460
1440 LINE(4,24)-(116,24),PSET
1450 LINE(4,184)-(116,184),PSET
1460 IF L<>1 OR F<>0 THEN 1490
1470 LINE(20,8)-(68,56),PSET
1480 LINE(28,191)-(68,152),PSET
1490 IF L<>1 OR F<>1 THEN 1550
1500 LINE(20,8)-(32,24),PSET
1510 LINE -(32,184),PSET
1520 LINE -(28,191),PSET
1530 LINE(32,24)-(116,24),PSET
1540 LINE(32,184)-(116,184),PSET
1550 IF R<>0 OR F<>0 THEN 1610
1560 LINE(228,24)-(196,24),PSET
1570 LINE -(196,184),PSET
1580 LINE -(228,184),PSET
1590 LINE(196,24)-(164,56),PSET
1600 LINE(196,184)-(164,152),PSET
1610 IF R<>0 OR F<>1 THEN 1640
1620 LINE(116,24)-(228,24),PSET
1630 LINE(116,184)-(228,184),PSET
1640 IF R<>1 OR F<>0 THEN 1670
1650 LINE(212,8)-(164,56),PSET
1660 LINE(204,191)-(164,152),PSET
1670 IF R<>1 OR F<>1 THEN 1730
1680 LINE(212,8)-(200,24),PSET
1690 LINE -(200,184),PSET
1700 LINE -(206,191),PSET
1710 LINE(116,24)-(200,24),PSET
1720 LINE(116,184)-(200,184),PSET
1730 IF F=1 THEN 2690
1740 XF=XF+XA: YF=YF+YA
1750 XR=XR+XA: YR=YR+YA
1760 XL=XL+XA: YL=YL+YA
1770 L=A(XL,YL): R=A(XR,YR): F=A(XF,YF)
1780 FOR I=1 TO 5
1790 IF XF=XC(I) AND YF=YC(I)  THEN CIRCLE
1800 NEXT I
1810 IF L<>0 OR F<>0 THEN 1880
1820 LINE(68,56)-(68,152),PSET
1830 LINE(68,72)-(84,72),PSET
1840 LINE -(84,136),PSET
1850 LINE -(68,136),PSET
1860 LINE(84,72)-(100,88),PSET
1870 LINE(84,136)-(100,120),PSET
1880 IF L<>0 OR F<>1 THEN 1920
1890 LINE(68,56)-(68,152),PSET
1900 LINE(68,72)-(116,72),PSET
1910 LINE(68,136)-(116,136),PSET
1920 IF L<>1 OR F<>0 THEN 1950
1930 LINE(68,56)-(100,88),PSET
1940 LINE(68,152)-(100,120),PSET
1950 IF L<>1 OR F<>1 THEN 2010
1960 LINE(68,56)-(84,72),PSET
1970 LINE -(84,136),PSET
1980 LINE -(68,152),PSET
1990 LINE(84,72)-(116,72),PSET
2000 LINE(84,136)-(116,136),PSET
2010 IF R<>0 OR F<>0 THEN 2080
2020 LINE(164,56)-(164,152),PSET
2030 LINE(164,72)-(148,72),PSET
2040 LINE -(148,136),PSET
2050 LINE -(164,136),PSET
2060 LINE(148,72)-(132,88),PSET
2070 LINE(148,136)-(132,120),PSET
2080 IF R<>0 OR F<>1 THEN 2120
2090 LINE(164,56)-(164,152),PSET
2100 LINE(96,72)-(164,72),PSET
2110 LINE(96,136)-(164,136),PSET
2120 IF R<>1 OR F<>0 THEN 2150
2130 LINE(164,56)-(132,88),PSET
2140 LINE(164,152)-(132,120),PSET
2150 IF R<>1 OR F<>1 THEN 2210
2160 LINE(164,56)-(148,72),PSET
2170 LINE -(148,136),PSET
2180 LINE -(164,152),PSET
2190 LINE(148,72)-(116,72),PSET
2200 LINE(148,136)-(116,136),PSET
2210 IF F=1 THEN 2690
2220 XF=XF+XA: YF=YF+YA
2230 XR=XR+XA: YR=YR+YA
2240 XL=XL+XA: YL=YL+YA
2250 L=A(XL,YL): R=A(XR,YR): F=A(XF,YF)
2260 FOR I=1 TO 5
2270 IF XF=XC(I)AND YF=YC(I) THEN CIRCLE(1
2280 NEXT I
2290 IF L<>0 OR F<>0 THEN 2360
2300 LINE(100,88)-(100,120),PSET
2310 LINE(100,96)-(108,96),PSET
2320 LINE -(108,112),PSET
2330 LINE -(100,112),PSET
2340 LINE(108,96)-(116,104),PSET
2350 LINE(108,112)-(116,104),PSET
2360 IF L<>0 OR F<>1 THEN 2400
2370 LINE(100,88)-(100,120),PSET
2380 LINE(100,96)-(116,96),PSET
2390 LINE(100,112)-(116,112),PSET
2400 IF L<>1 OR F<>0 THEN 2430
2410 LINE(100,88)-(116,104),PSET
2420 LINE(100,120)-(116,104),PSET
2430 IF L<>1 OR F<>1 THEN 2490
2440 LINE(100,88)-(108,96),PSET
2450 LINE -(108,112),PSET
2460 LINE -(100,120),PSET
2470 LINE(108,96)-(116,96),PSET
2480 LINE(108,112)-(116,112),PSET
2490 IF R<>0 OR F<>0 THEN 2560
2500 LINE(132,88)-(132,120),PSET
2510 LINE(132,96)-(124,96),PSET
2520 LINE -(124,112),PSET
2530 LINE -(132,112),PSET
2540 LINE(124,96)-(116,104),PSET
2550 LINE -(124,112),PSET
2560 IF R<>0 OR F<>1 THEN 2600
2570 LINE(132,88)-(132,120),PSET
2580 LINE(116,96)-(132,96),PSET
2590 LINE(116,112)-(132,112),PSET
2600 IF R<>1 OR F<>0 THEN 2630
2610 LINE(132,88)-(116,104),PSET
2620 LINE(132,120)-(116,104),PSET
2630 IF R<>1 OR F<>1 THEN 2690
2640 LINE(132,88)-(124,96),PSET
2650 LINE -(124,112),PSET
2660 LINE -(132,120),PSET
2670 LINE(124,96)-(116,96),PSET
2680 LINE(124,112)-(116,112),PSET
2690 RETURN
2700 LINE(112,16)-(112,10),PSET
2710 LINE -(120,16),PSET
2720 LINE -(120,10),PSET
2730 RETURN
2740 LINE(112,16)-(120,16),PSET
2750 LINE -(120,13),PSET
2760 LINE -(112,13),PSET
2770 LINE -(112,10),PSET
2780 LINE -(120,10),PSET
2790 RETURN
2800 LINE(120,16)-(112,16),PSET
2810 LINE -(112,10),PSET
2820 LINE -(120,10),PSET
2830 LINE(112,13)-(120,13),PSET
2840 RETURN
2850 LINE(112,10)-(112,16),PSET
2860 LINE -(120,16),PSET
2870 LINE -(120,10),PSET
2880 LINE(116,10)-(116,16),PSET
2890 RETURN
2900 SCREEN 1,1
2910 GOTO 2910
```



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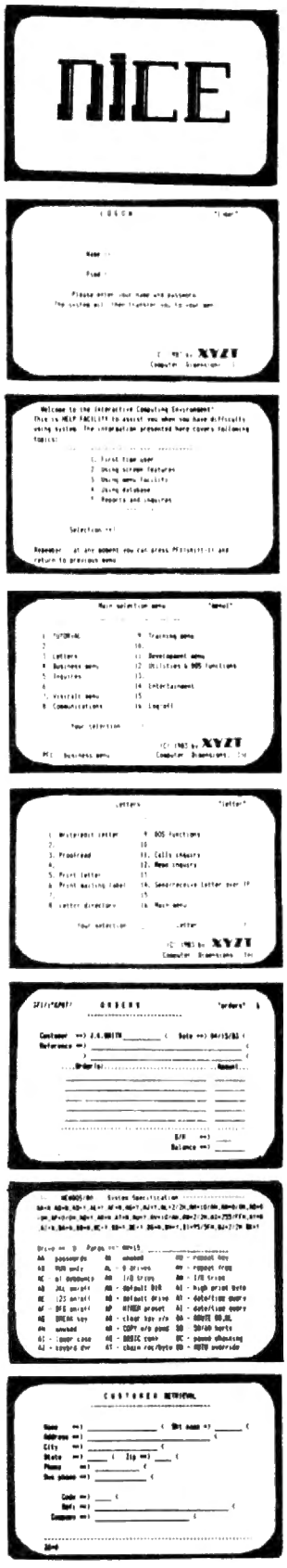

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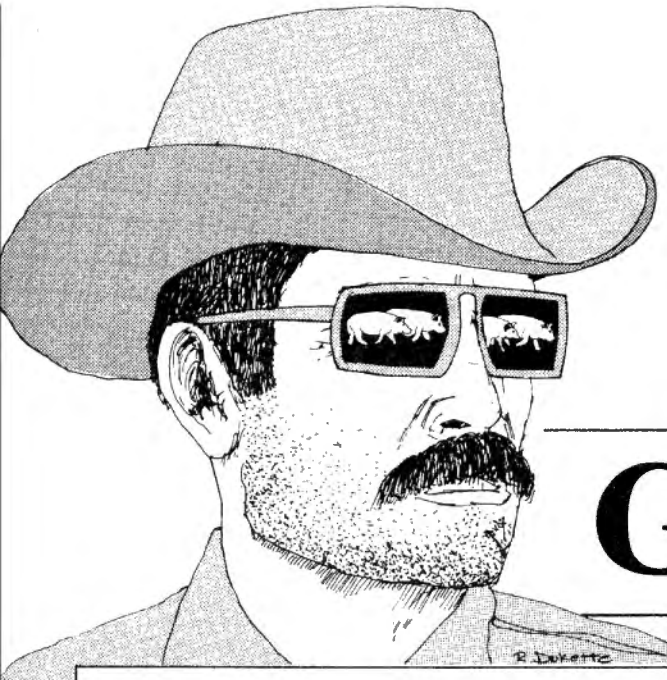

Muddy Pig Simulator

by Mike Conforti

Get ready for your next big muddy pig competition with this snazzy simulation in which its your job to round up two escaped pigs.

```
10 CLEAR500:CLS:PRINT@464,"";:IFPEEK(275)<>50V=253:K=214:L=195:W
=222:S=254:N=196:GOTO160ELSEV=120:K=42:L=43:W=89:N=35:S=111:GOTO
160
20 CLS:PRINT@467,"";:INPUT"LEVEL(0-HARD / 15-EASY)";LV:IFLV<0ORL
V>15THENGOTO20ELSECLS:PRINT@65,STRING$(11,131);:PRINT@0,STRING$(
64,176);:FORI=1TO14:POKE15360+I*64,191:POKE15423+I*64,191:NEXTI
30 PRINT@0,NM$;"...";HS$;:PRINT@960,STRING$(63,131);:POKE16383,1
31:PRINT@91,STRING$(7,131);:FORI=1TO10:P(I)=15834+I:POKEP(I),V:N
EXTI:J=1:POKE16919,0:POKE16920,0
40 H=(RND(3)-2)*64:IFH=0GOTO40ELSEA=15424+(RND(12))*64:FORI=1TOR
ND(18)+8:POKEA+I,L:IFI=6ORI=7POKEA+I,32:NEXTIELSENEXTI:A=A+I-1:F
ORI=1TO13:A=A+H:IFPEEK(A)=32POKEA,L:NEXTIELSENEXTI
50 FORI=1TO2:B(I)=15420+RND(900):IFPEEK(B(I))<>32GOTO50ELSENEXTI
60 FORI=1TORND(LV*20)+10:A=15420+RND(900):IFPEEK(A)<>32NEXTIELSE
POKEA,W:NEXTI:FORI=1TORND(5*LV)+5:A=15420+RND(900):IFPEEK(A)<>32
,NEXTIELSEPOKEA,K:NEXTI
70 FORF=1TO2:H=B(F):Z=RND(4):IFZ=1B(F)=H+64ELSEIFZ=2B(F)=H-64ELS
EIFZ=3B(F)=H+1ELSEB(F)=H-1
80 H(F)=H:NEXTF:PRINT@28,RIGHT$(TIME$,5);:PO=P(J):X=PEEK(14400):
IFX=0GOTO90ELSEIFX=64P(J)=P(J)+1:GOTO90ELSEIFX=32P(J)=P(J)-1:GOT
O90ELSEIFX=16P(J)=P(J)+64:GOTO90ELSEIFX=8P(J)=P(J)-64:GOTO90ELSE
IFX=128POKEP(J),V:J=J+1:IFJ=11J=1:PO=P(J):ELSEPO=P(J)
90 FORI=1TO2:IFPEEK(B(I))<>32B(I)=H(I):NN=NN+1:POKEB(I),N:NEXTIE
LSEPOKEB(I),N:POKEH(I),32:NN=0:NEXTI
100 IFPEEK(P(J))<>32P(J)=PO:POKEP(J),SELSEPOKEP(J),S:POKEPO,32
110 IFNN<50GOTO70ELSEE$=RIGHT$(TIME$,5)
120 A=VAL(LEFT$(E$,2)):IFHM>A,T=2ELSEIFHM=AANDHS>VAL(RIGHT$(E$,
2),T=2ELSET=1
130 J$=INKEY$:H=0:A=VAL(LEFT$(E$,2)):B=VAL(LEFT$(E$,2)):IFHM<AOR
HM=AANDHS<B,GOTO150ELSEPRINT@464,"YOU HAVE BEATEN THE HIGHSCORE"
;:PRINT@530,"PLEASE ENTER YOUR INITIALS";:PRINT@596,"========>
 <========";:HM=A:HS=B:HS$=E$:NM$=""
140 I$=INKEY$:IFI$=""THEN140ELSEH=H+1:IFH=3PRINT@604+H,I$;:NM$=N
M$+I$:GOTO150ELSENM$=NM$+I$:PRINT@604+H,I$;:GOTO140
150 PRINT@980,"PRESS <SPACE> BAR TO RUN";:IFINKEY$=" ",GOTO20
ELSEGOTO150
160 CLS:PRINT@28,"CORRAL";:PRINT@87,"BY MIKE CONFORTI":PRINT@150
,STRING$(18,131);:PRINT:PRINTTAB(5)"GUIDING YOUR CREW, TRY TO CA
PTURE 2 PIGS WHO ESCAPED":PRINTTAB(5)STRING$(52,131);:FORI=1TO10
:POKE15700+I,V:NEXTI
170 PRINT@352,"<== THE CREW":POKE15766,N:POKE15773,N:PRINT@416,"
<== THE WILD PIGS";:FORI=2TO10STEP2:POKE15827+I,K:NEXTI:PRINT@48
0,"<== ROCKS";:FORI=1TO9STEP2:POKE15892+I,W:NEXTI:PRINT@544,"<==
 CACTI";:FORI=1TO10:POKE15956+I,L:NEXTI:PRINT@608,"<== FENCE";
180 POKE16022,V:POKE16150,V:POKE16085,V:POKE16087,V:POKE16086,N:
POKE16028,L:POKE16092,K:POKE16156,W:POKE16093,N:POKE16094,V:POKE
16029,V:POKE16157,V:PRINT@736,"<== A CAPTURE";:HS=59:HM=59:NM$="
***":HS$="59:59":GOTO150
```

Program Listing. The Corral

Airplane pilots have all the fun. When they're not out flying, they can boot up Flight Simulator on a Model III.

But suppose your avocation is capturing muddy pigs. How can you practice your skills if you don't have any swine handy?

This may be the piece of software you're looking for—a muddy pig simulator.

How It Works

The corral fence is broken and two pigs have escaped. It's up to you and your crew to capture the pigs in as little time as possible.

This task isn't easy. The pigs are very muddy, and you must surround them on all sides to capture them. Guide your crew to strategic positions and use obstacles and corners to your advantage. Use the arrow keys to move players and the space bar to change which player you control.

The upper left corner holds the high scorer's initials and time. In the upper middle is your present time. ■

Contact Michael Conforti at 28 Somerset Road, Glastonbury, CT 06033.

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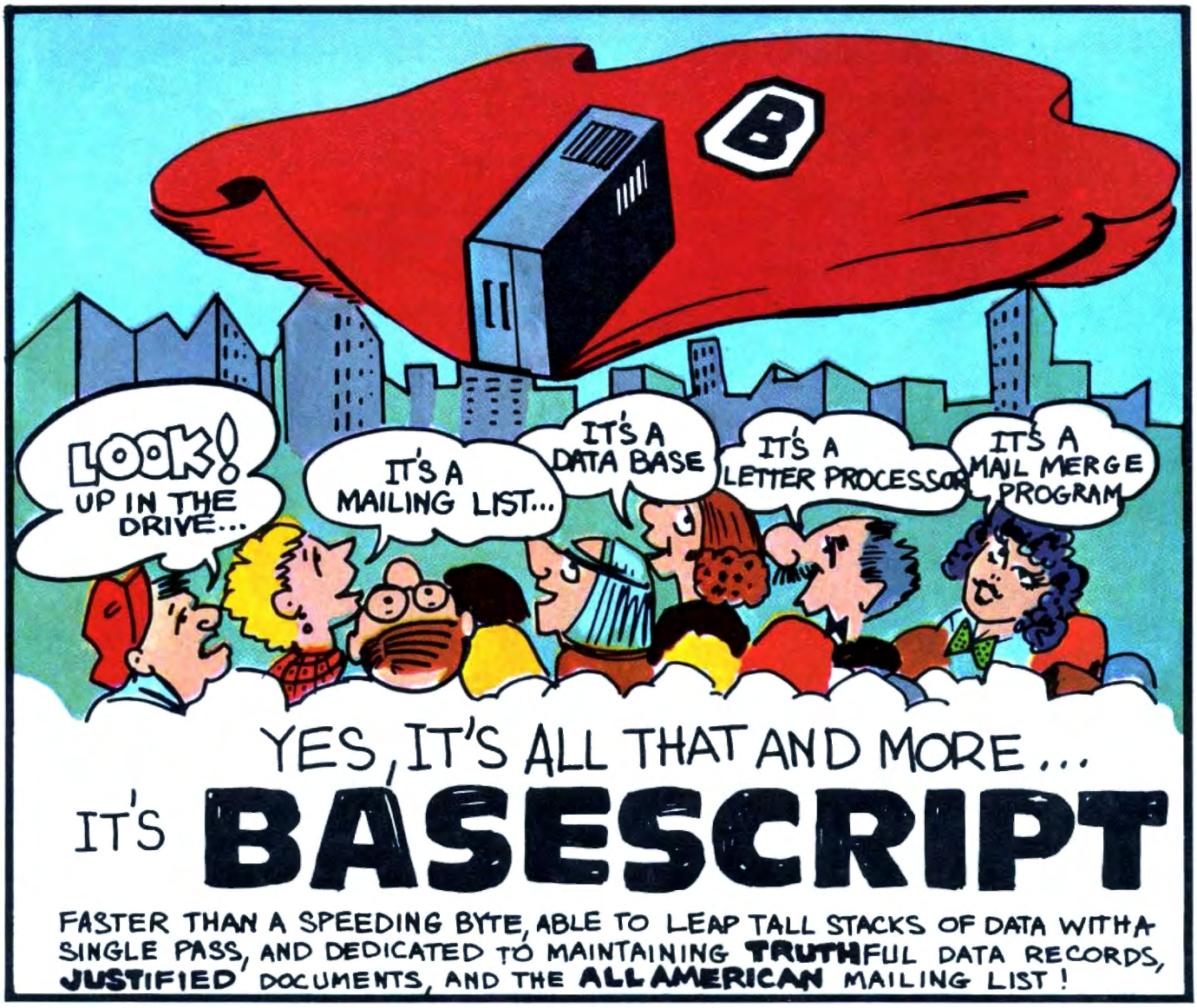

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By Dave Stambaugh

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My Foe Flicker

by Joseph Dlhopolsky

Eliminate the flickering that plagues your animation routines. This technique alerts your Z80 when the electron gun's aim is on target.

Does your Model III animation program exhibit jerky, flickering screen movement, instead of the smooth motion you see on a television, movie, or arcade screen? It's a common problem in machine-language animation programs. Here are some tips on how to eliminate that annoying screen flicker.

Microcomputer CRTs operate on the same principle as black and white television sets: The electron gun that excites (and lights) screen phosphors aims a beam of electrons in a sequential pattern over the screen's surface. In a television, the information displayed on the screen is a picture. In the Model III, and other computers, the information consists of ASCII and graphics characters.

The computer's electron beam scans the entire screen starting at the top left. The beam moves to the right to finish the top line, then executes a horizontal retrace to return the beam to the screen's leftmost point. It jumps down to the second line and traverses it from left to right. After 192 lines (for a TRS-80), the beam executes a vertical retrace and starts at the top again. The entire process operates at a frequency of 60 Hz (cycles per second) in the United States (50 Hz in Europe and other countries), refreshing the video screen every 16.667 milliseconds (ms).

The 17-ms interval is important in animation. Most human beings detect no flicker in a display updated at 60 Hz. This frequency is the minimum at which most people physiologically fuse a flickering display into one that appears to be solid—called critical flicker frequency or CFF. If you reduce the frequency, more and more people detect flicker. Animators must keep this in mind. A good animation program is written in machine language to make screen changes every 17 ms; a program written in Basic is much too slow for animation.

Sometimes, even machine language is too slow. To display movement of an object on the screen, an animation routine must erase the old material from the screen before, or as, the new material appears. A complex animation program can take longer than 17 ms to determine the new position of the screen's contents. So, a certain amount of jumping can occur as the video frame frequency falls below the critical flicker frequency. This can be written off as a practical limitation of the system, although a clever programmer might be able to speed up the routines to reduce the problem.

There is another flicker problem not associated with a limitation of the machine-language program. Rather, it is a characteristic of how the microcomputer displays information on the video screen. Many programmers are not aware of the design attributes that influence the quality of their visual displays.

For instance, Sublogic's T80-FS1 Flight Simulator program for the Model III, which lets the user "fly" a Sopwith Camel, is a very complex machine-language program that updates the video screen three to six times per second. This rate is well below the critical fusion frequency, so considerable screen flicker and jumping is apparent.

These video irregularities result from display design problems. When the machine-language routines update screen data, the update information is immediately loaded into video RAM. The results of some routines alter video RAM already changed by other routines. The changes in video RAM occur more often than the 3- to 6-Hz rate of the screen. As a result, material appears and disappears from the screen randomly. Moreover, noticeable flicker occurs when entire material is momentarily erased from the screen, only to be replaced a split second later.

The psychological experimentation I do requires precise, non-flickering video displays of visual stimuli. It is often necessary to know exactly when a stimulus appears on the screen so that the experimental subject's reaction time is precisely measured. In the process of my experimentation, I realized the stimulus does not merrily appear on the screen precisely when the Z80 tells it to. It appears when the electron beam gets around to it in its 60-Hz cyclic journey across the screen. Video screen scanning occurs independently of the intentions of the Z80 or of the program designer.

The TRS-80's video display is memory-mapped. There are 1,024 locations in random-access memory (RAM) for each character location on the video

The Key Box

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screen (RAM addresses 3C00–3FFF hexadecimal, 15360–16383 decimal). Most TRS-80 programmers are aware that whenever the TRS-80 is instructed to load a value into a video RAM location, the corresponding ASCII or graphics character appears on the video screen in the assigned location. However, the Z80 has not carried out the act of drawing the stimulus on the screen.

Rather, it has loaded a byte code into a video RAM address. The video RAM, then, serves as a base from which the video circuitry, operating independently of the Z80, reads and translates data to control the intensity of the electron beam as it scans the screen.

Since the Z80 does not actively draw material on the screen, a major problem exists for animators. Suppose, for example, you have a machine-language program that prints very large letters on the screen. It takes 17 ms for each 16-line letter to appear on the screen, even though the Z80 loads data into video RAM in a fraction of a millisecond.

Suppose your program draws the letter A, waits three seconds and then draws the letter B. The Z80 has no idea where the electron beam is pointing when it loads the letter data into video RAM. Ideally, the beam should be at the top of the screen. But, if the beam is in the middle of the screen, you could see the top half of the letter A and the bottom half of the letter B for an instant.

This nonsensical figure lasts only for an instant. For an alphabet display, the problem might not be acute. But if you're trying to navigate your Sopwith F.1 Camel, bomb a fuel depot without crashing into the mountains, and avoid being shot down by five German fighters on your tail, you don't want any distractions and you want clear screen displays.

What might resolve Flight Simulator's problems? Ideally, all intended screen updates should be carried out on an invisible page dedicated to video memory. Once an update is complete, the Z80 should wait until the electron beam is at the top of the screen or at an invisible location (more on this later). Then a block load instruction should be executed, transferring the invisible page to active video RAM just ahead of the electron beam. The resulting program retains the original jumpiness, but it is flicker-free. However, the TRS-80 display generator is not precisely timed nor is it designed to provide flicker-free, steady animation.

I wanted the Z80 to determine the electron beam's location at any given moment, a feature not included as a hardware option. Mike Berger, a design engineer for the Model III, helped me develop a routine, written in Z80 machine language, that uses the Model III's real-time clock (RTC). The RTC is software driven through an RTC interrupt operating at 30 Hz.

When an RTC interrupt occurs, the Z80 finishes the current machine-language instruction. Then processing shunts to an interrupt-handling address containing the RTC interrupt-handling routine.

A normal RTC routine increments a counter at RAM address 4216 hexadecimal (16918 decimal). This counter, therefore, increments every 33.3 ms. Every 30 incrementations, one second is added to the RTC's second counter. After the RTC is updated, the Z80 returns from the interrupt and continues its previous task. In short, the interrupt causes the Z80 to suspend its current processing for a fraction of a millisecond every 33.3 ms to update the clock.

The interrupt's 30 Hz operating frequency derives from the 60 Hz video scan frequency. The video circuitry produces a signal after every second screen page (every 33.3 ms). The Z80 interprets this signal as a maskable interrupt. Video synchronization is achieved because the electron beam's screen location is known when the interrupt occurs.

The programmer steals the interrupt from the real-time clock. The clock stops keeping accurate time (or stops altogether, depending on how you work it) but you don't have to tell time to produce a good animation.

RTC interrupt normally vectors the Z80 to RAM address 4046 hex (16454 decimal). This address and the following two addresses contain codes for an Assembly-language jump instruction, JP 2935H. This instruction tells the Z80 where to jump to in RAM to update the RTC. Normally, the address is 2935 hex (13609 decimal).

To use the RTC interrupt for video synchronization, the programmer must change the 2-byte address in 4047 and 4048 hex from the RTC interrupt-handling address to the address of the machine-language routine coordinating the Z80's screen printing.

Program Listing 1 is a machine-language routine that uses the RTC interrupt to move a 16-line vertical bar from the left side of the screen to the right side. The program assembles with any TRS-80 editor/assembler and loads

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```
                00100 ;17 MSEC MOVING BAR
                00110 ;By Joseph G. Dlhopolsky, Ph.D.
                00120
FE00            00130          ORG     0FE00H  ;RAM of routine
0060            00140 DELAY    EQU     0060H   ;Delay ROM
FE00 F3         00150          DI              ;Disable interrupts
FE01 210FFE     00160          LD      HL,START;New RTC int address
FE04 224740     00170          LD      (4047H),HL;New RTC int vect
FE07 FB         00180          EI              ;Enable interrupts
FE08 01320D     00190          LD      BC,3378 ;50 msec delay
FE0B CD6000     00200          CALL    DELAY
FE0E C9         00210          RET             ;Return to BASIC
FE0F F3         00220 START    DI              ;DRAW BAR ROUTINE
FE10 21003C     00230          LD      HL,3C00H        ;Video start
FE13 22FCFF     00240          LD      (0FFFCH),HL
FE16 113F00     00280          LD      DE,3FH
FE19 0610       00290 DRAW     LD      B,10H   ;Counts lines
FE1B FD2AFCFF   00300          LD      IY,(0FFFCH)
FE1F 3E80       00310 LOOPA    LD      A,128   ;Print blank
FE21 FD7700     00320          LD      (IY),A
FE24 3EBF       00330          LD      A,191   ;Bar CHR$ in A
FE26 FD23       00340          INC     IY      ;IY --> next space
FE28 FD7700     00350          LD      (IY),A  ;Print CHR$
FE2B FD19       00360          ADD     IY,DE   ;Skip to next line
FE2D 10F0       00370          DJNZ    LOOPA
FE2F ED4BDBFF   00380          LD      BC,(0FFDBH);Finish 16.7 msec
FE33 CD6000     00390          CALL    DELAY
FE36 21FCFF     00400          LD      HL,0FFFCH
FE39 34         00410          INC     (HL)    ;Move to next space
FE3A 3E3F       00420          LD      A,3FH   ;Check screen end
FE3C AE         00430          XOR     (HL)
FE3D C219FE     00440          JP      NZ,DRAW ;Do next bar
FE40 212935     00450          LD      HL,3529H;Normal RTC int
FE43 224740     00460          LD      (4047H),HL
FE46 FB         00470          EI
FE47 ED4D       00480          RETI
FE00            00490          END     0FE00H
00000 Total Errors
```

Program Listing 1

from disk. Alternatively, the object code (see Table 1) can be POKEd into RAM as part of a Basic program. Regardless of the technique used to get the program in RAM, it must begin at location FE00 hex (65024 decimal). If running the program as a USR call from Basic, be sure to answer less than 65024 to the Memory Size query.

Before delving into the details of Listing 1, you may want to run a simple Basic program that moves a vertical bar across the screen in a fashion similar to Listing 1. An example appears in Program Listing 2 that demonstrates the fatiguing flicker. While a machine-language routine might perform the task more quickly and efficiently, without video synchronization the program shows no great improvement in flicker.

Listing 1 revectors the RTC interrupt, waits for the interrupt, draws the first line, waits for 16.667 ms to pass, then erases the line and simultaneously draws the next line. When the vertical line moves to the right edge of the screen, the RTC interrupt returns to normal.

Line 140 locates the Delay ROM address so the program can call it when a delay is desired.

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Line 150 disables all maskable interrupts, including the RTC interrupt. This avoids the possibility of an interrupt occurring while the vector is being changed.

Lines 160 and 170 change the RTC interrupt vector to the RAM address of the Start routine (beginning at line 220).

Line 180 enables the interrupts so the new vector will operate.

Lines 190 and 200 execute a 50-ms pause during which the Z80 waits for the interrupt to occur. Once it does, 100 microseconds pass and the Z80 then begins processing the instructions in the Start routine. The RETI instruction in line 480 returns the Z80 to line 200 to complete the 50 ms pause.

Line 210 executes a return to Basic or to the machine-language program that called the routine.

Line 220 begins the interrupt-handling routine. It first disables all maskable interrupts because the routine takes longer than 33.3 ms to complete. If the interrupts are not disabled, the RTC interrupt would restart the routine every 33.3 ms and it would never be completed.

Lines 230 and 240 load the starting address (the top left location on the screen) of the first bar into RAM addresses FFFC (LSB) and FFFD (MSB) hex (65532 and 65533 decimal). This value is incremented as the bar appears in new locations.

Line 280 loads 3F hex (63 decimal) into the DE register for adding to the IY register. The IY register points to the current video address for printing one of the 16 portions of each bar.

Lines 310–360 erase an old bar and draw a new one in the video location immediately to the right.

Lines 380 and 390 time the remainder of the 16.7-ms duration of the screen page. This assures that the electron

```
10 '    BASIC MOVING BAR
        By Joseph G. Dlhopolsky, Ph.D.
        St. John's University
        Staten Island, New York 10301

20 '    Revised 8208.21

990 DEFSTRA-H:DEFINTI-N
1000 B0="":A=CHR$(191)+CHR$(24)+CHR$(26)
1001 FORJ=1TO15:B0=B0+A:NEXT
1002 B0=B0+CHR$(191)
1005 B1="":A=CHR$(128)+CHR$(24)+CHR$(26)
1006 FORJ=1TO15:B1=B1+A:NEXT
1007 B1=B1+CHR$(128)
1009 FORJ=1TO10
1010 FORJ0=0TO64
1012 PRINT@J0,B0;
1014 PRINT@J0,B1;
1016 NEXT
1020 NEXT:GOSUB9200:CLS:END
9200 A=INKEY$
9210 PRINT@962,"( P R E S S   A N Y   K E Y   T O   C O N T I
N U E )";
9220 A=INKEY$
9230 IFA=""THEN9220ELSERETURN
```

Program Listing 2

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FE00	F3	65024	243				
FE01	21	65025	33	FE25	BF	65061	191
FE02	0F	65026	15	FE26	FD	65062	253
FE03	FE	65027	254	FE27	23	65063	35
FE04	22	65028	34	FE28	FD	65064	253
FE05	47	65029	71	FE29	77	65065	119
FE06	40	65030	64	FE2A	00	65066	0
FE07	FB	65031	251	FE2B	FD	65067	253
FE08	01	65032	1	FE2C	19	65068	25
FE09	32	65033	50	FE2D	10	65069	16
FE0A	0D	65034	13	FE2E	F0	65070	240
FE0B	CD	65035	205	FE2F	ED	65071	237
FE0C	60	65036	96	FE30	4B	65072	75
FE0D	00	65037	0	FE31	DB	65073	219
FE0E	C9	65038	201	FE32	FF	65074	255
FE0F	F3	65039	243	FE33	CD	65075	205
FE10	21	65040	33	FE34	60	65076	96
FE11	00	65041	0	FE35	00	65077	0
FE12	3C	65042	60	FE36	21	65078	33
FE13	22	65043	34	FE37	FC	65079	252
FE14	FC	65044	252	FE38	FF	65080	255
FE15	FF	65045	255	FE39	34	65081	52
FE16	11	65046	17	FE3A	3E	65082	62
FE17	3F	65047	63	FE3B	3F	65083	63
FE18	00	65048	0	FE3C	AE	65084	174
FE19	06	65049	6	FE3D	C2	65085	194
FE1A	10	65050	16	FE3E	19	65086	25
FE1B	FD	65051	253	FE3F	FE	65087	254
FE1C	2A	65052	42	FE40	21	65088	33
FE1D	FC	65053	252	FE41	29	65089	41
FE1E	FF	65054	255	FE42	35	65090	53
FE1F	3E	65055	62	FE43	22	65091	34
FE20	80	65056	128	FE44	47	65092	71
FE21	FD	65057	253	FE45	40	65093	64
FE22	77	65058	119	FE46	FB	65094	251
FE23	00	65059	0	FE47	ED	65095	237
FE24	3E	65060	62	FE48	4D	65096	77

Table 1. Object Code for 17 Millisecond Moving Bar (Program Listing 1)

```
10 '    VIDEO SYNC MOVING BAR
        48 K DISK MODEL III TRS-80
        By Joseph G. Dlhopolsky, Ph.D.
        St. John's University
        Staten Island, New York 10301

20 '    Revised 8208.11

100 CLEAR500:CLS
110 DEFSTRA-H:DEFINTI-J
120 CMD"L","MOVEBAR/CMD":DEFUSR0=&HFE00
200 CLS:INPUT"How many passes";JA
270 P0=50000/3-882.5:'Removes bar draw & erase time from 17 msec
272 OA=(P0-2.46)/14.8:'Gets BC value for DELAY call
274 GOSUB9000:'Rounding
276 JD=INT(OA)
280 J0=JDAND255:J1=(-256ANDJD)/256:IFJ1<0THENJ1=-1-J1
282 J1=(-256ANDJD)/256:IFJ1<0THENJ1=-1-J1:'Gets MSB
290 POKE&HFFDB,J0:POKE&HFFDC,J1:'LSB & MSB for rest of 17 msec
300 GOSUB9200:CLS
400 FORJ=1TOJA:'Start flash sequence loop
410 J0=USR0(0):'Calls 17 msec MOVING BAR
430 NEXT:'Next pass
440 GOSUB9200:GOTO200:'Wait for response then start over
9000 IFOA-INT(OA)<.49999THENOA=INT(OA)ELSEOA=INT(OA+1)
9010 RETURN
9200 A=INKEY$
9210 PRINT@962,"( P R E S S   A N Y   K E Y   T O   C O N T I
N U E )";
9220 A=INKEY$
9230 IFA=""THEN9220ELSERETURN
```

Program Listing 3

beam is at the same starting position for each new bar. The BC register contains an MSB-LSB (most significant byte-least significant byte) value equivalent to 14.8 *(desired delay – 2.46 microseconds) described in Radio Shack's ROM call definition. This value must be stored in RAM addresses FFDB (LSB) and FFDC (MSB) hex (65499 and 65500 decimal) before the routine is called. It takes 882.5 microseconds to erase an old bar and draw a new one, so the value in FFDB and FFDC contains a value that carries out a pause of 15.78 ms (16.667 – .8825 ms).

Lines 400–430 increment the value in addresses FFFC and FFFD (the video starting location for each bar) to set up for drawing the next bar. They also check to see if the end of the screen is reached.

If the end of the screen is not reached, line 440 jumps to draw the next bar. If it has been reached, the program goes to line 450.

Lines 450 and 460 return the RTC interrupt vector back to normal.

Lines 470 and 480 enable the interrupts and return from the current interrupt. Note that the Start routine must end with an EI instruction and a RETI instruction. You cannot use a RET instruction. If you leave out these commands, there is no telling what might happen, but it wouldn't be what you wanted.

The software I designed to perform psychological experiments is a hybrid of programs where machine-language routines carry out critical functions within larger Basic programs. Similarly, Program Listing 3 shows a Basic program that loads the machine code for Listing 1 from a disk file and carries out a demonstration.

Line 120 of Listing 3 performs the disk load. The disk file with the machine-language object code should be named MOVEBAR/CMD for proper loading. For non-disk users, replace line 120 with commands to POKE the object code in Table 1 into RAM. When you do this, you must include the following two commands that tell Basic where the USR routine starts: POKE 16526,0 and POKE 16526,254.

To understand the timing of the RTC interrupt and its relationship to the location of the electron beam, you should understand the characteristics of the video screen operation. See Fig. 1 for a diagram of the video organization.

Most TRS-80 programmers are aware that the Model III's video screen consists of 16 lines of 64 characters each. Each of the 16 video lines consists

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of 12 scan lines. The electron stream travels from left to right as it draws each of the 12 lines in each character (actually, alphanumeric characters use only the top eight scan lines). It travels back from right to left before it starts the next scan line. This is called horizontal retrace and the beam is blanked during this interval. For convenience, it is said that the horizontal retrace really consists of 16 non-displayed characters that are tagged on at the end of the 64 character line; the TRS-80 thinks it is printing 80 character lines.

After the electron beam completes the last scan line on video line 16, it travels up to line 1 to begin the process anew. Just as 16 extra characters are figuratively added to the horizontal lines to accommodate the time it takes to make a horizontal retrace, six extra lines are added to the last line to accommodate the time it takes to complete a vertical retrace.

During vertical retrace, the electron beam is once again blanked. The result is that we have six video lines—17 through 22—that are not displayed. This would seem to be the ideal time to load data into video RAM because the changes wouldn't appear until the electron beam returned to the first scan line on the top of the screen. Even more advantageous, the RTC interrupt occurs at the beginning of invisible line 17!

Listing 1 uses this to accomplish all the changes in video RAM before the electron beam completes its vertical retrace to return to the top scan line: The Start routine begins 100 ms after the interrupt, and the changes in video RAM are completed 882.5 microseconds later.

LINE NUMBER	VISIBLE PORTION OF VIDEO LINE (64 CHARACTERS)	16 INVISIBLE CHARACTERS
1	4.54 msec from Real Time Clock interrupt	.....
2	5.30 msec	.....
3	6.06 msec	.....
4	6.82 msec	...Devoted to...
5	7.58 msec	...horizontal...
6	8.33 msec	....retrace.....
7	9.09 msec	.....
8	9.85 msec	.....
9	10.61 msec	.....
10	11.36 msec	.....
11	12.12 msec	.....
12	12.88 msec	.....
13	13.64 msec	.....
14	14.39 msec	.....
15	15.15 msec	.....
16	15.91 msec	.....
17	..Real Time Clock Interrupt occurs at beginning of line 17.....	
18	..0.757 msec from Real Time Clock interrupt.....	
19	..1.52 msec.....	
20	..2.27 msec.....Invisible lines.....	
21	.....devoted to..... ..3.03 msec.....vertical retrace.....	
22	..3.79 msec.....	

Fig. 1. Video configuration in the Model III. The visible portion of the video screen is the 16 dark horizontal lines. Each 64-character video line has 16 non-displayed characters at the end, shown here as dots. These characters describe the time it takes for the electron beam to complete a horizontal retrace. Lines 17 through 22 are non-displayed. These describe the time it takes for the electron beam to complete a vertical retrace. The Real Time Clock interrupt occurs at the beginning of line 17.

As to timing requirements, simple arithmetic tells you how much time you have to work. Twenty two lines are drawn in 16.7 ms. Each line, therefore, is drawn in 757.57 microseconds (including horizontal retrace). If the RTC interrupt arrives at zero microseconds, line 1 is printed 757.57 × 6 microseconds, or 4.54 ms, later. If your machine-language routines are completed in under 4.5 ms, it is possible to update video RAM before the electron beam

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Hex Address	Code	Dec Address	Code				
FE00	F3	65024	243	FE24	00	65060	0
FE01	21	65025	33	FE25	FD	65061	253
FE02	0F	65026	15	FE26	19	65062	25
FE03	FE	65027	254	FE27	10	65063	16
FE04	22	65028	34	FE28	F9	65064	249
FE05	47	65029	71	FE29	ED	65065	237
FE06	40	65030	64	FE2A	4B	65066	75
FE07	FB	65031	251	FE2B	DB	65067	219
FE08	01	65032	1	FE2C	FF	65068	255
FE09	32	65033	50	FE2D	CD	65069	205
FE0A	0D	65034	13	FE2E	60	65070	96
FE0B	CD	65035	205	FE2F	00	65071	0
FE0C	60	65036	96	FE30	06	65072	6
FE0D	00	65037	0	FE31	10	65073	16
FE0E	C9	65038	201	FE32	3E	65074	62
FE0F	F3	65039	243	FE33	80	65075	128
FE10	ED	65040	237	FE34	FD	65076	253
FE11	4B	65041	75	FE35	21	65077	33
FE12	E0	65042	224	FE36	20	65078	32
FE13	FF	65043	255	FE37	3C	65079	60
FE14	CD	65044	205	FE38	FD	65080	253
FE15	60	65045	96	FE39	77	65081	119
FE16	00	65046	0	FE3A	00	65082	0
FE17	11	65047	17	FE3B	FD	65083	253
FE18	40	65048	64	FE3C	19	65084	25
FE19	00	65049	0	FE3D	10	65085	16
FE1A	06	65050	6	FE3E	F9	65086	249
FE1B	10	65051	16	FE3F	21	65087	33
FE1C	FD	65052	253	FE40	29	65088	41
FE1D	21	65053	33	FE41	35	65089	53
FE1E	20	65054	32	FE42	22	65090	34
FE1F	3C	65055	60	FE43	47	65091	71
FE20	3E	65056	62	FE44	40	65092	64
FE21	BF	65057	191	FE45	FB	65093	251
FE22	FD	65058	253	FE46	ED	65094	237
FE23	77	65059	119	FE47	4D	65095	77

Table 2. Object Code for Beam Calibration (Program Listing 4)

```
                00100 ;BEAM CALIBRATION
                00110 ;By Joseph G. Dlhopolsky, Ph.D.
                00120
FE00            00130          ORG     0FE00H  ;RAM of routine
0060            00140 DELAY    EQU     0060H   ;Delay ROM
FE00 F3         00150          DI              ;Disable interrupts
FE01 210FFE     00160          LD      HL,START;New RTC int address
FE04 224740     00170          LD      (4047H),HL;New RTC int vect
FE07 FB         00180          EI              ;Enable interrupts
FE08 01320D     00190          LD      BC,3378 ;50 msec delay
FE0B CD6000     00200          CALL    DELAY
FE0E C9         00210          RET             ;Return to BASIC
FE0F F3         00220 START    DI              ;DRAW BAR ROUTINE
FE10 ED4BE0FF   00230          LD      BC,(0FFE0H);Pause
FE14 CD6000     00240          CALL    DELAY
FE17 114000     00250          LD      DE,40H
FE1A 0610       00260          LD      B,10H   ;Counts lines
FE1C FD21203C   00270          LD      IY,3C20H;Video RAM
FE20 3EBF       00280          LD      A,191   ;Print bar CHR$
FE22 FD7700     00290 LOOPA    LD      (IY),A
FE25 FD19       00300          ADD     IY,DE   ;Skip to next line
FE27 10F9       00310          DJNZ    LOOPA
FE29 ED4BDBFF   00320          LD      BC,(0FFDBH);Finish 16.7 msec
FE2D CD6000     00330          CALL    DELAY
FE30 0610       00340          LD      B,10H   ;Sets counter
FE32 3E80       00350          LD      A,128   ;Blank character
FE34 FD21203C   00360          LD      IY,3C20H;Points video RAM
FE38 FD7700     00370 LOOPB    LD      (IY),A  ;Draws blank
FE3B FD19       00380          ADD     IY,DE   ;Jump to next line
FE3D 10F9       00390          DJNZ    LOOPB
FE3F 212935     00400          LD      HL,3529H;Normal RTC int
FE42 224740     00410          LD      (4047H),HL
FE45 FB         00420          EI
FE46 ED4D       00430          RETI
FE00            00440          END     0FE00H
```

Program Listing 4

begins to print the updated information. Hence, no flicker is apparent.

Program Listing 4 shows the source code for a machine-language routine that prints a vertical bar in the center of the screen. The decimal conversions for the object code appear in Table 2. Program Listing 5 is a Basic program that allows the user to enter a microsecond pause that Listing 4 takes before it draws the bar. If you select a microsecond pause within the 16.7-ms range, you can demonstrate the location of the electron beam at various times from the RTC interrupt. Listing 4, therefore, can calibrate the electron beam's location at different times.

The machine-language program reassigns the RTC interrupt to the Start address and then waits for the interrupt. RAM addresses FFE0 and FFE1 hex (65504 and 65505 decimal) contain the LSB and MSB codes for the user-selected delay. During this time, the electron beam completes its vertical retrace and starts to scan the visible lines. When the pause ends, the Z80 loads 191s into the video RAM addresses for a single vertical bar in the middle of the screen. It takes 380 microseconds to complete this loading. So, in effect, the bar data is loaded into video RAM just ahead of the electron beam.

Once the bar is drawn, the program pauses (lines 320 and 330). The codes in addresses FFDB and FFDC hex (65499 and 65500 decimal) create a pause for the remainder of the 16.7 ms from the beginning of the Start routine. Then the code for a blank graphics character (128) is loaded into each of the 16 video RAM locations for the segments of the bar. With the next pass of the electron beam 17 ms from the RTC interrupt, the bar is erased.

For example, if you selected a 10-ms pause from the RTC interrupt before the data is stored in video RAM, the

```
10 '     Z-80 VIDEO SYNCH DEMONSTRATION
         48 K DISK MODEL III TRS-80
         Written for TRSDOS 1.3
20 '     Revised 8208.21

100 CLEAR500:CLS
110 DEFSTRA-H:DEFINTI-J
120 CMD"L","BEAMCAL/CMD":'Loads 17 MSEC VERTICAL BAR
130 DEFUSR0=&HFE00:'Defines origin of machine code
200 CLS:INPUT"How many flashes";JA
210 INPUT"Length of pause before drawing line (usec)";JB
240 P0=JB-40:'Corrects for machine language routine overhead
242 OA=(P0-2.46)/14.8:'Converts to BC register value
244 GOSUB9000:'Rounding
246 JC=INT(OA)
250 J0=JCAND255:'LSB
252 J1=(-256ANDJC)/256:IFJ1<0THENJ1=256+J1:'MSB
260 POKE&HFFE0,J0:POKE&HFFE1,J1:'LSB & MSB for DELAY call
270 P0=50000/3-P0-403.5:'Gets rest of 16.7 msec
272 OA=(P0-2.46)/14.8:'Converts to BC register value
274 GOSUB9000:'Rounding
276 JD=INT(OA)
280 J0=JDAND255:'LSB
282 J1=(-256ANDJD)/256:IFJ1<0THENJ1=256+J1:'MSB
290 POKE&HFFDB,J0:POKE&HFFDC,J1:'LSB & MSB for rest of 17 msec
300 GOSUB9200:CLS
310 CLS:'Lines 310-340 draw screen display
320 FORJ=29TO989STEP64
322 PRINT@J,CHR$(170);
324 PRINT@J+6,CHR$(149);
326 NEXT
330 PRINT@16,"VIDEO LINE";
331 J0=1:FORJ=26TO538STEP64
332 PRINT@J,J0;:PRINT@J+4,STRING$(5,95);
333 J0=J0+1:NEXT
334 FORJ=601TO985STEP64
335 PRINT@J,J0;:PRINT@J+5,STRING$(5,95);
336 J0=J0+1:NEXT
340 PRINT@361,"Pause from Real Time";
342 PRINT@425,"Clock interrupt:";
344 PRINT@488,JB;"+ 100 usec";
400 FORJ=1TOJA:'Start flash sequence loop
410 J0=USR0(0):'Calls BEAM CALIBRATION
430 NEXT:'Next flash
440 GOSUB9200:CLS:GOTO210:'Wait for response then start over
9000 IFOA-INT(OA)<.49999THENOA=INT(OA)ELSEOA=INT(OA+1)
9010 RETURN
9200 A=INKEY$
9210 PRINT@962,"( P R E S S   A N Y   K E Y   T O   C O N T I
N U E )";
9220 A=INKEY$
9230 IFA=""THEN9220ELSERETURN
```

Program Listing 5

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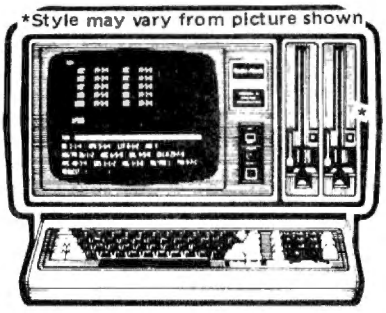

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electron beam is located within line 8 (see Fig. 2). The video data loads just in front of the beam. The Z80 then waits for the rest of the 16.7 ms from the RTC interrupt before it loads blank codes into video RAM. As a result, the top portion of the bar never appears. All you see is a bar starting somewhere within line 8, ending at the bottom of the screen, and lasting 17 ms.

When you run Listing 5, you must reserve high memory above address 65000. The object code for the machine-language routine should be in a disk file called BEAMCAL/CMD, as indicated in line 120. For non-disk users, POKE the object code decimal values starting in the address listed in Table 2.

Listing 5 asks the user to set two parameters. The first question, "How many flashes?", allows you to call the machine-language routine a number of times in succession. Each time the routine is called, the bar is displayed for 17 ms, so multiple flashes are helpful. The second question, "Length of pause before drawing line?", lets you select the initial microsecond pause that the machine-language routine takes.

When you select a pause, 40 microseconds are subtracted in line 240 of Listing 5. This is because those sections of the machine-language routine that precede drawing the bar take 40 microseconds to carry out. If you wish to use the values in Fig. 1 for each video line, be sure to subtract 100 microseconds, the time required for the Z80 to trigger the Start routine after the interrupt.

Upon answering the computer's queries, you can implement the demonstration by pressing any key. The program POKEs the correct values in RAM locations used by the machine-language routine and draws a screen display that helps to locate and interpret the length of the 17-ms bar (see Fig. 2). For calibration purposes, the short horizontal lines indicate the general location of each video line. About 2/3 of the video line (seven scan lines) is located above the horizontal line, 1/3 below it (four scan lines). All alphanumeric characters appear in the space above the horizontal line; some graphics characters span both above and below the horizontal line.

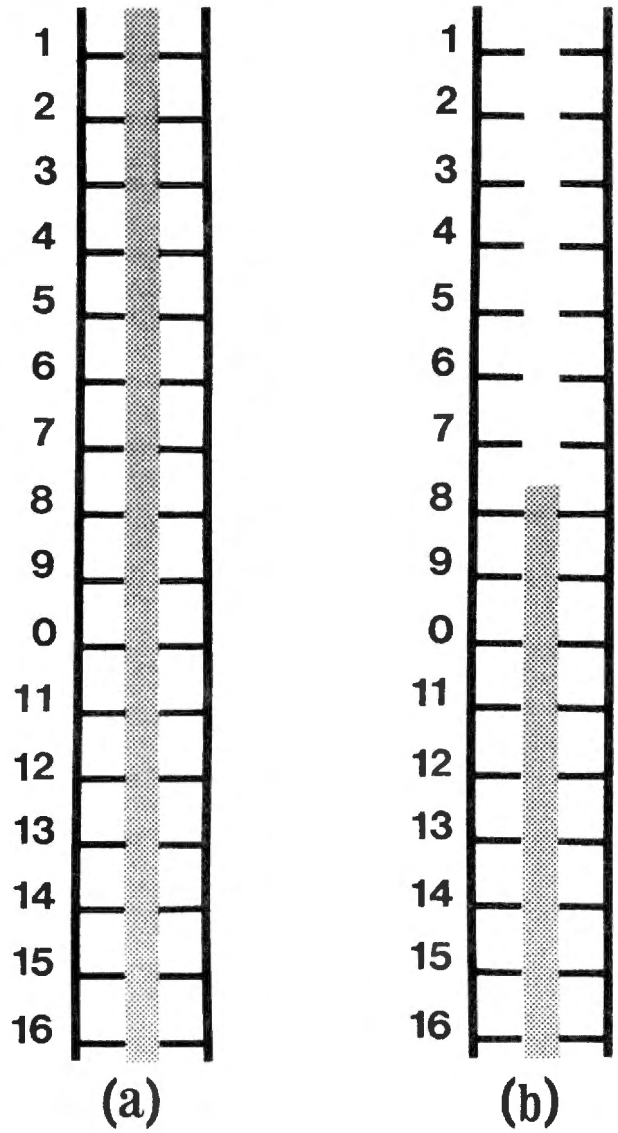

Fig. 2. Two sample screen displays produced by Program Listing 5 for electron beam calibration. The short horizontal lines are produced by CHR$(95) which appears as a short line about 2/3 of the way down the video line. When displayed, alphanumeric characters appear in the space above this character. The central grey bar depicts the vertical bar displayed by Program Listing 4. In (a), the entire bar appears. This would be the display if no pause were executed after the RTC interrupt. A 10-ms pause would give a result similar to (b). The entire bar is loaded into video RAM, but the top portions are erased before the electron beam can get to them.

I tested Listings 4 and 5 on my Model III and found a lack of agreement between the initial pause and the expected location of the electron beam. For example, a 10 ms pause should show a complete bar from the middle of line 8 down to the bottom of the screen. The actual line displayed, however, only started at line 9, an error on the order of some 500 microseconds.

The pattern of errors indicates that Listing 4 is either pausing 38 microseconds for each visible line or that the visible lines are drawn 38 microseconds sooner than the 757 microseconds supplied by Radio Shack. The 100-microsecond delay from the interrupt to the beginning of the Start routine appears to be accurate. But the microsecond values given for each line in Fig. 1 are not accurate. I found that the top of the bar appears in the expected location if the pause is adjusted based on the following equation:

MEASURED TIME = PREDICTED TIME − (LINE NUMBER × 38 microseconds)

From this value, you also have to subtract the 100 microseconds overhead from the RTC interrupt. Table 3 lists the results.

I am not certain where the error lies. It may be that the video circuitry of my unit isn't operating at the intended 60 Hz, or my system clock is off, but I somehow doubt this. I may have incorrectly timed the duration of the machine-language instructions. For this, I used Rodnay Zak's book, *How to Program the Z80*. And I double-checked my calculations.

Another problem might be in the Delay subroutine in the Model III's ROM. The user's manual gives instructions that imply a microsecond accuracy for this delay call. But if the Delay subroutine is the problem then it underestimates the time with a 5 percent error (38 microseconds per 757-microsecond line). However, I find it difficult to

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believe that this rather large error might have gone undetected by the Model III designers.

If you use Listings 4 and 5 on your own computer and enter the values in the third column of Table 3, the top of the bar should be located about 1/3 of the way down from the horizontal line. For each of the pauses listed, the corresponding video line should be lighted; that is, if you entered 8,005 microseconds, the bar should begin at the top of line 6. It would be interesting if there were some variation between different computers. This would mean that the error is due to a hardware inconsistency. If, on the other hand, the 38 microsecond-per-line error is constant from one unit to another, it reinforces our faith in the precision of TRS-80 hardware, but still causes us to wonder why the error is there.

While the existence of an error is apparent, the strength of Listing 4 is that it facilitates detecting and correcting the error in the programmer's own routines. As an experimental psychologist, I was unaware of the error until I designed and tested Listing 4. Now I can use this program to calibrate other machine-language routines that require the precise timing characteristic of psychological experimentation.

Animation techniques are not likely to be as demanding as psychological research, but it's nice to know that the video screen operation is predictable. I hope that software designers find the technique I described here to be useful in developing improved animation routines. ■

Joseph Dlhopolsky is employed by St. John's University, Staten Island, NY. Write to him at 27 Wilson St., Port Jefferson Station, NY 11776.

Line Number	Predicted Time From RTC (ms)	Measured Time From RTC (ms)	Difference (μs-100)
1	4.545	4.407	38
2	5.303	5.127	76
3	6.061	5.847	114
4	6.818	6.566	152
5	7.576	7.286	190
6	8.333	8.005	228
7	9.091	8.725	266
8	9.848	9.444	304
9	10.606	10.164	342
10	11.364	10.884	380
11	12.121	11.603	418
12	12.879	12.323	456
13	13.636	13.042	494
14	14.394	13.762	532
15	15.152	14.481	571
16	15.909	15.201	608

Table 3. Predicted millisecond pauses for beam calibration at each video line (column 2) do not show the electron beam to be in the expected position. When the values in column 3 are entered in Program Listing 5, the electron beam appears at the beginning of each video line. Column 4 lists the differences, in microseconds, between the predicted and measured pauses for each line. If you divide the value by the line number, you get a constant of 38 microseconds.

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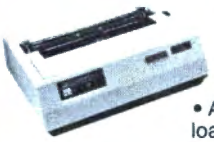

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Model II/12/16 Games

You might expect Color Computer and Model I/III game players, used to sitting out CLOADs or seeing ads for 32K games that won't fit their 16K machines, to be jealous of the Models II/12/16. A Model II disk can hold 416K; a Model 12 disk, over a megabyte. Someday, someone's going to use one to write the *War and Peace* of adventures.

In the meantime, however, Tandy's business machines seem stuck in the 9-to-5 grind. Comparatively few companies make games for the II/12/16; most answered *80 Micro*'s questionnaire, while data on others was gleaned from ads. Even so, this is one of *80*'s skimpier Buyer's Guides.

The following programs run under TRSDOS on 64K or larger Z80 machines. No one yet makes games for the 68000 or the Model 16's multi-user Xenix system, though workers blasting each others' starships from remote terminals is a lovely idea.

Advanced Data Design Inc., 184-08 Tudor Road, Jamaica Estates, NY 11432, 212-380-0124.

Two multi-game disks, with a modified Basic interpreter that allows finer graphic detail. Game Pack I ($50) features the two-player games Intercept (block your opponent's line while directing your own to avoid obstacles) and Reversem (Othello), and the arcade-style Lunar Lander and Sink the Battleship.

Game Pack II ($70) contains the above four, plus Eat'Um (control a growing snake at 10 levels of play) and Reversem II (you against the computer).

Adventure International, Box 3435, Longwood, FL 32750, 305-862-6917.

Scott Adams' Adventures 1–12—from Adventureland and Pirate Adventure through Ghost Town and Golden Voyage—on one TRSDOS 2.0 disk, for $129.95 (Florida residents add 5 percent tax).

B.O.S.S. Computer Group Ltd., 4136 Burke St., Burnaby, B.C., Canada V5H 1B1, 604-430-4612.

A TRSDOS 2.0/2.0a/2.0b/4.2 disk for $82.95 (Canadian), with 20 programs. The first 11 are "logic-oriented games," ranging from Biorhythm and Tic-Tac-Toe to Guillotine (you are a French aristocrat trying to talk the peasants out of beheading you) and Joseph (you have been sold to the Egyptians by your brothers and must prepare for the coming drought).

The other nine are graphics games: Extendapede, Parachutist, Satellite, Volleyball, and others like Farmyard (Farmer Brown chasing a chicken) and Subway (a Russian spy evading a Western agent).

Eberhard Engineering, P.C., 27 Pine Ridge Drive, Smithtown, NY 11787, 516-543-7777.

To quote the press release, Above Intelligence is a collection of "over 25 sophisticated games, brain teasers, and nude printer graphics" (if you have a Daisy Wheel II or line printer). The disk lets you check your I.Q. or biorhythm, rate the men and women in your life, play Hangman and Casino, and print the ever-popular Snoopy calendar as well as pictures of naked ladies.

"Targeted for use by the sophisticated executive," not to mention "ideal for children," the package "promotes interest by computer-fearing staffs, and dramatically reduces the mystique and apprehension associated with computers." All this for $49.95.

Kuzel Computer Services, 8654 W. Berwyn Ave. #3S, Chicago, IL 60656, 312-399-0273.

Programmer Kenneth Kuzel offers a Star Trek game called The Wrath of Ken, as well as 10 other programs. Munchman, Galactic Invaders, Meteors (an Asteroids game), and Bustout are familiar arcade adaptations. Wormy obliges you to control a ravenous, growing worm; Racer X involves dodging cars and potholes. In Quest for Adventure, you "recruit an army of adventurers and chart an unknown land." Traditional gamers can try Othello, Chess, or Computer Casino (blackjack and slots).

Each Kuzel game sells for $19.95; any two are available for $29.95.

Maryland Model II Games, 3304 Carlton Ave., Temple Hills, MD 20748, 301-894-1274.

Skydiver, Star Battle, The Wall, Space Swarm, and Mayhem—five arcade-style games for $29.95 (Maryland residents add $1.50 sales tax).

Rizzo Data Systems Corp., 577 Burlington Road, P.O. Box 458, Bridgeton, NJ 08302, 609-451-7979.

By day a small-business-systems dealer, Rizzo doubles as a distributor for AI's Adventures 1–12 ($132.95) and Interactive Fiction ($52.95) and the two ADD Game Packs ($53 and $73).

In addition, the firm offers Ricochet, Star Trek, and Biorhythms ($28 each), as well as Lance Micklus' $78 game disk (checkers, Starflight, Concentration, Treasure Hunt, Banko, and the Dog Star Adventure).

Tycoon ($38) is a Monopoly-like game, and Starship/1 ($42) lets you save the galaxy in real time. Finally, Electro Casino ($78) includes blackjack, five-card stud, roulette, and horse racing, and Handicapping ($103) classifies and ranks thoroughbreds.

Wilson Software Division, 539 Springhouse Lane, Camp Hill, PA 17011.

More gamblers' software: Draw5 ($23.50) is five-card draw poker and Stud5 ($18.50) is five-card stud. Spread80 ($25) computes pro football winners; Pool80 ($20) operates and maintains an office football pool; and Tout3 ($22.50) handicaps horse races. ■

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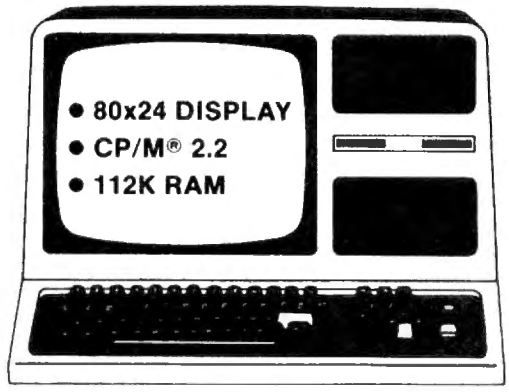

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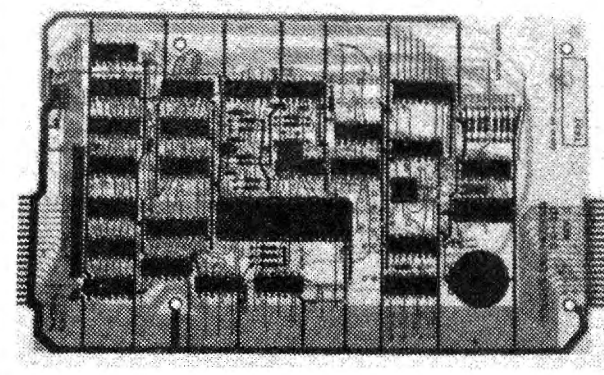

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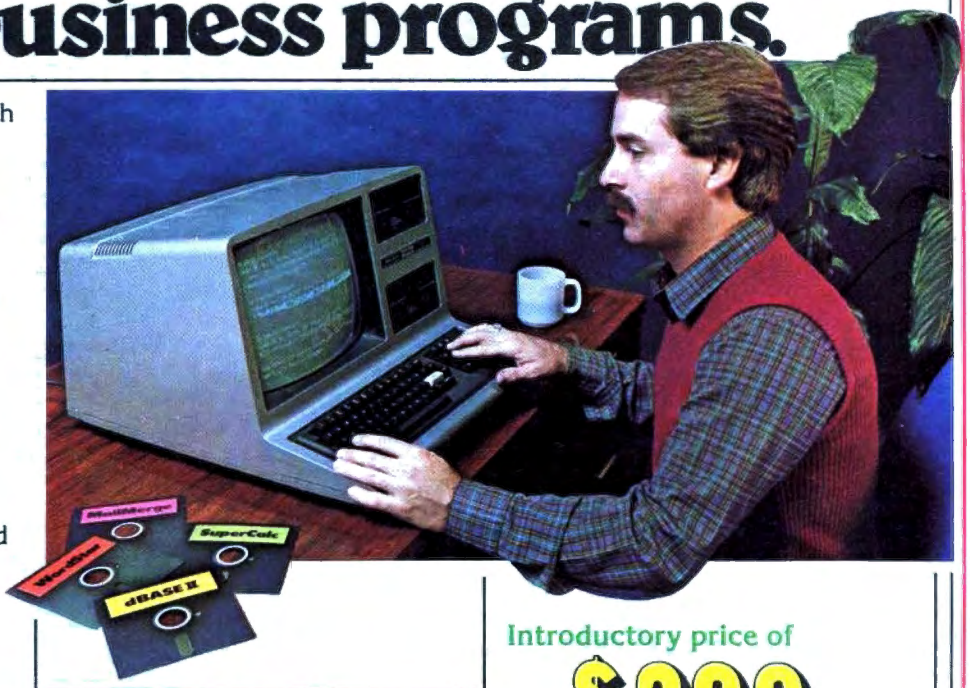

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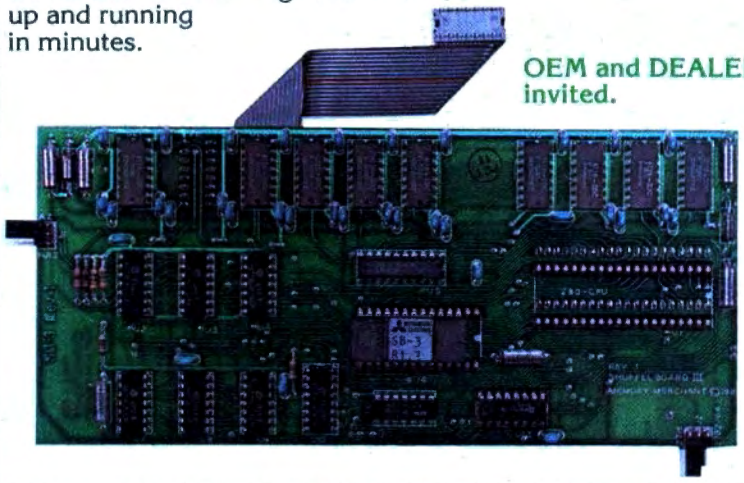

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Maxi Mail

by Jim Heid

Maxi Mail provides its own DOS to help your Model III manage a mailing list, but this is a system that requires time and patience.

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No, Maxi Mail is not the misspelled name of a new body-building magazine. It's a mailing list management system for the Model III, offered by the business software arm of Adventure International. Maxi Mail is an easy-to-use, well-documented system, but some of its functions take maxi-time.

System Components

The Maxi Mail software is a combination of machine-language programs and Basic programs with machine-language subroutines. The system comes on one double-density disk, packaged with a 50-page manual in a 7- by 9-inch binder.

The software includes a disk operating system (DOS), a scaled-down version of DOSPLUS called TDOS. It includes Format and Back-up utilities, and supports the seven library commands listed in Table 1. (A library is a list of commands that lets you control the DOS and manipulate your disk files.)

The DOSPLUS people mysteriously chose the word Cat (for catalog) as the command to display the directory. Most TRS-80 users are used to typing Dir for a directory display. The Cat command displays file names only; if you need more information, such as free disk space or file size, you must read the directory with a DOSPLUS 3.3 or 3.4 system disk.

Because DOSPLUS is a reliable, time-tested operating system, most users will be content with its scaled-down version. If you strongly prefer another DOS, you're on your own.

The manual provides no information on interfacing Maxi Mail with other operating systems. In fact, it states, "...there is no need to transfer Maxi Mail to another DOS." Owners of souped-up TRS-80s with nonstandard disk drives might disagree.

The manual says nothing about high-speed CPU support or about the types of drives TDOS supports. If you have a modified CPU machine or nonstandard drives (8-inch, for example), check with The Business Division before buying Maxi Mail.

Maxi Mail Main Menu

Code	Function
1	— Add New Records
2	— Edit Existing Records
3	— Print Options
4	— Text Merge
5	— Create New Mailing List
6	— End Program

Enter the function code desired

Fig. 1. Maxi Mail's Main Menu

Using Maxi Mail

Maxi Mail executes automatically when you press reset. A title page appears while the program loads, and the main menu appears after a few seconds (see Fig. 1). Before you can enter names and addresses, you must initialize a data disk by selecting option 5, "Create New Mailing List."

This option creates a series of data disk files that hold your mailing list. It also initializes a few data files on the system disk. You have several opportunities to abort the initialization process

if, for example, you insert a disk you don't want to use.

Maxi Mail requires a separate system disk for each of your mailing lists. If you want to keep three separate lists—one for past customers, one for present customers, and one for prospective customers—you must have three system disks, one for each list.

This doubles the number of back-up disks required, since you have to duplicate each system disk. To back up the three lists above, you need six blank disks—one for each data disk and one for each system disk. This can cost you a lot of blank disks.

The same requirement also invites disaster if you mistakenly use a system disk in combination with the wrong data disk. To see what would happen, I set up a mailing list and entered 55 sample records. (A record contains name and address information for one person—like one card in a Rolodex file.)

Using the same system disk, I set up another list and entered eight sample records. Everything worked properly. When I went back to add names to the first list, however, the system forgot there were 55 records. It stored only nine records, and sent the other 46 into magnetic oblivion.

Maxi Mail needs a test to warn you if you try to use a bad disk combination. Careful users will label their disks explicitly.

Field Information

Thirteen fields per record; names and lengths as follows:

- Last name: 28
- First name: 28
- Address: 26
- City: 15
- State/Country: 6
- Zip code: 9
- Telephone area code: 3
- Telephone exchange: 3
- Telephone number: 4
- Numeric code #1: 4
- Numeric code #2: 4
- Numeric code #3: 4
- Alpha code: 3

The user cannot change field lengths. He can change "Last name" and "First name" fields to "Company name" and "Attention," respectively. Other field names are permanent.

Sorting

Records are kept in zip code order, and in alphabetical order within zip code. No other sorting is possible.

Data File Specifications

Maximum size limited only by free disk space.
Holds approximately 1,000 records per disk.
Separate system disk required for each mailing list.

Label Printing

Capable of printing up to four labels across.
Multiple search criteria allowed.
Label size is user-definable.
Capable of printing summaries.

Form Letter Generation

Lets you supply data from keyboard during printing session.
Printing parameters are user definable.
Multiple search criteria allowed.
Separate word processor required that can save in ASCII format.

DOS Overview

TDOS (scaled-down version of DOSPLUS).
Supports 5-inch, single- or double-density, 35-96 track drives.
Utilities include Back-up and Format.

Description of Library Commands

Auto—activates/deactivates program loading upon reset.
Cat—displays disk contents.
Config—sets track-to-track stepping rate (6, 12, 20, 30, or 40 milliseconds).
Copy—duplicates files from one disk to another.
Kill—deletes files.
Rename—changes a file's name.
Verify—enables read-after-write feature to verify accuracy of disk writes.

Table 1. Maxi Mail Specifications

Adding Records

Adding records to your list is easy. When you select option 1, "Add New Records," the screen clears and a data-entry form appears (see Fig. 2). The program also displays the total number of records stored in your list.

Each record contains 13 fields. A field is comparable to a single line on the Rolodex card; each field contains a line of data pertaining to the record. The first two fields are "Last Name" and "First Name." You can replace these labels with "Company Name" and "Attention" by typing @ and pressing enter.

"Telephone Number" actually comprises three fields: area code, exchange, and number. The telephone number fields accept numbers only. This is a minor inconvenience if you refer to telephone exchanges by letter (such as KL5-1212). Maxi Mail does not let you type letters or other characters into the three numeric-code fields either.

Maxi Mail's code fields hold only three alphanumeric characters and 12 numeric characters. If you need to store more data with each record, or if you prefer to spell out data rather than code it into numeric fields, you might want a mailing list system that allows larger code fields or a data-base manager that lets you create the format to store your information.

The periods in each field represent possible characters. Enter your data one field at a time; the field you are working on is highlighted with small graphics squares instead of periods. To leave a field blank, simply press enter.

When you've entered a complete record, the program asks you if it's correct. If you answer no, it asks you for the number of the incorrect field. After you correct that field, Maxi Mail again asks you if the record is correct. By answering no and providing another field number, you can correct any incorrect data.

This method of field correction is common in Basic mailing list programs.

It's not as easy to use as a screen editor with a movable cursor, but it's adequate.

Once your record is correct, the program stores it on the system disk, clears the screen, and displays another data-entry form. As you type in the information for each field, the bottom of the screen displays your entry for that field in the last record.

By pressing clear, you can assign the data at the bottom of the screen to the current field without retyping it.

Assume you typed the last name Kelly into the first record. You are now at the "Last Name" field of the next record. The bottom of the screen displays the message "Press CLEAR if LAST NAME: KELLY". If you press clear, the name Kelly appears in the new "Last Name" field. This feature is valuable when many of your records share the same data.

When you finish a data-entry session, Maxi Mail begins the file insertion routine, a lengthy process in which the program sorts and transfers your data from the system disk to the data disk. It takes the system almost four minutes to transfer about 25 records. If you've added only one name, storing still takes almost a minute. It might be more convenient to wait until you have a number of records to add.

Data Entry Function — Total Records Filed = 11

1. LAST NAME: .....
2. FIRST NAME: .....
3. ADDRESS: .....
4. CITY: .....
5. STATE/COUNTRY: .....
6. ZIP CODE: .....
7. TELEPHONE NUMBER: ...- ...- ....
10. NUMERIC CODE #1: ....
11. NUMERIC CODE #2: ....
12. NUMERIC CODE #3: ....
13. ALPHA CODE: ...

Fig. 2. Data-entry Form

Editing

Maxi Mail's editing features are not as flexible as some other mailing lists. To edit or delete a record, you must supply the last name and the zip code under which you stored the record.

You can search for up to 100 different names and zips at a time, but the program does not permit other search criteria. You cannot search for a record by state, phone number, or any other field, for instance.

If you do not know a record's zip code, you must go to a different part of the program to display an abbreviated record listing of your mailing list, then go back to edit to search for the records. This is a significant restriction, especially if you have a large mailing list.

It would be easier to locate a record by searching any field you wanted. It would also be convenient to browse through your mailing list one record at a time, but Maxi Mail doesn't let you.

Once you supply a last name and zip code, the system searches your data disk for the record. If Maxi Mail doesn't find the record, it simply returns to its

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main menu. Some kind of "record not found" message would be helpful, especially to novice users.

If the program finds the record, it appears on the screen and you have the opportunity to delete it, edit it, display the next matching record, or search for the next name and zip you entered. If you delete the record, Maxi Mail manipulates its data files for a few seconds, then returns to the main menu.

If you choose to edit the record, the program asks which line you want to change. The field correction procedure is identical to that in the "Add New Names" section. A screen editor with movable cursor would be easier to use, but the line-oriented method serves its purpose.

The edit mode is also slow. It took about a minute for Maxi Mail to search through my 55-record mailing list. If you enter a name or zip code incorrectly, you have to wait while the system searches in vain for it. Pressing break stops the program and puts you in Basic's command mode, with nothing but open files and a "Break in line XXX" message to comfort you.

If you change the last name or the zip code of a record, the file insertion routine forces you to wait even longer. I changed the last name of one entry and had to wait over a minute. And the delays get longer as your mailing list grows.

Printing Your List

Maxi Mail performs well when printing. You can print up to four labels per line, and you can change the default values for margins and number of blank lines between labels. If you change the default values, the program stores the new values on the system disk, eliminating the need to change them in the future.

Maxi Mail supports printers with up to 132 columns. The system does not let you send control codes to the printer. This is a limitation if you have a dot-matrix printer with several print options.

You can print labels for your entire mailing list, or only for those records that match certain criteria. If you select the latter option, you must tell Maxi Mail which fields to search, and what to search for.

You can specify up to ten search fields, designating each search as exclusive or nonexclusive. An exclusive search looks for and prints records that match every parameter you specify; a nonexclusive search prints records that meet one or more of the parameters.

Telling Maxi Mail what to look for is easy. Type in the number next to the name of the field you want to search. Maxi Mail then asks if the search is to be exclusive or nonexclusive.

After you answer, a data-entry line of the appropriate length appears, and the system asks you for the search's beginning and ending range. If you want to print labels for all zip codes starting with zero, for example, you specify 00000 as the beginning range, and 10000 as the ending range.

Version A.0 contains a bug in its record search routine that crashes the program if you try to search by the area code or the area code and exchange fields. The crash results in no data loss, but it does rob you of two valuable search options.

Another search routine bug prohibits you from typing more than 11 characters when searching by the city field, which is 15 characters long. You can't search for a city with a name longer than 11 characters.

The Business Division is aware of these bugs, and future versions of Maxi Mail will not contain them. If you've already bought version A.0, list the program called PRINT/BAS. If its version number is A.1, return your copy of Maxi Mail for a corrected version.

Summaries and Form Letters

Maxi Mail also prints your mailing list in summary form (column form instead of mailing-label format). You can print a complete record listing (see Fig. 3), or an abbreviated record listing (see Fig. 4). You can also display the abbreviated record listing on the screen.

Maxi Mail's best feature, text merge, lets you print "personal" form letters. First, you write a letter that contains code words called field labels. These tell Maxi Mail that you want to insert something from your mailing list at that point in the letter.

Your letter can also contain keyboard variables that let you supply data from the keyboard during a printing session. Using field labels and keyboard variables, you can print what looks like a personal letter for each entry in your mailing list, or for only those entries that meet your search criteria.

Maxi Mail has a more cumbersome text merge feature than some other systems. Printing letters for all records (no search criteria) requires that you follow this maze of steps and prompts:

- clear file area (by selecting an option from a menu)
- load the file that contains your letter
- compile the file (Maxi Mail checks your letter and makes sure all field labels are spelled correctly)
- specify permanent (stays the same for each letter) or temporary (changes from

Complete Record Listing Total Records = 5 Disk No 1 Page 1

Zip Code / Street Address	*Company Name/Last Name / City	Attention:/First Name / St/Cty	Code #1	Code #2	Code #3	Telephone # / Alpha
09876	Johnson	Sam				987-654-3210
155 Any Road	Nowhere	NH	3	351	3	def
12345	Smith	Sam				123-456-0789
123 Main St.	Anytown	PA	3	351	3	ABC
34232	Kelly	Maryellen				331-555-2212
531 Street St.	Byteville	GA	33	0	1	bug
34333	Howard	Curly				221-543-1242
123 Fiction Blvd.	Anywhere	AK	1	0	0	ag
34992	Johnson	Amy				322-544-3456
1556 34th St., Apt. 3E	Notown	FL	32	2	2267	ga

Fig. 3. Complete Record Listing

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page to page) keyboard variable ● start printing, or change printing parameters if desired.

All these steps are probably necessary to support Maxi Mail's flexible text merge features. If your form letter requirements are relatively simple, however, they might be too much trouble.

Documentation and Support

The biggest error in Maxi Mail's documentation was its instruction to press shift and clear simultaneously to print whatever is on the screen. The proper key sequence is shift, down arrow, and asterisk. Otherwise, the documentation has no major errors or omissions.

The writing style is clear, and many sample screens guide the inexperienced user. The manual is attractively designed and printed on thick, durable stock. It's divided into eight tabbed sections, with an index and a two-page table of contents. Nine appendices cover such subjects as disk formatting and back-up, text formatting commands, and disk operating system use.

The Business Division prefers that you write them with your troubles, but according to the manual, they take phone calls "if you really get desperate." (I'm not sure how they can tell if you're desperate. Maybe they measure the quiver in your voice.)

Although the manual doesn't say so, The Business Division will replace a damaged master disk at no cost, provided you're a registered owner and you send in the original disk. The company replaces any bug-containing programs to registered owners free of charge.

Abbreviated Record Listing Total Records = 5 Disk No 1 Page 1

Zip Code	*Company Name/Last Name	Atten/First Name	St/Ctry	Cd#1	Cd#2	Cd#3	Alpha
09876	Johnson	Sam	NH	3	351	3	def
12345	Smith	Sam	PA	3	351	3	ABC
34232	Kelly	Maryellen	GA	33	0	1	bug
34333	Howard	Curly	AK	1	0	0	ag
34992	Johnson	Amy	FL	32	2	2267	ga

Fig. 4. Abbreviated Record Listing

Pros and Cons

Maxi Mail is a solid, reliable mailing list manager. Inexperienced users should have little trouble with it, although the complex text merge procedure might frighten some.

The system's letter-printing capabilities are very powerful and its search routines are flexible enough for most mailing applications. Its documentation is clear. Adventure International is a reputable company that has been in business for several years.

Maxi Mail is, however, painfully slow at times. Its editing features are inconvenient, partly because editing is done line by line instead of with a screen editor, but mostly because you have to supply the zip code with the last name of the record you want to edit.

As mailing list managers go, Maxi Mail is in the middle ground. For most applications, you could do worse, but you could also do better. ■

Jim Heid is a technical editor for Wayne Green Books Inc. Contact him c/o 80 Micro.

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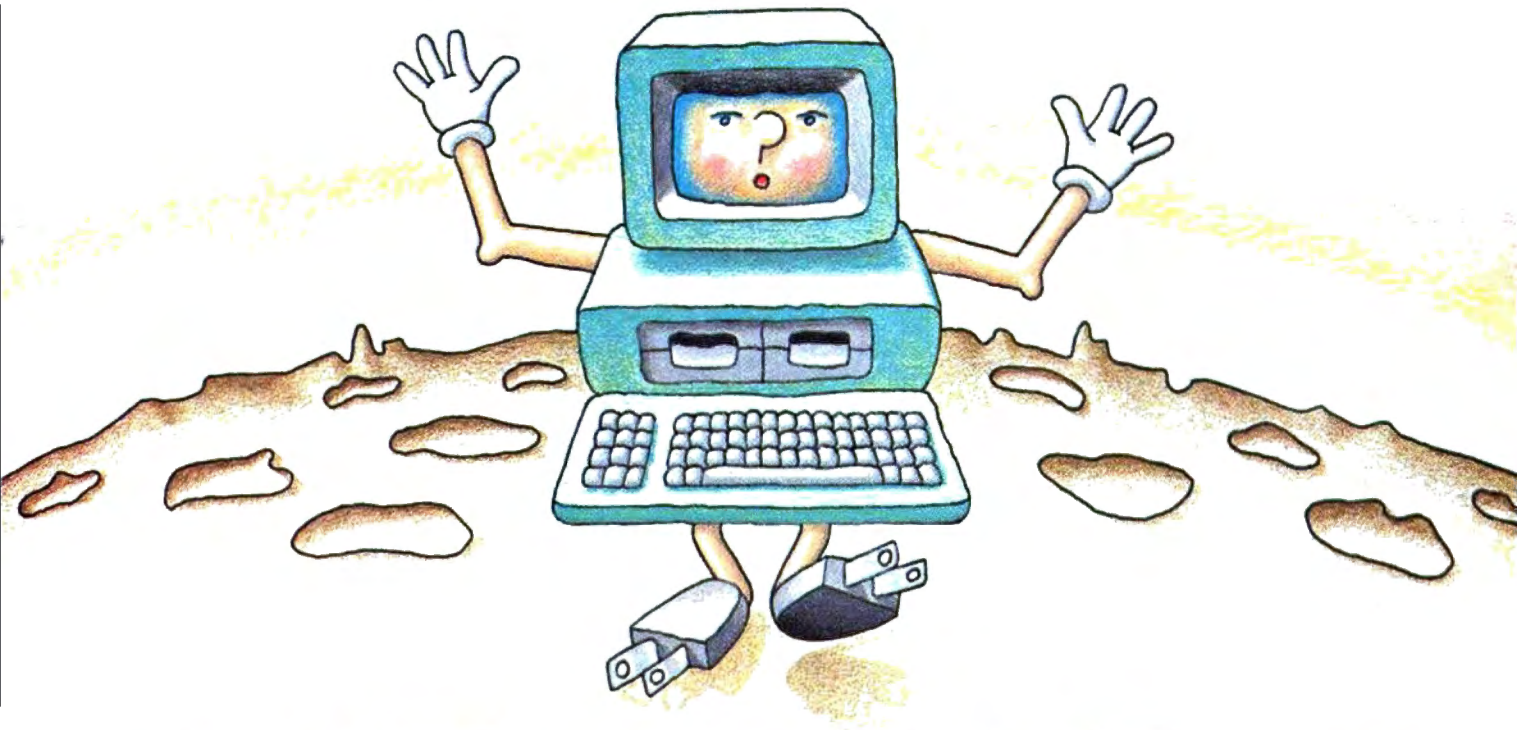

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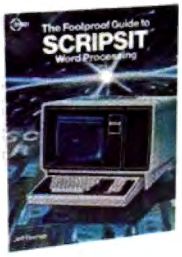

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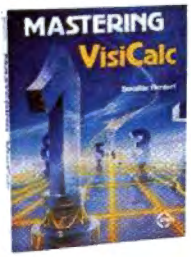

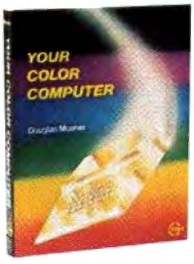

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Model II Casino

by Byron Lott

When you want to use your Model II for something other than business applications, try these 10 Las Vegas casino-style games.

Most Model II game articles begin with lines like: "So you think the Model II is all business and no play?" Actually, not only does the II like a little relaxation now and then, it even has a wild side. Witness these 10 programs, ready for anything from a charity Las Vegas Night to the seediest gambling den.

The programs, One-Armed Bandit, Craps, Big Six, Blackjack, Roulette, Keno, Draw Poker, Faro, Baccarat, and Four-Card Monte, run under Model II Disk Basic. They use the limited graphics capability of the Model II, along with simple subroutines, to provide casino-style play and scoring.

Line	Function
10–90	Introduction
100–270	Game rules
280–290	Slot machine graphics
300–330	Start play
340–540	Wheel random selection display and scoring
550–600	Wheel graphics selection subroutines
610–650	Play termination
660–680	Machine outline graphics subroutine
690	Wheel outline subroutine
700	Wheel rotation subroutine
710	Handles operate subroutine
720	Graphics blanking subroutine

Table 1. One-Armed Bandit

One-Armed Bandit

This program provides an interesting application of Model II graphics to simulate the typical casino slot machine.

The random display of the 20-sided wheel is a little unusual. It is the result of the R1, R2, and R3 statements in line 340. These are evaluated in lines 550–600 for display and scoring input. Scoring occurs in lines 380–470.

Roulette

In this roulette program, bet selection (in line 240) requires entry of a letter to identify the desired bet. This letter enters and posts the bet on the playing board display, just as a stack of chips would be placed.

When you've placed all the bets, press enter to start the wheel spinning and

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ball rolling. Then the results appear on the screen. The random winning number selection and simple graphics—to slow the ball down gradually before it drops into the pocket—start on line 1390.

PRINT@ statements produce both graphics and text. The program presents a challenge to improve with each simulation. Machine language would be faster, but Basic works because speed is not that critical here.

Craps

Craps in standard Disk Basic provides an interesting simulation of the conventional game. Betting is based on the casino rules of play and most, but not all, types of bets are accepted.

The standard graphics capability of

Line	Function
10–80	Program introduction
90–210	Game rules
220	Starts game and graphics layout
230–300	Enter pass-line bets
310–340	Come-out toss of the dice
350–400	First toss scoring logic
410–480	Enter come bets
490–550	Enter place bets
560–600	Enter field bets
610–630	Second toss of the dice
640–750	Evaluation and scoring after second toss
760–800	Game conclusion
810	Dice outline graphics subroutine
820	Graphics partial clear subroutine
830–880	Dice value graphics subroutine
890–910	Layout betting graphics subroutine

Table 3. Craps

Line	Function
10–130	Program introduction and array definition and loading
140–330	Faro playing rules
340–380	Playing layout graphics
390–410	First card draw (soda) and display
420–550	Bet selection and placement on the layout
560–600	Drawing of cards to lose and to win
610–660	Evaluation of bet(s) and scoring
670–850	Evaluation of last three cards in box and placement of appropriate bets
860–890	Game conclusion and results
900	Card suit determine subroutine
910	Graphics clearing subroutine
920	Card outline graphics subroutine
930	Layout graphics subroutine
940	Card printing subroutine
950	Turn counter and display subroutine
960	Card box graphics subroutine
970–980	Losing card evaluation subroutine
990–1000	Winning card evaluation subroutine

Table 5. Faro

Line	Function
10–90	Program variable and array definition and introduction
100–190	Rules of roulette
200–210	Playing layout graphics
220–250	Bet amount and type selection
260–350	Line bet entry and posting
360–480	Square bet entry and posting
490–780	Split bet entry and posting
790–930	Straight bet entry and posting
940–1040	Street bet entry and posting
1050–1110	Column bet entry and posting
1120–1180	Dozen bet entry and posting
1190–1240	High/low bet entry and posting
1250–1300	Odd/even bet entry and posting
1310–1360	Black/red bet entry and posting
1370	Partial screen clear subroutine
1380–1460	Play number selection and graphics
1470–1530	Game scoring and result display
1540–1570	Game conclusion
1580–1620	Layout graphics subroutine
1630–1660	Layout graphics numbering subroutine
1670–1700	Graphics support subroutine

Table 2. Roulette

Line	Function
10–130	Game introduction and array loading
140–440	Game rules
450–460	Layout graphics
470–510	Opening bet
520–570	First card dealing and scoring
580–600	First score posting
610–660	Continuing bet selection
670–720	Enter double bet
730–800	Enter insurance bet
810	Forced card draw subroutine
820–890	Continuing bet selection
900–1080	Scoring and results posting
1090–1140	Game conclusion
1150	Layout graphics subroutine
1160–1190	Card suit determination subroutine
1200	Card value printing subroutine
1210	Card outline printing subroutine
1220	Card back pattern subroutine
1230	Card content clear subroutine
1240	Card printing subroutine

Table 4. Blackjack

Line	Function
10–110	Program introduction
120–260	Game rules
270–280	Layout graphics
290–340	Start of play with bet selection
350–430	Bet placement
440–470	Random winning number selection
480–610	Game scoring and posting
620–640	Game conclusion
650–660	Layout graphics subroutine
670–710	Wheel rotation graphics subroutine
720	Rotation angular rate counter subroutine
730	Layout graphics subroutine

Table 6. Wheel of Fortune

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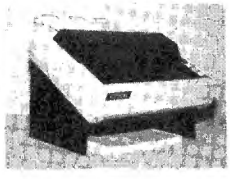

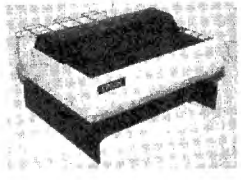

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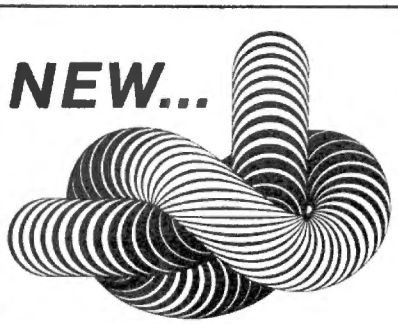

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the Model II prevents elaborate board layout and three-dimensional views. I've used a simplified table and dice-like structures.

The game starts on line 220; the program resets the appropriate variables and the graphics layout appears. After you make the initial bet (type and amount) in lines 230–300, the first toss of the dice takes place in lines 310–340. Lines 350–400 evaluate the results.

At this point, the player chooses and enters the remaining types of bets. You can skip each one and make no bet by

Program Listing 1. One-Armed Bandit

```
10 REM 02-JAN-83 *BDL MODEL II*
20 REM BANDIT/BAS
30 CLS:PRINTTAB(24)"PLAYING ONE-ARM BANDIT":PRINT:PRINT
40 CLEAR500:DEFDBLG,R,T:U$="#####.##":GC=10000:V$=CHR$(148):GA$=CHR$(128):GB$=CH
R$(131):GC$=CHR$(129):GD$=CHR$(130):GX$=CHR$(134):GS$=CHR$(158):GQ$=" "
50 PRINT"THIS PROGRAM SIMULATES THE MECHANICAL THREE-WHEEL ONE-ARM BANDIT SLOTS"
60 PRINT"AS PLAYED IN THE CASINOS IN NEVADA.":PRINT
70 PRINT"INSTRUCTIONS REQUIRED (Y/N)"
80 I$=INKEY$:IFI$=""THEN80ELSEIFI$="Y"THEN100ELSEIFI$="N"THEN280ELSE80
90 FORZ=1TO800:NEXTZ:GOTO280
100 CLS:PRINT@23,"CASINO SLOTS INSTRUCTIONS":PRINT:PRINT
110 PRINT"THE SCORING FOR THIS SIMULATION IS AS FOLLOWS:":PRINT
120 PRINTTAB(11)"B E L L";TAB(26)"B E L L";TAB(41)"B E L L";TAB(53)"PAYS   5 0 0
"
130 PRINTTAB(11)"B E L L";TAB(28)"X X X";TAB(41)"B E L L";TAB(53)"PAYS   3 0 0"
140 PRINTTAB(11)"B E L L";TAB(28)"X X X";TAB(43)"X X X";TAB(53)"PAYS   1 0 0"
150 PRINTTAB(13)"B A R";TAB(28)"B A R";TAB(43)"B A R";TAB(53)"PAYS   3 0 0"
160 PRINTTAB(13)"B A R";TAB(28)"B A R";TAB(43)"X X X";TAB(53)"PAYS   1 0 0"
170 PRINTTAB(11)"L O G O";TAB(26)"L O G O";TAB(41)"L O G O";TAB(53)"PAYS   3 0 0
"
180 PRINTTAB(11)"L O G O";TAB(22)"O R A N G E";TAB(43)"X X X";TAB(53)"PAYS     5
 0"
190 PRINTTAB(11)"L O G 0";TAB(26)"P L U M";TAB(43)"X X X";TAB(53)"PAYS     5 0"
200 PRINTTAB(7)"O R A N G E";TAB(22)"O R A N G E";TAB(37)"O R A N G E";TAB(53)"P
AYS   2 0 0"
210 PRINTTAB(7)"O R A N G E";TAB(22)"O R A N G E";TAB(43)"X X X";TAB(53)"PAYS
  5 0"
220 PRINTTAB(7)"C H E R R Y";TAB(22)"C H E R R Y";TAB(37)"C H E R R Y";TAB(53)"P
AYS   1 0 0"
230 PRINTTAB(7)"C H E R R Y";TAB(22)"C H E R R Y";TAB(43)"X X X";TAB(53)"PAYS
  2 0"
240 PRINTTAB(7)"C H E R R Y";TAB(28)"X X X";TAB(43)"X X X";TAB(53)"PAYS       5"
250 PRINT:PRINT"EACH COIN INSERTED IS WORTH $1.":PRINT
260 PRINT"GOOD-LUCK !!!!!"
270 PRINT:INPUT"WHEN READY, DEPRESS <ENTER>";Q$
280 CLS:PRINT"C A S I N O   S L O T S":K=K+1:PRINT@66,"G A M E :":PRINT@76,K
290 PRINTCHR$(2);:GOSUB660:GOSUB650:GOSUB710:PRINT@160,"G O O D   L U C K ! ! !"
;PRINTCHR$(1);
300 PRINT@215,"INSERT COINS (1-5)";
310 I$=INKEY$:IFI$=""THEN310ELSEIFI$>"0"ANDI$<"6"THENM=VAL(I$)ELSE310
320 PRINT@1213,"B E T ";M
330 PRINTCHR$(2);:GOSUB720:GOSUB710:PRINTCHR$(1);
340 GW=0:RE=0:RANDOM:R1=RND(20):R2=RND(20):R3=RND(20)
350 R=R1:ONRGOSUB550,560,560,570,570,580,580,580,580,590,590,590,590,590,600,600
,600,600,600,600:W1$=WS:R1$=R$
360 R=R2:ONRGOSUB550,550,550,550,550,550,550,550,550,560,570,580,590,590,590,590
,590,590,590,600:W2$=WS:R2$=R$
370 R=R3:ONRGOSUB550,560,570,580,580,580,580,580,580,580,580,580,580,590,590,590
,600,600,600,600:W3$=WS:R3$=R$
380 IFR1$="BL"THENIFR2$="BL"THENIFR3$="BL"THENGW=500:GOTO470
390 IFR1$="BL"THENIFR3$="BL"THENGW=300:GOTO470
400 IFR1$="BL"THENGW=100:GOTO470
410 IFR1$="BA"THENIFR2$="BA"THENIFR3$="BA"THENGW=300:GOTO470ELSEGW=100:GOTO470
420 IFR1$="LO"THENIFR2$="LO"THENIFR3$="LO"THENGW=300:GOTO470
430 IFR1$="LO"THENIFR2$="OR"ORR2$="PL"THENGW=50:GOTO470
440 IFR1$="OR"THENIFR2$="OR"THENIFR3$="OR"THENGW=200:GOTO470ELSEGW=50:GOTO470
450 IFR1$="CH"THENIFR2$="CH"THENIFR3$="CH"THENGW=100:GOTO470ELSEGW=20:GOTO470
460 IFR1$="CH"THENGW=5
470 GW=M*GW
480 L=656:GOSUB700:PRINT@656,W1$
490 L=674:GOSUB700:PRINT@674,W2$
500 L=692:GOSUB700:PRINT@692,W3$
510 IFGW>0THENX$="Y O U   H A V E   W O N :":RE=GWELSEX$="Y O U R   T U R N   C
O S T S :":RE=-M
520 PRINT@160,X$USINGU$;RE
530 TW=TW+RE:GC=10000-TW:GOSUB650
540 GOTO610
550 W$="  B E L L ":R$="BE":RETURN
560 W$="    B A R  ":R$="BA":RETURN
570 W$="  L O G O ":R$="LO":RETURN
580 W$="O R A N G E":R$="OR":RETURN
590 W$="C H E R R Y":R$="CH":RETURN
600 W$="  P L U M ":R$="PL":RETURN
610 PRINT@1213,"TO PLAY AGAIN, DEPRESS <ENTER>; TO EXIT DEPRESS <X> ";
620 I$=INKEY$:IFI$=""THEN620ELSEIFI$=CHR$(13)THEN280ELSEIFI$="X"THEN630ELSE620
630 CLS:PRINT@496,"ONE-ARM BANDIT SAYS GOOD-BYE.....COME AGAIN!!!"
640 PRINT:PRINT:END
650 PRINT@1760,SPACE$(80);:PRINT@1760,"M A C H I N E   H A S :"USINGU$;GC:PRINT@
1800,"T O T A L   W I N N I N G S :"USINGU$;TW:RETURN
660 PRINT@331,GA$:PRINT@332,STRING$(56,150):PRINT@388,GC$:PRINT@967,GA$:PRINT@96
8,STRING$(64,150):PRINT@1032,GC$:PRINT@1607,GB$:PRINT@1608,STRING$(64,150):PRINT
@1672,GD$
670 FORI=1TO7:PRINT@331+I*80,V$:NEXT:PRINT@971,GX$:FORI=1TO7:PRINT@388+I*80,V$:N
EXT:PRINT@1028,GX$:FORI=1TO7:PRINT@967+I*80,V$:NEXT:FORI=1TO7:PRINT@1032+I*80,V$
:NEXT
680 L=494:GOSUB690:L=512:GOSUB690:L=530:GOSUB690:RETURN
690 PRINT@L,GA$:PRINT@L+1,STRING$(14,150):PRINT@L+15,GC$:PRINT@L+320,GB$:PRINT@L
+321,STRING$(14,150):PRINT@L+335,GD$:FORI=1TO3:PRINT@L+I*80,V$:NEXT:FORI=1TO3:PR
INT@L+15+I*80,V$:NEXT:RETURN
700 PRINTCHR$(2);:FORI=1TO25:PRINT@L,STRING$(12,"X"):PRINT@L,SPACE$(12):NEXT:PRI
NTCHR$(1);:RETURN
710 PRINT@1352,CHR$(135);:PRINT@1353,GS$:PRINT@1354,GS$:PRINT@794,GS$:PRINT@874,G
S$:FORI=1TO5:PRINT@874+I*80,V$:NEXT:RETURN
720 PRINT@794,GQ$:PRINT@874,GQ$:FORI=1TO5:PRINT@874+I*80,GQ$:NEXT:RETURN
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pressing enter.

If you require a second roll of the dice, line 610 performs the toss with accompanying graphics. Lines 640–750 evaluate the second toss and post the betting results.

Line	Function
10–80	Introduction
90–100	Display field graphics
110–160	Select numbers to bet
170–210	Random selection of 20 numbers to win
220–380	Game scoring
390–430	Game conclusion
440–460	Display field graphics subroutine
470–480	Name ID subroutine
490	Graphics subroutine
500	Graphics subroutine
510–580	Display hi-lite subroutine
590	Number ID subroutine
600	Game ID subroutine
610–690	Game playing instructions

Table 7. Keno

Line	Function
10–110	Introduction
120–130	Produce screen graphics
140–170	Betting input
180–270	Random card selection
280	Layout subroutine
290–320	Card suit subroutine
330	Card content subroutine
340	Card outline subroutine
350–400	Calculation and conclusion
410	Card back graphics subroutine
420	Card content clear subroutine
430–510	Scoring subroutine
520–670	Scoring subroutine
680–760	Scoring subroutine
770–840	Condensed set of rules for game

Table 8. Baccarat

Line	Function
10–100	Program introduction
110–150	Playing screen graphics and prompt for entering bet
160–170	Bet amount evaluation and display
180	Start deal of first hand
190–250	Clear card contents of graphics pattern
260–300	Random selection of card values for original hand
310–340	Instructions for holding selected cards in original hand
350	Hold blanking for cancel selection
360–500	Selection of cards to replace those not retained in original hand
510–900	Program hand evaluation logic
910–1000	Display and scoring logic
1010–1060	Game conclusion
1070–1110	Card graphics location subroutines
1120–1150	Card graphics outline subroutine
1160–1200	Card graphics pattern subroutines
1210	Card value print subroutine
1220	Card suit determination subroutine
1230–1440	Game instruction and scoring information

Table 9. Draw Poker

Blackjack

Try your luck against the house in this game of blackjack using casino-style rules. The program uses four decks of cards, and the simulation includes dealing from a card shoe.

Starting at line 450, you reset the control variables and construct the layout graphics using subroutine 1150 and PRINT@ statements. Place bets using single INKEY statements (lines 480–500) for the number of chips and their color (value).

Lines 520–560 control card draws and display, with the results posted on the screen. If the game doesn't end at this point, betting continues with the prompts in lines 610–660. Betting for the choices available to the player is in line blocks 670–720, 730–800, and 830–890.

Final scoring and posting of the results on the screen occurs in lines 900–1080.

Subroutines using only a few of the characters available on the Model II call layout graphics and card-format graphics. Graphics in Basic can be slow, but their use is a straightforward approach in this type of program.

Faro

Faro is a card game often played in the casinos and saloons of the old West. It's not played much these days because the payoff to the house is not as favorable as in other games.

Using appropriate subroutines to minimize complexity, lines 350–380 construct and identify the playing layout. Then the first card is selected from the deck and displayed (line 390). This card is called "soda" and does not enter into the betting.

Placing bets on the 13 card values starts with line 420. It prompts the player for number of chips, played on which rank, and to win or lose.

Lines 560 and 570 randomly determine the cards drawn by the dealer: RL to lose and RW to win. Several lines of logic analyze and evaluate the cards drawn. Arrays score the plays: B(52) to win, H(52) to lose, C(52) for cards drawn, and L(13) for printing locations. Logical statements compare array contents and calculate results.

After you've played 24 regular turns, the remaining three cards are revealed, but not their order (lines 670–710). The final betting (last turn) is made on these cards (line 740).

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- AUTOMATIC STORAGE of incoming data at user's option.
- TRANSMIT or RECEIVE WITH VERIFICATION options included for communication between two TRS-80s using Smart Terminal.
- Full CONTROL KEYS, including control key mapping into any ASCII character. True BREAK key. Lower case supported on Model I.
- Buffered LINE PRINTER ECHO for incoming data.
- Disk and cassette files fully compatible with ELECTRIC PENCIL™ and SCRIPSIT™ programs.
- BAUD RATE and RS-232-C CHARACTERISTICS can be reset from within the program.
- SAVE PROGRAM option creates "personalized" back-up copy of program with all options set as specified by user.
- ONE PROGRAM supports both cassette and disk systems. Program is compatible with PMC-80 and other TRS-80 "work alike" computers.

Model I or III Version — **supplied on cassette $69.95**; **supplied on diskette $74.95**

Model II (CP/M) Version — **$79.95**

MON-3 and MON-5

Monitor Programs #3 and #5 are powerful utility programs which enable you to interact directly with the TRS-80 in machine language. They are useful both for beginners and for advanced programmers.

- BEGINNERS can learn to use machine language.
- COMPLETE instruction manual.
- SIMPLE commands, easy to use.

Both MON-3 and MON-5 contain the following features:

- DISPLAY memory in ASCII and hexadecimal form.
- DISASSEMBLE memory to see machine language commands.
- MOVE and COMPARE blocks.
- SEARCH through memory to find specific values.
- MODIFY memory in different ways.
- RELOCATE object programs.
- READ and WRITE object tapes in SYSTEM format.
- UNLOAD programs in low RAM on disk.
- CREATE SYMBOLIC CASSETTES of disassembled output for use as input to EDTASM program (MON-3 only).
- PRINT output optionally on video display or line printer.

Monitor #5 adds the following features:

- SAVE and LOAD disk files.
- INPUT and OUTPUT of disk sectors, bypassing disk operating system.
- RS-232-C COMMANDS for terminal mode, send and receive data.
- COMPLETE DEBUGGING PACKAGE including setting and displaying registers, single stepping, setting breakpoints and executing machine instructions.

Available for Model I and III Level II computers (16K, 32K and 48K).

Specify TRS-80™ Model I or III

MON-3 (for cassette systems) $39.95
MON-5 (for disk systems) $59.95

MAILING LIST

Maintains mailing lists of up to 1326 names (48K version). Add, change, delete, or find names. Machine language sort according to information in ANY field (first or last name, address, city, state, zip code). Three or four line labels printed in 1, 2, 3, or 4 columns, in master list, or on video display.

TRS-80 Model 1/3 Disk Version $69.95
IBM PC Disk Version $79.95

HOME BUDGET

Keeps track of your monthly and year-to-date income and expenses. Income and expenses classified by code numbers for identification of categories. Data includes date, code number, amounts and check number (optional). Computes monthly and year-to-date summaries showing income tax deductions. All output printed on video display or line printer at user's option. Complete instructions for customizing to suit your own budget.

TRS-80 Model 1/3 Cassette Version $29.95
TRS-80 Model 1/3 Disk Version $49.95
IBM PC Disk Version $59.95

SMALL BUSINESS ACCOUNTING

Based on Dome Bookkeeping Record #612, this program keeps track of income, expenditures, and payroll for a small business. Receipts and expenditures can be entered on a daily, weekly, or monthly basis. Program computes monthly, through last month, and year to date summaries. Payroll section (included in disk version only) keeps record of employees and paychecks with up to six categories of payroll deductions. Computes employee payroll records and year-to-date payroll totals. Complete instructions for customizing to suit your own business.

TRS-80 Model 1/3 Cassette Version $29.95
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luck at a simulated wheel of fortune. You only need to enter 73 Basic program lines.

The screen clears and the control variables reset starting on line 270. Line 280 provides the layout graphics using keyed subroutines that permit more compact programs.

Start betting on line 290, using fast INKEY inputs. To simplify the INKEY use, the number of accepted chips is limited to nine. If you wish, you can substitute a double INKEY; then a stack of up to 99 chips is possible. If you make the change, the first decade of inputs is 01, 02, and so on.

When the program prompts you, type in a number from one to nine to indicate the number of chips you wish to stack on a given location on the layout ($1, $2, $5, A for $10, B for $20, J for Joker, L for Logo) that you will specify shortly.

For the color prompt, type in W (white) for $1 chips, O (orange) for $2 chips, R (red) for $5 chips, G (green) for $25 chips, or B (black) for $100 chips. Next, specify the location on the layout where you want the chip or stack of chips placed as your bet.

If you intend to place only one bet, press enter to start the wheel spinning. If you wish to place additional bets, repeat the number of chips, value of each chip, and location of stack for each bet prior to starting the wheel with enter.

Wheel rotation comprises two parts. Line 440 selects one of three lines: 450, 460, or 470. You need a random selection of 54, and this divides the function into three groups of 18 for convenience.

You can try individual modifications if the simulated wheel rotation (including slowing) in subroutines 670 and 720 is too simplified.

Line	Function
10–110	Introduction, define variables, arrays, load card ID arrays
120–250	Rules for game
260–270	Start of game and layout graphics
280–310	Card draw selection and display
320–620	Placing of bets
630–670	Drawing the gate, scoring, and display of results
680–740	Game conclusion
750	Layout graphics subroutine
760	Card outline subroutine
770	Card value printing subroutine
780	Card content clearing subroutine
790	Card suit determination subroutine
800	Card graphics pattern subroutine
810	Play counter subroutine

Table 10. Four-Card Monte

Program Listing 2. Roulette

```
10 REM 22-JAN-83 *BDL MODEL II*
20 REM - PROGRAM ROULETTE/BAS
30 CLS:PRINT@20,"ROULETTE SIMULATION PROGRAM":PRINT:PRINT
40 CLEAR200:DIM(38),S(38),P(38),R(38),T(38),C(38),D(38),H(38),O(38),B(38):V$=CH
R$(148):P$="#":GA$=CHR$(128):GB$=CHR$(131):GC$=CHR$(129):GD$=CHR$(130):HH=5000:G
U$=CHR$(132):UU$="#####.##":U$="###.##":GL$=CHR$(134):A$="*":S$=" "
50 PRINT"ROULETTE IS THE GAME THAT MOST PEOPLE ENVISION WHEN THINKING ABOUT THE
FAMOUS":PRINT"CASINOS AT MONTE CARLO AND OTHER WORLD LOCATIONS.":PRINT
60 PRINT"THE GAME IS EASY TO PLAY, ALL THAT IS REQUIRED IS A KNOWLEDGE OF THE BE
TTING":PRINT"OPTIONS AND THE PLAYING LAYOUT.":PRINT
70 PRINT"INSTRUCTIONS REQUIRED (Y/N)";
80 I$=INKEY$:IFI$=""THEN80ELSEIFI$="Y"THEN100ELSEIFI$="N"THEN200ELSE80
90 DIMM$(52):GA$=CHR$(128):GB$=CHR$(129):GC$=CHR$(130):GD$=CHR$(131):GE$=CHR$(14
8):GF$=CHR$(150)
100 CLS:PRINT@20,"R U L E S   O F   R O U L E T T E":PRINT:PRINT
110 PRINT"THE WHEEL ITSELF IS A VERY CAREFULLY MADE, VERY DELICATELY BALANCED ST
RUCTURE":PRINT"WHICH IS DIVIDED INTO THIRTY-EIGHT EVEN COMPARTMENTS, OR 'POCKETS
'.":PRINT"THIRTY-SIX OF THESE POCKETS ARE NUMBERED INDIVIDUALLY FROM ONE TO THIR
TY-SIX"
120 PRINT"AND ARE COLORED EITHER RED OR BLACK.  THERE ARE EIGHTEEN OF EACH COLOR
.  THE":PRINT"REMAINING TWO POCKETS ARE COLORED GREEN AND ARE NUMBERED ZERO AND
DOUBLE ZERO.":PRINT
130 PRINT"TO ALLOW YOU TO PLACE BETS, THE CASINO PROVIDES A PLAYING LAYOUT WITH
ZERO":PRINT"AND DOUBLE ZERO MARKED IN GREEN, AND THE THIRTY-SIX NUMBERS MARKED I
N THEIR"
140 PRINT"RESPECTIVE COLORS, IN THREE COLUMNS OF TWELVE NUMBERS EACH.  BETS ON T
HIS AREA":PRINT"ARE CALLED 'INSIDE' BETS.  THERE IS AN AREA OUTSIDE THE THIRTY-E
IGHT NUMBERED"
150 PRINT"BOXES WHICH ALLOWS FOR BETTING ON ODD (ALL THE ODD NUMBERS), EVEN (ALL
 THE":PRINT"EVEN NUMBERS), RED OR BLACK (ALL THE RED, OR ALL THE BLACK NUMBERS).
"
160 PRINT:PRINT"THERE IS ALSO AN AREA FOR BETTING ON THE FIRST, THE SECOND, OR T
HE THIRD":PRINT"SET OF TWELVE NUMBERS (1 THRU 12, 13 THRU 24, OR 25 THRU 36); TH
E FIRST OR"
170 PRINT"SECOND SET OF EIGHTEEN NUMBERS (1 THRU 18, OR 19 THRU 36); AND EVEN AN
 AREA":PRINT"FOR BETTING ON COMPLETE COLUMNS.  BETS ON THESE AREAS ARE CALLED 'O
UTSIDE' BETS."
180 PRINT"EACH CHIP OF YOUR COLOR CHOOSING IS WORTH $1.":PRINT
190 INPUT"WHEN READY TO PLAY, DEPRESS <ENTER>";Q$
200 TT=0:TX=0:CA=0:CB=0:CC=0:CD=0:CE=0:CF=0:CG=0:CH=0:CI=0:CJ=0:CLS:PRINT"C A S
I N O   R O U L E T T E":PRINT@65,"G A M E :";K=K+1:PRINT@75,K
210 PRINTCHR$(2);:GOSUB1580:PRINTCHR$(26);:GOSUB1630:PRINTCHR$(25);:PRINTCHR$(1)
;
220 B=0:PRINT@160,SPACE$(80);:PRINT@160,"PLACE YOUR BETS...ENTER NUMBER OF CHIPS
 (1-9), <ENTER> TO PLAY";
230 I$=INKEY$:IFI$=""THEN230ELSEIFI$>"0"ANDI$<="9"THENB=VAL(I$):GOTO240ELSEIFI$=
CHR$(13)THEN1380ELSE230
240 PRINT@160,STRING$(70,32):PRINT@160,"SEL BET(L=LNE, S=SQU, P=SPL, R=STRA, T=S
TT, C=COL, D=DOZ, H=H/L, O=O/E, B=B/R)";
250 I$=INKEY$:IFI$=""THEN250ELSEIFI$="L"THEN260ELSEIFI$="S"THEN360ELSEIFI$="P"TH
EN490ELSEIFI$="R"THEN790ELSEIFI$="T"THEN940ELSEIFI$="C"THEN1050ELSEIFI$="D"THEN1
120ELSEIFI$="H"THEN1190ELSEIFI$="O"THEN1250ELSEIFI$="B"THEN1310ELSE250
260 PRINT@160,SPACE$(80);:CA=CA+B:PRINT@298,"*** L I N E ***"
270 PRINT@458,"1 - 00:3     7 - 18:21":PRINT@538,"2 -  3:6     8 - 21:24":PRINT@
618,"3 -  6:9     9 - 24:27":PRINT@698,"4 -  9:12   10 - 27:30":PRINT@778,"5 - 1
2:15   11 - 30:33":PRINT@858,"6 - 15:18   12 - 33:36"
280 PRINT@1018,"SELECTION (1-12)";:INPUTTA:IFTA<1ORTA>12THEN280ELSE290
290 IFTA=1THENL(38)=5*B:L(37)=5*B:L(1)=5*B:L(2)=5*B:L(3)=5*B:PRINT@244,USINGP$;B
ELSEIFTA=2THENL(1)=5*B:L(2)=5*B:L(3)=5*B:L(4)=5*B:L(6)=5*B:PRINT@248,USINGP$;BEL
SEIFTA=3THENL(4)=5*B:L(5)=5*B:L(6)=5*B:L(7)=5*B:L(8)=5*B:L(9)=5*B:PRINT@252,USIN
```

Listing 2 continues

"These winning numbers appear on lighted flashboards located throughout the casino area."

Keno

This Model II version of keno uses Disk Basic and the powerful PRINT@ statements to produce a wide range of graphics displays. The larger screen area available with the 1,920 discrete locations allows sufficient placement of both text and graphics. If...Then... Else statements form the conditional requirement for scoring.

The game starts on line 110 when it prompts the player to mark the spots desired. At a casino, you would mark from one to 15 of your favorite numbers on a keno ticket (in our case, the video screen) and present this along with the amount you wish to bet (line

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1	RULE78	Interest Apportionment by Rule of the 78's
2	ANNUI	Annuity computation program
3	DATE	Time between dates
4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKEVN	Breakeven analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAPI	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
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Listing 2 continued

```
GP$;B
300 IFTA=4THENL(7)=5*B:L(8)=5*B:L(9)=5*B:L(10)=5*B:L(11)=5*B:L(12)=5*B:PRINT@256
,USINGP$;BELSEIFTA=5THENL(10)=5*B:L(11)=5*B:L(12)=5*B:L(13)=5*B:L(14)=5*B:L(15)=
5*B:PRINT@260,USINGP$;B
310 IFTA=6THENL(13)=5*B:L(14)=5*B:L(15)=5*B:L(16)+5*B:L(17)=5*B:L(18)=5*B:PRINT@
264,USINGP$;BELSEIFTA=7THENL(16)=5*B:L(17)=5*B:L(18)=5*B:L(19)=5*B:L(20)=5*B:L(2
1)=5*B:PRINT@268,USINGP$;B
320 IFTA=8THENL(19)=5*B:L(20)=5*B:L(21)=5*B:L(22)=5*B:L(23)=5*B:L(24)=5*B:PRINT@
272,USINGP$;BELSEIFTA=9THENL(22)=5*B:L(23)=5*B:L(24)=5*B:L(25)=5*B:L(26)=5*B:L(2
7)=5*B:PRINT@276,USINGP$;B
330 IFTA=10THENL(25)=5*B:L(26)=5*B:L(27)=5*B:L(28)=5*B:L(29)=5*B:L(30)=5*B:PRINT
@280,USINGP$;BELSEIFTA=11THENL(28)=5*B:L(29)=5*B:L(30)=5*B:L(31)=5*B:L(32)=5*B:L
(33)=5*B:PRINT@284,USINGP$;B
340 IFTA=12THENL(31)=5*B:L(32)=5*B:L(33)=5*B:L(34)=5*B:L(35)=5*B:L(36)=5*B:PRINT
@288,USINGP$;B
350 GOSUB1370:GOTO220
360 PRINT@160,SPACE$(80);:CB=CB+B:PRINT@298,"*** S Q U A R E ***"
370 PRINT@458," 1 -  3:5   12 -  2:4":PRINT@538," 2 -  6:8   13 -  5:7":PRINT@61
8," 3 -  9:11  14 -  8:10":PRINT@698," 4 - 12:14  15 - 11:13":PRINT@778," 5 - 15
:17  16 - 14:16":PRINT@858," 6 - 18:20  17 - 17:19"
380 PRINT@938," 7 - 21:23  18 - 20:22":PRINT@1018," 8 - 24:26  19 - 23:25":PRINT
@1098," 9 - 27:29  20 - 26:28":PRINT@1178,"10 - 30:32  21 - 29:31":PRINT@1258,"1
1 - 33:35  22 - 32:34"
390 PRINT@1418,"SELECTION (1-22)";:INPUTTB:IFTB<1ORTB>22THEN390ELSE400
400 IFTB=1THENS(3)=8*B:S(6)=8*B:S(2)=8*B:S(5)=8*B:PRINT@648,USINGP$;BELSEIFTB=2T
HENS(6)=8*B:S(9)=8*B:S(5)=8*B:S(8)=8*B:PRINT@652,USINGP$;BELSEIFTB=3THENS(9)=8*B
:S(12)=8*B:S(8)=8*B:S(11)=8*B:PRINT@656,USINGP$;B
410 IFTB=4THENS(12)=8*B:S(15)=8*B:S(11)=8*B:S(14)=8*B:PRINT@660,USINGP$;BELSEIFT
B=5THENS(15)=8*B:S(18)=8*B:S(14)=8*B:S(17)=8*B:PRINT@664,USINGP$;BELSEIFTB=6THEN
S(18)=8*B:S(21)=8*B:S(17)=8*B:S(20)=8*B:PRINT@668,USINGP$;B
420 IFTB=7THENS(21)=8*B:S(24)=8*B:S(20)=8*B:S(23)=8*B:PRINT@672,USINGP$;BELSEIFT
B=8THENS(24)=8*B:S(27)=8*B:S(23)=8*B:S(26)=8*B:PRINT@676,USINGP$;BELSEIFTB=9THEN
S(27)=8*B:S(30)=8*B:S(26)=8*B:S(29)=8*B:PRINT@680,USINGP$;B
430 IFTB=10THENS(30)=8*B:S(33)=8*B:S(29)=8*B:S(32)=8*B:PRINT@684,USINGP$;BELSEIF
TB=11THENS(33)=8*B:S(36)=8*B:S(32)=8*B:S(35)=8*B:PRINT@688,USINGP$;BELSEIFTB=12T
HENS(2)=8*B:S(5)=8*B:S(1)=8*B:S(4)=8*B:PRINT@1048,USINGP$;B
440 IFTB=13THENS(5)=8*B:S(8)=8*B:S(4)=8*B:S(7)=8*B:PRINT@1052,USINGP$;BELSEIFTB=
14THENS(8)=8*B:S(11)=8*B:S(7)=8*B:S(10)=8*B:PRINT@1056,USINGP$;BELSEIFTB=15THENS
(11)=8*B:S(14)=8*B:S(10)=8*B:S(13)=8*B:PRINT@1060,USINGP$;B
450 IFTB=16THENS(14)=8*B:S(17)=8*B:S(13)=8*B:S(16)=8*B:PRINT@1064,USINGP$;BELSEI
FTB=17THENS(17)=8*B:S(20)=8*B:S(16)=8*B:S(19)=8*B:PRINT@1068,USINGP$;BELSEIFTB=1
8THENS(20)=8*B:S(23)=8*B:S(19)=8*B:S(22)=8*B:PRINT@1072,USINGP$;B
460 IFTB=19THENS(23)=8*B:S(26)=8*B:S(22)=8*B:S(25)=8*B:PRINT@1076,USINGP$;BELSEI
FTB=20THENS(26)=8*B:S(29)=8*B:S(25)=8*B:S(28)=8*B:PRINT@1080,USINGP$;B
470 IFTB=21THENS(29)=8*B:S(32)=8*B:S(28)=8*B:S(31)=8*B:PRINT@1084,USINGP$;BELSEI
FTB=22THENS(32)=8*B:S(35)=8*B:S(31)=8*B:S(34)=8*B:PRINT@1088,USINGP$;B
480 GOSUB1370:GOTO220
490 PRINT@160,SPACE$(80);:CC=CC+B:PRINT@300,"*** S P L I T ***"
500 PRINT@457,"SELECT A=1-32, B=33-62";
510 I$=INKEY$:IFI$=""THEN510ELSEIFI$="A"THEN520ELSEIFI$="B"THEN660ELSE510
520 PRINT@457,STRING$(23,32);:PRINT@378," 1- 00:3   17- 15:14":PRINT@458," 2-
3:6   18- 18:17":PRINT@538," 3-  6:9   19- 21:20":PRINT@618," 4-  9:12   20- 2
4:23":PRINT@698," 5- 12:15   21- 27:26":PRINT@778," 6- 15:18   22- 30:29"
530 PRINT@858," 7- 18:21   23- 33:32":PRINT@938," 8- 21:24   24- 36:35":PRINT@10
18," 9- 24:27   25- 00:2":PRINT@1098,"10- 27:30   26-  2:5":PRINT@1178,"11- 30:3
3   27-  5:8":PRINT@1258,"12- 33:36   28-  8:11":PRINT@1338,"13-  3:2   29- 11:
14"
540 PRINT@1418,"14-  6:5   30- 14:17":PRINT@1498,"15-  9:8   31- 17:20":PRINT@
1578,"16- 12:11   32- 20:23"
550 PRINT@1738,"SELECTION (1-32)";:INPUTTC:IFTC<1ORTC>32THEN550ELSE560
560 IFTC=1THENP(38)=17*B:P(3)=17*B:PRINT@484,USINGP$;BELSEIFTC=2THENP(3)=17*B:P(
6)=17*B:PRINT@488,USINGP$;BELSEIFTC=3THENP(6)=17*B:P(9)=17*B:PRINT@492,USINGP$;B
ELSEIFTC=4THENP(9)=17*B:P(12)=17*B:PRINT@496,USINGP$;B
570 IFTC=5THENP(12)=17*B:P(15)=17*B:PRINT@500,USINGP$;B
580 IFTC=6THENP(15)=17*B:P(18)=17*B:PRINT@504,USINGP$;BELSEIFTC=7THENP(18)=17*B:
P(21)=17*B:PRINT@508,USINGP$;BELSEIFTC=8THENP(21)=17*B:P(24)=17*B:PRINT@512,USIN
GP$;BELSEIFTC=9THENP(24)=17*B:P(27)=17*B:PRINT@516,USINGP$;B
590 IFTC=10THENP(27)=17*B:P(30)=17*B:PRINT@520,USINGP$;BELSEIFTC=11THENP(30)=17*
B:P(33)=17*B:PRINT@524,USINGP$;BELSEIFTC=12THENP(33)=17*B:P(36)=17*B:PRINT@528,U
SINGP$;BELSEIFTC=13THENP(3)=17*B:P(2)=17*B:PRINT@646,USINGP$;B
600 IFTC=14THENP(6)=17*B:P(5)=17*B:PRINT@650,USINGP$;BELSEIFTC=15THENP(9)=17*B:P
(8)=17*B:PRINT@654,USINGP$;BELSEIFTC=16THENP(12)=17*B:P(11)=17*B:PRINT@658,USING
P$;BELSEIFTC=17*BTHENP(15)=17*B:P(14)=17*B:PRINT@662,USINGP$;B
610 IFTC=18THENP(18)=17*B:P(17)=17*B:PRINT@666,USINGP$;BELSEIFTC=19THENP(21)=17*
B:P(20)=17*B:PRINT@670,USINGP$;BELSEIFTC=20THENP(24)=17*B:P(23)=17*B:PRINT@674,U
SINGP$;BELSEIFTC=21THENP(27)=17*B:P(26)=17*B:PRINT@678,USINGP$;B
620 IFTC=22THENP(30)=17*B:P(29)=17*B:PRINT@682,USINGP$;BELSEIFTC=23THENP(33)=17*
B:P(32)=17*B:PRINT@686,USINGP$;BELSEIFTC=24THENP(36)=17*B:P(35)=17*B:PRINT@690,U
SINGP$;BELSEIFTC=25THENP(38)=17*B:P(2)=17*B:PRINT@804,USINGP$;B
630 IFTC=26THENP(2)=17*B:P(5)=17*B:PRINT@888,USINGP$;BELSEIFTC=27THENP(5)=17*B:P
(8)=17*B:PRINT@892,USINGP$;BELSEIFTC=28THENP(8)=17*B:P(11)=17*B:PRINT@896,USINGP
$;BELSEIFTC=29THENP(11)=17*B:P(14)=17*B:PRINT@900,USINGP$;B
640 IFTC=30THENP(14)=17*B:P(17)=17*B:PRINT@904,USINGP$;BELSEIFTC=31THENP(17)=17*
B:P(20)=17*B:PRINT@908,USINGP$;BELSEIFTC=32THENP(20)=17*B:P(23)=17*B:PRINT@912,U
SINGP$;B
650 GOSUB1370:GOTO220
660 PRINT@457,STRING$(23,32);:PRINT@378,"33- 23:26   49- 32:31":PRINT@458,"34- 2
6:29   50- 35:34":PRINT@538,"35- 29:32   51-  0:1":PRINT@618,"36- 32:35   52-  1
:4":PRINT@698,"37- 00:0   53-  4:7":PRINT@778,"38-  0:2   54-  7:10"
670 PRINT@858,"39-  2:1   55- 10:13":PRINT@938,"40-  5:4   56- 13:16":PRINT@10
18,"41-  8:7   57- 16:19":PRINT@1098,"42- 11:10   58- 19:22":PRINT@1178,"43- 14
:13   59- 22:25":PRINT@1258,"44- 17:16   60- 25:28":PRINT@1338,"45- 20:19   61-
28:31"
680 PRINT@1418,"46- 23:22   62- 31:34":PRINT@1498,"47- 26:25":PRINT@1578,"48- 29
:28"
690 PRINT@1658,"SELECTION (33-62)";:INPUTTC:IFTC<33ORTC>62THEN690ELSE700
700 IFTC=33THENP(23)=17*B:P(26)=17*B:PRINT@916,USINGP$;BELSEIFTC=34THENP(26)=17*
B:P(29)=17*B:PRINT@920,USINGP$;BELSEIFTC=35THENP(29)=17*B:P(32)=17*B:PRINT@924,U
SINGP$;BELSEIFTC=36THENP(32)=17*B:P(35)=17*B:PRINT@928,USINGP$;B
710 IFTC=37THENP(37)=17*B:P(38)=17*B:PRINT@802,USINGP$;BELSEIFTC=38THENP(37)=17*
B:P(2)=17*B:PRINT@884,USINGP$;BELSEIFTC=39THENP(2)=17*B:P(1)=17*B:PRINT@1046,USI
NGP$;BELSEIFTC=40THENP(5)=17*B:P(4)=17*B:PRINT@1050,USINGP$;B
720 IFTC=41THENP(8)=17*B:P(7)=17*B:PRINT@1054,USINGP$;BELSEIFTC=42THENP(11)=17*B
:P(10)=17*B:PRINT@1058,USINGP$;BELSEIFTC=43THENP(14)=17*B:P(13)=17*B:PRINT@1062,
USINGP$;BELSEIFTC=44THENP(17)=17*B:P(16)=17*B:PRINT@1066;B
730 IFTC=45THENP(20)=17*B:P(19)=17*B:PRINT@1070,USINGP$;BELSEIFTC=46THENP(23)=17
*B:P(22)=17*B:PRINT@1074,USINGP$;BELSEIFTC=47THENP(26)=17*B:P(25)=17*B:PRINT@107
8,USINGP$;BELSEIFTC=48THENP(29)=17*B:P(28)=17*B:PRINT@1082,USINGP$;B
740 IFTC=49THENP(32)=17*B:P(31)=17*B:PRINT@1086,USINGP$;BELSEIFTC=50THENP(35)=17
*B:P(34)=17*B:PRINT@1090,USINGP$;BELSEIFTC=51THENP(37)=17*B:P(1)=17*B:PRINT@1284
,USINGP$;B
```

Listing 2 continues

150) at the keno counter.

There a writer marks a receipted copy on numbered paper that is good only for that game. At some casinos, a keno runner places your bet and returns your ticket copy to you.

In this simulation, you type in the number and hit enter to mark selected spots. The input is range-protected so that only numbers in the 1–80 range are accepted. If you make a mistake, type in C followed by enter; your current ticket is discarded and a new ticket appears, ready for a fresh start.

When you've made all one to 15 choices, type B and enter to place the amount of the bet (line 150). The function Clear, Bet is protected, so only one of these two letters is accepted.

When the "Place bet" prompt appears, you can type in the amount up to a maximum of $99,999.99 (although the highest amount normally accepted at a casino is $25). This value is not range-protected.

After you enter the bet, 20 winning numbers are selected. At the casino, air pressure mixes the 80 numbered balls (line 190) in the keno bowl. The 20 winning balls are ejected from the bowl at random (Basic's random function).

These winning numbers appear on lighted flashboards located throughout the casino area (lines 170–210). For this program, a graphics cross displays the winning numbers D$ = CHR$(140) from line 40, which defines them, to line 200, which prints them.

Scoring occurs in lines 220–380 and is based on the payoff for the number of spots marked and the amount of the bet. Line 150 also displays the total number of spots marked during selection.

Various colors refer to the games. These are loaded into array G$(16) from the data stored in line 600.

Baccarat

In this version of baccarat, line 40 clears string space and defines the string variables. An array containing the value of each card in the eight decks used to play the game is dimensioned in M$(416). Lines 50, 60, and 80 load the contents of this array. To minimize the tedium of waiting, I've added text between the lines when a large array is loading (line 70).

This program requires one INKEY statement for single-character data, and two INKEY statements for two-character input. INKEY is a string input, so if the data is numeric you must use VAL($) to obtain the numeric equivalent. You can use the alphanumeric value in the program directly.

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18. RATE OF RETURN-VARIABLE INFLOW
19. RATE OF RETURN-CONSTANT INFLOW
20. REGULAR WITHDRAWAL FROM INVESTMENT
21. STRAIGHT LINE DEPRECIATION
22. SUM OF DIGITS DEPRECIATION
23. DECLINING BALANCE DEPRECIATION
24. BREAK EVEN ANALYSIS
25. SALVAGE VALUE OF INVESTMENT
26. PAYMENT ON A LOAN
27. FUTURE SALES PROJECTIONS
28. CREDIT CARD FILE
29. ECONOMIC ORDER QUANTITY (EOQ) INVENTORY MODEL
30. VALUE OF HOUSE CONTENTS
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32. MONTHLY CALENDAR
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83. HANGMAN
84. GAME OF NIM
85. RUSSIAN ROULETTE
86. ROULETTE GAME
87. ONE-ARMED BANDIT
88. HIT THE TARGET
89. WALKING DRUNK
90. STATE CAPITAL QUIZ
91. TIC-TAC-TOE
92. DICE GAME
93. LUNAR LANDAR GAME
94. BIORHYTHM
95. HORSE SELECTOR (CLASS CALCULATOR)
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98. RANDOM CARD DEALER
99. GUESS THE NUMBER
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750 IFTC=52THENP(1)=17*B:P(4)=17*B:PRINT@1288,USINGP$;BELSEIFTC=53THENP(4)=17*B:
P(7)=17*B:PRINT@1292,USINGP$;BELSEIFTC=54THENP(7)=17*B:P(10)=17*B:PRINT@1296,USI
NGP$;BELSEIFTC=55THENP(10)=17*B:P(13)=17*B:PRINT@1300,USINGP$;B
760 IFTC=56THENP(13)=17*B:P(16)=17*B:PRINT@1304,USINGP$;BELSEIFTC=57THENP(16)=17
*B:P(19)=17*B:PRINT@1308,USINGP$;BELSEIFTC=58THENP(19)=17*B:P(22)=17*B:PRINT@131
2,USINGP$;BELSEIFTC=59THENP(22)=17*B:P(25)=17*B:PRINT@1316,USINGP$;B
770 IFTC=60THENP(25)=17*B:P(28)=17*B:PRINT@1320,USINGP$;BELSEIFTC=61THENP(28)=17
*B:P(31)=17*B:PRINT@1324,USINGP$;BELSEIFTC=62THENP(31)=17*B:P(34)=17*B:PRINT@132
8,USINGP$;B
780 GOSUB1370:GOTO220
790 PRINT@160,SPACE$(80);:CD=CD+B:PRINT@301,"*** STRAIGHT ****
800 PRINT@458," 1-  1  13- 13  25- 25":PRINT@538," 2-  2  14- 14  26- 26":PRINT@
618," 3-  3  15- 15  27- 27":PRINT@698," 4-  4  16- 16  28- 28":PRINT@778," 5-
 5  17- 17  29- 29"
810 PRINT@858," 6-  6  18- 18  30- 30":PRINT@938," 7-  7  19- 19  31- 31":PRINT@
1018," 8-  8  20- 20  32- 32":PRINT@1098," 9-  9  21- 21  33- 33":PRINT@1178,"10
- 10  22- 22  34- 34":PRINT@1258,"11- 11  23- 23  35- 35"
820 PRINT@1338,"12- 12  24- 24  36- 36":PRINT@1418,"37-  0  38- 00"
830 PRINT@1578,"SELECTION (1-38)";:INPUTTD:IFTD<1ORTD>38THEN830ELSE840
840 IFTD=1THENR(1)=35*B:PRINT@1125,USINGP$;BELSEIFTD=2THENR(2)=35*B:PRINT@725,US
INGP$;BELSEIFTD=3THENR(3)=35*B:PRINT@325,USINGP$;BELSEIFTD=4THENR(4)=35*B:PRINT@
1129,USINGP$;BELSEIFTD=5THENR(5)=35*B:PRINT@729,USINGP$;B
850 IFTD=6THENR(6)=35*B:PRINT@329,USINGP$;BELSEIFTD=7THENR(7)=35*B:PRINT@1133,US
INGP$;BELSEIFTD=8THENR(8)=35*B:PRINT@733,USINGP$;BELSEIFTD=9THENR(9)=35*B:PRINT@
333,USINGP$;BELSEIFTD=10THENR(10)=35*B:PRINT@1137,USINGP$;B
860 IFTD=11THENR(11)=35*B:PRINT@737,USINGP$;BELSEIFTD=12THENR(12)=35*B:PRINT@337
,USINGP$;BELSEIFTD=13THENR(13)=35*B:PRINT@1141,USINGP$;BELSEIFTD=14THENR(14)=35*
B:PRINT@741,USINGP$;BELSEIFTD=15THENR(15)=35*B:PRINT@341,USINGP$;B
870 IFTD=16THENR(16)=35*B:PRINT@1145,USINGP$;BELSEIFTD=17THENR(17)=35*B:PRINT@74
5,USINGP$;BELSEIFTD=18THENR(18)=35*B:PRINT@345,USINGP$;BELSEIFTD=19THENR(19)=35*
B:PRINT@1149,USINGP$;BELSEIFTD=20THENR(20)=35*B:PRINT@749,USINGP$;B
880 IFTD=21THENR(21)=35*B:PRINT@349,USINGP$;BELSEIFTD=22THENR(22)=35*B:PRINT@115
3,USINGP$;BELSEIFTD=23THENR(23)=35*B:PRINT@753,USINGP$;BELSEIFTD=24THENR(24)=35*
B:PRINT@353,USINGP$;B
890 IFTD=25THENR(25)=35*B:PRINT@1157,USINGP$;BELSEIFTD=26THENR(26)=35*B:PRINT@75
7,USINGP$;BELSEIFTD=27THENR(27)=35*B:PRINT@357,USINGP$;BELSEIFTD=28THENR(28)=35*
B:PRINT@1161,USINGP$;B
900 IFTD=29THENR(29)=35*B:PRINT@761,USINGP$;BELSEIFTD=30THENR(30)=35*B:PRINT@361
,USINGP$;BELSEIFTD=31THENR(31)=35*B:PRINT@1165,USINGP$;BELSEIFTD=32THENR(32)=35*
B:PRINT@765,USINGP$;B
910 IFTD=33THENR(33)=35*B:PRINT@365,USINGP$;BELSEIFTD=34THENR(34)=35*B:PRINT@116
9,USINGP$;BELSEIFTD=35THENR(35)=35*B:PRINT@769,USINGP$;BELSEIFTD=36THENR(36)=35*
B:PRINT@369,USINGP$;BELSEIFTD=37THENR(37)=35*B:PRINT@961,USINGP$;B
920 IFTD=38THENR(38)=35*B:PRINT@321,USINGP$;B
930 GOSUB1370:GOTO220
940 PRINT@160,SPACE$(80);:CE=CE+B:PRINT@298,"*** S T R E E T ***"
950 PRINT@458," 1 -  1   2   3":PRINT@538," 2 -  4   5   6":PRINT@618," 3 -
 7   8   9":PRINT@698," 4 - 10  11  12":PRINT@778," 5 - 13  14  15":PRINT@
858," 6 - 16  17  18":PRINT@938," 7 - 19  20  21":PRINT@1018," 8 - 22  23
 24"
960 PRINT@1098," 9 - 25  26  27":PRINT@1178,"10 - 28  29  30":PRINT@1258,"11
 - 31  32  33":PRINT@1338,"12 - 34  35  36"
970 PRINT@1498,"SELECTION (1-12)";:INPUTTE:IFTE<1ORTE>12THEN970ELSE980
980 IFTE=1THENT(1)=11*B:T(2)=11*B:T(3)=11*B:PRINT@246,USINGP$;BELSEIFTE=2THENT(4
)=11*B:T(5)=11*B:T(6)=11*B:PRINT@250,USINGP$;B
990 IFTE=3THENT(7)=11*B:T(8)=11*B:T(9)=11*B:PRINT@254,USINGP$;BELSEIFTE=4THENT(1
0)=11*B:T(11)=11*B:T(12)=11*B:PRINT@258,USINGP$;B
1000 IFTE=5THENT(13)=11*B:T(14)=11*B:T(15)=11*B:PRINT@262,USINGP$;BELSEIFTE=6THE
NT(16)=11*B:T(17)=11*B:T(18)=11*B:PRINT@266,USINGP$;B
1010 IFTE=7THENT(19)=11*B:T(20)=11*B:T(21)=11*B:PRINT@270,USINGP$;BELSEIFTE=8THE
NT(22)=11*B:T(23)=11*B:T(24)=11*B:PRINT@274,USINGP$;B
1020 IFTE=9THENT(25)=11*B:T(26)=11*B:T(27)=11*B:PRINT@278,USINGP$;BELSEIFTE=10TH
ENT(28)=11*B:T(29)=11*B:T(30)=11*B:PRINT@282,USINGP$;B
1030 IFTE=11THENT(31)=11*B:T(32)=11*B:T(33)=11*B:PRINT@286,USINGP$;BELSEIFTE=12T
HENT(34)=11*B:T(35)=11*B:T(36)=11*B:PRINT@290,USINGP$;B
1040 GOSUB1370:GOTO220
1050 PRINT@160,SPACE$(80);:CF=CF+B:PRINT@298,"*** C O L U M N ***"
1060 PRINT@458,"1 -   1:34":PRINT@618,"2 -   2:35":PRINT@778,"3 -   3:36"
1070 PRINT@938,"SELECTION (1-3)";:INPUTTF:IFTF<1ORTF>3THEN1070ELSE1080
1080 IFTP=1THENC(1)=2*B:C(4)=2*B:C(7)=2*B:C(10)=2*B:C(13)=2*B:C(16)=2*B:C(19)=2*
B:C(22)=2*B:C(25)=2*B:C(28)=2*B:C(31)=2*B:C(34)=2*B:PRINT@1175,USINGP$;B
1090 IFTP=2THENC(2)=2*B:C(5)=2*B:C(8)=2*B:C(11)=2*B:C(14)=2*B:C(17)=2*B:C(20)=2*
C(23)=2*B:C(26)=2*B:C(29)=2*B:C(32)=2*B:C(35)=2*B:PRINT@775,USINGP$;B
1100 IFTP=3THENC(3)=2*B:C(6)=2*B:C(9)=2*B:C(12)=2*B:C(15)=2*B:C(18)=2*B:C(21)=2*
B:C(24)=2*B:C(27)=2*B:C(30)=2*B:C(33)=2*B:C(36)=2*B:PRINT@375,USINGP$;B
1110 GOSUB1370:GOTO220
1120 PRINT@160,SPACE$(80);:CG=CG+B:PRINT@298,"*** D O Z E N ***"
1130 PRINT@458,"1 -  1ST 12":PRINT@618,"2 -  2ND 12":PRINT@778,"3 -  3RD 12"
1140 PRINT@938,"SELECTION (1-3)";:INPUTTG:IFTG<1ORTG>3THEN1140ELSE1150
1150 IFTG=1THENFORI=1TO12:D(I)=2*B:NEXT:PRINT@1525,USINGP$;B
1160 IFTG=2THENFORI=1TO12:D(I+12)=2*B:NEXT:PRINT@1541,USINGP$;B
1170 IFTG=3THENFORI=1TO12:D(I+24)=2*B:NEXT:PRINT@1557,USINGP$;B
1180 GOSUB1370:GOTO220
1190 PRINT@160,SPACE$(80);:CH=CH+B:PRINT@298,"*** HIGH / LOW ***"
1200 PRINT@458,"1 -  HIGH":PRINT@618,"2 -  LOW"
1210 PRINT@778,"SELECTION (1,2)";:INPUTTH:IFTH<1ORTH>2THEN1210ELSE1220
1220 IFTH=1THENFORI=1TO18:H(I+18)=1*B:NEXT:PRINT@1725,USINGP$;B
1230 IFTH=2THENFORI=1TO18:H(I)=1*B:NEXT:PRINT@1685,USINGP$;B
1240 GOSUB1370:GOTO220
1250 PRINT@160,SPACE$(80);:CI=CI+B:PRINT@298,"*** ODD / EVEN ***"
1260 PRINT@458,"1 -  ODD":PRINT@618,"2 -  EVEN"
1270 PRINT@778,"SELECTION (1,2)";:INPUTTI:IFTI<1ORTI>2THEN1270ELSE1280
1280 IFTI=1THENFORI=1TO35STEP2:O(I)=1*B:NEXT:PRINT@1717,USINGP$;B
1290 IFTI=2THENFORI=2TO36STEP2:O(I)=1*B:NEXT:PRINT@1693,USINGP$;B
1300 GOSUB1370:GOTO220
1310 PRINT@160,SPACE$(80);:CJ=CJ+B:PRINT@298,"*** BLACK / RED ***"
1320 PRINT@458,"1 -  BLACK":PRINT@618,"2 -  RED"
1330 PRINT@778,"SELECTION (1,2)";:INPUTTJ:IFTJ<1ORTJ>2THEN1330ELSE1340
1340 IFTJ=1THENB(2)=1*B:B(4)=1*B:B(6)=1*B:B(8)=1*B:B(10)=1*B:B(11)=1*B:B(13)=1*B
:B(15)=1*B:B(17)=1*B:B(20)=1*B:B(22)=1*B:B(24)=1*B:B(26)=1*B:B(28)=1*B:B(29)=1:B
(31)=1*B:B(33)=1*B:B(35)=1*B:PRINT@1789,USINGP$;B
1350 IFTJ=2THENB(1)=1*B:B(3)=1*B:B(5)=1*B:B(7)=1*B:B(9)=1*B:B(12)=1*B:B(14)=1*B:
B(16)=1*B:B(18)=1*B:B(19)=1*B:B(21)=1*B:B(23)=1*B:B(25)=1*B:B(27)=1*B:B(30)=1*B:
B(32)=1*B:B(34)=1*B:B(36)=1*B:PRINT@1701,USINGP$;B
1360 GOSUB1370:GOTO220
1370 FORI=1TO20:PRINT@217+I*80,SPACE$(23);:NEXT:RETURN
1380 TT=CA+CB+CC+CD+CE+CF+CG+CH+CI+CJ
1390 RANDOM:R=RND(38):GW=L(R)+S(R)+P(R)+R(R)+T(R)+C(R)+D(R)+H(R)+O(R)+B(R)
1400 REM  WHEEL SPIN
1410 N=0:PRINT@388,A$:PRINT@462,A$:PRINT@539,A$:PRINT@698,A$:PRINT@859,A$:PRINT@
```

Listing 2 continues

Line 110 uses INKEY as a direct alphanumeric, whereas line 160 uses input to obtain the amount (value) of the bet directly as a numeric. You could enter the bet using multiple INKEY statements, but it would be difficult with both integer (dollar) and decimal (cents) values.

In this game simulation, you must determine the way the hands should be played. Make this selection in line 140 (player, bank, or a tie). The bet amount is acceptable up to a limit of $999.99 (line 160).

Six characters, including the decimal point, are allowed for the bet. This number is limited by the spacing between the locaters on the screen (line 150, locations for the L$ and R$), and your desire to limit losses should you lose.

After you finish betting, card value selection starts on line 180, with dealing from the preshuffled eight decks in the shoe. You cannot select an individual card more than once. This is the purpose of the loopback statements in lines 190, 210, 220, 230, and 250 (R1 through R6).

Line 280 contains the simplified graphics for the playing layout using the vertical string graphics character V$ = CHR$(148) and horizontal character "150". To write and erase locations on the screen for text and graphics, use PRINT@ with appropriate locations and data type to preclude erasing the complete screen and rewriting the contents.

Line 410 contains the subroutine to provide the artistic pattern for the card back. Line 420 blanks out the card outline front or back, while line 330 provides the subroutine to display the card value. The subroutine in lines 290–320 determines the selected card suit during the random function operation.

Scoring of the player and house hands occurs in lines 430–760. These are structed as subroutines for convenience. The rules and scoring begin with line 770.

Draw Poker

This program simulates the latest in draw poker gaming machines. The color is missing, but the action is the same.

The graphics start on line 110 with initialization of certain scoring variables and printing of screen playing layout to the format used in the casino game. The machine accepts only quarters, and you can play from one to five quarters for each hand (lines 150–170).

Inserting the chosen number of coins brings you to line 180, where you start

Continues on p. 164

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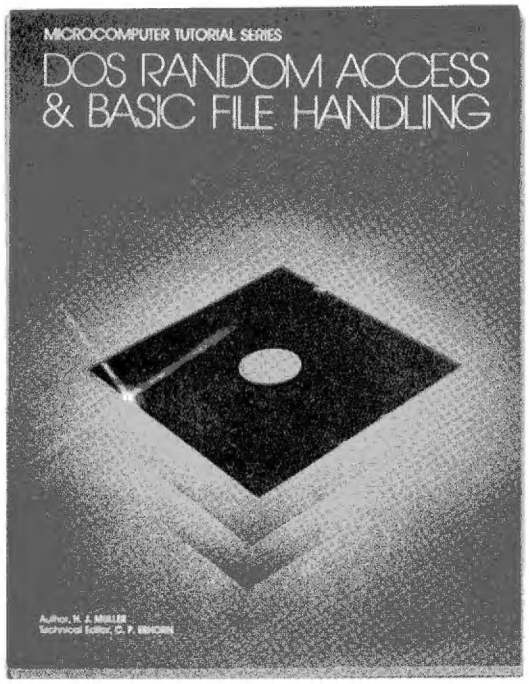

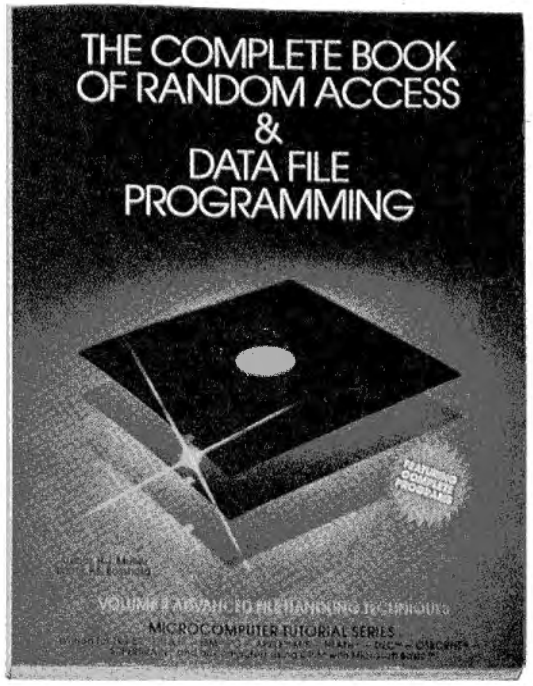

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Continued from p. 160

the first deal. The border outlines (lines 210–250) and the random selection of the five cards occurs in lines 260–300, variables R1 through R5. The face values of the cards are within the border outlines (subroutine 1220 for suit, and subroutine 1210 for printing location).

At this point, you must decide whether to play the hand as it stands or to hold specific cards and replace the others. This is accomplished in lines 310–500. Press the numeric keyboard keys 1–5 to hold cards one through five. If you make a mistake, press C to start over.

For the cards held, the original variables R1 through R5 are active and determine the card value. New variables RA through RE replace R1 through R5 in printing and scoring the card value.

Next, press D (for draw) to replace your cards and start the automatic scoring process. This begins on line 510. The numeric array M(52) consists of the 13 cards in each suit from ace to king. Set at 1 to score each of the appropriate cards in the final hand.

When line 40 dimensions the array, all locations are set to zero. This array determines the value of the hand. Starting on line 520, the array is tested for a royal flush. If it passes, the program jumps to line 910 where the type of hand is printed on the screen at location 160 (line 1020), and the value of variable GW (game winnings) is determined from the amount of the bet "M" and the odds (250). Then the game conclusion starts on line 1010.

If the hand does not contain a royal flush, further analysis of the M(52) array contents determines if it meets any of the tests for hands of lesser value down to none.

The next test determines if all the cards are in the same suit (lines 540–570 for hearts, diamonds, clubs, and spades—HX, DX, CX, and SX, respectively). If so, the hand might be a straight flush (lines 600–630). If this test fails, the sequence falls through to line 640, which then indicates only a flush (GOTO line 950 for winnings and display).

If line 580 determines that all the cards are not in the same suit, evaluation continues at line 650. The array contents are tested for a straight (lines 650–720), four of a kind (line 730), three of a kind (lines 740–770), two of a kind (lines 780–830), and whether the three of a kind and two of a kind are related for a full house (line 840) or stand-alone for three of a kind (line 840 fall-through), or two pair (line 850).

Lines 860–890 test your hand for a

Listing 2 continued

```
942,A$:PRINT@1028,A$:PRINT@955,A$:PRINT@878,A$:PRINT@719,A$:PRINT@558,A$:PRINT@4
75,A$:PRINT@788,CHR$(143)
1420 L=388:GOSUB1690:L=462:GOSUB1690:L=539:GOSUB1690:L=698:GOSUB1690:L=859:GOSUB
1690:L=942:GOSUB1690:L=1028:GOSUB1690:L=955:GOSUB1690:L=878:GOSUB1690:L=719:GOSU
B1690:L=558:GOSUB1690:L=475:GOSUB1690
1430 IFN>50THEN1440ELSE1420
1440 IFR=38THENPRINT@387,"00":PRINT@1338,"WINNING NUMBER: 00":GOTO1470
1450 IFR=37THENPRINT@388,"0":PRINT@1338,"WINNING NUMBER: 0":GOTO1470
1460 PRINT@387,R:PRINT@1338,"WINNING NUMBER:"R
1470 TX=L(R)/5+S(R)/8+P(R)/17+R(R)/35+T(R)/11+C(R)/2+H(R)+O(R)+B(R)
1480 TW=TW+GW-TT+TX:HH=5000-TW
1490 PRINT@1840,"H O U S E   H A S :";:PRINT@1860,USINGUU$;HH;:PRINT@1879,"T O T
 A L   W I N N I N G S :";:PRINT@1909,USINGUU$;TW;
1500 IF(GW-TT+TX)>0THEN1510ELSEIF(GW-TT+TX)=0THEN1530ELSE1520
1510 PRINT@160,SPACE$(80);:PRINT@160,"YOU HAVE WON ";:PRINT@173,USINGU$;GW-TT+TX:
GOTO1540
1520 PRINT@160,SPACE$(80);:PRINT@160,"YOU HAVE LOST ";:PRINT@174,USINGU$;TT-GW-TX
:GOTO1540
1530 PRINT@160,SPACE$(80);:PRINT@160,"YOU ARE EVEN..."
1540 PRINT@218,"PLAY AGAIN (Y/N)";
1550 I$=INKEY$:IFI$=""THEN1550ELSEIFI$="Y"THEN1560ELSEIFI$="N"THEN1570ELSE1550
1560 ERASEL,S,P,R,T,C,D,H,O,B:DIML(38),S(38),P(38),R(38),T(38),C(38),D(38),H(38)
,O(38),B(38):GOTO200
1570 CLS:PRINT@485,"T H A N K   Y O U   F O R   P L A Y I N G   R O U L E T T E
. . .":PRINT@658,"P L E A S E   C O M E   A G A I N !":PRINT:PRINT:PRINT:END
1580 PRINT@240,STRING$(56,150):PRINT@644,STRING$(52,150):PRINT@1044,STRING$(52,1
50):PRINT@1440,STRING$(56,150):PRINT@1604,STRING$(48,150):PRINT@1764,STRING$(48,
150):L=240:GOSUB1670:L=248:GOSUB1670:L=252:GOSUB1670:L=256:GOSUB1670:L=264:GOSUB
1670
1590 PRINT@881,STRING$(3,152):PRINT@888,V$:L=268:GOSUB1670:L=272:GOSUB1670:L=280
:GOSUB1670:L=284:GOSUB1670:L=288:GOSUB1670:L=296:GOSUB1670:L=244:GOSUB1680:L=260
:GOSUB1680:L=276:GOSUB1680:L=292:GOSUB1680
1600 PRINT@240,GA$:PRINT@1440,GB$:PRINT@1764,GB$:PRINT@296,GC$:PRINT@1496,GD$:PR
INT@1812,GD$
1610 FORI=1TO13:PRINT@240+I*4,GU$:NEXT:PRINT@1448,GL$:PRINT@1452,GL$:PRINT@1456,
GL$:PRINT@1464,GL$:PRINT@1468,GL$:PRINT@1472,GL$:PRINT@1480,GL$:PRINT@1484,GL$:P
RINT@1488,GL$:PRINT@1780,GL$:PRINT@1796,GL$
1620 PRINT@1692,V$:PRINT@1708,V$:PRINT@1724,V$:PRINT@1612,GU$:PRINT@1772,GL$:PRI
NT@1628,GU$:PRINT@1788,GL$:PRINT@1644,GU$:PRINT@1804,GL$:RETURN
1630 PRINT@562,"00":PRINT@486,"3":PRINT@490,"6":PRINT@494,"9":PRINT@498,"12":PRI
NT@502,"15":PRINT@506,"18":PRINT@510,"21":PRINT@514,"24":PRINT@518,"27":PRINT@52
2,"30":PRINT@526,"33":PRINT@530,"36":PRINT@454,"2":PRINT@533,"TO":PRINT@614,"1"
1640 PRINT@886,"2":PRINT@890,"5":PRINT@894,"8":PRINT@898,"11":PRINT@902,"14":PRI
NT@906,"17":PRINT@910,"20":PRINT@914,"23":PRINT@918,"26":PRINT@922,"29":PRINT@92
6,"32":PRINT@930,"35":PRINT@933,"TO":PRINT@854,"2":PRINT@1014,"1"
1650 PRINT@1122,"0":PRINT@1286,"1":PRINT@1290,"4":PRINT@1294,"7":PRINT@1298,"10"
:PRINT@1302,"13":PRINT@1306,"16":PRINT@1310,"19":PRINT@1314,"22":PRINT@1318,"25"
:PRINT@1322,"28":PRINT@1326,"31":PRINT@1330,"34":PRINT@1333,"TO":PRINT@1254,"2":
PRINT@1414,"1"
1660 PRINT@1530,"1ST 12":PRINT@1546,"2ND 12":PRINT@1562,"3RD 12":PRINT@1687,"1-1
8":PRINT@1695,"EVEN":PRINT@1703,"RED":PRINT@1718,"BLACK":PRINT@1719,"ODD":PRINT@
1726,"19-36":RETURN
1670 FORI=1TO14:PRINT@L+I*80,V$:NEXT:RETURN
1680 FORI=1TO18:PRINT@L+I*80,V$:NEXT:RETURN
1690 PRINT@L,S$:GOSUB1700:PRINT@L,A$:GOSUB1700:RETURN
1700 N=N+2:FORI=1TON:NEXT:RETURN
```

Program Listing 3. Craps

```
10 REM 12-JAN-83 *BDL MODEL II*
20 REM - PROGRAM CRAPS/BAS
30 CLS:CLEAR500:A$="*";S$=" ";V$=CHR$(148):GA$=CHR$(128):GB$=CHR$(131):GC$=CHR$(
129):GD$=CHR$(130):U$="$$$$$.$$":HH=5000:W$="$$$"
40 PRINT@20,"CRAPS SIMULATION PROGRAM":PRINT:PRINT
50 PRINT"CRAPS IS PROBABLY THE MOST WIDELY PLAYED CASINO GAME IN THE UNITED STAT
ES.":PRINT:PRINT"IT PROVIDES THE FASTEST OPPORTUNITY TO MAKE MONEY, AS DECISIONS
 ON MANY BETS"
60 PRINT"ARE MADE IN SECONDS WITH EVERY TOSS OF THE DICE!":PRINT
70 PRINT"INSTRUCTIONS REQUIRED (Y/N)";
80 I$=INKEY$:IFI$=""THEN80ELSEIFI$="Y"THEN90ELSEIFI$="N"THEN220ELSE80
90 CLS:PRINT@25,"*** RULES OF CRAPS ***":PRINT
100 PRINT"YOU CAN BET 'WITH' THE SHOOTER OR 'AGAINST' THE SHOOTER.":PRINT
110 PRINT"A 7 OR 11 ON THE FIRST TOSS WITH-WINS, AGAINST-LOSES."
120 PRINT:PRINT"YOU CAN ALSO WITH-WIN, AGAINST-LOSE, BY TOSSING A 4,5,6,8,9,OR 1
0 AND MATCHING":PRINT"IT BEFORE TOSSING A 7.":PRINT"
130 PRINT"IF A 2,3,OR 12 COMES UP ON THE FIRST TOSS, YOU WITH-LOSE, AGAINST-WIN,
"
140 PRINT"AUTOMATICALLY."
150 PRINT:PRINT"WHITE (W) CHIPS ARE WORTH $1.00";:PRINTTAB(40)"ORANGE (O) CHIPS
ARE WORTH $2.00"
160 PRINT"RED (R) CHIPS ARE WORTH $5.00";:PRINTTAB(40)"GREEN (G) CHIPS ARE WORTH
 $25.00"
170 PRINT"BLACK (B) CHIPS ARE WORTH $100.00";:PRINTTAB(40)"MINIMUM BET IS $1.00"
180 PRINT:PRINT"RULES FOR COME, PLACE, AND FIELD BETS ARE CONVENTIONAL.  WINNING
 'PLACE'":PRINT"BETS PAY: 4,10 9-TO-5; 5,9 7-TO-5; 6,8 7-TO-6.":PRINT
190 PRINT"ONLY ONE STACK OF A SINGLE VALUE (COLOR) CHIP CAN BE USED FOR A SINGLE
 BET.":PRINT
200 PRINT"FOR COME,PLACE, AND FIELD BETS: W=WIN, L=LOSE, N=NO SCORE, S=STANDOFF.
":PRINT
210 PRINT"GOOD-LUCK...ENJOY PLAYING!          ";:INPUT"WHEN READY TO PLAY, DEPRE
SS <ENTER>";Q$
220 CLS:CS=0:PS=0:FS=0:PL=0:DL=0:PRINT"C A S I N O   C R A P S":K=K+1:PRINT@66,"
G A M E :";PRINT@76,K:PRINTCHR$(2);:GOSUB890:PRINTCHR$(1);
230 I$="":PRINT@160,"SELECT TYPE OF BET (P PASS-LINE/D DON'T PASS-LINE)";
240 I$=INKEY$:IFI$=""THEN240ELSEIFI$="P"THENPL=0:PRINT@524,A$:GOTO250ELSEIFI$="D
"THENPL=1:PRINT@684,A$:GOTO250ELSE240
250 PRINT@160,STRING$(60," ");:PRINT@160,"ENTER NUMBER OF CHIPS (1-9)";
260 I$=INKEY$:IFI$=""THEN260ELSEIFI$>"0"ANDI$<="9"THENBN=VAL(I$):GOTO270ELSE260
270 PRINT@160,STRING$(60," ");:PRINT@160,"ENTER VALUE (COLOR) OF CHIPS";
280 I$=INKEY$:IFI$=""THEN280ELSEIFI$="W"THENB=1:GOTO290ELSEIFI$="O"THENB=2:GOTO2
90ELSEIFI$="R"THENB=5:GOTO290ELSEIFI$="G"THENB=25:GOTO290ELSEIFI$="B"THENB=100:G
OTO290ELSEPRINT@320,"USE VALID CHIPS ONLY, PLEASE...";:GOTO280
290 B=BN*B:PRINT@320,STRING$(40," ")
300 IFPL=0THENPRINT@556,USINGW$;BELSEPRINT@716,USINGW$;B
```

Listing 3 continues

Listing 3 continued

```
310 RANDOM:D1=RND(6):D2=RND(6):D3=D1+D2
320 PRINT@160,STRING$(60," "):PRINT@160,"COME-OUT TOSS.....":PRINTCHR$(2);
330 L=727:GOSUB810:OND1GOSUB830,840,850,860,870,880
340 L=740:GOSUB810:OND2GOSUB830,840,850,860,870,880:PRINTCHR$(1);
350 IFD3=7ORD3=11THEN380
360 IFD3=2ORD3=3ORD3=12THEN390
370 PRINT@320,"THE POINT IS "D3:GOTO400
380 PRINT@320,"A NATURAL - "D3;:IFPL=0THENPRINT@332,"YOU WIN!":GOTO750ELSEIFPL=1
THENPRINT@332,"YOU LOSE!":B=-B:GOTO750
390 PRINT@320,"CRAPS - "D3;:IFPL=0THENPRINT@328,"YOU LOSE!":B=-B:GOTO750ELSEIFPL
=1THENPRINT@328,"YOU WIN":GOTO750
400 CL=0:RANDOM:D4=RND(6):D5=RND(6):D6=D4+D5
410 PRINT@160,"SELECT TYPE OF BET (C COME/D DON'T COME), <ENTER> TO SKIP";
420 I$=INKEY$:IFI$=""THEN420ELSEIFI$="C"THENCL=0:PRINT@844,A$;GOTO430ELSEIFI$="D
"THENCL=1:PRINT@1004,A$;GOTO430ELSEIFI$=CHR$(13)THEN490ELSE420
430 CS=1:PRINT@160,STRING$(60," "):PRINT@160,"ENTER NUMBER OF CHIPS (1-9)";
440 I$=INKEY$:IFI$=""THEN440ELSEIFI$>"0"ANDI$<="9"THENMN=VAL(I$):GOTO450ELSE440
450 PRINT@160,STRING$(60," "):PRINT@160,"ENTER VALUE (COLOR) OF CHIPS";
460 I$=INKEY$:IFI$=""THEN460ELSEIFI$="W"THENM=1:GOTO470ELSEIFI$="O"THENM=2:GOTO4
70ELSEIFI$="R"THENM=5:GOTO470ELSEIFI$="G"THENM=25:GOTO470ELSEIFI$="B"THENM=100:G
OTO470ELSEPRINT@320,"USE VALID CHIPS ONLY, PLEASE...";:GOTO450
470 M=MN*M:PRINT@320,STRING$(40," ")
480 IFCL=0THENPRINT@876,USINGW$;MELSEPRINT@1036,USINGW$;M
490 PRINT@160,STRING$(60," "):PRINT@160,"ENTER NUMBER OF PLACE BET CHIPS (1-9),
<ENTER> TO SKIP";
500 I$=INKEY$:IFI$=""THEN500ELSEIFI$>"0"ANDI$<="9"THENPN=VAL(I$):GOTO510ELSEIFI$
=CHR$(13)THEN560ELSE500
510 PS=1:PRINT@1164,A$;PRINT@160,STRING$(60," "):PRINT@160,"ENTER VALUE (COLOR)
OF CHIPS ";
520 I$=INKEY$:IFI$=""THEN520ELSEIFI$="W"THENP=1:GOTO530ELSEIFI$="O"THENP=2:GOTO5
30ELSEIFI$="R"THENP=5:GOTO530ELSEIFI$="G"THENP=25:GOTO530ELSEIFI$="B"THENP=100:G
OTO530ELSEPRINT@320,"USE VALID CHIPS ONLY, PLEASE...";:GOTO510
530 P=PN*P:PRINT@1196,USINGW$;P:PRINT@160,STRING$(60," "):PRINT@160,"ENTER PLACE
 NUMBER DESIRED (4-6, 8-9, A FOR 10)";
540 I$=INKEY$:IFI$=""THEN540ELSEIFI$>"3"ANDI$<"7"ORI$>"7"ANDI$<="9"THENCZ=VAL(I$
)ELSEIFI$="A"THENCZ=10ELSE540
550 PRINT@1176,USINGW$;C2:PRINT@320,STRING$(40," ")
560 PRINT@160,STRING$(60," "):PRINT@160,"ENTER NUMBER OF FIELD BET CHIPS (1-9),
<ENTER> TO SKIP";
570 I$=INKEY$:IFI$=""THEN570ELSEIFI$=CHR$(13)THEN610ELSEIFI$>"0"ANDI$<="9"THENFX
=VAL(I$):GOTO580ELSE570
580 FS=1:PRINT@1324,A$:PRINT@160,STRING$(60," "):PRINT@160,"ENTER VALUE (COLOR)
OF CHIPS ";
590 I$=INKEY$:IFI$=""THEN590ELSEIFI$="W"THENF=1:GOTO600ELSEIFI$="O"THENF=2:GOTO6
00ELSEIFI$="R"THENF=5:GOTO600ELSEIFI$="G"THENF=25:GOTO600ELSEIFI$="B"THENF=100EL
SEPRINT@320,"USE VALID CHIPS ONLY, PLEASE...";:GOTO580
600 F=FX*F:PRINT@1356,USINGW$;F:PRINT@320,STRING$(40," ")
610 L=727:GOSUB820:PRINT@160,STRING$(60," "):PRINT@160,"SECOND TOSS....."
620 L=727:GOSUB810:OND4GOSUB830,840,850,860,870,880
630 L=740:GOSUB810:OND5GOSUB830,840,850,860,870,880
640 IFD6=D3THEN650ELSE660
650 PRINT@320,STRING$(30," "):PRINT@320,"POINT MADE";:IFCL=0THENPRINT@330,", P/L
 WINS BY MATCHING!":PRINT@842,"W":GOTO670ELSEPRINT@330,", SORRY, P/L LOSES":PRIN
T@1002,"L":GOTO670
660 PRINT@320,STRING$(30," "):PRINT@320,"POINT NOT MADE";:IFCL=0THENPRINT@334,",
 SORRY, P/L LOSES":B=-B:DL=1:PRINT@842,"L"ELSEPRINT@334,", P/L WINS BY MATCHING!
":PRINT@1002,"W"
670 IFDL=1THENIFCL=1THENIFD6=12THENM=0:PRINT@1002,"S"ELSEM=-M:PRINT@1002,"L"
680 IFCZ=D6THEN690ELSEPRINT@1162,"L":GOTO710
690 IFD6=2ORD6=3ORD6=12THENPT=0:PRINT@1162,"N"ELSEIFD6=7THENPT=-P:PRINT@1162,"L"
700 IFD6=4ORD6=10THENPT=9*P/5:PRINT@1162,"W"ELSEIFD6=5ORD6=9THENPT=7*P/5:PRINT@1
162,"W"ELSEIFD6=6ORD6=8THENPT=7*P/6:PRINT@1162,"W"
710 IFD6=5ORD6=6ORD6=7ORD6=8THENFT=-F:PRINT@1322,"L"ELSEFT=F:PRINT@1322,"W"
720 IFCS=0THENPRINT@842,S$:PRINT@1002,S$
730 IFPS=0THENPRINT@1162,S$
740 IFFS=0THENPRINT@1322,S$
750 TW=TW+B+M+PT+FT:HH=5000-TW
760 PRINT@1760,"H O U S E   H A S :"USINGU$;HH:PRINT@1800,"T O T A L   W I N N I
 N G S :"USINGU$;TW
770 PRINT@1520,"DO YOU WANT TO PLAY AGAIN (Y OR N)";
780 I$=INKEY$:IFI$=""THEN780ELSEIFI$="Y"THEN220ELSEIFI$="N"THEN790ELSE780
790 CLS:PRINT@818,"CRAPS SAYS GOOD-BYE.....COME AGAIN!!!"
800 PRINT:PRINT:END
810 PRINT@L,GA$:PRINT@L+1,STRING$(7,150):PRINT@L+8,GC$:PRINT@L+320,GB$:PRINT@L+3
21,STRING$(7,150):PRINT@L+328,GD$:FORI=1TO3:PRINT@L+I*80,V$:NEXT:FORI=1TO3:PRINT
@L+8+I*80,V$:NEXT:RETURN
820 FORI=1TO5:PRINT@L-80+I*80,SPACE$(22);:NEXT:RETURN
830 PRINT@L+164,A$:RETURN
840 PRINT@L+82,A$:PRINT@L+246,A$:RETURN
850 PRINT@L+82,A$:PRINT@L+164,A$:PRINT@L+246,A$:RETURN
860 PRINT@L+82,"*   *":PRINT@L+242,"*   *":RETURN
870 PRINT@L+82,"*   *":PRINT@L+164,A$:PRINT@L+242,"*   *":RETURN
880 PRINT@L+82,"*   *":PRINT@L+162,"*   *":PRINT@L+242,"*   *":RETURN
890 PRINT@480,GA$:PRINT@481,STRING$(35,150):PRINT@516,GC$:PRINT@1280,GB$:PRINT@1
281,STRING$(35,150):PRINT@1316,GD$:FORI=1TO9:PRINT@480+I*80,V$:NEXT:FORI=1TO9:PR
INT@516+I*80,V$:NEXT
900 PRINT@372,"- - B E T S - -":PRINT@526,"P A S S   L I N E          :":PRINT@
686,"D O N'T   P A S S   L I N E :":PRINT@846,"C O M E":PRINT@874,":":PRINT@1006
,"D O N'T   C O M E      :"
910 PRINT@1166,"P L A C E":PRINT@1194,":":PRINT@1326,"F I E L D":PRINT@1354,":":
RETURN
```

Program Listing 4. Blackjack

```
10 REM 13-JAN-83 *BDL MODEL II*
20 REM - PROGRAM BLACKJAK/BAS
30 CLS:CLEAR500:PRINT@20,"BLACKJACK SIMULATION PROGRAM":PRINT:PRINT
40 DIMM(208),M$(208):V$=CHR$(148):GA$=CHR$(128):GB$=CHR$(131):GC$=CHR$(129):GD$=
CHR$(130):U$="###.##":UU$="######.##":HH=5000
50 M$(1)="A":M$(14)="A":M$(27)="A":M$(40)="A":M$(11)="J":M$(24)="J":M$(37)="J":M
$(50)="J":M$(12)="Q":M$(25)="Q":M$(38)="Q":M$(51)="Q":M$(13)="K":M$(26)="K":M$(3
9)="K":M$(52)="K"
60 FORI=2TO10:M(I)=I:M$(I)=STR$(I):NEXT:FORI=15TO23:M(I)=I-13:M$(I)=STR$(I-13):N
EXT:FORI=28TO36:M(I)=I-26:M$(I)=STR$(I-26):NEXT:FORI=41TO49:M(I)=I-39:M$(I)=STR$
```

Listing 4 continues

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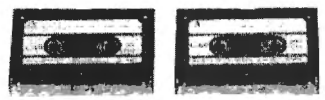

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pair of jacks or better. If the array contents fail all the tests, line 900 directs the jump to the fate of all unsuccessful players: line 1000 with the bad news that you've lost.

Line 1050 gives you a chance to play again. The M(52) scoring array is erased and then redimensioned prior to the jump to line 110 for a new start.

Four-Card Monte

Four-card monte is a card game played in the gambling halls of the old West. Its rules are simple, and no real skill is required.

The program's first prompt asks if you need instructions. Persons unfamiliar with monte should read the rules for help in placing bets and understanding scoring.

Your first choice is whether to place a bet on the bottom layout, top layout, or both (line 320). If you choose the bottom layout by entering B, line 340 indicates this selection by placing the group <***> below the bottom layout cards and prompting you to fill in the amount of your bet.

Line 360 asks for the number of chips you wish to bet. After you enter the number (from one to nine), line 380 asks for the value of each chip.

The bottom line of the screen displays the value of each chip by color (string variable CV$, line 320). The value appears below the chosen layout: The dollar value of the bet replaces the asterisks.

Next, the program jumps to line 550 to ask if you will also make a bet on the top layout by entering T, or draw the gate card and play only the one bet by pressing enter. You can bet on either or both layouts in either order.

The RND(52) statement in line 630 selects the gate card, and line 650 starts the scoring evaluation. The four cards for the two layouts are selected in lines 280–310 using array M$(52) for card identification and array M(52) for card usage.

In line 70, setting any card location equal to 1 precludes selection in the random selection program statements (lines 280, 290, 300, 310, and 630). This excludes 8s, 9s, and 10s.

After scoring the first pair of layouts, line 680 and the play counter subroutine (line 810) allow another pair of layouts and betting until the card deck is depleted. Each pack contains 40 cards and five cards are used per play, so there are eight plays. ■

Byron Lott can be reached at 913 Inverness Way, Sunnyvale, CA 94087.

Listing 4 continued

```
(I-39):NEXT
70 PRINT"BLACKJACK USUALLY HAS MORE TABLE SPACE ALLOCATED TO IT THAN ANY OTHER G
AME":PRINT"IN THE CASINO."
80 PRINT:PRINT"THE MODERN GAME HAS DEVELOPED FROM THE ANCIENT GAME OF '21'.":PRI
NT
90 PRINT"STANDBY...THE CROUPIER IS NOW SHUFFLING THE CARDS AND LOADING THE 'SHOE
'.":PRINT
100 M(1)=11:M(14)=11:M(27)=11:M(40)=11:M(11)=10:M(24)=10:M(37)=10:M(50)=10:M(12)
=10:M(25)=10:M(38)=10:M(51)=10:M(13)=10:M(26)=10:M(39)=10:M(52)=10
110 FORI=1TO3:FORJ=1TO52:M(I*52+J)=M(J):M$(I*52+J)=M$(J):NEXT:NEXT
120 PRINT"INSTRUCTIONS REQUIRED (Y/N)";
130 I$=INKEY$:IFI$=""THEN130ELSEIFI$="Y"THEN140ELSEIFI$="N"THEN450ELSE130
140 CLS:PRINT@25,"*** RULES OF BLACKJACK ***":PRINT:PRINT
150 PRINT"The computer, as the Dealer, deals two cards to itself and two cards t
o the"
160 PRINT"Player."
170 PRINT
180 PRINT"The Player's two cards are shown face up, while only one of the Dealer
's cards"
190 PRINT"is shown."
200 PRINT
210 PRINT"Both the Dealer and the Player may draw additional cards."
220 PRINT"The Player's goal is to reach 21 or less, but be closer to 21 than the
 Dealer's hand."
230 PRINT:PRINT"If the Player's or the Dealers hand totals greater than 21, eith
er is BUSTED!"
240 PRINT"Face cards all count as 10 points."
250 PRINT:PRINT"All other cards, except the ACE, count as their face value."
260 PRINT:PRINT"The ACE counts as 11 unless this would cause the hand to be over
 21,"
270 PRINT"in this case the ACE counts as 1."
280 PRINT"If both the dealer and the player get BLACKJACK, (21), neither wins, i
t is"
290 PRINT"a PUSH!"
300 PRINT:INPUT"When ready to continue, depress <ENTER>";Q$
310 PRINT:PRINT"If the Dealer's hand is below or equal to 16, Dealer must DRAW;
after 17 Dealer must STAND."
320 PRINT"To receive a card you want a HIT."
330 PRINT:PRINT"To stop where you are, you STAND."
340 PRINT:PRINT"A 'Double-down' bet is normally twice the original bet.  An 'Ins
urance bet'";PRINT"is normally half the value of the original bet and pays 2 for
 1 if the Dealer";PRINT"has a BLACKJACK and you lose your original bet.";PRINT
350 PRINT"Should you choose to 'Surrender', you return your cards and lose half
your bet."
360 PRINT:PRINT"WHITE (W) CHIPS are worth $1.00"
370 PRINT"ORANGE (O) CHIPS are worth $2.00"
380 PRINT"RED (R) CHIPS are worth $5.00"
390 PRINT"GREEN (G) CHIPS are worth $25.00"
400 PRINT"BLACK (B) CHIPS are worth $100.00"
410 PRINT:PRINT"Minimum bet is $1.00"
420 PRINT:PRINT
430 PRINT"*** GOOD-LUCK.....ENJOY THE GAME!!!!! ***"
440 PRINT:INPUT"When ready to play depress <ENTER>";Q$
450 DX=0:IX=0:DB=0:IB=0:R8=0:R3=0:R4=0:R5=0:CLS:PRINT"C A S I N O   B L A C K J
A C K":PRINT@62,"G A M E :";K=K+1:PRINT@72,K
460 PRINTCHR$(2);:GOSUB1150:PRINT@333,"P L A Y E R":PRINT@373,"D E A L E R"
470 PRINTCHR$(1);:PRINT@160,"PLACE YOUR BET...ENTER NUMBER OF CHIPS (1-9)";
480 I$=INKEY$:IFI$=""THEN480ELSEIFI$>"0"ANDI$<="9"THENBN=VAL(I$):GOTO490ELSE480
490 PRINT@160,STRING$(60,32):PRINT@160,"ENTER VALUE (COLOR) OF CHIPS";
500 I$=INKEY$:IFI$=""THEN500ELSEIFI$="W"THENB=1:GOTO510ELSEIFI$="O"THENB=2:GOTO5
10ELSEIFI$="R"THENB=5:GOTO510ELSEIFI$="G"THENB=25:GOTO510ELSEIFI$="B"THENB=100:G
OTO510ELSEPRINT@200,"USE VALID CHIPS ONLY, PLEASE...";:GOTO500
510 B=BN*B:PRINT@1061,"O BET:";PRINT@1069,USING$;B:PRINT@160,SPACE$(80);
520 RANDOM:R1=RND(208):L=562:T$=M$(R1):RX=R1:GOSUB1160:GOSUB1210:L=643:GOSUB1200
530 R6=RND(208):IFR6=R1THEN530ELSEL=602:GOSUB1210:L=683:GOSUB1220
540 R2=RND(208):IFR2=R1ORR2=R6THEN540ELSEL=571:T$=M$(R2):RX=R2:GOSUB1160:GOSUB12
10:L=652:GOSUB1200
550 R7=RND(208):IFR7=R1ORR7=R6ORR7=R2THEN550ELSEL=611:T$=M$(R7):RX=R7:GOSUB1160:
GOSUB1210:L=692:GOSUB1200
560 PRINT@80,STRING$(20,32):PRINTCHR(1);:IF(M(R1)+M(R2))=21AND(M(R6)+M(R7))<>21T
HENGOSUB1240:GOTO580ELSEIF(M(R1)+M(R2))=21AND(M(R6)+M(R7))=21THENGOSUB1240:GOTO5
90
570 GOTO600
580 PRINT@160,"B L A C K J A C K...YOU WIN!";GW=B:GOTO1080
590 PRINT@160,"P U S H....NEITHER WINS":GOTO1080
600 IFM(R7)=33THEN630
610 PRINT@160,"SELECT: C-CONTINUE, D-DOUBLE DOWN, S-SURRENDER";
620 I$=INKEY$:IFI$=""THEN620ELSEIFI$="C"THEN650ELSEIFI$="D"THEN670ELSEIFI$="S"TH
EN780ELSE620
630 PRINT@160,"SELECT: C-CONTINUE, D-DOUBLE DOWN, I=INSURANCE, S-SURRENDER";
640 I$=INKEY$:IFI$=""THEN640ELSEIFI$="C"THEN650ELSEIFI$="D"THEN670ELSEIFI$="I"TH
EN730ELSEIFI$="S"THEN780ELSE640
650 PRINT@160,SPACE$(80);:PRINT@160,"SELECT H-HIT OR S-STAND";
660 I$=INKEY$:IFI$=""THEN660ELSEIFI$="H"THEN790ELSEIFI$="S"THENGOSUB800:GOTO890E
LSE660
670 PRINT@160,SPACE$(80);:PRINT@160,"PLACE YOUR DOUBLE BET...ENTER NUMBER OF CHI
PS (1-9)";
680 I$=INKEY$:IFI$=""THEN680ELSEIFI$>"0"ANDI$<="9"THENDN=VAL(I$):GOTO690ELSE680
690 PRINT@160,STRING$(60,32):PRINT@160,"ENTER VALUE (COLOR) OF CHIPS";
700 I$=INKEY$:IFI$=""THEN700ELSEIFI$="W"THENDB=1:GOTO710ELSEIFI$="O"THENDB=2:GOT
O710ELSEIFI$="R"THENDB=5:GOTO710ELSEIFI$="G"THENDB=25:GOTO710ELSEIFI$="B"THENDB=
100:GOTO710ELSEPRINT@200,"USE VALID CHIPS ONLY, PLEASE...";:GOTO700
710 DX=1:DB=DN*DB:PRINT@1141,"D BET:";PRINT@1149,USING$;DB:PRINT@160,SPACE$(80)
;
720 GOTO650
730 PRINT@160,SPACE$(80);:PRINT@160,"PLACE YOUR INSURANCE BET...ENTER NUMBER OF
CHIPS (1-9)";
740 I$=INKEY$:IFI$=""THEN740ELSEIFI$>"0"ANDI$<="9"THENIN=VAL(I$):GOTO750ELSE740
750 PRINT@160,STRING$(60,32):PRINT@160,"ENTER VALUE (COLOR) OF CHIPS";
760 I$=INKEY$:IFI$=""THEN760ELSEIFI$="W"THENIB=1:GOTO770ELSEIFI$="O"THENIB=2:GOT
O770ELSEIFI$="R"THENIB=5:GOTO770ELSEIFI$="G"THENIB=25:GOTO770ELSEIFI$="B"THENIB=
100:GOTO770ELSEPRINT@200,"USE VALID CHIPS ONLY, PLEASE...";:GOTO760
770 IX=1:IB=IN*IB:PRINT@1221,"I BET:";PRINT@1229,USING$;IB:PRINT@160,SPACE$(80)
;
780 PRINT@160,"PLAYER CARDS ARE RETURNED...HALF OF BET IS FORFEIT";GW=-B/2:GOSUB
1240:GOTO1080
790 RANDOM:R3=RND(208):IFR3=R1ORR3=R2ORR3=R6ORR3=R7THEN790ELSEL=581:T$=M$(R3):RX
=R3:GOSUB1160:GOSUB1210:L=662:GOSUB1200:GOSUB800:GOTO820
800 IFM(R6)+M(R7)<=16THEN810ELSE830
810 RANDOM:R8=RND(208):IFR8=R1ORR8=R2ORR8=R3ORR8=R4ORR8=R5ORR8=R6ORR8=R7THEN810E
```

Listing 4 continues

Listing 4 continued

```
LSEL=621:T$=M$(R8):RX=R8:GOSUB1160:GOSUB1210:L=702:GOSUB1200:RETURN
820 IFDX=1THEN890
830 PRINT@160,SPACE$(80);:PRINT@160,"SELECT H-HIT OR S-STAND";
840 I$=INKEY$:IFI$=""THEN840ELSEIFI$="H"THEN850ELSEIFI$="S"THEN890ELSE840
850 RANDOM:R4=RND(208):IFR4=R1ORR4=R2ORR4=R6ORR4=R7THEN850ELSEL=590:T$=M$(R4):RX
=R4:GOSUB1160:GOSUB1210:L=671:GOSUB1200
860 PRINT@160,SPACE$(80);:PRINT@160,"SELECT H-HIT OR S-STAND";
870 I$=INKEY$:IFI$=""THEN870ELSEIFI$="H"THEN880ELSEIFI$="S"THEN890ELSE870
880 RANDOM:R5=RND(208):IFR5=R1ORR5=R2ORR5=R3ORR5=R6ORR5=R7THEN880ELSEL=1042:T$=M
$(R5):RX=R5:GOSUB1160:GOSUB1210:L=1123:GOSUB1200
890 PS=M(R1)+M(R2)+M(R3)+M(R4)+M(R5):IFPS<=21THEN950
900 IFM(R1)=11THENM(R1)=1:GOTO890
910 IFM(R2)=11THENM(R2)=1:GOTO890
920 IFM(R3)=11THENM(R3)=1:GOTO890
930 IFM(R4)=11THENM(R4)=1:GOTO890
940 IFM(R5)=11THENM(R5)=1:GOTO890
950 DS=M(R6)+M(R7)+M(R8)+M(R9):IFDS<=21THEN1000
960 IFM(R6)=11THENM(R6)=1:GOTO950
970 IFM(R7)=11THENM(R7)=1:GOTO950
980 IFM(R8)=11THENM(R8)=1:GOTO950
990 IFM(R9)=11THENM(R9)=1:GOTO950
1000 IFPS>21THENIFDS<=21THENB=-B:DB=-DB:PRINT@160,STRING$(60,32):PRINT@160,"YOU
ARE BUSTED!":GOTO1060
1010 IFDS>21THENPRINT@160,STRING$(60,32):PRINT@160,"DEALER BUSTED...":GOTO1060
1020 IFPS=21ANDDS<>21THENPRINT@160,STRING$(60,32):PRINT@160,"BLACKJACK...YOU HAV
E WON...":GOTO1060
1030 IFPS=DSTHENB=0:DB=0:PRINT@160,STRING$(60,32):PRINT@160,"PUSH...NEITHER WINS
...":GOTO1050
1040 IF(21-PS)<(21-DS)THENPRINT@160,STRING$(60,32):PRINT@160,"YOU HAVE WON....."
:GOTO1060ELSEB=-B:DB=-DB:PRINT@160,STRING$(60,32):PRINT@160,"YOU HAVE LOST..."
1050 IFDS=21THENIFIX=1THENIB=2*IB:PRINT@160,STRING$(60,32):PRINT@160,"DEALER HAS
 BLACKJACK...INSURANCE BET WINS"ELSEIB=-IB:PRINT@160,"STRING$(60,32):PRINT@160,"
DEALER HAS BLACKJACK..."
1060 GW=B+DB+IB
1070 GOSUB1240
1080 TW=TW+GW:HH=5000-TW
1090 PRINT@1381,"GAME":PRINT@1461,"TOTAL:"USINGUU$;GW
1100 PRINT@1760,"H O U S E  H A S :"USINGUU$;HH:PRINT@1800,"T O T A L  W I N N
 I N G S :"USINGUU$;TW
1110 PRINT@1482,"Do you want to play again (Y/N)";
1120 I$=INKEY$:IFI$=""THEN1120ELSEIFI$="Y"THEN450ELSEIFI$="N"THEN1130ELSE1120
1130 CLS:PRINT@495,"BLACKJACK says GOOD-BYE.....COME AGAIN!!!"
1140 PRINT:PRINT:END
1150 FORI=1TO14:PRINT@400+I*80,V$:NEXT:FORI=1TO14:PRINT@439+I*80,V$:NEXT:FORI=1T
O14:PRINT@440+I*80,V$:NEXT:FORI=1TO14:PRINT@479+I*80,V$:NEXT:PRINT@400,STRING$(8
0,150):PRINT@1600,STRING$(80,150):RETURN
1160 IFRX>0ANDRX<14ORRX>52ANDRX<66ORRX>104ANDRX<118ORRX>156ANDRX<170THENB$="HEAR
TS":RETURN
1170 IFRX>13ANDRX<27ORRX>65ANDRX<79ORRX>117ANDRX<131ORRX>169ANDRX<183THENB$="DIM
NDS":RETURN
1180 IFRX>26ANDRX<40ORRX>78ANDRX<92ORRX>130ANDRX<144ORRX>182ANDRX<196THENB$="CLU
BS":RETURN
1190 B$="SPADES":RETURN
1200 PRINT@L,T$:PRINT@L+80,B$:RETURN
1210 PRINTCHR$(2);:LT=L+7:PRINT@L,GA$:FORI=1TO3:PRINT@L+I*80,V$:NEXT:PRINT@L+320
,GB$:PRINT@L+7,GC$:FORI=1TO3:PRINT@LT+I*80,V$:NEXT:PRINT@L+327,GD$:PRINT@L+1,STR
ING$(6,150):PRINT@L+321,STRING$(6,150):PRINTCHR$(1);:RETURN
1220 PRINTCHR$(2);:PRINT@L,"* * * * ":PRINT@L+80," * * * *":PRINT@L+160,"* * * * ":PRI
NTCHR$(1);:RETURN
1230 PRINTCHR$(2);:PRINT@L,"      ":PRINT@L+80,"      ":PRINT@L+160,"      ":PRI
```

Program Listing 5. Faro

```
 10 REM 12-FEB-83 *BDL MODEL II*
 20 REM PROGRAM FARO/BAS
 30 CLS:PRINT@24,"FARO SIMULATION PROGRAM":PRINT:PRINT
 40 CLEAR200:V$=CHR$(148):P$="##":GA$=CHR$(128):GB$=CHR$(129):GC$=CHR$(130):GD$=C
HR$(131):U$="###.##":UU$="#####.##"
 50 DIMM$(52),C(52),B(52),H(52),L(13):C$="SPADES"
 60 M$(1)="A":M$(14)="A":M$(27)="A":M$(40)="A":M$(11)="J":M$(24)="J":M$(37)="J":M
$(50)="J":M$(12)="Q":M$(25)="Q":M$(38)="Q":M$(51)="Q":M$(13)="K":M$(26)="K":M$(3
9)="K":M$(52)="K"
 70 FORI=2TO10:M$(I)=STR$(I):NEXT:FORI=15TO23:M$(I)=STR$(I-13):NEXT:FORI=28TO36:M
$(I)=STR$(I-26):NEXT:FORI=41TO49:M$(I)=STR$(I-39):NEXT
 80 FORI=1TO13:READL(I):NEXT
 90 DATA 779,770,761,752,743,734,965,1214,1223,1232,1241,1250,1259
100 PRINT"FARO AND ITS VARIANTS HAVE BEEN THE MOST POPULAR OF GAMBLING GAMES FOR
":PRINT"CENTURIES AND WERE SEEN IN MOST SALOONS AND 'GAMING PALACES' IN THE OLD
WEST.":PRINT
110 PRINT"BY THE END OF THE NINETEENTH CENTURY, OTHER GAMES, MORE PROFITABLE TO
THE":PRINT"CASINOS, HAD SUPPLANTED FARO WHICH IS SEEN TODAY ONLY IN A FEW PLACES
.":PRINT
120 PRINT"INSTRUCTIONS REQUIRED (Y/N)";
130 I$=INKEY$:IFI$=""THEN130ELSEIFI$="Y"THEN140ELSEIFI$="N"THEN340ELSE130
140 CLS:PRINT@17,"R U L E S  F O R  C A S I N O  F A R O":PRINT:PRINT
150 PRINT"THE FARO LAYOUT, ON WHICH THE GAME IS PLAYED, CONSISTS OF A FELT CLOTH
 ON":PRINT"WHICH THE THIRTEEN 'CARDS' ARE PRINTED, USUALLY WITH ENAMEL.  SUITS A
RE IGNORED":PRINT"IN THE GAME, HOWEVER BY TRADITION THE LAYOUT IS MARKED WITH SP
ADES.":PRINT
160 PRINT"PLAYERS MAY BET ON A 'RANK' EITHER TO WIN OR TO LOSE BY PLACING AN IND
IVIDUAL":PRINT"COLOR CHIP OR CHIPS ON THE CARD DISPLAYED ON THE LAYOUT.  A BET P
LACED TO"
170 PRINT"LOSE IS SO INDICATED BY PLACING A COPPER TOKEN (OR PENNY) ON THE CHIP(
S).  THIS":PRINT"IS CALLED 'COPPERING THE STAKE'.  IN THIS SIMULATION, EACH CHIP
 USED TO BET":PRINT"IS WORTH $1.":PRINT
180 PRINT"TO PLAY, ONE DECK OF 52 CARDS IS SHUFFLED, THEN PLACED FACE-UP IN AN O
PEN":PRINT"'DEALING BOX'.  THE FIRST CARD, CALLED 'SODA', IS NOT USED IN THE BET
TING.":PRINT"AFTER THE BETS ARE PLACED, THE DEALER DRAWS 'SODA' OUT OF THE BOX A
ND PLACES IT"
190 PRINT"FACE-UP BESIDE THE BOX TO START THE PILE OF CARDS THAT 'WIN'.  THE SEC
OND CARD":PRINT"WITHDRAWN IS ALSO PLACED FACE-UP BESIDE THE BOX TO START THE PIL
```

Listing 5 continues

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Listing 5 continued

```
830 I$=INKEY$:IFI$=""THEN830ELSEIFI$>"0"ANDI$<="9"THENBN=VAL(I$):GOTO840ELSE830
840 R=RND(2):IPB=RTHENBD=BN:GW=GW+BDELSEGW=GW-BN
850 PRINT@1760,"CARDS ARE ALIKE...NO ACTION"
860 GW=GW-GN:PRINT@160,STRING$(70,32):PRINT@160,"GAME WINNINGS:";PRINT@175,USING
US;GW
870 TW=TW+GW:PRINT@1760,STRING$(67,32):PRINT@1600,STRING$(67,32):PRINT@1600,"TOT
AL WINNINGS;";PRINT@1616,USINGUU$;TW:PRINT@1640,"PLAY AGAIN (Y/N)";
880 I$=INKEY$:IFI$=""THEN880ELSEIFI$="Y"THENERASEC,B,H:DIMC(52),B(52),H(52):GOTO
340ELSEIFI$="N"THEN890ELSE880
890 CLS:PRINT@644,"G O O D B Y E . . . T H A N K S  F O R  P L A Y I N G  F A
 R O I":PRINT@900,"C O M E  A G A I N . . . .":PRINT:PRINT:END
900 IFD>0ANDD<14THEND$="HEARTS":RETURNELSEIFD>13ANDD<27THEND$="DIMOND":RETURNELS
EIFD>26ANDD<40THEND$="CLUBS":RETURNELSED$="SPADES":RETURN
910 PRINT@L+81,SPACE$(6);:PRINT@L+161,SPACE$(6);:PRINT@L+241,SPACE$(6);:RETURN
920 PRINT@L+1,STRING$(6,150):PRINT@L+321,STRING$(6,150):FORI=1TO3:PRINT@L+I*80,V
$:NEXT:FORI=1TO3:PRINT@L+7+I*80,V$:NEXT:PRINT@L,GA$:PRINT@L+320,GD$:PRINT@L+7,GB
$:PRINT@L+327,GC$:RETURN
930 PRINT@321,STRING$(64,150):PRINT@1441,STRING$(64,150):FORI=1TO13:PRINT@320+I*
80,V$:NEXT:FORI=1TO13:PRINT@385+I*80,V$:NEXT:PRINT@320,GA$:PRINT@385,GB$:PRINT@1
505,GC$:PRINT@1440,GD$:RETURN
940 PRINT@L+81,N$:PRINT@L+161,X$:RETURN
950 PRINT@1600,"T U R N :":T=T+1:IFT=25THENPRINT@1610,"LAST":GOTO670ELSEPRINT@16
10,T:RETURN
960 PRINT@L,GA$:PRINT@L+480,GD$;:PRINT@L+11,GB$:PRINT@L+491,GC$;:PRINT@L+1,STRIN
G$(10,150):PRINT@L+481,STRING$(10,150);:FORI=1TO5:PRINT@L+I*80,V$:NEXT:FORI=1TO5
:PRINT@L+11+I*80,V$;:NEXT:RETURN
970 IFRL>39THENRL=RL-39ELSEIFRL>26THENRL=RL-26ELSEIFRL>13THENRL=RL-13
980 H(RL)=0:H(RL+13)=0:H(RL+26)=0:H(RL+39)=0:PRINT@L(RL)-2,SPACE$(6);:RETURN
990 IFRW>39THENRW=RW-39ELSEIFRW>26THENRW=RW-26ELSEIFRW>13THENRW=RW-13
1000 B(RW)=0:B(RW+13)=0:B(RW+26)=0:B(RW+39)=0:PRINT@L(RW)-2,SPACE$(6);:RETURN
```

Program Listing 6. Wheel of Fortune

```
10 REM 20-JAN-83 *BDL MODEL II*
20 REM - PROGRAM BIGSIX/BAS
30 CLS:CLEAR200:PRINT@20,"BIG-SIX WHEEL SIMULATION PROGRAM":PRINT:PRINT
40 V$=CHR$(148):O$="###":GA$=CHR$(128):GB$=CHR$(131):GC$=CHR$(129):GD$=CHR$(130)
:U$="#####.##":HH=5000:S$=CHR$(42):X$=" "
50 A$="  $1  ":B$="  $2  ":C$="  $5  ":D$=" $10  ":E$=" $20  ":F$="JOKER ":G$="
LOGO "
60 PRINT"THE BIG-SIX WHEEL, ALSO CALLED THE 'WHEEL OF FORTUNE', HAS BEEN SEEN AT
":PRINT"FAIRS AND FUND-RAISING FUNCTIONS FOR MANY YEARS.":PRINT
70 PRINT"THE WHEEL IS OPERATED MANUALLY BY A DEALER, WHO, USING ONLY HIS OWN STR
ENGTH,":PRINT"PULLS THE WHEEL TO START IT SPINNING.":PRINT
80 PRINT"FRICTION, CAUSED BY A RUBBER 'FINGER' BANGING AGAINST THE 'STOPS' THEMS
ELVES,":PRINT"SLOWS AND FINALLY STOPS THE WHEEL.":PRINT
90 PRINT"WHEREVER THE RUBBER 'FINGER' COMES TO REST IS THE WINNING POSITION."
100 PRINT:PRINT"INSTRUCTIONS REQUIRED (Y/N)";
110 I$=INKEY$:IFI$=""THEN110ELSEIFI$="Y"THEN120ELSEIFI$="N"THEN270ELSE110
120 CLS:PRINT@16,"R U L E S  F O R  B I G - S I X  W H E E L":PRINT
130 PRINT"DIRECTLY IN FRONT OF THE DEALER IS A GLASS COVERED TABLE.  UNDER THE G
LASS":PRINT"ARE VARIOUS PIECES OF MONEY.  YOU WILL FIND $1, $2, $5, $10, AND $20
 BILLS.":PRINT"THERE WILL ALSO BE AN AREA MARKED WITH A JOKER AND A LOGO, TO COR
RESPOND"
140 PRINT"WITH THE TWO EXTRA STOPS ON THE WHEEL.":PRINT
150 PRINT"TO BET ON THIS GAME, YOU SIMPLY PLACE YOUR BET ONTO THE FACE OF THE BI
LL":PRINT"THAT YOU THINK WILL WIN.  SHOULD IT WIN, YOU WIN THAT BILL'S VALUE TI
MES":PRINT"YOUR BET.  A $5 CHIP ON THE $1 BILL ON THE TABLE, IF IT WINS, WILL RE
TURN"
160 PRINT"AN ADDITIONAL $5 BACK AS WINNINGS.  THAT SAME $5 CHIP PLACED ON THE $5
 BILL":PRINT"ON THE TABLE, IF IT WINS, WILL RETURN $25 AS WINNINGS.":PRINT
170 PRINT"THE FOLLOWING TABLE SHOWS THE BETS, CHANCES, AND PAYOFFS:"
180 PRINTTAB(10)"FACE";TAB(20)"NO. OF FACES";TAB(40)"PAYOFF"
190 PRINTTAB(11)"$1";TAB(24)"23";TAB(40)"1 TO 1"
200 PRINTTAB(11)"$2";TAB(24)"15";TAB(40)"2 TO 1"
210 PRINTTAB(11)"$5";TAB(25)"8";TAB(40)"5 TO 1"
220 PRINTTAB(10)"$10";TAB(25)"4";TAB(39)"10 TO 1"
230 PRINTTAB(10)"$20";TAB(25)"2";TAB(39)"20 TO 1"
240 PRINTTAB(9)"JOKER";TAB(25)"1";TAB(39)"40 TO 1"
250 PRINTTAB(9)"LOGO";TAB(25)"1";TAB(39)"40 TO 1"
260 PRINT:PRINT"ENJOY THE GAME....WHEN READY TO PLAY, DEPRESS <ENTER>";:INPUTQ$
270 CLS:WB=0:T1=0:T2=0:T3=0:T4=0:T5=0:T6=0:T7=0:TT=0:PRINT"B I G - S I X  W H E
 E L":PRINT@62,"G A M E :";K=K+1:PRINT@72,K
280 PRINTCHR$(2);:GOSUB650:L=373:L$=A$:GOSUB730:L=387:L$=B$:GOSUB730:L=773:L$=C$
:GOSUB730:L=787:L$=D$:GOSUB730:L=1173:L$=E$:GOSUB730:L=1187:L$=F$:GOSUB730:L=150
0:L$=G$:GOSUB730
290 PRINT@160,"PLACE YOUR BET....ENTER NUMBER OF CHIPS (1-9), <ENTER> TO PLAY";
300 I$=INKEY$:IFI$=""THEN300ELSEIFI$>"0"ANDI$<="9"THENBN=VAL(I$):GOTO310ELSEIFI$
=CHR$(13)THEN420ELSE300
310 PRINT@160,STRING$(70,32):PRINT@160,"ENTER VALUE (COLOR) OF CHIPS";
320 I$=INKEY$:IFI$=""THEN320ELSEIFI$="W"THENB=1:GOTO330ELSEIFI$="O"THENB=2:GOTO3
30ELSEIFI$="R"THENB=5:GOTO330ELSEIFI$="G"THENB=25:GOTO330ELSEIFI$="B"THENB=100:G
OTO330ELSEPRINT@200,"USE VALID CHIPS ONLY, PLEASE...";:GOTO320
330 B=BN*B:PRINT@160,STRING$(70,32):PRINT@160,"SELECT BET LOCATION (1, 2, 5, A=1
0, B=20, J=JOKER, L=LOGO);
340 I$=INKEY$:IFI$=""THEN340ELSEIFI$="1"THEN350ELSEIFI$="2"THEN360ELSEIFI$="5"TH
EN370ELSEIFI$="A"THEN380ELSEIFI$="B"THEN390ELSEIFI$="J"THEN400ELSEIFI$="L"THEN41
0ELSE340
350 PRINT@450,USINGO$;B:T1=B:GOTO290
360 PRINT@464,USINGO$;B:T2=B:GOTO290
370 PRINT@850,USINGO$;B:T3=B:GOTO290
380 PRINT@864,USINGO$;B:T4=B:GOTO290
390 PRINT@1250,USINGO$;B:T5=B:GOTO290
400 PRINT@1264,USINGO$;B:T6=B:GOTO290
410 PRINT@1577,USINGO$;B:T7=B:GOTO290
420 N=2:GOSUB670:PRINTCHR$(1);
430 TT=T1+T2+T3+T4+T5+T6+T7
440 RANDOM:S=RND(3):ONSGOTO450,460,470
450 R=RND(18):ONRGOTO510,500,490,500,490,480,480,490,480,520,480,490,510,480,480
,530,490,480
460 R=RND(18):ONRGOTO500,480,490,480,490,510,480,490,480,490,500,490,490,480,480
,500,480,540
470 R=RND(18):ONRGOTO480,500,480,490,480,490,480,480,490,480,510,480,490,520,500
,480,500,480
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Listing 6 continues

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Listing 6 continued

```
480 GW=T1:WB=T1:W$=A$:L=454:P$=" 1":GOTO550
490 GW=T2*2:WB=T2:W$=B$:L=468:P$=" 2":GOTO550
500 GW=T3*5:WB=T3:W$=C$:L=854:P$=" 5":GOTO550
510 GW=T4*10:WB=T4:W$=D$:L=868:P$="10":GOTO550
520 GW=T5*20:WB=T5:W$=E$:L=1254:P$="20":GOTO550
530 GW=T6*40:WB=T6:W$=F$:L=1268:P$=" J":GOTO550
540 GW=T7*40:WB=T7:W$=G$:L=1581:P$=" L"
550 PRINT@424,X$:PRINT@423,P$
560 PRINTCHR$(26);:PRINT@L,W$:PRINTCHR$(25);
570 PRINT@160,STRING$(70,32):IF(GW-TT)>0THENPRINT@160,"LUCKY....YOU HAVE WON"GW+
WB-TT
580 IF(TT-GW)>0THENPRINT@160,"SORRY....YOU HAVE LOST "TT-(GW+WB)
590 IFTT=GWTHENPRINT@160,"AT LEAST....YOU BROKE EVEN"
600 TW=TW+GW+WB-TT:HH=5000-TW
610 PRINT@1760,"H O U S E  H A S :"USINGU$;HH:PRINT@1800,"T O T A L  W I N N I
 N G S :"USINGU$;TW
620 PRINT@204,"DO YOU WANT TO PLAY AGAIN (Y/N)";
630 I$=INKEY$:IFI$=""THEN630ELSEIFI$="Y"THENGW=0:GOTO270ELSEIFI$="N"THEN640ELSE6
30
640 CLS:PRINT@492,"THE BIG-SIX WHEEL SAYS GOOD-BYE.....COME AGAIN!!!":PRINT:PRIN
T:PRINT:END
650 PRINT@344,V$:PRINT@984,CHR$(143):PRINT@424,S$:PRINT@571,S$:PRINT@967,S$:PRIN
T@1371,S$:PRINT@1544,S$:PRINT@1397,S$:PRINT@1001,S$:PRINT@597,S$
660 PRINT@495,S$:PRINT@728,S$:PRINT@1208,S$:PRINT@1455,S$:PRINT@1473,S$:PRINT@12
40,S$:PRINT@760,S$:PRINT@513,S$:RETURN
670 PRINT@424,X$:PRINT@967,X$:PRINT@1544,X$:PRINT@1001,X$:GOSUB720:PRINT@424,S$:
PRINT@967,S$:PRINT@1544,S$:PRINT@1001,S$:GOSUB720
680 PRINT@495,X$:PRINT@1208,X$:PRINT@1473,X$:PRINT@760,X$:GOSUB720:PRINT@495,S$:
PRINT@1208,S$:PRINT@1473,S$:PRINT@760,S$:GOSUB720
690 PRINT@571,X$:PRINT@1371,X$:PRINT@1397,X$:PRINT@597,X$:GOSUB720:PRINT@571,S$:
PRINT@1371,S$:PRINT@1397,S$:PRINT@597,S$:GOSUB720
700 PRINT@728,X$:PRINT@1455,X$:PRINT@1240,X$:PRINT@513,X$:GOSUB720:PRINT@728,S$:
PRINT@1455,S$:PRINT@1240,S$:PRINT@513,S$:GOSUB720
710 IFN>80THENRETURNELSE670
720 N=N+2:FORI=1TON:NEXT:RETURN
730 PRINT@L,GA$:PRINT@L+80,V$:PRINT@L+160,GB$:PRINT@L+7,GC$:PRINT@L+87,V$:PRINT@
L+167,GD$:PRINT@L+1,STRING$(6,150):PRINT@L+161,STRING$(6,150):PRINT@L+81,L$:RETU
RN
```

Program Listing 7. Keno

```
10 REM 04-JAN-83 *BDL*
20 REM - PROGRAM KENO/BAS
30 CLS:CLEAR500:DEFDBLG,T:PRINT@20,"KENO SIMULATION PROGRAM":PRINT:PRINT
40 DIMG$(16),M(80),S(80),W(80),R(20):U$="##":V$=CHR$(148):A$="*":D$=CHR$(140):UU
$="######.##"
50 FORI=1TO16:READG$(I):NEXT
60 PRINT"THIS PROGRAM SIMULATES THE KENO GAMES AS PLAYED IN THE CASINOS IN NEVAD
A.";PRINT
70 PRINT"INSTRUCTIONS REQUIRED (Y/N)"
80 I$=INKEY$:IFI$=""THEN80ELSEIFI$="Y"THEN610ELSEIFI$="N"THEN90ELSE80
90 CLS:PRINT"C A S I N O  K E N O":PRINT@62,"G A M E :";K=K+1:PRINT@72,G$(K)
100 GOSUB440:GOSUB510:GOSUB470:PRINTCHR$(1)
110 Q$="":PRINT@160,STRING$(25,32):PRINT@160,"MARK SPOTS";:INPUTQ$:Q=VAL(Q$)
120 IFCT>14THENQ$="B":GOTO140ELSEIFQ>80THEN110
130 IFQ>=1ANDQ<81THENBL=M(Q):CT=CT+1:S(Q)=1:PRINT@BL-3,A$:PRINT@BL+2,A$
140 IFQ$="C"THENK=K-1:CT=0:GOTO90ELSEIFQ$="B"THEN150ELSE110
150 PRINT@160,STRING$(25,32):PRINT@160,"S P O T S  M A R K E D :"USINGU$;CT:PRI
NT@210,"PLACE BET";:INPUTM
160 IFCT>10THENIFM<2THEN150
170 WS=0:GW=0
180 FORI=1TO20
190 R(I)=RND(80)
200 IFW(R(I))=1THEN190ELSEW(R(I))=1:PRINT@M(R(I))-2,D$:PRINT@M(R(I))+1,D$:NEXTI
210 FORI=1TO80:IFW(I)ANDS(I)=1THENWS=WS+1:NEXTELSENEXT
220 IFCT=1THENIFWS<1THENGW=0ELSEIFWS=1THENGW=3*M
230 IFCT=2THENIFWS<2THENGW=0ELSEIFWS=2THENGW=12*M
240 IFCT=3THENIFWS<2THENGW=0ELSEIFWS=2THENGW=MELSEGW=42*M
250 IFCT=4THENIFWS<2THENGW=0ELSEIFWS=2THENGW=MELSEIFWS=3THENGW=4*MELSEGW=113*M
260 IFCT=5THENIFWS<3THENGW=0ELSEIFWS=3THENGW=MELSEIFWS=4THENGW=11*MELSEGW=750*M
270 IFCT=6THENIFWS<3THENGW=0ELSEIFWS=3THENGW=MELSEIFWS=4THENGW=3*MELSEIFWS=5THEN
GW=100*MELSEGW=1480*M
280 IFCT=7THENIFWS<4THENGW=0ELSEIFWS=4THENGW=MELSEIFWS=5THENGW=20*MELSEIFWS=6THE
NGW=410*MELSEGW=8100*M
290 IFCT=8THENIFWS<5THENGW=0ELSEIFWS=5THENGW=9*MELSEIFWS=6THENGW=100*MELSEIFWS=7
THENGW=1480*MELSEGW=19000*M
300 IFCT=9THENIFWS<5THENGW=0ELSEIFWS=5THENGW=3*MELSEIFWS=6THENGW=45*MELSEIFWS=7T
HENGW=335*MELSEIFWS=8THENGW=4700*MELSEGW=18500*M
310 IFCT=10THENIFWS<5THENGW=0ELSEIFWS=5THENGW=2*MELSEIFWS=6THENGW=20*MELSEIFWS=7
THENGW=142*MELSEIFWS=8THENGW=1000*MELSEIFWS=9THENGW=4500*MELSEGW=19000*M
320 IFCT=11THENIFWS<6THENGW=0ELSEIFWS=6THENGW=20*MELSEIFWS=7THENGW=150*MELSEIFWS
=8THENGW=760*MELSEIFWS=9THENGW=4000*MELSEIFWS=10THENGW=25000*MELSEGW=39000*M
330 IFCT=12THENIFWS<6THENGW=0ELSEIFWS=6THENGW=12*MELSEIFWS=7THENGW=56*MELSEIFWS=
8THENGW=400*MELSEIFWS=9THENGW=1700*MELSEIFWS=10THENGW=4800*MELSEIFWS=11THENGW=26
000*MELSEGW=50000*M
340 IFCT=13THENIFWS<6THENGW=0ELSEIFWS=6THENGW=4*MELSEIFWS=7THENGW=32*MELSEIFWS=8
THENGW=156*MELSEIFWS=9THENGW=1400*MELSEIFWS=10THENGW=7200*MELSEIFWS=11THENGW=180
00*MELSEGW=50000*M
350 IFCT=14THENIFWS<6THENGW=0ELSEIFWS=6THENGW=6*MELSEIFWS=7THENGW=16*MELSEIFWS=8
THENGW=64*MELSEIFWS=9THENGW=600*MELSEIFWS=10THENGW=1600*MELSEIFWS=11THENGW=5000*
MELSEIFWS=12THENGW=24000*MELSEGW=50000*M
360 IFCT=15THENIFWS<6THENGW=0ELSEIFWS=6THENGW=4*MELSEIFWS=7THENGW=16*MELSEIFWS=8
THENGW=42*MELSEIFWS=9THENGW=150*MELSEIFWS=10THENGW=480*MELSEIFWS=11THENGW=4800*M
ELSEIFWS=12THENGW=16000*MELSEGW=50000*M
370 IFGW=0THENDL=MELSEDL=0
380 TW=TW+GW-DL
390 PRINT@1760,"G A M E  W I N N I N G S :"USINGUU$;GW:PRINT@1800,"T O T A L
W I N N I N G S :"USINGUU$;TW
400 PRINT@160,SPACE$(80):PRINT@160,"TO PLAY AGAIN, DEPRESS <ENTER>, TO EXIT THE
PROGRAM DEPRESS <E>";
410 I$=INKEY$:IFI$=""THEN410ELSEIFI$=CHR$(13)THEN420ELSEIFI$="E"THEN430ELSE410
420 CT=0:RANDOM:IFK>16THENRESTORE:GOTO90ELSE90
430 CLS:PRINT@895,"T H A N K  Y O U - - C O M E  A G A I N ! ! !":PRINT:PRINT:
PRINT:END
440 PRINTCHR$(2):L=240:GOSUB490:L=400:GOSUB490:L=560:GOSUB490:L=720:GOSUB490:L=8
80:GOSUB490:L=960:GOSUB490:L=1120:GOSUB490:L=1280:GOSUB490:L=1440:GOSUB490:L=160
```

Listing 7 continues

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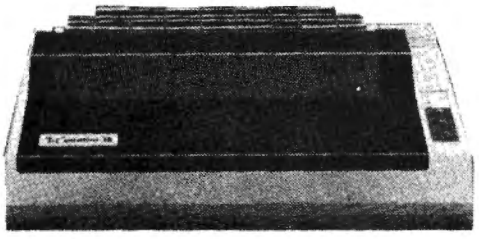

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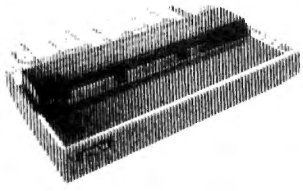

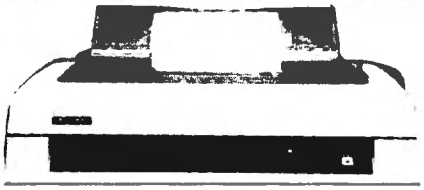

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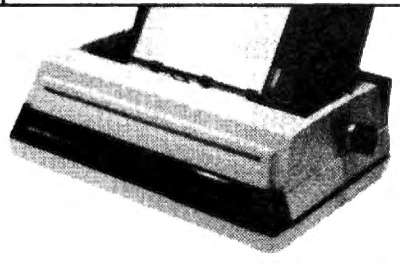

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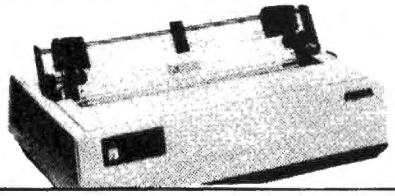

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Listing 7 continued

```
0:GOSUB490
450 L=160:GOSUB500:L=164:GOSUB500:L=171:GOSUB500:L=178:GOSUB500:L=185:GOSUB500:L
=192:GOSUB500:L=199:GOSUB500
460 L=200:GOSUB500:L=207:GOSUB500:L=214:GOSUB500:L=221:GOSUB500:L=228:GOSUB500:L
=235:GOSUB500:L=239:GOSUB500:RETURN
470 PRINT@322,"K":PRINT@482,"E":PRINT@642,"N":PRINT@802,"O":PRINT@1042,"K":PRINT
@1202,"E":PRINT@1362,"N":PRINT@1522,"O"
480 PRINT@397,"K":PRINT@557,"E":PRINT@717,"N":PRINT@877,"O":PRINT@1117,"K":PRINT
@1277,"E":PRINT@1437,"N":PRINT@1597,"O":RETURN
490 PRINT@L,STRING$(80,150):RETURN
500 FORI=1TO18:PRINT@L+I*80,V$;NEXT:RETURN
510 L=328:N=1:GOSUB590:L=364:N=6:GOSUB590
520 L=488:N=11:GOSUB590:L=524:N=16:GOSUB590
530 L=648:N=21:GOSUB590:L=684:N=26:GOSUB590
540 L=808:N=31:GOSUB590:L=844:N=36:GOSUB590
550 L=1048:N=41:GOSUB590:L=1084:N=46:GOSUB590
560 L=1208:N=51:GOSUB590:L=1244:N=56:GOSUB590
570 L=1368:N=61:GOSUB590:L=1404:N=66:GOSUB590
580 L=1528:N=71:GOSUB590:L=1564:N=76:GOSUB590:RETURN
590 FORI=1TO5:PRINT@L-1,USINGU$;N;:M(N)=L:L=L+7:N=N+1:NEXT:RETURN
600 DATA "GOLD","SILVER","BLACK","BROWN","RED","ORANGE","YELLOW","GREEN","BLUE",
"VIOLET","ROSE","BRONZE","LT BLUE","COPPER","TAN","WHITE"
610 CLS:PRINT@20,"R U L E S   F O R   K E N O":PRINT
620 PRINT"KENO IS AN EXCITING, SUSPENSEFUL GAME THAT PAYS HIGH ODDS!":PRINT
630 PRINT"TO PLAY KENO, FROM 1 TO 15 NUMBERS ARE SELECTED FROM THE RANGE OF":PRI
NT"1 TO 80 AVAILABLE ON THE 'TICKET'.":PRINT
640 PRINT"TO MARK THE SELECTED NUMBERS, ENTER THE NUMBER AND THEN DEPRESS <ENTER
> FOR AS":PRINT"MANY NUMBERS (MAX OF 15) AS YOU DESIRE.  AS THE NUMBERS ARE 'MAR
KED',":PRINT"TWO ASTERISKS WILL APPEAR IN THE BOX SPACE WITH THE NUMBER."
650 PRINT:PRINT"TO BEGIN OVER (WITH A NEW TICKET), ENTER C AND DEPRESS <ENTER>.
 TO PLACE A BET, ENTER B AND DEPRESS <ENTER>.":PRINT
660 PRINT"WHEN THE GAME BEGINS, TWENTY NUMBERS ARE SELECTED AT RANDOM FROM THE":
PRINT"TOTAL OF EIGHTY AVAILABLE.  THESE WINNING NUMBERS ARE INDICATED BY":PRINT"
THE GRAPHIC 'CROSS' ADJACENT TO EACH NUMBER.":PRINT
670 PRINT"THE WINNINGS FOR EACH GAME IS COMPUTED FROM STANDARD TABLES BASED ON T
HE":PRINT"NUMBER OF SPOTS MARKED AND THE AMOUNT OF THE BET.":PRINT
680 PRINT"GOOD LUCK, AND HAVE FUN!!!":PRINT
690 INPUT"WHEN READY TO PLAY, DEPRESS <ENTER>";Q$:GOTO90
```

Program Listing 8. Baccarat

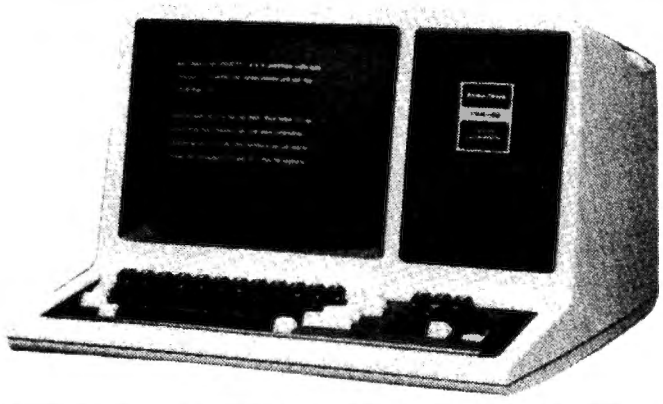
```
10 REM 07-JAN-83 *BDL MODEL II*
20 REM - PROGRAM BACCARAT/BAS
30 CLS:CLEAR1000:DEFDBLG,T:PRINT@20,"BACARRAT SIMULATION PROGRAM":PRINT:PRINT
40 DIMM$(416):V$=CHR$(148):GA$=CHR$(128):GB$=CHR$(131):GC$=CHR$(129):GD$=CHR$(13
0):LS="<":RS=">":U$="###.##":UU$="######.##"
50 M$(1)="A":M$(14)="A":M$(27)="A":M$(40)="A":M$(11)="J":M$(24)="J":M$(37)="J":M
$(50)="J":M$(12)="Q":M$(25)="Q":M$(38)="Q":M$(51)="Q":M$(13)="K":M$(26)="K":M$(3
9)="K":M$(52)="K"
60 FORI=2TO10:M$(I)=STR$(I):NEXT:FORI=15TO23:M$(I)=STR$(I-13):NEXT:FORI=28TO36:M
$(I)=STR$(I-26):NEXT:FORI=41TO49:M$(I)=STR$(I-39):NEXT
70 PRINT"THE ANCIENT GAME OF BACCARAT IS PLAYED WITH 8 COMPLETE DECKS OF CARDS."
:PRINT:PRINT"THE CARDS ARE BEING SHUFFLED BY THE CROUPIER AT THIS TIME....":PRIN
T
80 FORI=1TO7:FORJ=1TO52:M$(I*52+J)=M$(J):NEXT:NEXT
90 PRINT"THIS PROGRAM SIMULATES THE BACCARAT GAMES AS PLAYED IN THE CASINOS":PRI
NT"IN NEVADA.":PRINT
100 PRINT"INSTRUCTIONS REQUIRED (Y/N)"
110 I$=INKEY$:IFI$=""THEN110ELSEIFI$="Y"THEN770ELSEIFI$="N"THEN120ELSE110
120 CLS:PRINT"C A S I N O   B A C C A R A T":PRINT@62,"G A M E :";K=K+1:PRINT@72
,K
130 PRINTCHR$(2):GOSUB280:PRINT@414,"P L A Y E R":PRINT@455,"B A N K":L=643:GOSU
B340:L=725:GOSUB410:L=655:GOSUB340:L=737:GOSUB410:L=683:GOSUB340:L=765:GOSUB410:
L=695:GOSUB340:L=777:GOSUB410:PRINTCHR$(1)
140 SE=0:PRINT@240,"PLACE BET (P-PLAYER, B-BANK, T-TIE)";
150 I$=INKEY$:IFI$=""THEN150ELSEIFI$="P"THENSE=1:PRINT@1455,L$:PRINT@1462,R$ELSE
IFI$="B"THENSE=3:PRINT@1497,L$:PRINT@1504,R$ELSEIFI$="T"THENSE=2:PRINT@1476,L$:P
RINT@1483,R$:PRINT@1477,"      "ELSE150
160 PRINT@290,SPACE$(25):PRINT@290,"ENTER AMOUNT OF BET";:INPUTM:IFM<0ORM>999.99
THEN160
170 PRINT@1443,"B E T :";IFI$="P"THENPRINT@1456,USINGU$;MELSEIFI$="B"THENPRINT@1
498,USINGU$;MELSEIFI$="T"THENPRINT@1477,USINGU$;M
180 R1=RND(416):L=725:T$=M$(R1):RX=R1:GOSUB290:GOSUB420:GOSUB330
190 R2=RND(416):IFR2=R1THEN190ELSEL=737:T$=M$(R2):RX=R2:GOSUB290:GOSUB420:GOSUB3
30
200 GOSUB430:IFFG=0THEN220ELSEL=667:GOSUB340
210 R3=RND(416):IFR3=R1ORR3=R2THEN210ELSEL=749:T$=M$(R3):RX=R3:GOSUB290:GOSUB420
:GOSUB330
220 R4=RND(416):IFR4=R1ORR4=R2ORR4=R3THEN220ELSEL=765:T$=M$(R4):RX=R4:GOSUB290:G
OSUB420:GOSUB330
230 R5=RND(416):IFR5=R1ORR5=R2ORR5=R3ORR5=R4THEN230ELSEL=777:T$=M$(R5):RX=R5:GOS
UB290:GOSUB420:GOSUB330
240 GOSUB520:IFFZ=0THEN260ELSEL=707:GOSUB340
250 R6=RND(416):IFR6=R1ORR6=R2ORR6=R3ORR6=R4ORR6=R5THEN250ELSEL=789:T$=M$(R6):RX
=R6:GOSUB290:GOSUB420:GOSUB330
260 GOSUB680
270 GOTO350
280 FORI=1TO13:PRINT@480+I*80,V$:NEXT:FORI=1TO13:PRINT@519+I*80,V$:NEXT:FORI=1TO
13:PRINT@520+I*80,V$:NEXT:FORI=1TO13:PRINT@559+I*80,V$:NEXT:PRINT@480,STRING$(80
,150):PRINT@1600,STRING$(80,150):RETURN
290 IFRX>0ANDRX<14ORRX>52ANDRX<66ORRX>104ANDRX<118ORRX>156ANDRX<170ORRX>208ANDRX
<222ORRX>260ANDRX<274ORRX>312ANDRX<326ORRX>364ANDRX<378THENB$="HEARTS":RETURN
300 IFRX>13ANDRX<27ORRX>65ANDRX<79ORRX>117ANDRX<131ORRX>169ANDRX<183ORRX>221ANDR
X<235ORRX>273ANDRX<287ORRX>325ANDRX<339ORRX>377ANDRX<391THENB$="DIAMONDS":RETURN
310 IFRX>26ANDRX<40ORRX>78ANDRX<92ORRX>130ANDRX<144ORRX>182ANDRX<196ORRX>234ANDR
X<248ORRX>286ANDRX<300ORRX>338ANDRX<352ORRX>390ANDRX<404THENB$="CLUBS":RETURN
320 B$="SPADES":RETURN
330 PRINT@L,T$:PRINT@L+80,B$:RETURN
340 LT=L+10:PRINT@L,GA$:FORI=1TO7:PRINT@L+I*80,V$:NEXT:PRINT@L+640,GB$:PRINT@L+1
0,GC$:FORI=1TO7:PRINT@LT+I*80,V$:NEXT:PRINT@L+650,GD$:PRINT@L+1,STRING$(9,150):P
RINT@L+641,STRING$(9,150):RETURN
350 TW=TW+GW-DL
360 PRINT@1760,"G A M E   W I N N I N G S :"USINGUU$;GW:PRINT@1800,"T O T A L
W I N N I N G S :"USINGUU$;TW
370 PRINT@240,SPACE$(80):PRINT@240,"W I N N E R : "W$:PRINT@300,"PLAY AGAIN (Y/N
```

Listing 8 continues

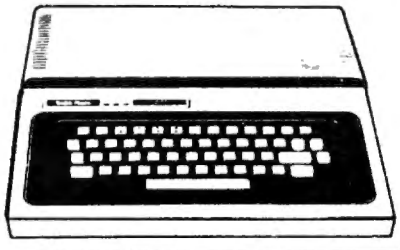
COMPUTERS

TRS-80
MODEL 4
128K 2-Drive

$1699.00



RS-232 INTERFACE BOARD $92.00



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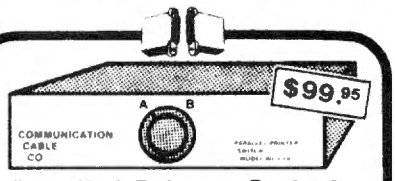

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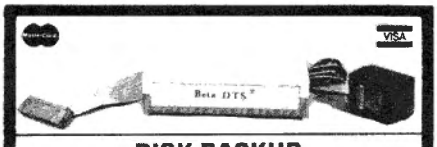

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Listing 8 continued

```
)";
380 I$=INKEY$:IFI$=""THEN380ELSEIFI$="Y"THEN390ELSEIFI$="N"THEN400ELSE380
390 R3=0:R6=0:RANDOM:GOTO120
400 CLS:PRINT@480,"T H A N K  Y O U  F O R  P L A Y I N G ! ! !  -  C O M E
 A G A I N . . .":PRINT:PRINT:PRINT:END
410 PRINT@L,"* * * *";:PRINT@L+80," * * *";:PRINT@L+160,"* * * *";:PRINT@L+240," *
* *";:PRINT@L+320,"* * * *";:PRINT@L+400," * * *";:PRINT@L+480,"* * * *":RETURN
420 PRINT@L,"        ";:PRINT@L+80,"        ";:PRINT@L+160,"        ";:PRINT@L+240,"
    ";:PRINT@L+320,"        ";:PRINT@L+400,"        ";:PRINT@L+480,"        ";:RETURN
430 FG=0:FX=0:V1=VAL(M$(R1)):V2=VAL(M$(R2))
440 IFM$(R1)="A"THENV1=1
450 IFM$(R2)="A"THENV2=1
460 IFV1=10THENV1=0
470 IFV2=10THENV2=0
480 V3=V1+V2
490 IFV3>=0ANDV3<6THENFG=1
500 IFV3>5ANDV3<8THENFG=0
510 IFV3>7ANDV3<10THENFX=1:RETURN
520 FZ=0:VP=VAL(M$(R3)):VX=VP:V4=VAL(M$(R4)):V5=VAL(M$(R5))
530 IFM$(R3)="A"THENVP=1
540 IFM$(R4)="A"THENV4=1
550 IFM$(R5)="A"THENV5=1
560 IFVP=10THENVX=0
570 IFV4=10THENV4=0
580 IFV5=10THENV5=0
590 VT=V4+V5
600 IFVT=3THENIFVP>0ANDVP<11THENFZ=1
610 IFVT=4THENIFVP>1ANDVP<8THENFZ=1
620 IFVT=5THENIFVP>3ANDVP<8THENFZ=1
630 IFVT=6THENIFVP>5ANDVP<8THENFZ=1
640 IFVT=7THENFZ=0
650 IFVT<3THENFZ=1
660 IFFX=1THENFZ=0
670 RETURN
680 GW=0:V6=VAL(M$(R6)):IFM$(R6)="A"THENV6=1
690 IFV6=10THENV6=0
700 DP=V3+VX:DB=VT+V6
710 IFSE=1THENIFDP>DBTHENGW=M:W$="PLAYER":GOTO750ELSE740
720 IFSE=2THENIFDP=DBTHENGW=M*9:W$="PLAYER (TIE)":GOTO750ELSE740
730 IFSE=3THENIFDB>DPTHENGW=M*.95:W$="PLAYER":GOTO750
740 GW=0:W$="HOUSE"
750 IFGW=0THENDL=MELSEDL=0
760 RETURN
770 CLS:PRINT@20,"R U L E S  F O R  B A C C A R A T":PRINT:PRINT
780 PRINT"THE OBJECT OF THE GAME IS TO WAGER ON THE HAND (BANK OR PLAYER) WHICH
THE":PRINT"PLAYER FEELS WILL BE CLOSEST TO 9.  THE HIGHEST HAND IN BACCARAT IS 9
.":PRINT"THE LOWEST IS 0.  THE CLOSEST HAND TO 9 IS THE WINNER.":PRINT
790 PRINT"FACE CARDS, TENS, AND ANY COMBINATION OF CARDS TOTALING TEN, HAVE 'ZER
O'":PRINT"VALUE.  THE ACE IS WORTH 1.":PRINT
800 PRINT"IN BACCARAT THERE ARE ONLY TWO NORMAL WAYS TO BET, THE PLAYER'S HAND O
R THE":PRINT"BANK'S HAND.  EACH HAND IS DEALT TWO CARDS FROM THE DECKS WHICH ARE
":PRINT"PLACED IN A BOX CALLED THE 'SHOE'.  THE PLAYER'S HAND IS ACTED UPON FIRS
T,"
810 PRINT"THEN THE BANK'S HAND.  THE PLAYER'S HAND IS EVALUATED FIRST AND IF THE
 RULES":PRINT"CALL FOR A THIRD CARD IT IS DEALT.":PRINT
820 PRINT"THERE ARE NO OPTIONAL CARDS IN BACCARAT.  PLAYERS MAY BET ON A 'TIE' H
AND.":PRINT"TIE BETS ARE DECLARED AT THE START OF BETTING AND PAY 9 FOR 1.":PRIN
T
830 PRINT"THE HOUSE COLLECTS A 5% COMMISSION ON ALL WINNING BETS ON THE BANK HAN
D."
840 PRINT:INPUT"WHEN READY TO PLAY, DEPRESS <ENTER>";Q$:GOTO120
```

Program Listing 9. Draw Poker

```
10 REM 25-FEB-83 *BDL MODEL II*
20 REM PROGRAM DRWPOKER/BAS
30 CLS:CLEAR500
40 DIMM$(52),M(52):GA$=CHR$(128):GB$=CHR$(129):GC$=CHR$(130):GD$=CHR$(131):GE$=C
HR$(148):GF$=CHR$(150)
50 M$(1)="A":M$(14)="A":M$(27)="A":M$(40)="A":M$(11)="J":M$(24)="J":M$(37)="J":M
$(50)="J":M$(12)="Q":M$(25)="Q":M$(38)="Q":M$(51)="Q":M$(13)="K":M$(26)="K":M$(3
9)="K":M$(52)="K"
60 FORI=2TO10:M$(I)=STR$(I):NEXT:FORI=15TO23:M$(I)=STR$(I-13):NEXT:FORI=28TO36:M
$(I)=STR$(I-26):NEXT:FORI=41TO49:M$(I)=STR$(I-39):NEXT
70 PRINT@20,"DRAW-POKER SIMULATION PROGRAM":PRINT:PRINT
80 PRINT"THIS PROGRAM IS PATTERNED AFTER THE ELECTRONIC GAMING MACHINES FOUND":P
RINT"AT THE CASINOS IN NEVADA.":PRINT
90 PRINT"NEED INSTRUCTIONS (Y/N)";
100 I$=INKEY$:IFI$=""THEN100ELSEIFI$="Y"THEN1230ELSEIFI$="N"THEN110ELSE100
110 HX=0:DX=0:CX=0:SX=0:CLS:PRINT@29,"D R A W  P O K E R"
120 PRINT@348,"- G O O D  L U C K -"
130 GOSUB1070:GOSUB1160:GOSUB1080:GOSUB1170:GOSUB1090:GOSUB1180:GOSUB1100:GOSUB1
190:GOSUB1110:GOSUB1200
140 PRINT@1665,"* * * 2 5 * * *"
150 PRINT@1489,"I N S E R T  C O I N (1 - 5) ";
160 I$=INKEY$:IFI$=""THEN160ELSEIFI$>="1"ANDI$<="5"THENM=VAL(I$):GOTO170ELSE160
170 PRINT@1440,"C O I N S":PRINT@1600,"I N  -"M"-"
180 PRINT@1760,"TO DEAL, DEPRESS <ENTER>";:INPUTQ$;
190 PRINT@1760,STRING$(32,24)
200 GOSUB210:GOSUB220:GOSUB230:GOSUB240:GOSUB250:GOTO260
210 PRINT@722,"        ";:PRINT@803,"        ";:PRINT@882,"        ";:PRINT@963,
"        ";:PRINT@1042,"        ";:PRINT@1123,"        ";:PRINT@1202,"        ":RETU
RN
220 PRINT@739,"        ";:PRINT@820,"        ";:PRINT@899,"        ";:PRINT@980,"
        ";:PRINT@1059,"        ";:PRINT@1140,"        ";:PRINT@1219,"        ":RETUR
N
230 PRINT@756,"        ";:PRINT@837,"        ";:PRINT@916,"        ";:PRINT@997,
"        ";:PRINT@1076,"        ";:PRINT@1157,"        ";:PRINT@1236,"        ":RETU
RN
240 PRINT@773,"        ";:PRINT@854,"        ";:PRINT@933,"        ";:PRINT@1014
,"        ";:PRINT@1093,"        ";:PRINT@1174,"        ";:PRINT@1253,"        ":RET
URN
250 PRINT@790,"        ";:PRINT@871,"        ";:PRINT@950,"        ";:PRINT@1031
,"        ";:PRINT@1110,"        ";:PRINT@1191,"        ";:PRINT@1270,"        ":RET
URN
```

Listing 9 continues

DISK DRIVES

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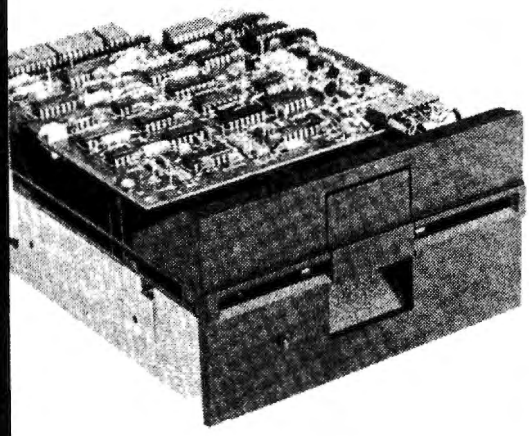
Drive 0 includes the controller board, power supply, cables and all mounting hardware. Complete instructions are included for installation. It takes 30 minutes to an hour to install disk drives in a Model III. No soldering is required. TRSDOS operating system is not included in this low price.



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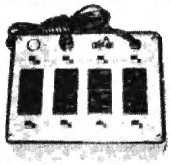

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Listing 9 continued

```
260 R1=RND(52):L=722:T$=M$(R1):RX=R1:GOSUB1220:GOSUB1210
270 R2=RND(52):IFR2=R1THEN270ELSEL=739:T$=M$(R2):RX=R2:GOSUB1220:GOSUB1210
280 R3=RND(52):IFR3=R1ORR3=R2THEN280ELSEL=756:T$=M$(R3):RX=R3:GOSUB1220:GOSUB121
0
290 R4=RND(52):IFR4=R1ORR4=R2ORR4=R3THEN290ELSEL=773:T$=M$(R4):RX=R4:GOSUB1220:G
OSUB1210
300 R5=RND(52):IFR5=R1ORR5=R2ORR5=R3ORR5=R4THEN300ELSEL=790:T$=M$(R5):RX=R5:GOSU
B1220:GOSUB1210
310 PRINT@1760,"TO HOLD CARDS, USE KEYS 1 - 5 : TO CANCEL USE <C> : TO DRAW USE
<D>";
320 K1=0:K2=0:K3=0:K4=0:K5=0:QH$=""
330 I$=INKEY$:IFI$=""THEN330ELSEPRINTCHR$(2):IFI$="1"THENK1=1:PRINT@562,"H O L D
"ELSEIFI$="2"THENK2=1:PRINT@579,"H O L D"ELSEIFI$="3"THENK3=1:PRINT@596,"H O L D
"ELSEIFI$="4"THENK4=1:PRINT@613,"H O L D"ELSEIFI$="5"THENK5=1:PRINT@630,"H O L D
";
340 IFI$="D"THENGOSUB350:GOTO360ELSEIFI$="C"THENGOSUB350:K1=0:K2=0:K3=0:K4=0:K5=
0:GOTO330ELSE330
350 PRINT@562,"        ":PRINT@579,"        ":PRINT@596,"        ":PRINT@613,"
  ":PRINT@630,"        ":RETURN
360 IFK1=0THENGOSUB210:GOTO370ELSE380
370 RA=RND(52):IFRA=R1ORRA=R2ORRA=R3ORRA=R4ORRA=R5THEN370ELSEL=722:T$=M$(RA):RX=
RA:GOSUB1220:GOSUB1210
380 IFK2=0THENGOSUB220:GOTO390ELSE400
390 RB=RND(52):IFRB=R1ORRB=R2ORRB=R3ORRB=R4ORRB=R5ORRB=RATHEN390ELSEL=739:T$=M$(
RB):RX=RB:GOSUB1220:GOSUB1210
400 IFK3=0THENGOSUB230:GOTO410ELSE420
410 RC=RND(52):IFRC=R1ORRC=R2ORRC=R3ORRC=R4ORRC=R5ORRC=RAORRC=RBTHEN410ELSEL=756
:T$=M$(RC):RX=RC:GOSUB1220:GOSUB1210
420 IFK4=0THENGOSUB240:GOTO430ELSE440
430 RD=RND(52):IFRD=R1ORRD=R2ORRD=R3ORRD=R4ORRD=R5ORRD=RAORRD=RBORRD=RCTHEN430EL
SEL=773:T$=M$(RD):RX=RD:GOSUB1220:GOSUB1210
440 IFK5=0THENGOSUB250:GOTO450ELSE460
450 RE=RND(52):IFRE=R1ORRE=R2ORRE=R3ORRE=R4ORRE=R5ORRE=RAORRE=RBORRE=RCORRE=RDTH
EN450ELSEL=790:T$=M$(RE):RX=RE:GOSUB1220:GOSUB1210
460 IFK1=0THENM(RA)=1ELSEM(R1)=1
470 IFK2=0THENM(RB)=1ELSEM(R2)=1
480 IFK3=0THENM(RC)=1ELSEM(R3)=1
490 IFK4=0THENM(RD)=1ELSEM(R4)=1
500 IFK5=0THENM(RE)=1ELSEM(R5)=1
510 PRINT@160,"STANDBY.....EVALUATING HAND!"
520 IFM(10)=1ANDM(11)=1ANDM(12)=1ANDM(13)=1ANDM(1)=1THEN910ELSEIFM(23)=1ANDM(24)
=1ANDM(25)=1ANDM(26)=1ANDM(14)=1THEN910
530 IFM(36)=1ANDM(37)=1ANDM(38)=1ANDM(39)=1ANDM(27)=1THEN910ELSEIFM(49)=1ANDM(50
)=1ANDM(51)=1ANDM(52)=1ANDM(40)=1THEN910
540 FORI=1TO13:IFM(I)=0THENHX=1:NEXTELSEHX=0:GOTO550
550 FORI=14TO26:IFM(I)=0THENDX=1:NEXTELSEDX=0:GOTO560
560 FORI=27TO39:IFM(I)=0THENCX=1:NEXTELSECX=0:GOTO570
570 FORI=40TO52:IFM(I)=0THENSX=1:NEXTELSESX=0
580 IFHX=1ANDDX=1ANDCX=1THEN600ELSEIFHX=1ANDDX=1ANDSX=1THEN600ELSEIFHX=1ANDCX=1A
NDSX=1THEN600ELSEIFDX=1ANDCX=1ANDSX=1THEN600
590 GOTO650
600 CT=0:IFHX=0THENFORI=1TO9:FORJ=0TO4:IFM(I+J)=1THENCT=CT+1:NEXTELSENEXT:CT=0:N
EXT:IFCT=5THEN920
610 CT=0:IFDX=0THENFORI=14TO22:FORJ=0TO4:IFM(I+J)=1THENCT=CT+1:NEXTELSENEXT:CT=0
:NEXT:IFCT=5THEN920
620 CT=0:IFCX=0THENFORI=27TO35:FORJ=0TO4:IFM(I+J)=1THENCT=CT+1:NEXTELSENEXT:CT=0
:NEXT:IFCT=5THEN920
630 CT=0:IFSX=0THENFORI=40TO48:FORJ=0TO4:IFM(I+J)=1THENCT=CT+1:NEXTELSENEXT:CT=0
:NEXT:IFCT=5THEN920
640 GOTO950
650 CT=0:FORI=1TO9:FORJ=0TO4:IFM(I+J)=1ORM(I+13+J)=1ORM(I+26+J)=1ORM(I+39+J)=1TH
ENCT=CT+1:NEXTELSENEXT
660 IFCT=5THEN960ELSECT=0:NEXT
670 T1=0:T2=0:T3=0:T4=0:T5=0:IFM(10)=1ORM(23)=1ORM(36)=1ORM(49)=1THENT1=1
680 IFM(11)=1ORM(24)=1ORM(37)=1ORM(50)=1THENT2=1
690 IFM(12)=1ORM(25)=1ORM(38)=1ORM(51)=1THENT3=1
700 IFM(13)=1ORM(26)=1ORM(39)=1ORM(52)=1THENT4=1
710 IFM(1)=1ORM(14)=1ORM(27)=1ORM(40)=1THENT5=1
720 IFT1=1ANDT2=1ANDT3=1ANDT4=1ANDT5=1THEN960
730 FORI=1TO13:IFM(I)=1ANDM(I+13)=1ANDM(I+26)=1ANDM(I+39)=1THEN930ELSENEXT
740 BD=0:FORI=1TO13:IFM(I)=1ANDM(I+13)=1ANDM(I+26)=1THENBD=1:GOTO780ELSENEXT
750 FORI=1TO13:IFM(I)=1ANDM(I+13)=1ANDM(I+39)=1THENBD=1:GOTO780ELSENEXT
760 FORI=1TO13:IFM(I+13)=1ANDM(I+26)=1ANDM(I+39)=1THENBD=1:GOTO780ELSENEXT
770 FORI=1TO13:IFM(I)=1ANDM(I+26)=1ANDM(I+39)=1THENBD=1:GOTO780ELSENEXT
780 BX=0:FORI=1TO13:IFM(I)=1ANDM(I+13)=1ANDM(I+26)=0ANDM(I+39)=0THENBX=BX+1:NEXT
ELSENEXT
790 FORI=1TO13:IFM(I)=1ANDM(I+26)=1ANDM(I+13)=0ANDM(I+39)=0THENBX=BX+1:NEXTELSEN
EXT
800 FORI=1TO13:IFM(I+13)=1ANDM(I+26)=1ANDM(I)=0ANDM(I+39)=0THENBX=BX+1:NEXTELSEN
EXT
810 FORI=1TO13:IFM(I)=1ANDM(I+39)=1ANDM(I+13)=0ANDM(I+26)=0THENBX=BX+1:NEXTELSEN
EXT
820 FORI=1TO13:IFM(I+26)=1ANDM(I+39)=1ANDM(I)=0ANDM(I+13)=0THENBX=BX+1:NEXTELSEN
EXT
830 FORI=1TO13:IFM(I+13)=1ANDM(I+39)=1ANDM(I)=0ANDM(I+26)=0THENBX=BX+1:NEXTELSEN
EXT
840 IFBD=1ANDBX>0THEN940ELSEIFBD=1THEN970
850 IFBX>1THEN980
860 IFM(11)=1ANDM(24)=1ORM(11)=1ANDM(37)=1ORM(11)=1ANDM(50)=1THEN990ELSEIFM(24)=
1ANDM(37)=1ORM(24)=1ANDM(50)=1ORM(37)=1ANDM(50)=1THEN990
870 IFM(12)=1ANDM(25)=1ORM(12)=1ANDM(38)=1ORM(12)=1ANDM(51)=1THEN990ELSEIFM(25)=
1ANDM(38)=1ORM(25)=1ANDM(51)=1ORM(38)=1ANDM(51)=1THEN990
880 IFM(13)=1ANDM(26)=1ORM(13)=1ANDM(39)=1ORM(13)=1ANDM(52)=1THEN990ELSEIFM(26)=
1ANDM(39)=1ORM(26)=1ANDM(52)=1ORM(39)=1ANDM(52)=1THEN990
890 IFM(1)=1ANDM(14)=1ORM(1)=1ANDM(27)=1ORM(1)=1ANDM(40)=1THEN990ELSEIFM(14)=1AN
DM(27)=1ORM(14)=1ANDM(40)=1ORM(27)=1ANDM(40)=1THEN990
900 GOTO1000
910 W$="ROYAL FLUSH":GW=M*250:Z=0:GOTO1010
920 W$="STRAIGHT FLUSH":GW=M*50:Z=0:GOTO1010
930 W$="FOUR OF A KIND":GW=M*25:Z=0:GOTO1010
940 W$="FULL HOUSE":GW=M*8:Z=0:GOTO1010
950 W$="FLUSH":GW=M*5:Z=0:GOTO1010
960 W$="STRAIGHT":GW=M*4:Z=0:GOTO1010
970 W$="THREE OF A KIND":GW=M*3:Z=0:GOTO1010
980 W$="TWO PAIR":GW=M*2:Z=0:GOTO1010
990 W$="RETURN BET":GW=0:Z=0:GOTO1010
1000 W$="SORRY...YOU LOST":GW=0:Z=M
1010 PRINT@1760,SPACE$(80);:PRINT@1760,"G A M E   O V E R";
1020 PRINT@1488,STRING$(32,32):PRINT@160,STRING$(40,32):PRINTCHR$(1):PRINT@160,W
$
1030 TW=TW+(GW-Z)/4
```

Listing 9 continues

SCM

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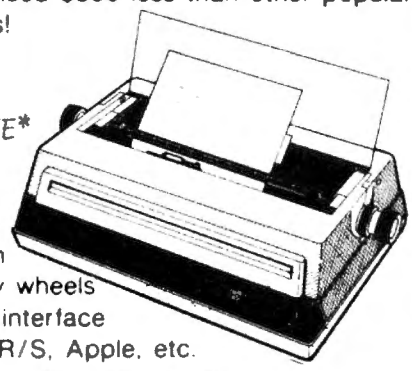

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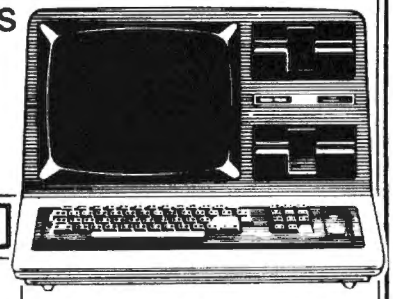

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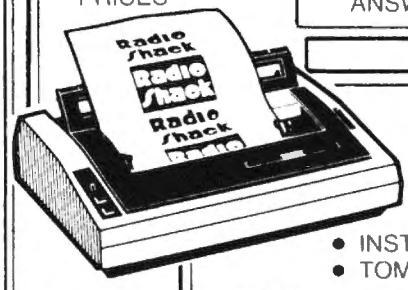

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Listing 9 continued

```
1040 PRINT@320,SPACE$(80):PRINT@320,"G A M E   W I N N I N G :"USING"####.##";GW
/4:PRINT@362,"T O T A L   W I N N I N G S :"USING"####.##";TW
1050 PRINT@480,"TO PLAY AGAIN DEPRESS <ENTER>, TO END GAME DEPRESS <E>";
1060 I$=INKEY$:IFI$=""THEN1060ELSEIFI$=CHR$(13)THENERASEM:DIMM(52):GOTO110ELSEIF
I$="E"THENCLS:PRINT@975,"T H A N K   Y O U - - - C O M E   A G A I N ! ! !":PRIN
T:PRINT:PRINT:ENDELSE1060
1070 GA=640:GB=651:GC=1280:GD=1291:GOSUB1120:RETURN
1080 GA=657:GB=668:GC=1297:GD=1308:GOSUB1120:RETURN
1090 GA=674:GB=685:GC=1314:GD=1325:GOSUB1120:RETURN
1100 GA=691:GB=702:GC=1331:GD=1342:GOSUB1120:RETURN
1110 GA=708:GB=719:GC=1348:GD=1359:GOSUB1120:RETURN
1120 PRINT@GA,GA$:FORI=1TO8:PRINT@GA+I*80,GE$:NEXT:PRINT@GC,GD$
1130 PRINT@GB,GB$:FORI=1TO8:PRINT@GB+I*80,GE$:NEXT:PRINT@GD,GC$
1140 FORI=1TO10:PRINT@GA+1*I,GF$:NEXT
1150 FORI=1TO10:PRINT@GC+1*I,GF$:NEXT:RETURN
1160 PRINT@722,"* * * *";:PRINT@803,"* * * *";:PRINT@882,"* * * *";:PRINT@963,"*
 * * *";:PRINT@1042,"* * * *";:PRINT@1123,"* * * *";:PRINT@1202,"* * * *":RETURN
1170 PRINT@739,"* * * *";:PRINT@820,"* * * *";:PRINT@899,"* * * *";:PRINT@980,"*
 * * *";:PRINT@1059,"* * * *";:PRINT@1140,"* * * *";:PRINT@1219,"* * * *":RETURN
1180 PRINT@756,"* * * *";:PRINT@837,"* * * *";:PRINT@916,"* * * *";:PRINT@997,"*
 * * *";:PRINT@1076,"* * * *";:PRINT@1157,"* * * *";:PRINT@1236,"* * * *":RETURN
1190 PRINT@773,"* * * *";:PRINT@854,"* * * *";:PRINT@933,"* * * *";:PRINT@1014,"
* * * *";:PRINT@1093,"* * * *";:PRINT@1174,"* * * *";:PRINT@1253,"* * * *":RETUR
N
1200 PRINT@790,"* * * *";:PRINT@871,"* * * *";:PRINT@950,"* * * *";:PRINT@1031,"
* * * *";:PRINT@1110,"* * * *";:PRINT@1191,"* * * *";:PRINT@1270,"* * * *":RETUR
N
1210 PRINT@L,T$:PRINT@L+160,B$:RETURN
1220 IFRX>0ANDRX<14THENB$="HEARTS":RETURNELSEIFRX>13ANDRX<27THENB$="DIAMONDS":RE
TURNELSEIFRX>26ANDRX<40THENB$="CLUBS":RETURNELSEB$="SPADES":RETURN
1230 CLS:PRINT@24,"RULES FOR DRAW POKER":PRINT:PRINT
1240 PRINT"1.  THIS MACHINE ACCEPTS ONLY QUARTERS.  DEPOSIT FROM 1 TO 5.":PRINT
1250 PRINT"2.  THE HOUSE WILL DEAL YOU 5 CARDS, FACE UP.  IF YOU WISH TO KEEP AN
D":PRINT"     PLAY ANY OF THE 5 CARDS, 'HOLD' EACH BY DEPRESSING THE NUMBER KEYS
1 TO 5.":PRINT"     ANY CARD NOT SO PROTECTED WILL BE REPLACED AS YOU -DRAW-."
1260 PRINT"     TO RESELECT THE 'HOLD' CARDS YOU MAY -CANCEL- AND START OVER.":PR
INT
1270 PRINT"3.  THE PROGRAM WILL EVALUATE THE FINAL HAND ACCORDING TO STANDARD RU
LES:":PRINT
1280 PRINT"  COINS-";TAB(30)"1";TAB(35)"2";TAB(40)"3";TAB(45)"4";TAB(51)"5"
1290 PRINT"     ROYAL FLUSH";TAB(29)"250";TAB(34)"500";TAB(39)"750";TAB(44)"1000"
;TAB(50)"1250"
1300 PRINT"     STRAIGHT FLUSH";TAB(30)"50";TAB(34)"100";TAB(39)"150";TAB(45)"200
";TAB(51)"250"
1310 PRINT"     4 OF A KIND";TAB(30)"25";TAB(35)"50";TAB(40)"75";TAB(45)"100";TAB
(51)"125"
1320 PRINT"     FULL HOUSE";TAB(31)"8";TAB(35)"16";TAB(40)"24";TAB(46)"32";TAB(52
)"40"
1330 PRINT"     FLUSH";TAB(31)"5";TAB(35)"10";TAB(40)"15";TAB(46)"20";TAB(52)"25"
1340 PRINT"     STRAIGHT";TAB(31)"4";TAB(36)"8";TAB(40)"12";TAB(46)"16";TAB(52)"2
0"
1350 PRINT"     3 OF A KIND";TAB(31)"3";TAB(36)"6";TAB(41)"9";TAB(46)"12";TAB(52)
"15"
1360 PRINT"     2 PAIR";TAB(31)"2";TAB(36)"4";TAB(41)"6";TAB(47)"8";TAB(52)"10"
1370 PRINT:INPUT"WHEN READY TO CONTINUE, DEPRESS <ENTER>";Q$
1380 CLS:FORI=1TO7:PRINT:NEXT
1390 PRINT:PRINT"4.  A PAIR OF JACKS OR HIGHER RETURNS THE BET.":PRINT
1400 PRINT"5.  FOR A HAND WITH NO POINT VALUE, 'SORRY....YOU LOST' WILL BE DISPL
AYED.":PRINT
1410 PRINT"6.  THE DECK CONSISTS OF 52 CARDS (NO JOKER).":PRINT
1420 PRINT"7.  CHOOSE YOUR CARDS CAREFULLY, AND ENJOY THE GAME!":PRINT
1430 FORI=1TO6:PRINT:NEXT
1440 PRINT:INPUT"WHEN READY TO PLAY, DEPRESS <ENTER>";Q$:GOTO110
```

Program Listing 10. Four-Card Monte

```
10 REM 01-MAR-83 *BDL MODEL II*
20 REM PROGRAM MONTE/BAS
30 CLS:PRINT@18,"FOUR-CARD-MONTE SIMULATION PROGRAM":PRINT:PRINT
40 CLEAR200:V$=CHR$(148):D$=CHR$(124):CA$=CHR$(128):CB$=CHR$(129):CC$=CHR$(130):
CD$=CHR$(131):CV$="CHIP VALUES: (W)HITE=$1, (O)RANGE=$2, (R)ED=$5, (G)REEN=$25,
(B)LACK=$100"
50 DIMM$(52),M(52):P$="###":UU$="#####.##":A$="****"
60 M$(1)="A":M$(14)="A":M$(27)="A":M$(40)="A":M$(11)="J":M$(24)="J":M$(37)="J":M
$(50)="J":M$(12)="Q":M$(25)="Q":M$(38)="Q":M$(51)="Q":M$(13)="K":M$(26)="K":M$(3
9)="K":M$(52)="K"
70 FORI=2TO10:M$(I)=STR$(I):NEXT:FORI=15TO23:M$(I)=STR$(I-13):NEXT:FORI=28TO36:M
$(I)=STR$(I-26):NEXT:FORI=41TO49:M$(I)=STR$(I-39):NEXT:M(8)=1:M(21)=1:M(34)=1:M(
47)=1:M(9)=1:M(22)=1:M(35)=1:M(48)=1:M(10)=1:M(23)=1:M(36)=1:M(49)=1
80 PRINT"THIS GAME IS ONE OF THE MORE FAMOUS OF THE MANY VARIATIONS PLAYED IN TH
E":PRINT"GAMBLING HALLS AND SALOONS IN THE OLD WEST."
90 PRINT:PRINT"IN THIS SIMULATION, A SINGLE PERSON PLAYS AGAINST THE HOUSE, USIN
G THE":PRINT"RULES FROM YEARS GONE BY....."
100 PRINT:PRINT"INSTRUCTIONS REQUIRED (Y/N)";
110 I$=INKEY$:IFI$=""THEN110ELSEIFI$="Y"THEN120ELSEIFI$="N"THEN260ELSE110
120 CLS:PRINT@14,"R U L E S   F O R   F O U R - C A R D   M O N T E":PRINT:PRINT
130 PRINT"THE DECK OF CARDS USED FOR 'FOUR-CARD MONTE', ALSO CALLED THE 'PACK',
CONSISTS":PRINT"OF A STANDARD DECK OF 52 WITH THE 8S, 9S, AND 10S REMOVED FOR A
TOTAL OF 40.":PRINT
140 PRINT"AFTER SHUFFLING AND CUTTING THE DECK HAVE BEEN COMPLETED, THE DEALER D
RAWS TWO":PRINT"CARDS FROM THE BOTTOM OF THE PACK AND PLACES THEM FACE-UP ON THE
 TABLE. THESE"
150 PRINT"TWO ARE CALLED THE 'BOTTOM LAYOUT'.  STILL HOLDING THE PACK FACE-DOWN,
 THE":PRINT"DEALER DRAWS TWO CARDS FROM THE TOP OF THE PACK AND PLACES THESE FAC
E-UP ON THE":PRINT"TABLE FOR THE 'TOP LAYOUT'.":PRINT
160 PRINT"THE PLAYER(S) BET ON EITHER LAYOUT BY PLACING CHIPS NEXT TO THE CARD P
AIRS. THE":PRINT"REMAINDER OF THE PACK IS THEN TURNED FACE-UP AND THE CARD VISIB
LE IS"
170 PRINT"CALLED THE 'GATE'. IF THE GATE IS THE SAME SUITE AS EITHER OF THE CARD
S IN THE":PRINT"BOTTOM LAYOUT, THE DEALER PAYS THE BET. IF THE GATE IS THE SAME
SUITE AS EITHER"
180 PRINT"OF THE CARDS IN THE TOP LAYOUT, THE DEALER ALSO PAYS THE BET. THE HOUS
E WINS":PRINT"ALL BETS ON A LAYOUT WHICH HAS NO CARD OF THE SAME SUITE AS THE GA
TE.":PRINT
```

Listing 10 continues

Listing 10 continued

```
190 INPUT"WHEN READY TO CONTINUE, DEPRESS <ENTER>";Q$
200 CLS:FORI=1TO6:PRINT:NEXT
210 PRINT"AFTER THE BETS ARE SETTLED, THE FOUR CARDS FROM THE LAYOUTS ARE COLLEC
TED AND":PRINT"SET ASIDE, THE PACK IS TURNED FACE-DOWN, THE OLD GATE CARD SET AS
IDE, AND FOUR"
220 PRINT"CARDS FOR TWO NEW LAYOUTS ARE DRAWN AND DISPLAYED. THE PACK IS THEN TU
RNED FACE":PRINT"UP TO SHOW THE NEW GATE, AND NEW BETS ARE MADE. THIS SEQUENCE I
S CONTINUED"
230 PRINT"UNTIL ALL CARDS REMAINING IN THE PACK ARE USED.":PRINT
240 PRINT"ENJOY THE GAME AND GOOD-LUCK!!!":PRINT
250 INPUT"WHEN READY TO PLAY, DEPRESS <ENTER>";Q$
260 H=1:B=0:T=0:CLS:RANDOM:PRINT"C A S I N O   F O U R - C A R D   M O N T E :":
PRINT@65,"G A M E :";K=K+1:PRINT@75,K
270 PRINTCHR$(2);:GOSUB750:L=565:GOSUB760:L=646:GOSUB800:PRINT@327,"P A C K":PRI
NT@343,"B O T T O M - L A Y O U T":PRINT@374,"T O P - L A Y O U T"
280 RG=RND(52):IFM(RG)=1THEN280ELSEM(RG)=1:E=RG:GOSUB790:T$=M$(RG):B$=E$:S1$=E$:
L=583:GOSUB760:L=665:GOSUB770
290 RH=RND(52):IFM(RH)=1THEN290ELSEM(RH)=1:E=RH:GOSUB790:T$=M$(RH):B$=E$:S2$=E$:
L=597:GOSUB760:L=679:GOSUB770
300 RT=RND(52):IFM(RT)=1THEN300ELSEM(RT)=1:E=RT:GOSUB790:T$=M$(RT):B$=E$:S3$=E$:
L=612:GOSUB760:L=694:GOSUB770
310 RU=RND(52):IFM(RU)=1THEN310ELSEM(RU)=1:E=RU:GOSUB790:T$=M$(RU):B$=E$:S4$=E$:
L=626:GOSUB760:L=708:GOSUB770
320 GOSUB810:PRINT@1760,CV$;PRINTCHR$(1);:PRINT@160,SPACE$(80);:PRINT@160,"PLACE
 BET ON BOTTOM-LAYOUT OR TOP-LAYOUT (B/T), <ENTER> TO PLAY";
330 I$=INKEY$:IFI$=""THEN330ELSEIFI$="B"THENS$=I$:GOTO340ELSEIFI$="T"THENS$=I$:G
OTO350ELSEIFI$=CHR$(13)THEN630ELSE330
340 PRINT@1312,"<";PRINT@1314,A$;PRINT@1318,">":GOTO360
350 PRINT@1341,"<";PRINT@1343,A$;PRINT@1347,">":GOTO410
360 PRINT@160,SPACE$(80);:PRINT@160,"ENTER NUMBER OF CHIPS (1-9)";
370 I$=INKEY$:IFI$=""THEN370ELSEIFI$>"0"ANDI$<="9"THENBN=VAL(I$):GOTO380ELSE370
380 PRINT@160,SPACE$(80);:PRINT@160,"ENTER VALUE (COLOR) OF CHIPS (W, O, R, G, O
R B)";
390 I$=INKEY$:IFI$=""THEN390ELSEIFI$="W"THENB=1:GOTO400ELSEIFI$="O"THENB=2:GOTO4
00ELSEIFI$="R"THENB=5:GOTO400ELSEIFI$="G"THENB=25:GOTO400ELSEIFI$="B"THENB=100:G
OTO400ELSEPRINT@208,"USE VALID CHIPS ONLY....PLEASE!":GOTO390
400 B=B*BN:PRINT@1314,USINGP$;B:GOTO460
410 PRINT@160,SPACE$(80);:PRINT@160,"PLACE YOUR BET...ENTER NUMBER OF CHIPS (1-9
)";
420 I$=INKEY$:IFI$=""THEN420ELSEIFI$>"0"ANDI$<="9"THENTN=VAL(I$):GOTO430ELSE420
430 PRINT@160,SPACE$(80);:PRINT@160,"ENTER VALUE (COLOR) OF CHIPS (W, O, R, G, O
R B)";
440 I$=INKEY$:IFI$=""THEN440ELSEIFI$="W"THENT=1:GOTO450ELSEIFI$="O"THENT=2:GOTO4
50ELSEIFI$="R"THENT=5:GOTO450ELSEIFI$="G"THENT=25:GOTO450ELSEIFI$="B"THENT=100:G
OTO450ELSEPRINT@208,"USE VALID CHIPS ONLY....PLEASE!":GOTO440
450 T=T*TN:PRINT@1343,USINGP$;T
460 IFS$="T"THEN470ELSE550
470 PRINT@160,SPACE$(80);:PRINT@160,"PLACE BET ON BOTTOM-LAYOUT <B> OR <ENTER> T
O PLAY";
480 I$=INKEY$:IFI$=""THEN480ELSEIFI$="B"THEN490ELSEIFI$=CHR$(13)THEN630ELSE480
490 PRINT@1312,"<";PRINT@1314,A$;PRINT@1318,">"
500 PRINT@160,SPACE$(80);:PRINT@160,"ENTER NUMBER OF CHIPS (1-9)";
510 I$=INKEY$:IFI$=""THEN510ELSEIFI$>"0"ANDI$<="9"THENBN=VAL(I$):GOTO520ELSE510
520 PRINT@160,SPACE$(80);:PRINT@160,"ENTER VALUE (COLOR) OF CHIPS (W, O, R, G, O
R B)";
530 I$=INKEY$:IFI$=""THEN530ELSEIFI$="W"THENB=1:GOTO540ELSEIFI$="O"THENB=2:GOTO5
40ELSEIFI$="R"THENB=5:GOTO540ELSEIFI$="G"THENB=25:GOTO540ELSEIFI$="B"THENB=100:G
OTO540ELSEPRINT@208,"USE VALID CHIPS ONLY....PLEASE!":GOTO530
540 B=B*BN:PRINT@1314,USINGP$;B:GOTO630
550 PRINT@160,SPACE$(80);:PRINT@160,"PLACE BET ON TOP-LAYOUT <T> OR <ENTER> TO P
LAY";
560 I$=INKEY$:IFI$=""THEN560ELSEIFI$=CHR$(13)THEN630ELSEIFI$="T"THEN570ELSE560
570 PRINT@1341,"<";PRINT@1343,A$;PRINT@1347,">"
580 PRINT@160,SPACE$(80);:PRINT@160,"ENTER NUMBER OF CHIPS (1-9)";
590 I$=INKEY$:IFI$=""THEN590ELSEIFI$>"0"ANDI$<="9"THENTN=VAL(I$):GOTO600ELSE590
600 PRINT@160,SPACE$(80);:PRINT@160,"ENTER VALUE (COLOR) OF CHIPS (W, O, R, G, O
R B)";
610 I$=INKEY$:IFI$=""THEN610ELSEIFI$="W"THENT=1:GOTO620ELSEIFI$="O"THENT=2:GOTO6
20ELSEIFI$="R"THENT=5:GOTO620ELSEIFI$="G"THENT=25:GOTO620ELSEIFI$="B"THENT=100:G
OTO620ELSEPRINT@208,"USE VALID CHIPS ONLY....PLEASE!":GOTO610
620 T=T*TN:PRINT@1343,USINGP$;T
630 RP=RND(52):IFM(RP)=1THEN630ELSEM(RP)=1:L=646:GOSUB780:E=RP:GOSUB790:T$=M$(RP
):B$=E$:L=647:GOSUB770:PRINT@327,"G A T E"
640 PRINT@160,SPACE$(80);:IFB=0THEN660
650 IFB$=S1$ORB$=S2$THENGW=GW+B:PRINT@160,"(B/L) YOU HAVE WON":PRINT@180,BELSEGW
=GW-B:PRINT@160,"(B/L) YOU HAVE LOST":PRINT@180,B
660 IFT=0THEN680
670 IFB$=S3$ORB$=S4$THENGW=GW+T:PRINT@210,"(T/L) YOU HAVE WON":PRINT@230,TELSEGW
=GW-T:PRINT@210,"(T/L) YOU HAVE LOST":PRINT@230,T
680 IFH=9THEN710
690 PRINT@1760,SPACE$(80);:PRINT@1760,"WHEN READY TO CONTINUE, DEPRESS <ENTER>";
:INPUTQ$:PRINTCHR$(2);:L=646:PRINT@327,"P A C K":GOSUB780:GOSUB800
700 L=664:GOSUB780:L=678:GOSUB780:L=693:GOSUB780:L=707:GOSUB780:PRINT@1312,STRIN
G$(36,32):B=0:T=0:GOTO280
710 TW=TW+GW:HH=8000-TW:PRINT@1600,SPACE$(80);:PRINT@1600,"H O U S E   H A S :":
PRINT@1620,USINGUU$;HH:PRINT@1760,SPACE$(80);:PRINT@1760,"G A M E   W I N N I N
G S :";PRINT@1788,USINGUU$;GW:PRINT@1800,"T O T A L   W I N N I N G S :";PRINT@1
832,USINGUU$;T
W;
720 PRINT@1640,"PLAY AGAIN (Y/N)";
730 I$=INKEY$:IFI$=""THEN730ELSEIFI$="Y"THENERASEM:DIMM(52):GW=0:GOTO260ELSEIFI$
="N"THEN740ELSE730
740 CLS:PRINT@640,"G O O D B Y E . . .  T H A N K S   F O R   P L A Y I N G   M O
 N T E !";PRINT@900,"C O M E   A G A I N . . .":PRINT:PRINT:PRINT:END
750 FORI=1TO12:PRINT@400+I*80,V$:NEXT:PRINT@401,STRING$(78,150):FORI=1TO12:PRINT
@479+I*80,V$:NEXT:PRINT@1441,STRING$(78,150):PRINT@400,CA$:PRINT@479,CB$:PRINT@1
519,CC$:PRINT@1440,CD$:RETURN
760 FORI=1TO6:PRINT@L+I*80,V$:NEXT:PRINT@L+1,STRING$(9,150):PRINT@L+561,STRING$(
9,150):FORI=1TO6:PRINT@L+10+I*80,V$:NEXT:PRINT@L,CA$:PRINT@L+10,CB$:PRINT@L+560,
CD$:PRINT@L+570,CC$:RETURN
770 PRINT@L,T$:PRINT@L+80,B$:RETURN
780 PRINT@L,STRING$(9,32);:PRINT@L+80,STRING$(9,32);:PRINT@L+160,STRING$(9,32);:
PRINT@L+240,STRING$(9,32);:PRINT@L+320,STRING$(9,32);:PRINT@L+480,STRING$(9,32);
:RETURN
790 IFE>0ANDE<14THENE$="HEARTS":RETURNELSEIFE>13ANDE<27THENE$="DIAMONDS":RETURNE
LSEIFE>26ANDE<40THENE$="CLUBS":RETURNELSEE$="SPADES":RETURN
800 PRINT@L,"* * * * *";PRINT@L+80," * * * * ";PRINT@L+160,"* * * * *";PRINT@L+2
40," * * * * ";PRINT@L+320,"* * * * *";PRINT@L+400," * * * * ";RETURN
810 PRINT@1600,SPACE$(80);:IFH=1THENH$="INITIAL":PRINT@1600,"P L A Y :";PRINT@16
10,H$;H=H+1:RETURNELSEH$=STR$(H):PRINT@1600,"P L A Y :";PRINT@1610,H$;H=H+1:RETU
RN
```


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From Melbourne House

You are the warrior-savior of cities under relentless alien attack. You're armed with rapid-fire missiles, radar and incendiary star-shells, but you'll need your fastest thinking and instantaneous response to protect yourself and your people. Great real-time graphics!

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From Cornsoft

A new feature allows two people to play at one time! Sentinels on guard for barbarians must repair the brick walls and defend the castles. Capture the enemy for extra points!

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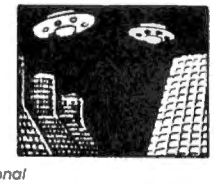

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This may be the battle to destroy the universe. Your enemies have perfected the dreaded Matte Ravager. Wave after wave of the deadly craft attack your planet and puncture the energy envelope surrounding it. You are in control of the Armageddon Wave, the only weapon capable of destroying the alien ships. Exciting challenging non-stop action. "Out of this world" sounds and graphics. 1 or 2 players, requires joystick.

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DEFENSE COMMAND

By Hogue & Konyu from Big Five

You are the lone defender of 10 Krotnium fuel cells essential for the survival of the planet. Aliens swoop down from above to steal the fuel, it's your job to destroy them. You can still save the cells after a raid, but you must shoot the alien and simultaneously move under the cell to catch it. If things look bad you can set off one of your 4 antimatter bombs and destroy all enemies on the screen! Arcade fun with action and sound. Joystick compatible.

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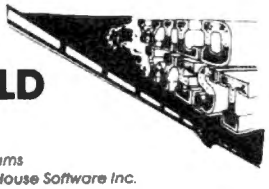

THE WILD WEST

By Clifford Abrahams
from Melbourne House Software Inc.

Relive the exploits of the notorious outlaw Jesse James as lawmen, bounty hunters and renegades gun for you through an Indian camp, train hijacking and bank heist. Keep your finger on the trigger.

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FROGGER

From Cornsoft

One of the most popular arcade games ever made now available for your home computer! Just as in the arcade game, you must dodge heavy traffic and jump the moving logs in the stream to get home. Fantastic graphics! Requires joystick.

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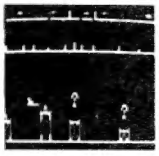

ELIMINATOR

By Westmoreland & Gilman
from Adventure International

You'll need all your keyboard manipulative skills to keep up with the action in this arcade game. You travel across the planet's low-altitude airspace in an effort to prevent the marauding enemy from capturing your energizer cells. All manner of alien craft await your arrival with destructive forces. For 1 or 2 players, with sound.

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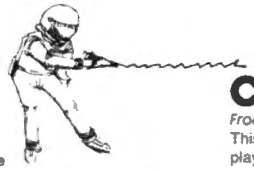

ROBOT ATTACK

By Hogue & Konuy from Big Five

One of the top names in TRS-80 arcade games adds a new dimension, voice sound effects! It's you against the robots in this fast-moving shoot-em-up. Electrified Mazes and the "Flagship" complicate things as you stalk the evil androids.

The innovations built into ROBOT ATTACK take your TRS-80 near the limits of its capabilities. You MUST see and hear it! Joystick compatible.

18098 16K Tape ~~$15.95~~ $12.76
18166 32K Disk ~~$19.95~~ $15.96

WEERD

By Arthur Gleckler from Big Five

Maybe you think you've seen some pretty strange things on your computer screen already, but you haven't seen ANYTHING until you've tried WEERD. It's you against the WEERDEST set of space craft ever. But don't just stare at them, get your shields up before they wipe out your planet. Desk version has voice sound effects and permanent high scores. Both are trisstick compatible.

43388 16K Tape or ~~$19.95~~ $15.96
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CRAZY PAINTER

From Cornsoft

Your assignment is to *paint the maze*, avoiding everything that tries to stop you. If anything walks in the paint, it's ruined, and you must go back and repaint it. With sound, great graphics... truly "a-maze-ing."

37808 16K Tape ~~$15.95~~ $12.76
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SEA DRAGON

By Westmoreland & Gilman
from Adventure International

Underwater adventure is yours as you command a nuclear sub armed with deadly missiles and torpedoes. Guide it carefully through sea mines and underwater mountains, watch out for depth charges being fired by overhead ships ... and don't run out of air! Scrolling sea bottom for added excitement.

35705 16K Tape ~~$19.95~~ $15.96
35716 32K Disk ~~$24.95~~ $19.96

PENETRATOR

From Melbourne House

Armed with missiles and bombs, you must fly your fighter to the enemy's cache of neutron bombs and destroy them. Your mission is in four stages, involving rugged terrain, caverns and manmade obstacles—not to mention enemy radar missiles and paratroopers. This new departure in arcade gaming allows you to set up your own terrain and enemy emplacements then save them for future use. Make your mission as hard or easy as you like. Joystick compatible.

21160 16K Tape ~~$24.95~~ $19.96
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CATERPILLAR

From Soft Sector Marketing

This is the fast-action arcade game you've been waiting to play at home! You must hit mushrooms and caterpillars—segment by segment—moths and tumble bugs. The challenges they are all moving when hit they split into additional segments or metamorphose into different shapes, when you destroy a caterpillar the new one that replaces it is a segment longer than the original.

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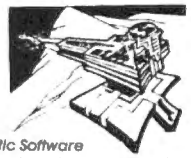

DEVIL'S TOWER

By John Olsen, Jr. from Fantastic Software

It's up to you to save your planet from the aliens. They've reached the other side of DEVIL'S TOWER. Robot Scouts come at you from the mountain, their war machines fire from the valley and their protector ships put up force fields to protect them. Your skill and reflexes may protect you. Machine language, good graphics and sound effects. For 1 or 2 players.

43366 16K Tape ~~$15.95~~ $12.76
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DEMON SEED

By Sorensen & MacKensie from Trend

This arcade style game is only for the strong at heart who are persistent enough to try and try again until the Demonic Forces have been destroyed. Your powerful star cruiser has high energy missiles and defensive shields. Can you develop the skill to defeat the Demons, and conquer the 3 special challenge levels?

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APPLE PANIC

by Y. Lempereur from Funsoft

Trap crazed apples by digging holes in brick floors, beat them thru the hole to squash on the floor below, 3 lives are extended by points. Has voice and music, freeze action saves high score on disk, joystick compatible. Don't let an apple get you.

33433 16K Tape ~~$19.95~~ $15.96
37246 32K Disk ~~$24.95~~ $19.96

SNEAK THIEF

By Larry Ashman
From Soft Sector

Protect the treasure chest of gold from lurking thieves. Capture them, attack them, or put them in jail but beware of the protectors who use trickery. Guard the intricate maze and keep your eye on the pile of gold—don't blink or the treasue may vanish.

36290 16K Tape ~~$19.95~~ $15.96
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RALLY

By J. Weaver
From Soft Sector

Courage skill and daring are needed to speed through a treacherous maze course while pursued by hostile cars. Maneuver the wheel away from obstacles and enemies as you respond to the ultra modern tracking equiment. Joystick compatible outstanding sound effects and the diversion talks and saves high scores. All this makes a racing simulation certain to add adventure to your arcade game experience.

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43445 32K Disk ~~$21.95~~ $17.56

SKYSCRAPER

By Fine from Superior

3-part maze game for the nimble-fingered. First, you must move through maze while avoiding barrels coming at you, second, you must look out for fires that break out randomly on screen, third, you nde elevators up and down from platform to platform. The sky's the limit. . . how far can you go? 1 or 2 player game with sound, joystick compatible.

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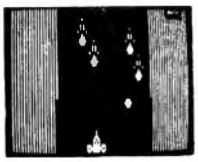

THE BLACK HOLE

by Y. Lempereur from Funsoft

Seek out and destroy the Gorflan leader taking refuge in the black hole. You have only one ship to reach and eliminate him—so make it count. Great sound, three phases of action, joystick compatible. Survive the perils of the black hole.

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By Demos from Fantastic

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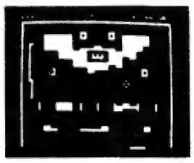

KING OF THE JUNGLE

By Vandewalle from Acorn

An unusual combination of fast pinball action plus the challenges and dangers of an arcade game. Keep the ball in play, scoring points as it caroms from obstacle to obstacle, while wandering through the jungle searching for the hidden crown. And try to avoid the deadly Cobra. Lots of action, sound and fun! Choice of 3 screens. Can be used with Trisstick joystick.

39080 16K Tape ~~$19.95~~ $15.96
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From Avalon Hill

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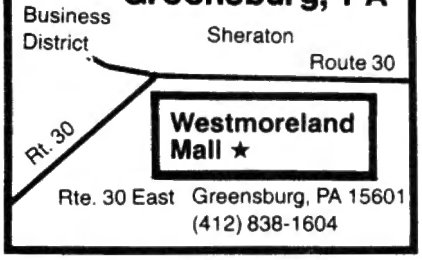

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Micro-Melodies

by Jef Bell

Micro-Melodies is a Concentration-style game that tests your recall in a unique way—you have to match tunes instead of pictures.

Micro-Melodies is a matching game based on the games Concentration and Memory. Instead of matching prizes or picture parts, however, Micro-Melodies uses the sound capability of a Model I or III to match the opening notes from familiar songs.

The Game

The Micro-Melodies display features a four-by-six-block grid (see Program Listing 1). Each of the 24 blocks contains a letter. Two players alternate turns. The first player chooses a letter and listens to the music played. Then, either by luck or by memory, that player chooses a second letter and another song plays.

If two songs match, the player receives points and the blocks, taken out of play, display "MATCH." If the songs

10001	Happy Birthday
10002	Yankee Doodle
10003	Row, Row, Row Your Boat
10004	Mary Had a Little Lamb
10005	Fifth of Beethoven
10006	National Anthem
10007	Sound of Silence
10008	Silent Night
10009	Big Ben (Westminster chimes)
10010	Funeral dirge
10011	Charge!!
10012	Entertainer

Table 1. Song titles and their corresponding line numbers.

The Key Box

Model I & III
16K RAM
Basic

A	Used to read data for songs.
B	For reading data to scramble squares.
C1	Your choice.
C1$	INKEY$ for choices.
CC	Storage for first choice.
CP	Cursor position for inputting names.
DD(1–30)	Holds scrambled data for the squares, later the point value of each square.
DI	Helps in determining Print at position of squares.
EG	Number of matched squares.
FL	Flag set if not first game.
I	Loop variable.
IN$	Used for INKEY$.
J	Timer loop variable.
MA$	The "MATCH" square.
N$	Name of player (used to input names).
N1$	Player one's name.
N2$	Player two's name.
NO$	The note (graphics characters).
PA	Print at position of chosen square.
PL	Loop (1 to 2) for player one or player two.
PP	Temporary storage of PA of the first choice.
R	Random number for scrambling.
S1	Score of player one.
S2	Score of player two.
SC(1–24)	The song numbers (1–12) for each of the 24 squares.
SO(1–12, 1–12, 1–2)	Data for the 12 songs.
SQ$	The squares.
TU	Loop (1 to 2) for each turn.
TU$	"1st" or "2nd."
W$	Name of the winner.
X	Dummy variable for counting.
XX	Used to call sound routine.
XX$	Stores the sound routine.
YN$	INKEY$ for yes/no questions.

Table 2. Variables List.

DV's
120 DAY
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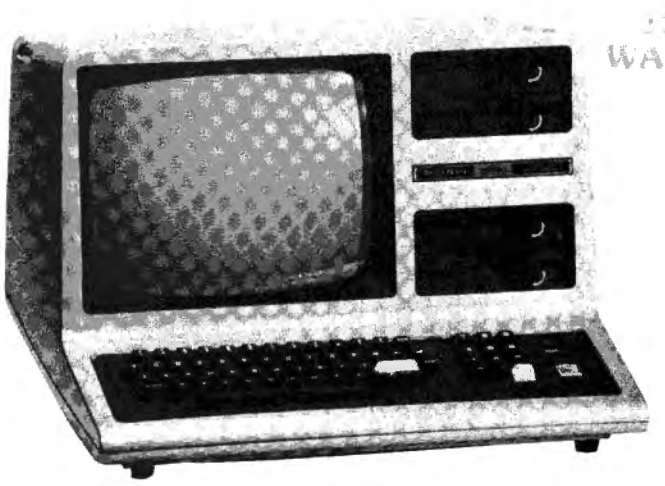

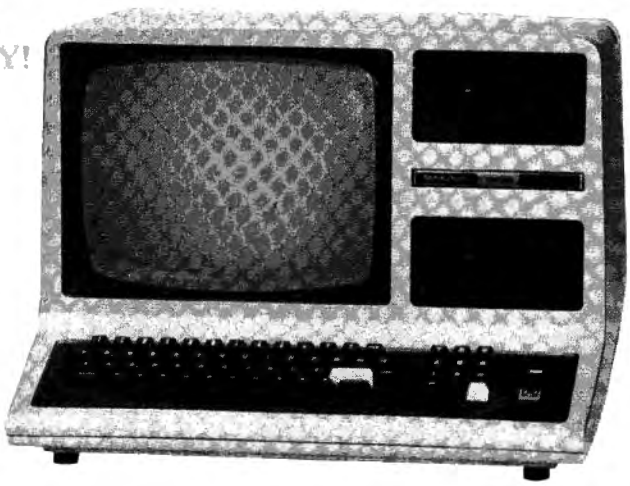

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10	General Housekeeping.	610–630	More processing of choice.
20–60	Instructions.	1000–1070	Name input subroutine.
100–120	Variable initialization.	2000–2010	Plays songs.
130–140	Machine language routine initialization.	3000–3020	Process routine for matches.
150–170	Data reading for songs.	4000–4020	End of game.
180–230	Scrambling the board.	4030–4060	Winner.
240–250	Name input.	4070–4080	Scores.
260–310	Screen set up for game.	4090–4130	Play again.
500–540	Choice input.	10000	Data for sound routine.
550–590	Process choice.	10001–10012	Data for songs.
600	Check for finish.	10013	Data for scrambling the board.

Table 3. Micro-Melodies line descriptions.

don't match, the blocks revert to letters and the turn passes to the next player. The player with the most points wins.

Micro-Melodies has an unusual scoring system. Each square is worth five points at the beginning of the game. Once a player chooses a square, its value decreases by one point, and continues decreasing each time that square is selected. The minimum value of a square is one point.

Players' strategy is not only to make matches, but to match the squares with the greatest number of points remaining. The point value of a match ranges between a high of 10 and a low of two.

Program Listing 1. Micro-Melodies

```
0 '     ****************************************************
        ***                MICRO-MELODIES                  ***
        ***                                                ***
1 '     ***                   BY                           ***
        ***                JEFFREY BELL                    ***
        ***            2150 MARGARETT ST. NW               ***
2 '     ***              SALEM, OR  97304                  ***
        ****************************************************
10 CLS:CLEAR1000:DIMSO(12,12,2),SC(24),DD(30)
20 PRINTTAB(19);"MICRO-MELODIES:  BY JEF BELL":PRINT"     THIS G
AME IS MUCH LIKE THE POPULAR ";CHR$(34); "CONCENTRATION";CHR$(34
);"GAME.": PRINT"THE PLAYING BOARD CONSISTS OF 24 SQUARES, BEHIN
D WHICH LIE 12"
30 PRINT"PAIRS OF MATCHES.  THE TWO PLAYERS TAKE TURNS UNCOVERIN
G TWO":PRINT"SQUARES AT A TIME.  THE BASIC IDEA OF THE GAME IS T
O REVEAL MORE PAIRS THAN YOUR OPPONENT REVEALS.":PRINT
40 PRINT"     THE DIFFERENCE BETWEEN MICRO-MELODIES AND OTHER GA
MES OF":PRINT"THIS NATURE IS THAT THERE ARE NO WORDS OR OBJECTS
BEHIND THE":PRINT"SQUARES.  INSTEAD, EACH SQUARE HOUSES A SHORT
MUSICAL TUNE."
50 PRINT:PRINT"     EVERY SQUARE IS GIVEN THE VALUE OF 5 AT THE
BEGINNING OF": PRINT "THE GAME.  WHENEVER A SQUARE IS UNCOVERED,
ITS VALUE DECREASES":PRINT"BY 1, WITH A MINIMUM VALUE OF 1 POINT
.  BECAUSE OF THIS, EACH"
60 PRINT"MATCH MADE WILL HAVE A VALUE FROM TWO POINTS TO TEN POI
NTS.":PRINTTAB(12);"PLEASE WAIT A FEW MOMENTS WHILE I SET UP.";
100 SQ$=CHR$(191)+STRING$(7,131)+CHR$(191)+CHR$(26)+STRING$(9,24
)+CHR$(191)+"        "+CHR$(191)+CHR$(26)+STRING$(9,24)+CHR$(143)
+STRING$(7,140)+CHR$(143)
110 NO$="     "+CHR$(157)+CHR$(144)+"    "+CHR$(26)+STRING$(9,24
)+"   "+STRING$(2,176)+CHR$(149)+"   "+CHR$(26)+STRING$(9,24)+"
 "+CHR$(130)+STRING$(2,143)+CHR$(129)+"   "
120 MA$="*********"+CHR$(26)+STRING$(9,24)+"* MATCH *"+CHR$(26)+
STRING$(9,24)+"*********"
130 XX$="":FORI=1TO29:READA:XX$=XX$+CHR$(A):NEXTI
140 POKE16782,201:IFPEEK(16396)=201THENPOKE16526,PEEK(VARPTR(XX$
)+1):POKE16527,PEEK(VARPTR(XX$)+2)ELSEDEFUSR=PEEK(VARPTR(XX$)+1)
+PEEK(VARPTR(XX$)+2)*256+65536*(PEEK(VARPTR(XX$)+2)>127):CMD"T"
150 FORI=1TO12:X=1
160 READA,B:IFA=0ANDB=0THENNEXTI:GOTO180
170 SO(I,X,1)=A:SO(I,X,2)=B:X=X+1:GOTO160
180 R=RND(30):IFDD(R)>0THEN180
190 READA:IFA<13,DD(R)=A:GOTO180
200 X=1:FORI=1TO30:IFDD(I)=0NEXTIELSESC(X)=DD(I):X=X+1:NEXTI
210 FORI=1TO24:DD(I)=6:NEXTI:IFFL=1THEN240
220 PRINT@971,"*******  PRESS <ENTER> TO BEGIN *******   ";
230 IFPEEK(14400)<>1THEN230
240 CLS:PRINTCHR$(23):PRINT@0,STRING$(32,191);:PRINT@896,STRING$
(32,191);:FORI=64TO832STEP64:PRINT@I,CHR$(191);:PRINT@I+62,CHR$(
191);:NEXT
250 N$="":PRINT@262,"WHAT IS PLAYER #1'S NAME?";:GOSUB1000:N1$=N
$:N$="":PRINT@598,"          ";:PRINT@262,"WHAT IS PLAYER #2'S NA
ME?";:GOSUB1000:N2$=N$:CLS
260 S1=0:S2=0
270 CLS:PRINT@20,"***  MICRO-MELODIES  ***";
280 FORI=66TO116STEP10:PRINT@I,SQ$;:PRINT@I+192,SQ$;:PRINT@I+384
```

Listing 1 continues

The Program

The songs for Micro-Melodies come from Program Listing 2, Music Maker, adapted from sound routines in "Pow-Bang-Zap-Crash" (*80 Microcomputing*, November 1980, p. 230). Plug the Model I or III gray AUX cord into an amplifier to hear the Micro-Melodies songs.

The first mode of Music Maker, create tones, enters frequency (1 is the highest, 255 the lowest) and duration (1 is the shortest, 255 the longest) for each note. The second mode, edit tones, displays all frequencies and durations, and allows you to change them. The final mode, play tones, does just that, displaying frequencies and durations as it goes along.

Since I am no musical expert, some notes may be flat. To modify a note, type in the note number, then the new frequency and new duration you desire. Hit the enter key to return to the menu from the edit mode.

To modify the songs in Micro-Melodies, change the data in lines 10001–10012. Each line has the data for the songs. The data alternates frequency and duration to produce a melody. Refer to Table 1 for data on specific songs.

Refer to the variable chart (Table 2) and the brief program description (Table 3) to understand the code more clearly.

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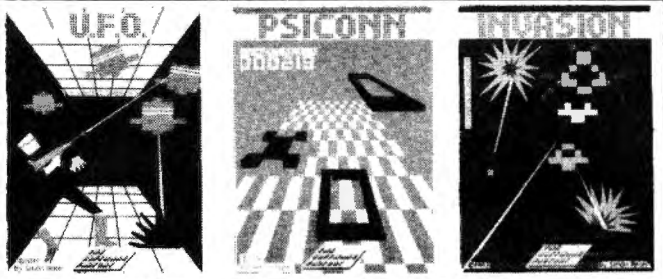

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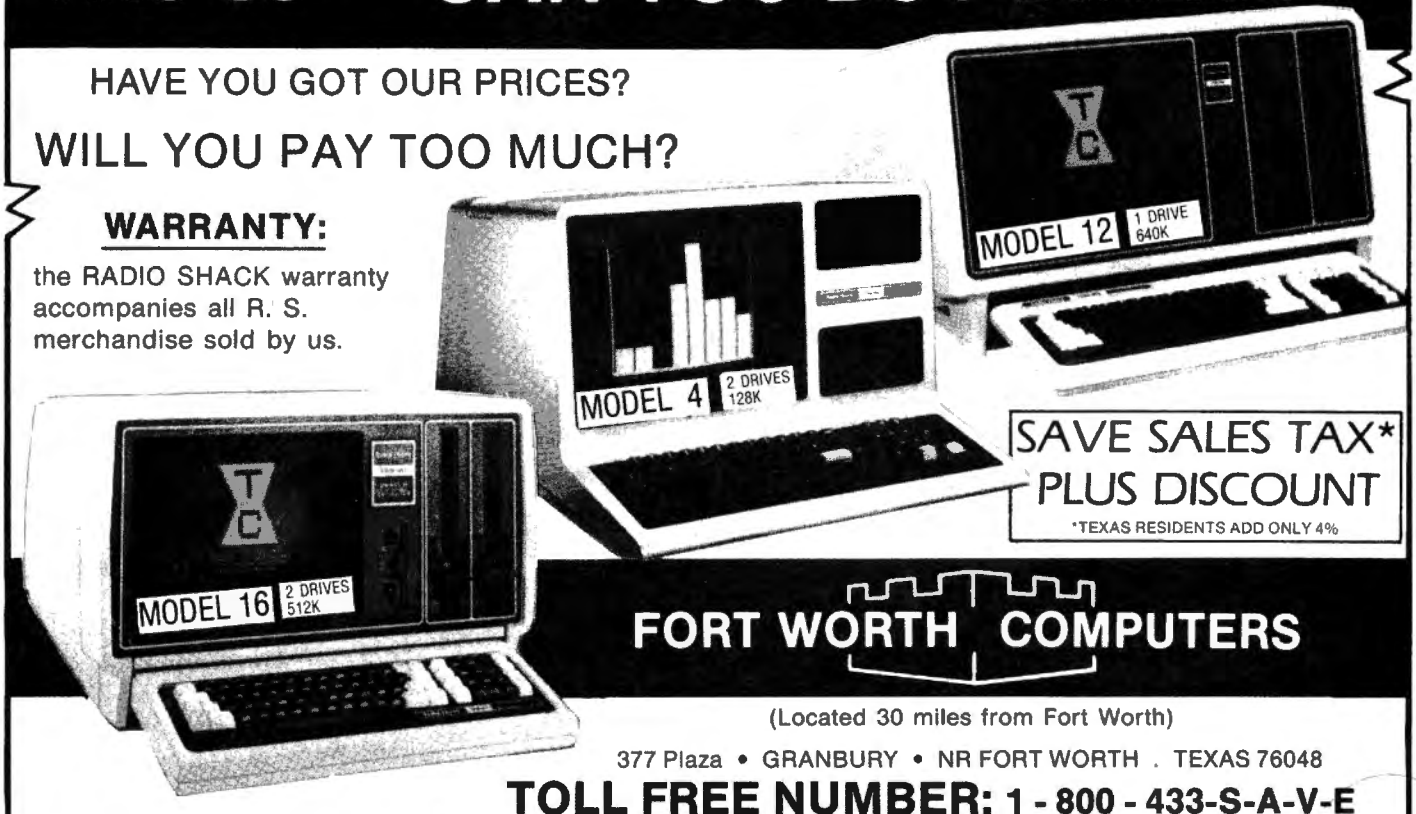

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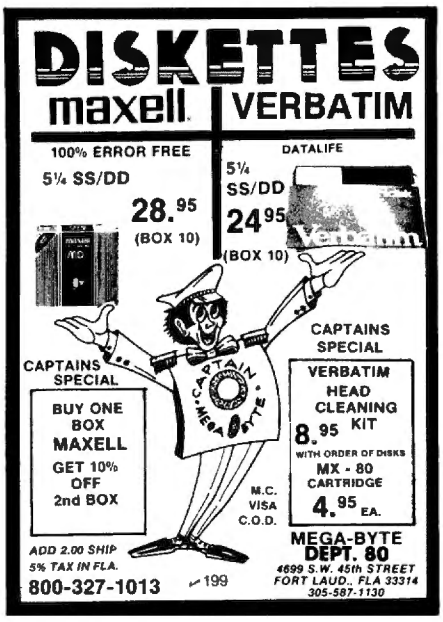

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Listing 1 continued

```
,SQ$;:PRINT@I+576,SQ$;:NEXTI
290 X=65:FORI=134TO184STEP10:PRINT@I,CHR$(X);:PRINT@I+192,CHR$(X
+6);:PRINT@I+384,CHR$(X+12);:PRINT@I+576,CHR$(X+18);:X=X+1:NEXTI
300 PRINT@897,N1$;":";:PRINT@954-LEN(N2$),N2$;":";
310 PRINT@898+LEN(N1$),S1;:PRINT@955,S2;
500 FORPL=1TO2:IFPL=1N$=N1$ELSEN$=N2$
510 FOR TU=1TO2:IFTU=1TU$="1ST"ELSETU$="2ND"
520 PRINT@975,STRING$(34,32);:PRINT@960+((64-(26+LEN(N$)))/2),N$
;",WHAT IS YOUR ";TU$;" CHOICE?";
530 C1$=INKEY$:IFC1$=""THEN530ELSEIFASC(C1$)<65ORASC(C1$)>88THEN
530
540 C1=ASC(C1$)-64:IFSC(C1)=0THEN530
550 IFTU=2ANDCC=C1THEN530
560 IFC1<7PA=66:DI=0ELSEIFC1<13PA=258:DI=6ELSEIFC1<19PA=450:DI=1
2ELSEPA=642:DI=18
570 PA=PA+(C1-DI)*10-10:PRINT@PA-1,NO$;:DD(C1)=DD(C1)-1:IFDD(C1)
=0,DD(C1)=1
580 GOSUB2000:IFTU=1CC=C1:PP=PA
590 NEXTTU:IFSC(CC)=SC(C1)GOSUB3000
600 EG=0:FORI=1TO24:EG=EG+SC(I):NEXTI:IFEG=0THEN4000
610 IFSC(CC)=SC(C1)THENIFPL=1THEN500ELSEIFPL=2THEN510
620 PRINT@PA,SQ$;:PRINT@PA+68,CHR$(C1+64);:PRINT@PP,SQ$;:PRINT@P
P+68,CHR$(CC+64);
630 NEXTPL:GOTO500
1000 FORI=1TO10:IN$=INKEY$:NEXT:CP=598
1010 PRINT@CP,CHR$(143);:FORI=1TO10:IN$=INKEY$:IFIN$<>""THEN1030
ELSENEXT
1020 PRINT@CP," ";:FORI=1TO10:IN$=INKEY$:IFIN$<>""THEN1030ELSENE
XT:GOTO1010
1030 IFIN$=CHR$(8)ANDCP<>598THENPRINT@CP," ";:CP=CP-2:N$=LEFT$(N
$,LEN(N$)-1):GOTO1010
1040 IFIN$=CHR$(13)THENRETURN
1050 PRINT@CP,IN$;:CP=CP+2:IFCP=616CP=614
1060 IFLEN(N$)<8N$=N$+IN$
1070 GOTO1010
2000 X=1:IFSO(SC(C1),X,1)=0RETURN
2010 POKE16783,SO(SC(C1),X,2):POKE16784,SO(SC(C1),X,1):XX=USR(0)
:X=X+1:IFSO(SC(C1),X,1)>0THEN2010ELSERETURN
3000 SC(CC)=0:SC(C1)=0:IFPL=1,S1=S1+DD(C1)+DD(CC)ELSES2=S2+DD(C1
)+DD(CC)
3010 PRINT@PA,MA$;:PRINT@PP,MA$;:PRINT@898+LEN(N1$),S1;:PRINT@95
5,S2;
3020 RETURN
4000 PRINT@975,STRING$(34,32);:FORI=1TO1000:NEXTI:CLS
4010 IFS1>S2,W$=N1$ELSEIFS2>S1,W$=N2$ELSEW$="NO ONE !?"
4020 PRINTCHR$(23):PRINT@0,STRING$(32,"*");:FORI=64TO832STEP64:P
RINT@I,"**";:PRINT@I+60,"**";:NEXT:PRINT@896,STRING$(32,"*");
4030 PRINT@326,"AND THE WINNER IS";:X=362:FORI=1TO5:PRINT@X,".";
:FORJ=1TO200:NEXTJ:X=X+2:NEXTI
4040 PRINT@474,STRING$(9-LEN(W$),32);W$;:IFS1<>S2PRINT"!!!!";
4050 POKE16783,50:FORI=255TO5STEP-5:POKE16784,I:XX=USR(0):NEXT:C
LS:IFS1<>S2THEN4080
4060 PRINT@71,"WE'RE SORRY, BUT THROUGH A BIZZARE TWIST OF FATE,
";:PRINT@146,"THE GAME HAS ENDED IN A TIE.";
4070 PRINT@192,STRING$(64,140);
4080 PRINT@345,"S C O R E S ";:PRINT@409,N1$;"--";S1;:PRINT@473
,N2$;"--";S2;
4090 PRINT@720,"WOULD YOU LIKE TO PLAY AGAIN (Y/N)?";
4100 YN$=INKEY$:IFYN$<>"Y"ANDYN$<>"N"$THEN4100
4110 IFYN$="N"THENCLS:END
4120 PRINT@856,"JUST ONE MOMENT.";:RESTORE:FORI=1TO241:READX:NEX
TI
4130 FL=1:FORI=1TO30:DD(I)=0:NEXTI:GOTO180
10000 DATA221,33,143,65,221,78,0,221,70,1,62,1,211,255,16,254,22
1,70,1,62,2,211,255,16,254,13,32,235,201
10010 DATA150,120,150,120,130,255,150,200,110,255,120,240,0,0
10020 DATA150,120,150,120,130,150,120,120,150,130,120,120,130,20
0,0,0
10030 DATA150,240,150,240,150,100,130,130,120,255,120,100,130,80
,120,120,110,120,100,205,0,0
10040 DATA120,180,130,140,150,140,130,140,120,140,120,140,120,20
0,0,0
10050 DATA110,100,110,100,110,100,140,255,125,100,125,100,125,10
0,145,255,0,0
10060 DATA110,200,130,100,165,170,130,150,110,150,80,255,0,0
10070 DATA160,90,160,90,125,100,125,100,105,120,105,120,115,255,
0,0
10080 DATA130,250,115,110,130,200,160,255,1,255,130,250,115,110,
130,200,160,255,0,0
10090 DATA100,255,125,200,110,200,125,255,1,255,165,170,110,200,
100,200,125,255,0,0
10100 DATA200,255,200,200,200,100,200,250,165,250,175,120,175,20
0,200,100,200,200,210,120,200,255,0,0
10110 DATA220,70,165,80,130,110,110,220,130,100,110,200,0,0
10120 DATA160,100,160,100,150,100,110,250,150,100,110,250,150,10
0,110,250,0,0
10130 DATA1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,
13
```

```
0 REM  MUSIC MAKER PROGRAM BY JEF BELL
1 REM  USED TO WRITE SONGS FOR "MICRO MELODIES" BY JEF BELL
5 CLEAR200:GOSUB1000:DIMF(20),D(20):X=1
10 CLS:PRINT"     MENU
1) CREATE TONES
2) EDIT TONES
3) PLAY TONES
YOUR CHOICE?"
20 CH$=INKEY$:IFVAL(CH$)<1ORVAL(CH$)>3THEN20ELSECLS:ONVAL(CH$)GO
TO30,40,70
30 PRINT"FREQUENCY #";X;"=";:INPUTF(X):PRINT"DURATION #";X;"=";:
INPUTD(X):IFF(X)=0ANDD(X)=0THEN10ELSEX=X+1:GOTO30
40 FORI=1TOX-1:PRINT"FREQUENCY #";I;"=";F(I),"DURATION #";I;"=";
D(I):NEXTI
50 INPUT"NUMBER, FREQUENCY, DURATION";N,FR,DU
60 IFN=0ANDFR=0ANDDU=0THEN10ELSEF(N)=FR:D(N)=DU:GOTO40
70 FORI=1TOX-1:PRINTI,"FREQ.=";F(I),"DUR.=";D(I):POKE16783,D(I):
POKE16784,F(I):XX=USR(0):NEXT:GOTO10
1000 P$="":FORI=1TO29:READJ:P$=P$+CHR$(J):NEXT:POKE16782,201:IFP
EEK(16396)=201THENPOKE16526,PEEK(VARPTR(P$)+1):POKE16527,PEEK(VA
RPTR(P$)+2)ELSEDEFUSR=PEEK(VARPTR(P$)+1)+PEEK(VARPTR(P$)+2)*256+
65536*(PEEK(VARPTR(P$)+2)>127):CMD"T"
1010 RETURN
1020 DATA221,33,143,65,221,78,0,221,70,1,62,1,211,255,16,254,221
,70,1,62,2,211,255,16,254,13,32,235,201
```

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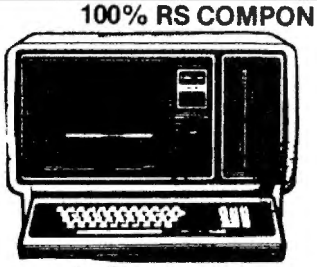

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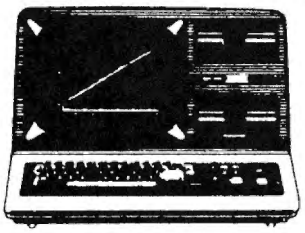

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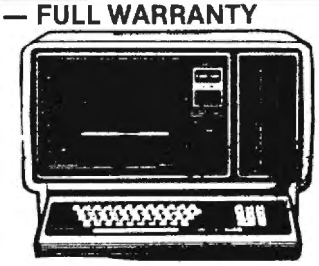

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ARCDOS for ARCNET

by Joseph E. Trojak

If the networking possibilities for your Model II, 12, or 16 have always tempted you, read this overview of ARCNET and Tandy's ARCDOS.

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In March 1983 Tandy released ARCDOS, its local network operating system for TRS-80 Models II, 12, and 16. ARCDOS uses ARCNET, Datapoint's local area network.

First, I want to describe three network operating systems that use ARCNET: Datapoint's ARC and RMS, and Tandy's ARCDOS. Then I'll explain the ARCNET protocol and the hardware necessary to implement the system.

Networks and ARCNET

A local area network (LAN) is a system that transfers digital information among computer resources within a relatively small geographic area. It's a system of interconnected computers (processors) that share resources (disk drives, printers, and so on), programs, and possibly data.

Coaxial cable is the most common transmission medium, although networks also use copper wire and fiber-optic cable. All LANs require a local network operating system (LNOS) to allocate resources among users. The design of an LNOS depends on the processors, peripheral resources, and network structure.

In 1977 Datapoint introduced the hardware to implement the ARCNET networking protocol, but the implementation required much more than ARCNET. A sophisticated network operating system was necessary to control interaction between processors and allocate resources in the system.

Datapoint has developed two systems that use ARCNET. The first, ARC (Attached Resource Computer), is an extension of the disk operating system (DOS) used on stand-alone Datapoint equipment.

The second, RMS (Resource Management System), is a much more sophisticated system that provides multitasking (several programs running on one processor at the same time), has a hierarchical file structure, and allows sharing nondisk resources by all network members. Tandy's ARCDOS network operating system is an extension of TRSDOS and is very similar to Datapoint's ARC.

ARC

The basic philosophy behind the ARC network operating system is the dedication of one or more processors to disk file management, thus allowing other processors in the network access to disk files without attaching each computer directly to a disk drive. Also, multiple computers can share common files.

Computers in an ARC system are either file processors (FPs) or applications processors (APs). A file processor is attached to ARCNET, has mass storage disk drives, and runs a special program (ARC/FP) that allows applications processors to gain access to disk files.

A file processor is functionally dedicated to data management, buffers data, optimizes use of its disks, coordinates data-base updating, provides security, services incoming requests, and is not capable of performing any other task while it is executing the ARC/FP program.

An applications processor is any computer attached to ARCNET capable of executing program tasks. The two types of applications processors include those with peripheral disk storage units (or with the capability of having attached disk drives) and those that you cannot attach to peripheral disk drives.

The latter APs have firmware that downloads the ARC system program into the processor. APs with locally attached disk drives can load the operating system from the local disk or also download the system from a file processor.

A simple ARC system consists of one file processor (FP_1) and five applications processors (see Fig. 1). Applications processors AP_1, AP_3, AP_4, and AP_5 do not have disk drives and must obtain the operating system instructions and application programs from the file processor disk files.

When you turn on applications processor AP_1, a small ROM program requests that you download the operating system from the disk of FP_1. The ARC/FP program first requests the

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AP_1 user's identity and code word, then downloads the operating system into AP_1.

If the user wants to run a Basic program or edit a letter, the FP loads the appropriate program from disk to AP_1. A user at AP_3 can sign on to the ARC system similarly, have the operating system downloaded, and begin word processing, data processing, or using a system utility.

If the AP_1 user wants to create a file on drive 1 called "TEXT/TXT" and the AP_3 user wants to create a file with the same name on drive 1, a conflict arises. Assigning each user a different disk subdirectory resolves this problem.

A subdirectory is a logical division of a disk that allows multiple users to have files with the same name on the same disk. When a user signs on at an AP, he enters a name and code word that determine which subdirectory he uses.

In addition to individual user subdirectories, each disk has two subdirectories called System and Main. The System subdirectory contains disk system files shared by all the users and might also have programs and data files that every user can share. The Main subdirectory has information about the name and code word of each subdirectory on the disk. For security reasons, the information contained in Main is not available to AP users.

Peripheral devices attached to an AP can only be used by that processor. Only AP_1 can use the printer attached to AP_1, and only AP_5 can use the magnetic tape drive attached to AP_5. ARC solves the printer problem by dedicating one or more APs to manage the printer.

If the AP_1 user wants to print a file he has just edited, he first stores the document in a print file format on FP_1's disk drive using a print spooler that AP_1 executes. AP_4 runs a program called the unspooler. As print files are created, a queue forms to indicate the printing priority, printer type, and printer parameters for each print job. The unspooler then prints each file.

With this system, several APs can use a common printer. However, at least one AP must be dedicated to the task of printing. You can use the unspooler AP for other applications, but when it is not executing the unspooler program, print files accumulate and other users must wait for the AP to start its task of unspooling before they can receive printouts.

". . . heavy disk traffic can inundate a lone FP and result in poor system performance."

No similar mechanism exists for APs to share other peripheral devices. If a user at AP_2 wants to read a magnetic tape file from AP_5, he must use AP_5 to dump the tape file onto a disk file and then access the disk file from AP_2.

As the number of APs in a system grows, users can add additional disk drives to a single FP or additional FPs to the system. In a network with many APs and a single FP, all file transactions must go through the one FP.

In systems with very large, infrequently accessed files, adding disk drives to a single FP is sufficient. However, heavy disk traffic can inundate a lone FP and result in poor system performance. In such cases, it's best to distribute the file transactions among several file processors.

In Fig. 1, adding FP_2 to the system would increase system storage and speed. AP_2 and AP_4 can access a data file from drive 1 on FP_1 and a utility program from drive 2 on FP_2. The ARC/FP program provides both APs with access to the common data file and prevents the simultaneous addition or updating of information to the file.

For example, if the data file is an inventory list and the user at AP_2 has just removed an item, the user at AP_5 should be denied access to the inventory count until the program on AP_2 has properly adjusted it.

Datapoint currently has two distinct and incompatible ARC systems. One runs under DOS.G (Disk Operating System version G) and is designed for minicomputers. The other runs under DOS.H for use with the Datapoint 1560 processor, a Z80-based microcomputer.

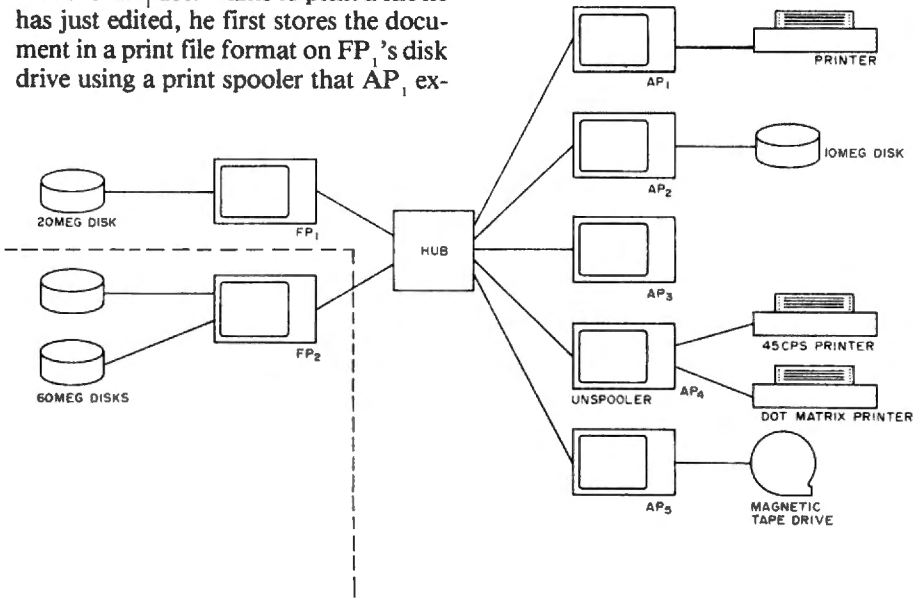

Figure 1

RMS

ARC's limitations include the requirement for dedicated FPs and unspooling APs, and the inability to share other common resources. After ARC had been on the market for several years, Datapoint released RMS (Resource Management System), a sophisticated software system that allows almost complete sharing of processor resources within a network.

Although RMS is currently implemented as an LAN, it can cover very large distances. The same processors that utilize ARC work in an RMS installation.

Under RMS, each participating processor devotes a certain amount of its memory and cycle time to the system. The remainder of each processor's memory and cycle time is available for multiple tasks. Software configuration determines the extent to which a processor participates in an RMS system. In Fig. 2, two processors have attached disk drives, two have no peripheral devices, and one has a printer.

Under RMS, file processors perform other tasks in addition to file management and are called Data Resource Processors (DRPs). A portion of DRP_1's memory performs file management for the system. The additional memory is used for multiple tasks accessed by the processor's console and keyboard and three work stations connected by copper wire.

Each work station is a video display terminal that utilizes DRP_1's memory. AP_2 has an attached disk drive, but the

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system is configured so the disk drive files are available only to AP_2. In the event of a disk drive failure on DRP_1, users can easily change the system's software configuration so AP_2 functions as a DRP and its disk drive is available to all or select users on the system.

AP_3 has a high-speed dot-matrix printer and AP_4 has a letter-quality daisy-wheel printer. The system is configured so that all processors and work stations can access both printers.

ARCDOS

ARCDOS is Tandy's local area network operating system for the Model II, 12, and 16. Each processor must have 64K of memory and an ARCNET board to participate in the network. Model II processors also require a 16K expansion board.

TRS-80 processors can only participate in ARCDOS while running in Model II mode, using the Z80 CPU and associated memory boards. Currently the Model 16's MC68000 CPU cannot use ARCNET.

ARCDOS is similar to Datapoint's ARC. Each network is limited to 255 processors and must have at least one file processor dedicated to file management. Unlike ARC, each FP can have one attached printer and any AP can use the printer. Like the Datapoint system, ARCDOS has two types of applications processors: those with disk drives (or the capability for attached disk drives) and those with no disk drives that use firmware to download the operating system.

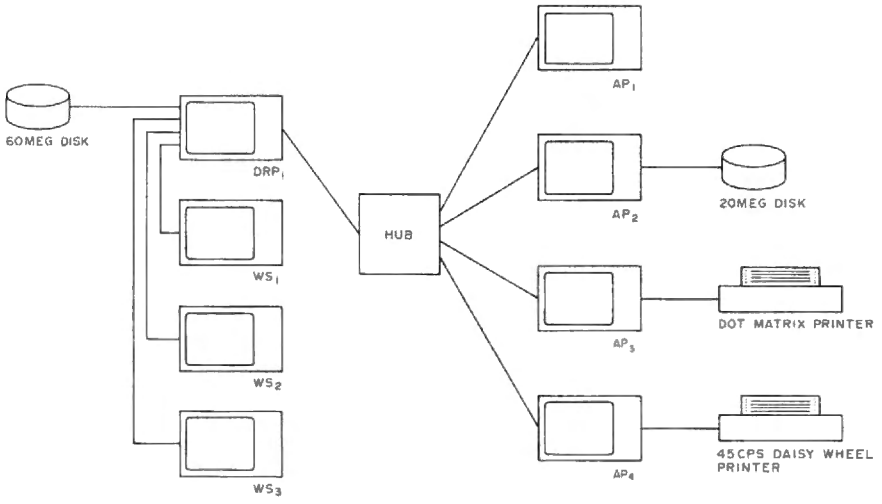
Calling up ARCDOS is simple. The file processor first boots TRSDOS, and then executes the program ARC80FP to start ARCDOS. Once ARCDOS is running, the file processor cannot run other programs. While the FP is running ARCDOS, you can use the command SHOWVOL to show which volumes (disks) are on line.

Applications processors can access up to 10 logical disk drives, local (connected to the AP by the parallel input/output bus) or remote, attached to an FP. You initially access remote volumes by name using the Mount command. For example, to access a remote disk volume named Account, you would sign on, then type MOUNT ACCOUNT:5.

After a remote volume is logically mounted on an AP, further reference to it is by the disk drive number that Mount assigns. In our example, any disk read or write to drive 5 accesses volume Accounts on the file processor. When the user is finished, he Dismounts the remote volume and signs off the ARC system.

Since ARCDOS operates under TRSDOS, it doesn't have subdirectories like Datapoint's ARC. Each user must take care that his files on any particular FP disk have unique names.

For example, a user at one AP writes a Basic program and saves it on FP disk drive 1 as PROG01. Later another user writes a different program in Fortran and saves it on FP disk drive 1 as PROG01. The latter user's file will overwrite the first and the Basic program is lost. The first user could protect his file by assigning it a password, and the second user has to choose another file name.



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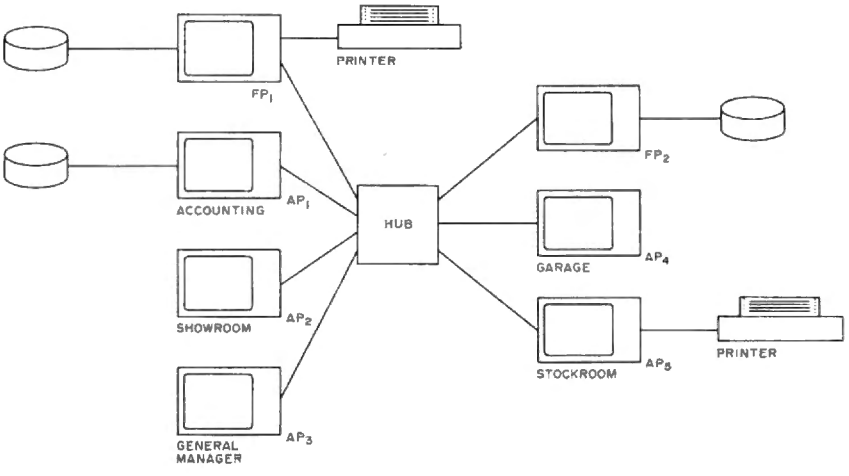

Figure 3.

ARCDOS Application

As an example of how an ARCDOS network works, consider its application in a large automobile dealership (Fig. 3). FP_1 manages files dealing with new car inventory and sales. FP_2 manages files for mechanic scheduling and parts inventory.

AP_1 has its own disk drives that store sensitive accounting and personnel data. AP_2 is used in the showroom to match inventory to customer needs, enter sales, and place requests for specially equipped cars. AP_3 is used in the general manager's office as a back-up for AP_1 or AP_2.

AP_4 is used in the garage to schedule customer service and request parts from the stockroom. In the parts stockroom, employees enter all parts sales on AP_5 to facilitate inventory control and accounting procedures. Should FP_1 or FP_2 fail, AP_2 can quickly substitute and return the system to normal function with a minimum delay.

ARC-ARCDOS Incompatibilities

You cannot use TRS-80 processors in ARC systems or Datapoint processors in ARCDOS systems because of the difference in the architecture of Datapoint and Tandy computers. ARC DOS.G processors are minicomputers that use a different instruction set from the Z80

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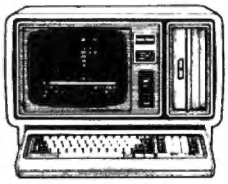

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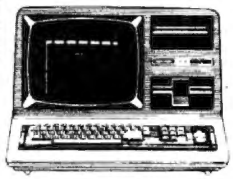

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chip in TRS-80s.

Although the Datapoint 1560 processor is a Z80-based microcomputer, it has other hardware (ROM, disk drive interface, video display, and keyboard units) that is different from TRS-80 microcomputers. A TRS-80 with appropriately designed software could participate in a Datapoint ARC system and vice versa, but I doubt that either manufacturer has an incentive to develop the necessary software. It is likely that other software vendors will develop such programs.

The most limiting feature of ARCDOS is that, as an extension of TRSDOS, it doesn't have multitasking capabilities. It seems inevitable that Tandy will develop an LNOS based on Xenix, the multitasking operating system for the Model 16's 68000 CPU. Such a system would have many features of Datapoint's RMS: multitasking at individual processors, hierarchical file structure, and complete sharing of peripheral resources among the system's processors.

Local Networking Concepts

Two transmission techniques are in general use for local networks: baseband and broadband methods. In baseband transmission, information is encoded and transmitted directly. Only one message is on the system at a time. Baseband systems can usually support up to several hundred users.

Broadband transmission allows multiple simultaneous signals on the line. Coaxial and fiberoptic cables are the most suitable media for this type of transmission. Broadband systems can handle thousands of users, and support audio and video signals. However, the initial costs of bidirectional signal amplifiers and the expense of maintenance are great.

"Baseband systems can usually support up to several hundred users."

Two LAN communication protocols are common: CSMA/CD and token passing. With the Carrier Sense Multiple Access/Collision Detection (CSMA/CD) methods, each unit that needs to transmit first checks to see if any message is being distributed. If a message is present, the unit waits until the line is clear.

All units have the capability of detecting transmission collision (the transmission of messages over the line by two or more units at the same time). If a collision occurs, all units pause for a predetermined amount of time, then each unit waits an additional, randomly determined interval before transmitting.

In the token passing protocols, each unit assumes the role of master controller, transmits if necessary, then passes control to the next unit. Figuratively, a token passes from the current master unit to the one that will assume the role of master unit. When all units have had a chance to transmit, the process begins again.

ARCNET

ARCNET is a token passing local-area network system in which each node (ARCNET interface and computer) has a unique address and shares control of the system. The node that currently controls the system is called the master node.

The master node sends information, then passes control to the node with the next higher address. If that node does not accept the attempt to pass control, the master node checks for activity. If activity is present, the master node relinquishes control; otherwise it waits,

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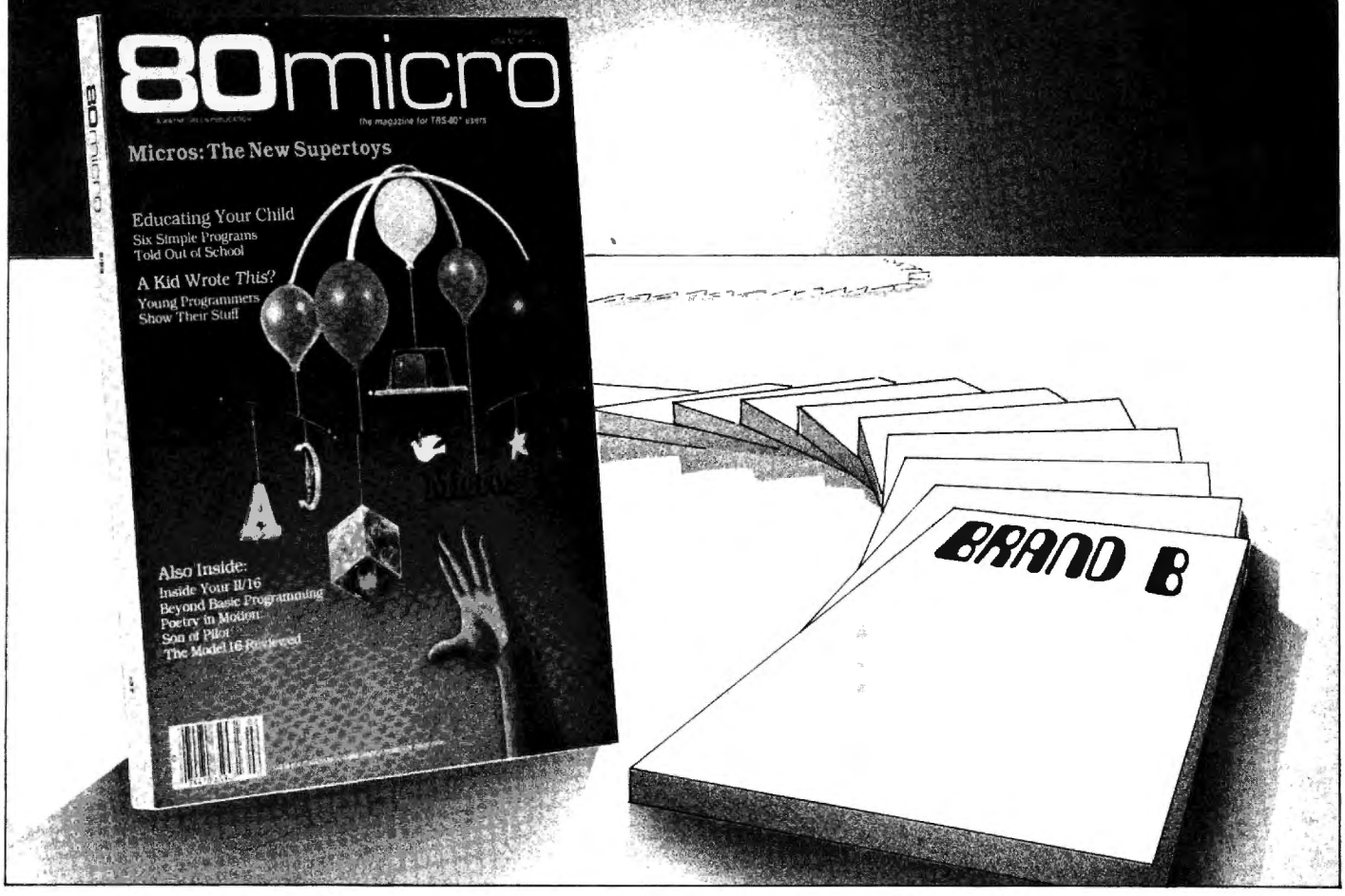

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then repeats the attempt to pass control to the node with the next higher address.

Each node remembers the address of the node to which it last passed control. This avoids polling of nonexistent nodes and enhances the speed of the system. The master node enquires whether the receiving node has a free buffer to hold the packet of information to be transmitted before it actually sends the packet.

This avoids sending information to a node that cannot accept the message. If the receiving node is not able to receive, the master node passes control to the next node and repeats the attempt to send the message when it again gains control of the system.

ARCNET Hardware

ARCNET uses baseband transmission hardware that transmits over RG62 coaxial cable at 2.5 megabaud. Nodes are attached as collections of stars: Coaxial cable connects each node to an ARCNET hub. Coaxial cable can connect each hub in turn to other hubs.

The two types of hubs are passive and active. A passive hub is a connector attached to the coaxial cables from up to four nodes. It requires no power and sells for $79 at Radio Shack (a high price for a small 2 by 2 by 4-inch connector box). You cannot attach passive hubs to other passive hubs, and the combined lengths of the longest two coaxial cables attached to a hub must be less than 200 feet.

". . . the maximum distance between the two nodes farthest apart should be four or less miles."

Active hubs have separate power supplies and transceivers to condition the ARCNET signal for improved reliability. They sell for $799 at Radio Shack. You can attach up to eight (16 as an option on Datapoint hubs) nodes to an active hub and use up to 2,000 feet of coaxial cable between an active hub and a directly connected node.

To increase the number of nodes in a system or increase the distance the network covers, you can connect two active hubs with up to 2,000 feet of cable. All nodes must be close enough so the maximum time delay between a message being sent and received is 31 microseconds (μs). In practice, the maximum distance between the two nodes farthest apart should be four or less miles. You cannot attach passive hubs to active hubs.

The ARCNET interface between the coaxial cable and processor is called a RIM (Resource Interface Module) or ARCNET board. It consists of a parallel interface to the processor, a variable number of 256-byte memory buffers, a controller, a transmitter, a receiver, and a line interface. You can make data transfers to or from the processor at any time, whether or not the transmitter is busy.

The RIM handles all ARCNET protocol procedures. You do not need to involve the attached processor in the details of token passing or data transfer among RIMs. Each RIM in the network has a unique address ranging from 1 to 255.

ARCNET Protocol

ARCNET is a serial, asynchronous system. A 200 nanosecond (ns) dipulse (a 100 ns positive pulse followed by a 100 ns negative pulse) is transmitted as a mark, and no pulse is transmitted as a space. Information transmits through 11 bit units at 2.5 megabaud.

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The line idles with no signal present. A transmission starts with an alert burst of six unit-intervals of mark. Data is transmitted as 8 bit characters preceded by two unit-intervals of mark and one unit-interval of space. The five types of transmission include:

- Invitations To Transmit (ITT) is an alert burst followed by one EOT (end of transmission) and two DID (destination identification) characters. This transmission passes control of the line from one unit to another.
- Free buffer enquiry (FBE) is one alert burst followed by one ENQ (enquiry) and two DID characters. It determines whether a unit is ready to receive a transmission.
- Packet is one alert burst followed by one SOH (start of header), one SID (source identification), two DIDs, the character Count (number of characters in packet: 1-253) and two CRCs (cyclical redundancy checks). It contains data transmitted from one node to another.
- Acknowledgement is one alert burst followed by one ACK (acknowledgement). It acknowledges reception of packet or free buffer enquiry.
- Negative Acknowledgement is one alert burst followed by one NAK (negative acknowledgement) character.

When you first turn on ARCNET, system reconfiguration occurs. When any node determines that no token is circulating (the line is idle for 78 μs), it begins a time-out sequence equal to 146 $\times$ (255 $-$ ID) μs where ID is the identification number of the unit (1-255). When the time-out is complete, the unit begins to send invitations to transmit unless there is activity on the line.

The node with the highest ID begins sending invitations to transmit first. After sending an invitation to transmit, the node waits for the receiving node to respond with an FBE, packet, or ITT. If there is no line activity for 78 μs, the node increments NID by one and sends an ITT.

When a new node joins an active network, it is bypassed repeatedly (since each active node remembers the next highest ID and passes the token to that node), without the following network entering protocol. The new node (or a node that has not received the token for more than 840 ms) enters the network by destroying the token and causing reconfiguration. A reconfiguration burst (consisting of eight marks and one space repeated 765 times) is longer than any other transmission and interface with the master node's invitation to transmit. Since the reconfiguration burst is activity on the line, the master node relinquishes control. The line then remains quiet for 78 μs before system reconfiguration occurs.

When a node leaves the system, there is no need for network reconfiguration. The node that had been passing the token to the now silent node does not receive a response to its ITT, so it increments NID and sends another ITT. This process continues until the master node's NID corresponds to the ID of the next highest node.

Summary

ARCNET has been an efficient token passing local-area network in over five years of use in Datapoint systems. Its application to TRS-80 based networks is straightforward and ARCNET provides a reliable network at a relatively low cost. Extension to 68000 based processors such as the Model 16 should help Tandy keep ahead of the competition in the business microcomputer market. ■

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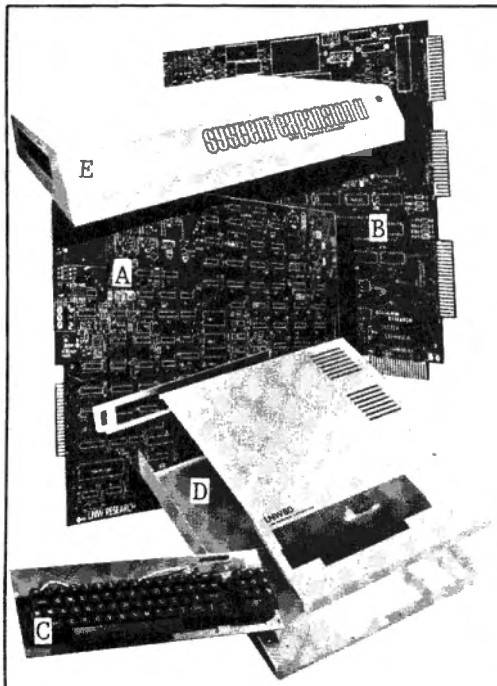

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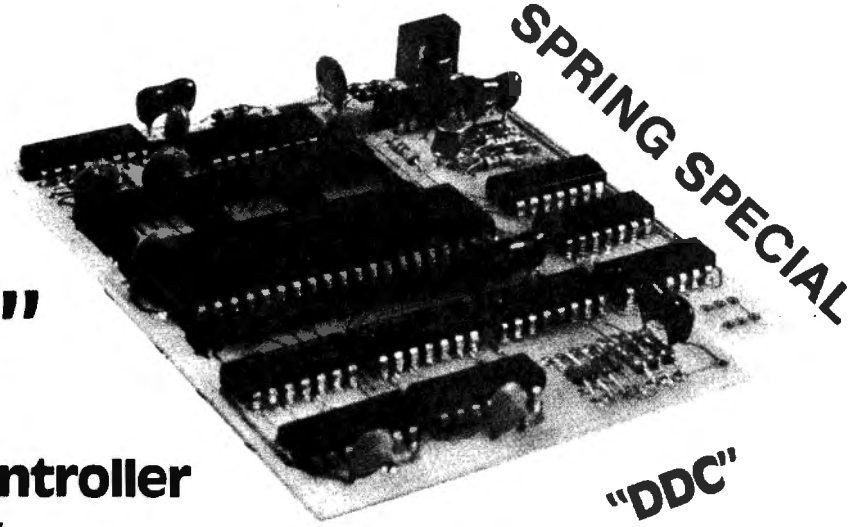

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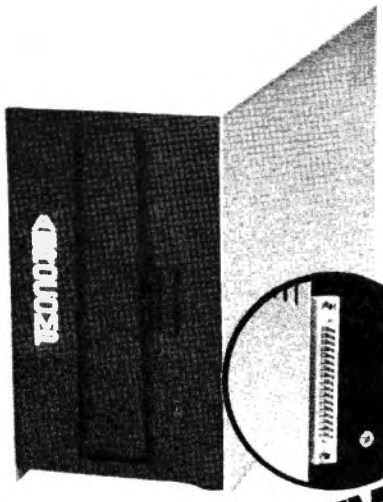

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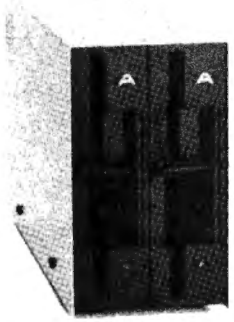

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Five Portable Programs

Foxfighter

by Brad Dixon
80 Micro **Technical Editor**

The Model 100 is fast proving itself a powerful computer with great potential in business and home environments. However, there are times when the drudgery of computing must be replaced with some fast-paced entertainment. Foxfighter (Program Listing 1) is a Model 100 game that uses a meager 3K of memory, yet provides plenty of action.

At the game's start you're given the option of receiving flight instructions or moving directly to your mission. The instructions are provided in lines 390–440. As pilot of a Foxfighter aircraft, your mission is to clear the sky of deadly airmines over an enemy city. To operate the Foxfighter, use the O key to move your aircraft up, the P key to move down, and the space bar to fire the fighter's laser cannon. An INKEY function in line 80 scans the keyboard for these flight instructions. Upward flight is performed in line 90 while downward flight and laser fire are controlled in lines 110 and 190, respectively.

Foxfighter's position is guided by the PRINT@ values produced by the loop in line 70. Once in flight, the fighter moves to the beginning of the next line on the screen when it reaches the end of the previous line. When the fighter reaches number 198 in the loop, it is recycled back to the top left corner of the screen.

If you have little interest in guiding the fighter, but would rather obtain a high score, this feature pilots the craft while you sit back and fire at the appropriate time.

This feature produces an interesting characteristic during laser fire called "wrap around, zap around." If you fire the laser cannon within eight spaces of the end of a row, part of the laser fire wraps around to the beginning of the next row. In effect, you are able to shoot around corners.

Another feature makes the game even more challenging. If an airmine is brushed by the nose or tail of your Foxfighter, the airmine becomes invisible on the screen. Don't let this fool

The Key Box

Foxfighter and Intel require 4K RAM, The Year in Review needs 8K RAM, and Subterra and Renumber 100 take 24K RAM.

Program Listing 1. Foxfighter.

```
 10 DIM X(6):V=3:SCR=0:CLS:PRINT@92,"<<
FOXFIGHTER >>":PRINT:PRINT:INPUT"DO YOU
NEED INSTRUCTIONS (Y OR N )";A$:IF A$="Y
"THEN390 ELSE20
20 DATA 45,79,115,95,102,124,19,83,58,23
,150,128,51,73,140,113,102,31,16,118,88,
67,81,75,100,12,68,95,64,28,116,147,159,
48,95,114,149,140,119,57,107,30
30 FORM=1TO6:READX(M):IFX(M)=30THENRESTO
RE20ELSENEXT
40 P=0:CLS
50 GOSUB220
60 Z$=CHR$(237)+CHR$(232)+CHR$(254)
70 FORB=7TO198:FORM=1TO6:IFB<198ANDB<>X(
M)THENNEXTELSEIFB=198THEN180ELSEIFB=X(M)
THEN380
80 C$=INKEY$:IFC$=""THEN120ELSEIFC$=CHR$
(32)THEN190ELSEIFC$="O"THEN90ELSEIFC$="P
"THEN110ELSE120
90 PRINT@(B-1),"    ":B=B-39:IFB<0THENB=B
+40ELSE120
100 GOTO120
110 PRINT@(B-1),"    ":B=B+41:IFB>198THEN
B=B-40
120 PRINT@B,Z$
130 SOUND12538,1
140 IFB=0THEN170ELSEC=B-1
150 IFSCR=500ORSCR=1000ORSCR=2000THENPRI
NT@0,V+1
160 PRINT@C," "
170 NEXTB
180 PRINT@(B-1),"    ":GOTO70
190 PRINT@(B-1),Z$:PRINT@(B+2),".......
":FORT=1TO8:SOUND1479,1:NEXT:PRINT@(B+2)
,"       "
200 FORM=1TO6:IFX(M)>(B+2)ANDX(M)<(B+10)
THEN370ELSENEXT
210 GOTO140
220 PRINT@200,CHR$(237):PRINT@203,CHR$(2
39):PRINT@208,CHR$(234)+CHR$(233)+CHR$(2
28)+CHR$(233)+CHR$(228)
230 PRINT@216,CHR$(234):PRINT@225,CHR$(2
32)+CHR$(233)+CHR$(238)+CHR$(238)+CHR$(2
39)+CHR$(239)
240 PRINT@233,CHR$(233)+CHR$(238):PRINT@
238,CHR$(237)
250 PRINT@240,CHR$(239):PRINT@242,CHR$(2
27)+CHR$(239)+CHR$(227):PRINT@248,CHR$(2
39)+CHR$(239)+CHR$(239)
260 PRINT@251,CHR$(237)+CHR$(238):PRINT@
```

Listing 1 continues

you. The airmine is still there and will destroy you if you crash into it. Airmines also disappear if the sensor field around each is disturbed by laser fire aimed at nearby airmines.

Crashes and airmine hits provide similar explosions with flashing asterisks and sounds. In each case, the scoreboard is updated in the upper left corner of the screen. When you exhaust all your fighters, the screen clears and your final score is posted. You can play again or exit the program. Each airmine is worth 10 points and additional fighters are awarded at 500, 1000, and 2000 points.

Enhancements

The cityscape in the program is more for visual effect than for increasing the game's difficulty. Crashes into buildings are not difficult to add, but in Basic the checks for crashes might inhibit fast game play. Moving targets or anti-aircraft missiles from the surface would also add to the excitement of the game, but, again, the limitations of Basic programming make such refinements impractical.

The available RAM in the Model 100 limits the level of game modification. One nice addition that doesn't sacrifice speed is incorporating a time limit on the game so that a player has to shoot all the airmines within a specified time. If this is not accomplished, points are deducted from the player's score.

I think you'll find Foxfighter a fast and challenging game that's a nice alternative to the Model 100's more serious applications. ■

Listing 1 continued

```
254,CHR$(238):PRINT@256,CHR$(239):PRINT@
260,CHR$(238)+CHR$(239)
270 PRINT@262,CHR$(237)+CHR$(232):PRINT@
265,CHR$(239)+CHR$(239)+CHR$(239)+CHR$(2
39)+CHR$(239)+CHR$(239)
280 PRINT@271,CHR$(232)+CHR$(238)+CHR$(2
39)+CHR$(239)+CHR$(232)+CHR$(232)+CHR$(2
32)+CHR$(239)
290 PRINT@280,CHR$(239)+CHR$(239)+CHR$(2
39)+CHR$(239)+CHR$(239)+CHR$(239)+CHR$(2
39)+CHR$(239)+CHR$(239);:
300 PRINT@288,CHR$(239)+CHR$(239)+CHR$(2
39)+CHR$(239)+CHR$(239)+CHR$(239)+CHR$(2
39)+CHR$(239)+CHR$(239);:
310 PRINT@297,CHR$(239)+CHR$(239)+CHR$(2
39)+CHR$(239)+CHR$(239)+CHR$(239)+CHR$(2
39)+CHR$(239)+CHR$(239);
320 PRINT@306,CHR$(239)+CHR$(239)+CHR$(2
39)+CHR$(239)+CHR$(239)+CHR$(239)+CHR$(2
39)+CHR$(239)+CHR$(239);
330 PRINT@315,CHR$(239)+CHR$(239)+CHR$(2
39)+CHR$(239);
340 FORM=1TO6:PRINT@X(M),CHR$(169):NEXT
350 PRINT@0,V":":PRINT@3,SCR
360 RETURN
370 FORT=1TO5:PRINT@X(M),"***":SOUND9394
,2:NEXTT:PRINT@X(M),"   ":SCR=SCR+10:PRI
NT@3,SCR:P=P+1:IFP=6THEN30ELSEX(M)=290:G
OTO140
380 FORT=1TO5:PRINT@(B-1),"***":SOUND995
2,2:NEXTT:V=V-1:PRINT@0,V:IFV=0THEN450EL
SE30
390 CLS:PRINT@52,"FOXFIGHTER":PRINT"YOUR
MISSION IS TO DESTROY THE AIRMINE":PRINT
"FIELDS ABOVE THE ENEMY CAPITOL."
400 PRINT"YOUR FIGHTERS ARE GUIDED USING
THE 'O'  KEY TO GO UP AND THE 'P' KEY TO
GO DOWN.THE SPACEBAR FIRES THE FIGHTER'S
LASER  CANNON."
410 FORT=1TO4000:NEXTT
420 CLS:PRINT@52,"*** WARNING ***":PRINT
:PRINT"IF LASER FIRE OR PART OF YOUR FIG
HTER":PRINT"BRUSHES THE SENSOR FIELD ARO
UND"
430 PRINT"EACH AIRMINE, IT WILL BECOME I
NVISIBLE  YET REMAINS ARMED. GOOD LUCK!"

440 FORT=1TO4000:NEXT:GOTO20
450 CLS:PRINT@82,"YOU HAVE RUN OUT OF FI
GHTERS!!":PRINT@122,"YOUR FINAL SCORE IS
";SCR:PRINT:V=3:SCR=0:INPUT"PLAY AGAIN (
Y OR N)";A$:IF A$<>"Y"THENENDELSE20
```

Variable	Description
V	Number of Foxfighters
SCR	Score
B	Foxfighter screen position
P	Score counter
Z$	Foxfighter graphics

Table 1. Foxfighter variables list.

Line	Description
10	Initialization and title page
20–30	Data for airmine placements
60–70	Foxfighter setup and screen definitions
80–130	INKEY routine to check steering and laser fire
150	Check score for extra fighter
190–200	Firing routine and check for airmine hits
220–350	City graphics and scoreboard
370	Airmine hit routine and scoreboard update
380	Crash routine and fighter count update
390–440	Instructions for play
450	Final score and replay option

Table 2. Foxfighter line descriptions.

Intel

Conversion by Beve Woodbury
***80 Micro* Technical Editor**

"4K Intelligence," a game by William M. Lopez, (*80 Micro*, March 1980, p. 55) was designed so that a computer would "learn" from its mistakes; when it is defeated, it doesn't repeat its last move again. Thus the first few games are easy to win, but as play continues, the computer becomes unbeatable.

"4K Intelligence" is played with chess pawns on a 3- by 3-block matrix. Pawns can move one space forward to an empty space, or diagonally to capture an opponent. That player whose pawn reaches the opposite side first, or who blocks his opponent from moving, wins.

When you start the game, you are given the opportunity to see the game instructions. Type and enter a Y for instructions,

or an N to begin the game. Before the game starts, there is a brief pause while arrays are set up.

You always get the first move. Move a pawn forward one space to a blank space, or diagonally to an occupied space to capture the opponent's pawn. When the screen prompts FROM, choose the pawn to be moved, type the pawn location and press the enter key. When the screen prompts TO, type the desired destination and press enter. If you make an invalid move (move forward to occupied space, move diagonally to unoccupied space, skip a space), the computer is unforgiving. You lose the game!

The Program

Program Listing 2 sets up four arrays. Array M contains values for each board configuration. When a move results in a loss, that move is changed to zero, so that the next time the configuration comes up, the computer uses the next possible move. A 15 appears on the display if the computer cannot make a move. If the computer loses in that way, it changes its previous move to zero. If all three possible moves become zero, column 2 changes to 15 so that next time around the previous move is changed.

Array B contains all possible computer block configurations—those with which the computer has won by blocking all your possible moves.

Array C contains the possible computer moves using the matrix locations. Column 1 has the FROM matrix location and column 2 has the TO matrix location.

Array G contains a summary of the game matrix. The screen location for the pawn is in column 0, the matrix location of the computer pawn in column 1, and your pawn in column 3. A 1 indicates a pawn in that location and zero indicates an empty space. Column 2 contains specific values for the corresponding matrix location for computer pawns, and column 4 has the values for your pawns.

The program occupies almost 4K and contains several REM statements for program clarity. If you have limited memory space, remove all remark lines. ■

Arrays	
B( )	Computer block configurations
C( )	Possible computer moves
G( )	Game matrix summary
M( )	Board configurations and possible moves
General	
A	Row location of computer move
BL	Human blocked if 1
C	Computer configuration value
F	Matrix location to move computer pawn from
H	Human configuration value
I	For . . . Next loop counter
J	Matrix location to move human pawn from
K	Matrix location to move human pawn to
L	Number of human losses
LC	Column number of previous computer move
LR	Row number of previous computer move
M	Computer move
N$	? Play again?
T	Matrix location to move computer pawn to
W	Number of human wins
X	Value to check for invalid move
Y$	? Instructions wanted?

Table 3. "4K Intelligence" variables list.

Program Listing 2. Intel.

```
10 DIMG(8,4),M(38,4),C(15,1),B(14,1)
20 CLS:PRINT@12,"INTEL":PRINT:W=0:L=0
30 INPUT"DO YOU WANT INSTRUCTIONS? Y/
N";Y$
40 IFY$="Y"THEN1170ELSEIFY$="N"THEN70
50 GOTO30
60              'set up possible moves
70 DATA4,3,7,5,4,1,2,1,0,6,8,2,11,7,3
80 DATA7,6,2,5,4,3,11,10,5,6,5,0,9,8,0
90 DATA3,2,0,5,4,3,7,6,0,7,6,0,7,0,0
100 DATA11,8,0,2,0,0,8,5,0,3,14,0,8,11,0
110 DATA15,0,0,15,0,0,11,14,0,8,7,6
120 DATA3,11,0,5,11,0,2,8,0,6,14,0,2,0,0
130 DATA1,2,6,15,0,0,15,0,0,6,0,0,6,7,0
140 DATA7,0,0,1,0,0,1,2,14,14,0,0,11,5,0
150 FORI=0TO38:READM(I,2),M(I,3),M(I,4)
:NEXT
160   'set up computer model table
170 DATA392,7,224,7,336,7,272,13,264,22
180 DATA152,5,296,3,96,22,112,14,160,13
190 DATA280,35,104,6,144,6,80,6,136,5
200 DATA32,28,56,1,48,10,24,34,32,25
210 DATA40,5,136,17,8,52,16,12,8,18
220 DATA16,10,8,5,16,36,24,1,176,5
230 DATA16,2,168,21,56,4,272,6,264,5
240 DATA96,5,80,37,136,37,32,18
250 FORI=0TO38:READM(I,0),M(I,1):NEXT
260        'blocked human move table
270 DATA1,8,2,16,4,32,8,64,16,128
280 DATA12,96,33,264,32,256,5,40
290 DATA40,320,21,168,17,136,20,160
300 DATA34,272,9,80
310 FORI=0TO14:READB(I,0),B(I,1):NEXT
320         'possible computer moves
330 DATA0,3,0,4,1,3,1,4,1,5,2,4,2,5
340 DATA3,6,3,7,4,6,4,7,4,8,5,7,5,8
350 FORI=1TO14:READC(I,0),C(I,1):NEXT
360 '            set up graphic array
370 DATA67,1,1,0,0,72,1,2,0,0
380 DATA77,1,4,0,0,147,0,8,0,8
390 DATA152,0,16,0,16,157,0,32,0,32
400 DATA227,0,0,1,64,232,0,0,1,128
410 DATA237,0,0,1,256
420 FORI=0TO8:READ G(I,0),G(I,1),G(I,2),G
(I,3),G(I,4):NEXT
430 CLS            ' setup board graphic
440 LINE(146,4)-(234,50),1,B:LINE(145,3)-
(235,51),1,B
450 LINE(174,5)-(174,50):LINE(205,5)-(
205,50)
460 LINE(147,20)-(233,20):LINE(147,35)-(
233,35)
470 PRINT@65,"0":PRINT@67,CHR$(128)
480 PRINT@70,"1":PRINT@72,CHR$(128)
490 PRINT@75,"2":PRINT@77,CHR$(128)
500 PRINT@145,"3":PRINT@150,"4"
:PRINT@155,"5"
510 PRINT@225,"6":PRINT@227,CHR$(148)
520 PRINT@230,"7":PRINT@232,CHR$(148)
530 PRINT@235,"8":PRINT@237,CHR$(148)
540 '                    get human move
550 GOSUB1300
560 GOSUB750
570         ' get model table value.
580 IFH=0THEN970
590 FORI=0TO14
600 IFC=B(I,0)AND H=B(I,1)THENBL=1
610 NEXT
620 IFBL=1THENPRINT@200,"BLOCKED! I
WIN!":BL=0:GOTO990
630 PRINT@200,"YOUR MOVE HUMAN!"
```

Listing 2 continues

Listing 2 continued

```
640 INPUT"FROM";J:PRINT@250,"TO";:INPUTK
650 X=J-K
660 IFX<2ORX>4THEN1090
670 IFX=3ANDG(K,1)=1THEN1090
680 IFX=4ANDG(K,1)=0THEN1090
690 IFX=2ANDG(K,1)=0THEN1090
700 G(K,3)=1:G(K,1)=0:G(J,3)=0
710 PRINT@G(K,0),CHR$(148):PRINT@G(J,0),"
  "
720 IFK<3THEN1120
730 GOSUB740:GOTO810
740 'get array values for comp. move
750 C=0:H=0
760 FORI=0TO8
770 IFG(I,1)=1THENC=C+G(I,2)
780 IFG(I,3)=1THENH=H+G(I,4)
790 NEXT
800 RETURN
810  '                get computer move #
820 FORI=0TO38
830 IFH=M(I,0)ANDC=M(I,1)THENA=I:GOTO860
840 NEXT
850 '      get and make computer move
860 FORI=2TO4
870 IFM(A,I)>0THENM=M(A,I):GOTO900
880 NEXT
890 IFM=0THENM(A,2)=15
900 IFM=15THEN1140
910 F=C(M,0):T=C(M,1)
920 G(F,1)=0:G(T,3)=0:G(T,1)=1
930 PRINT@G(F,0)," ":PRINT@G(T,0),CHR$(
128)
940 IFT>5THEN980
950 LR=A:LC=I
960 GOTO550
970  '            computer win routine
980 GOSUB1300:PRINT@200,"I WIN, HUMAN!"
990 '                    ending routine
1000 L=L+1
1010 PRINT"YOU'VE WON";W; "AND LOST";L
1020 INPUT"DO YOU WANT TO PLAY AGAIN? (Y/
N)";N$
1030 FORI=0TO2:G(I,1)=1:G(I,3)=0:NEXTI
1040 FORI=3TO5:G(I,1)=0:G(I,3)=0:NEXTI
1050 FORI=6TO8:G(I,1)=0:G(I,3)=1:NEXTI
1060 M=0:IFN$="Y"THEN430
1070 END
1080 '             invalid move routine
1090 GOSUB1300:PRINT@200,"INVALID MOVE!
I WIN!"
1100 GOTO990
1110 '                human win routine
1120 PRINT@200,"YOU'VE WON, HUMAN!"
1130 W=W+1:M(A,B)=0:GOTO1010
1140 PRINT@200,"YOU'VE WON,HUMAN!"
1150 W=W+1:M(LR,LC)=0:GOTO1010
1160 '               game instructions
1170 CLS:PRINT:PRINT"INTEL IS PLAYED ON A
3 BY 3 MATRIX."
1180 PRINT"THE PAWNS ARE MOVED ONE SPACE
FORWARD"
1190 PRINT"OR ONE SPACE DIAGONALLY TO
CAPTURE."
1200 PRINT"MY PAWNS ARE ";CHR$(128);"
YOURS ARE ";CHR$(148)
1210 INPUT Y$:CLS:PRINT
1220 PRINT"WIN OCCURS WHEN YOU REACH THE
OPPOSITE"
1230 PRINT"SIDE OF THE BOARD  OR"
1240 PRINT"WHEN ALL OPPONENTS PAWNS ARE
BLOCKED."
1250 PRINT"AN INVALID MOVE RESULTS IN A
LOSS."
1260 PRINT"TO MAKE A MOVE, ENTER PRESENT
PAWN"
1270 PRINT"POSITION, THEN ENTER NEW PAWN
POSITION."
1280 INPUT Y$:GOTO70
1290 '                blank screen text
1300 FORI=0TO16:PRINT@(200+I)," ":PRINT@(
240+I)," ":NEXT:RETURN
```

Subterra

Conversion by Mare-Anne Jarvela
***80 Micro* Technical Editor**

Subterra, an adventure game by Richard Ramella, first appeared in our Fun House column (*80 Micro*, November 1982, p. 488). It requires a 24K Model 100.

Variable	Description
A$	Data from data statements
B	Array counter
T	For...Next counter
X$	Input variable
C$	Input variable
K$	Input variable
I	For...Next counter
Z	Random number
M	Random number
K	Found key flag
H	Going in or out flag
P	Mile counter

Table 4. Subterra variables list.

Program Listing 3. Subterra.

```
10 REM SUBTERRA
20 CLS
30 DATA NORTH,SOUTH,EAST,WEST,KEY,NOTE-S
OMETIMES EMPTY
40 DATA DESERT,HOME,LOCATION,DO YOU WALK
 INTO WALLS A LOT?
50 DATA WALL,CAVE ENTRANCE,TUNNEL OF MIC
A,CRAWL SPACE,VESTIBULE OF EVIL
60 DATA TRIANGLE TUNNEL,ENDLESS PASSAGE,
GROTTO OF GRIEF,DRAGON,WELL
70 DATA FOUR CORNERS,TROLL WAY,ROCK TUNN
EL,THREE CORNERS,ECHO CAVERN
80 DATA RIVER,THREE DOORWAYS,SULPHUR LAN
E,WATERY ELBOW,DARKLING WAY
90 DATA COBWEBBED HALLWAY,CIRCLE CHAMBER
,WHITE WATER,RIVER ROCK,ABYSMAL WATERFAL
L
100 DATA SACRIFICIAL ALTAR,SHORT HALL,SN
AKE CITY,POISON HALL,RAT CHAMBER
110 DATA IT'S ENDLESS SO GO BACK !!
120 DATA I'M SORRY.. YOU WILL NEVER RETU
RN.
130 DATA HER FIERY BREATH DRIVES YOU BAC
K,A DOORWAY,RIVER BANK
140 DATA LIMBO JAUNT,CAVE-IN NOW BLOCKS
ENTRANCE,A ROUND PORTAL
```

Listing 3 continues

In Subterra, you must traverse underground caves and passages in search of a precious idol. Travel in any direction, but tread cautiously—many hidden traps await you. And don't assume you're through when you find the idol—you are in danger until you and the idol are safely above ground.

Pictures add to the fun, and show off some of the Model 100's graphics. I used CHR$(27);"p" to make the background dark and CHR$(27);"q" to make it light. Lines 2230–2730 contain all the graphics. (See Program Listing 3.)

Subterra produces sound in conjunction with the graphics. Change line 2310 to compose a different tune for the key, line 2390 for the doors, line 2500 for the dragon, line 2620 for the well, and line 2700 for the idol.

The Model 100's random function (RND) gives you numbers between zero and one. I used INT(10*RND(1)) for an integer between zero and nine. RND always gives the same order of random numbers; to avoid that, I used the clock to pick up a different sequence each time (see p. 175 of the Model 100 manual).

Enjoy Subterra—but don't get lost. ■

Listing 3 continued

```
150 CLEAR 500
160 DIM A$(48)
170 FOR B=1 TO 48
180 READ A$(B)
190 NEXT B
200 PRINT@50,"HAVE FUN FINDING THE IDOL!
!!"
210 PRINT@90,"HOLD YOUR EYES OPEN FOR...
..":FOR T=1 TO 1200:NEXT T:CLS
220 GOSUB 2350: CLS: GOSUB 2240: CLS: GO
SUB 2420: CLS: GOSUB 2530: CLS: GOSUB 26
40: CLS
230 REM CAVE
240 L=12: N=7: W=7: S=8: E=13
250 GOSUB 2000
260 IF X$="N" OR X$="W" THEN PRINT "LOST
...NEVER HEARD OF AGAIN.":END
270 IF X$="S" THEN PRINT "WENT HOME AND
DIDN'T EVEN TRY.":END
280 IF X$="E" GOTO 300
290 REM TUNNEL OF MICA
300 L=13: N=11: W=13: S=14: E=13
310 GOSUB 2000
320 IF X$="N" THEN PRINT A$(10):GOTO300
330 IF X$="W" THEN PRINT A$(47):GOTO300
340 IF X$="S" GOTO 370
350 IF X$="E" GOTO 480
360 REM VESTIBULE OF EVIL
370 L=15: N=14: W=11: S=11: E=16
380 SEC = VAL(RIGHT$(TIME$,2))
390 FOR I=1 TO SEC
400 Z=INT(10*RND(1))
410 NEXT I
420 IF Z<6 THEN GOSUB 2100
430 GOSUB 2000
440 IF X$="W" OR X$="S" THEN PRINT A$(10
):GOTO 370
450 IF X$="N" GOTO 300
460 IF X$="E" GOTO 600
470 REM GROTTO OF GRIEF
480 L=18: W=13: S=22: E=20
490 IF H=2 THEN N=14 ELSE N=19
500 GOSUB 2000
510 IF X$="W"THEN GOTO 300
520 IF X$="E" THEN GOTO 770
530 IF X$="S"GOTO 600
540 IF X$="N" AND H<>2 THEN GOSUB 2420:C
LS
550 IF X$="N" AND H<>2 THEN SEC=VAL(RIGH
T$(TIME$,2)):FOR I=1 TO SEC:Z=INT(10*RND
(1)):NEXT I
560 IF X$="N" AND H=2 THEN PRINT "YOU EX
IT TO SUNLIGHT. THE IDOL IS YOURS":END
570 IF Z<6 THEN PRINT A$(42): END
580 IF Z>5 THEN PRINT A$(43): Z=0: GOTO
480
590 REM FOUR CORNERS
600 L=21: N=22: W=16: S=17: E=23
610 GOSUB 2000
620 IF X$="N" GOTO 480
630 IF X$="W" GOTO 370
640 IF X$="E" GOTO 1170
650 IF X$="S" GOTO 660
660 P=2
670 REM ENDLESS PASSAGE
680 L=17: W=11: S=17: E=11
690 GOSUB 2000
700 IF P=2 AND X$="N" THEN PRINT "YOU LE
AVE ";A$(17): P=0:GOTO600
710 IF X$="S" THEN P=P+2
720 IF X$="N" THEN P=P-2
730 IF P=10 THEN GOSUB 2100
740 PRINT "DISTANCE INTO ";A$(17);":";P;
"MILES"
750 GOTO 680
760 REM WELL
770 GOSUB2530:CLS
780 L=20: N=11: W=11: S=11: E=11
790 GOSUB 2000
800 IF X$="N" OR X$="S"THEN PRINT"YOU CA
N'T GET OUT!!!":END
810 IF X$="W"THEN PRINT"THAT HURT!":FOR
T=1 TO 500:NEXT T:GOTO 770
820 IF X$="E"THEN PRINT"A WALL AGAIN ?":
FOR T=1 TO 500:NEXT T:GOTO 770
830 N=11: W=11: S=25: E=11
840 IF Z=1 THEN L=38
850 IF Z=2 THEN L=39
860 IF Z=3 THEN L=40: E=37
870 SEC = VAL(RIGHT$(TIME$,2))
880 FOR I=1 TO SEC
890 M=INT(10*RND(1))
900 NEXT I
910 IF M<6 THEN PRINT"FOUND-CHEST WITH A
 ";
920 IF M>5 GOTO 1000
930 SEC = VAL(RIGHT$(TIME$,2))
940 FOR I=1 TO SEC
950 M=INT(10*RND(2))
960 NEXT I
970 IF M<6 THEN PRINT A$(5):FOR T=1 TO 5
00:NEXT T:GOSUB 2230:CLS
980 IF M>5 THEN PRINT A$(6)
990 IF M<6 THEN K=1
1000 GOSUB 2000
1010 IF X$="N" OR X$="W" GOTO 1000
1020 IF X$="E" AND Z=3 GOTO 1450
1030 IF X$="E" GOTO 1000
1040 IF X$="S" GOTO 1060
1050 REM ECHO CAVERN
1060 L=25: N=27: W=20: S=28: E=44
1070 GOSUB 2000
1080 IF X$="W" GOTO 770
```

Listing 3 continues

Listing 3 continued

```
1090 IF X$="S" GOTO 1170
1100 IF X$="E" AND K<>1 THEN PRINT "NO "
;A$(5): GOTO 1060
1110 IF X$="E" AND K=1 THEN PRINT A$(5)
;" DOESN'T WORK.":GOTO 1060
1120 GOSUB2350
1130 PRINT@42, "WHICH DOOR - 1,2 OR 3";:
INPUT Z:CLS
1140 IF Z<>1 AND Z<>2 AND Z<>3 GOTO 1130
1150 GOTO 830
1160 REM RIVER BANK
1170 L=45: N=28: W=23: S=11: E=26
1180 GOSUB 2000
1190 IF X$="N" GOTO 1060
1200 IF X$="W" GOTO 600
1210 IF X$="S" THEN PRINT "HURT YOUR HEA
D?":GOTO 1170
1220 REM WATERY ELBOW
1230 L=29: N=26: W=26: S=46: E=11
1240 GOSUB 2000
1250 IF X$="N" GOTO 1390
1260 IF X$="W" GOTO 1170
1270 IF X$="E" THEN PRINT "OOPS,ANOTHER
WALL EH?": GOTO 1230
1280 REM LIMBO JAUNT
1290 L=46: N=29: W=11: S=46: E=11
1300 PRINT "DISTANCE IN:";P;"MILES"
1310 GOSUB 2000
1320 IF X$="S" THEN P=P+2
1330 IF X$="N" THEN P=P-2
1340 IF P<2 THEN PRINT "YOU'RE OUT":GOTO
 1230
1350 IF P=10 THEN PRINT A$(41)
1360 IF P=12 THEN PRINT "TOO LATE . LOST
 IN THE DARK. THAT'S ALL": END
1370 GOTO 1290
1380 REM RIVER ROCK
1390 L=34: N=33: W=44: S=26: E=31
1400 GOSUB2000
1410 IF X$="W" GOTO 1060
1420 IF X$="S" GOTO 1230
1430 IF X$="E" GOTO 1610
1440 REM SACRIFICIAL ALTAR
1450 L=36: N=35: W=40: S=33: E=11
1460 GOSUB 2000
1470 IF X$="W" THEN Z=3: GOTO 830
1480 IF X$="S" GOTO 1390
1490 IF X$="E" THEN PRINT"ANOTHER BRUISE
": GOTO 1450
1500 IF X$="N" THEN PRINT "YOU KNOW WHAT
 AN ";A$(35);" IS AND STILL WANT TO GO?"
1510 INPUT "ANSWER YES OR NO";X$
1520 IF X$<>"YES" AND X$<>"NO" GOTO 1510
1530 IF X$="NO" GOTO 1450
1540 PRINT
1550 PRINT "NOW YOU FALL FOREVER ";:GOTO
 1590
1560 PRINT "AND EVER ";
1570 FOR T=1 TO 200
1580 NEXT T
1590 GOTO 1560
1600 REM COBWEBBED HALLWAY
1610 L=31: N=11: W=34: S=11: E=48
1620 PRINT "YOU STAND AT ";A$(48)
1630 IF K<>1 THEN PRINT "NO ";A$(5);" TO
 ENTER": GOTO 1390
1640 IF K=1 THEN PRINT "YOUR ";A$(5)" WO
RKS!"
1650 GOSUB 2000
1660 PRINT "YOU NOW ENTER THE ";A$(32)
1670 FOR T=1 TO 500
1680 NEXT T
1690 PRINT "DO YOU RECALL THE MAGIC DIRE
CTION?"
1700 PRINT "IF YOU DON'T KNOW, GUESS QUI
CKLY!"
1710 PRINT"THE CEILING WILL START TO LOW
ER..."
1720 FOR T=1 TO 1000
1730 NEXT T
1740 PRINT "PRESS ANY KEY IF YOU KNOW."
1750 PRINT
1760 FOR T=1 TO 500
1770 NEXT T
1780 FOR M=10 TO 1 STEP -1
1790 CLS
1800 PRINT M;"SECONDS TO GO"
1810 C$=INKEY$
1820 IF C$<>""GOTO 1860
1830 FOR T=1 TO 200
1840 NEXT T
1850 NEXT M
1860 PRINT "THE MAGIC DIRECTION IS "
1870 INPUT"(NORTH-EAST-SOUTH-WEST)";C$
1880 IF C$=K$ GOTO 1900
1890 PRINT "BAD GUESSING, A CRUSHING DEF
EAT, EH?": END
1900 CLS:GOSUB 2640:CLS
1910 PRINT "YOU FOUND THE GOLDEN IDOL IN
 TIME."
1920 PRINT "YOUR WORRIES ARE OVER..."
1930 PRINT "EXCEPT YOU HAVE TO FIND YOUR
 WAY OUT."
1940 PRINT"YOU EXIT WITH TREASURE IN HAN
D."
1950 H=2
1960 FOR T=1 TO 1500
1970 NEXT T
1980 CLS
1990 GOTO 1390
2000 PRINT A$(9);": ";A$(L)
2010 PRINT A$(1);": ";A$(N)
2020 PRINT A$(4);": ";A$(W)
2030 PRINT A$(2);": ";A$(S)
2040 PRINT A$(3);": ";A$(E)
2050 PRINT"DIRECTION - (N-W-S-E)";
2060 INPUT X$
2070 IF X$<>"N" AND X$<>"W" AND X$<>"S"
AND X$<>"E" GOTO 2050
2080 CLS
2090 RETURN
2100 IF K$<>""THEN RETURN
2110 SEC = VAL(RIGHT$(TIME$,2))
2120 FOR I=1 TO SEC
2130 Z=INT(10*RND(1))
2140 NEXT I
2150 IF Z<3 AND Z>0 THEN K$=A$(1):GOTO 2
190
2160 IF Z<5 THEN K$=A$(2):GOTO 2190
2170 IF Z<8 THEN K$=A$(3):GOTO 2190
2180 IF Z<10 THEN K$=A$(4)
2190 Z=0
2200 PRINT "A WALL OPENS. A MESSAGE SCRO
LL APPEARS:"
2210 PRINT "REMEMBER THE MAGIC DIRECTION
: ";K$;"!"
2220 RETURN
2230 REM KEY
2240 PRINT@59,CHR$(230);CHR$(231);CHR$(2
31);CHR$(229)
2250 PRINT@99,CHR$(229);CHR$(232);CHR$(2
32);CHR$(230)
2260 PRINT@141,CHR$(233)
2270 PRINT@181,CHR$(233)
2280 PRINT@220,CHR$(232);CHR$(233)
2290 PRINT@259,CHR$(232);CHR$(232);CHR$(
```

Listing 3 continues

Listing 3 continued

```
233)
2300 PRINT@301,CHR$(225)
2310 SOUND 2348,25: SOUND 1864,25: SOUND
 7456,25: SOUND11172,25
2320 FOR T=1 TO 500:NEXT T
2330 RETURN
2340 REM DOORS
2350 PRINT@282,CHR$(234);" ";CHR$(233);"
 ";CHR$(234);" ";CHR$(233);"  ";CHR$(234
);" ";CHR$(233)
2360 PRINT@242,CHR$(233);"1";CHR$(234);"
  ";CHR$(233);"2";CHR$(234);"  "CHR$(233
);"3";CHR$(234)
2370 PRINT@202,CHR$(233);" ";CHR$(234);"
  ";CHR$(233);" ";CHR$(234);"  ";CHR$(23
3);" ";CHR$(234)
2380 PRINT@162,CHR$(235);CHR$(231);CHR$(
236);"  ";CHR$(235);CHR$(231);CHR$(236);
"  ";CHR$(235);CHR$(231);CHR$(236)
2390 SOUND 3134,25: SOUND 12538,25: SOUN
D 2348,25: SOUND 9394,25: SOUND 1660,25:
 SOUND 6642,25
2400 FOR T=1 TO 500:NEXT T
2410 RETURN
2420 REM DRAGON
2430 PRINT@59,CHR$(229);"    ";CHR$(230)
2440 PRINT@100,CHR$(229);CHR$(228);CHR$(
227);CHR$(230)
2450 PRINT@139,CHR$(228);CHR$(238);CHR$(
239);CHR$(239);CHR$(237);CHR$(227)
2460 PRINT@178,CHR$(228);CHR$(238);CHR$(
232);CHR$(239);CHR$(239);CHR$(232);CHR$(
237);CHR$(227)
2470 PRINT@218,CHR$(239);CHR$(239);CHR$(
239);CHR$(254);CHR$(252);CHR$(239);CHR$(
239);CHR$(239)
2480 PRINT@258,CHR$(236);CHR$(167);CHR$(
167);CHR$(167);CHR$(167);CHR$(167);CHR$(
167);CHR$(235)
2490 PRINT@299,CHR$(229);CHR$(232);CHR$(
232);CHR$(232);CHR$(232);CHR$(230)
2500 SOUND 15000,50: SOUND 16383,50: SOU
ND 15000,50
2510 FOR T=1 TO 500:NEXT T
2520 RETURN
2530 REM WELL
2540 PRINT@59,CHR$(252);CHR$(239);CHR$(2
39);CHR$(239);CHR$(239);CHR$(239);CHR$(2
39);CHR$(254)
2550 PRINT@100,CHR$(233);"    ";CHR$(234
)
2560 PRINT@140,CHR$(237);CHR$(232);CHR$(
232);CHR$(232);CHR$(232);CHR$(238);CHR$(
238)
2570 PRINT@180,CHR$(235);CHR$(231);CHR$(
231);CHR$(231);CHR$(231);CHR$(236)
2580 PRINT@219,CHR$(239);CHR$(255);CHR$(
239);CHR$(255);CHR$(239);CHR$(255);CHR$(
239);CHR$(255)
2590 PRINT@259,CHR$(255);CHR$(239);CHR$(
255);CHR$(239);CHR$(255);CHR$(239);CHR$(
255);CHR$(239)
2600 PRINT@299,CHR$(239);CHR$(255);CHR$(
239);CHR$(255);CHR$(239);CHR$(255);CHR$(
239);CHR$(255)
2610 FOR T=1 TO 500:NEXT T
2620 SOUND 1567,25: SOUND 3134,20: SOUND
 6269,25: SOUND 12538,25
2630 RETURN
2640 REM IDOL
2650 PRINT@99,CHR$(252);CHR$(239);CHR$(2
39);CHR$(239);CHR$(239);CHR$(239);CHR$(2
39);CHR$(254)
2660 PRINT@139,CHR$(253);CHR$(239);CHR$(
27);"p";CHR$(92);CHR$(245);CHR$(245);CHR
$(47);CHR$(27);"q";CHR$(239);CHR$(251)
2670 PRINT@180,CHR$(253);CHR$(239);CHR$(
27);"p";CHR$(92);CHR$(47);CHR$(27);"q";C
HR$(239);CHR$(251)
2680 PRINT@221,CHR$(253);CHR$(27);"p";CH
R$(92);CHR$(47);CHR$(27);"q";CHR$(251)
2690 PRINT@262,CHR$(253);CHR$(251)
2700 SOUND 932,25: SOUND 2793,50: SOUND
7456,25: SOUND 1174,25
2710 FOR T=1 TO 500:NEXT T
2720 RETURN
2730 END
```

Renumber 100

by Beve Woodbury
***80 Micro* Technical Editor**

Running out of room to insert additional line numbers in a program is frustrating. This renumber utility solves that problem. It lets you choose line increments and then renumbers the entire program, including all GOTO, GOSUB, Then, and Else lines. (See Program Listing 4.)

The program first reads a Do file (ASCII), then writes a file (NWNUMB.DO) with the corrected line numbers. Because of these file requirements, the number of bytes available to renumber a program must at least equal the number of bytes in the Do file plus 500 bytes for string space and 4 bytes for each line (array). I can renumber a file of approximately 7,000 bytes on a 24K Model 100 with no other files.

When you run the program, it requests the name of the file you want renumbered. Enter the file name, including the .DO extension. The computer pauses while it determines the number of lines in the file and dimensions an array to store the old and new program line numbers.

The program then requests the desired line increments. After you enter this figure, there is another pause while the old/new line-number array is set up.

When the program starts to number lines, "Processing, Please Wait" appears on the screen each time a new line is read. If the program is quite long and a line has several line

Line	Description
10	Clear $ space for old and renumbered line
20	Title
30	Get name of file to renumber
40–70	Read file to count lines and dimension array
80–120	Set up array of old and new line numbers
130–140	Open files for input and output
150–190	Read old line and replace line number
200–230	Search for GOTO in line
240–270	Search for GOSUB in line
280–310	Search for THEN followed by line number in line
320–360	Search for ELSE followed by line number in line
370	Get next line
380–390	Sound "beep" and end program
400–520	Replace old line number reference with new

Table 5. Renumber line descriptions.

references, the processing notice remains steady while all the line changes are checked through the array.

It took approximately one minute to renumber the 7,000-byte program mentioned above. This is a long time by computer standards, but it beats renumbering manually. When the program finishes writing the renumber file, it beeps. This lets you do other tasks while your program is renumbered.

If there is an undefined line number ("Line number is not in program") referenced in a line, the number is replaced with asterisks.

When the program ends, "Unlisted Line" appears on the screen.

The renumbered file is in NWNUMB.DO. The original file is unchanged. ■

```
10 CLEAR500
20 CLS:PRINT@50,"RENUMBER UTILITY":
PRINT
30 INPUT"NAME OF FILE TO RENUMBER: ";F$
40 FF$="RAM:"+F$:OPENFF$FORINPUTAS1
50 IF EOF(1)THENCLOSE:GOTO70
60 LINEINPUT#1,A$:D=D+1:GOTO50
70 D=D-1:DIMT(D,1)
80 OPENFF$FORINPUTAS1:PRINT
90 INPUT"  LINE INCREMENT DESIRED: ";I
100 FORK=0TOD:LINEINPUT#1,A$:N=N+I
110 V=VAL(LEFT$(A$,5)):T(K,0)=V:T(K,1)=N

120 NEXT
130 CLOSE:OPENFF$FORINPUTAS1
140 OPEN"RAM:NWNUMB.DO"FOROUTPUTAS2
150 FORK=0TOD:CLS
160 PRINT@125,"PROCESSING, PLEASE WAIT"
170 LINEINPUT#1,A$:V=VAL(LEFT$(A$,5))
180 Y=LEN(A$):H=LEN(STR$(V))
190 A$=STR$(T(K,1))+MID$(A$,H)
200 X=1
210 X=INSTR(X,A$,"GOTO")
220 IFX>0THENGOSUB410ELSE240
230 GOTO210
240 X=1
250 X=INSTR(X,A$,"GOSUB")
260 IFX>0THENGOSUB400ELSE280
270 GOTO250
280 X=1
290 X=INSTR(X,A$,"THEN"):IFX=0THEN320
300 IFVAL(MID$(A$,X+4))>
0THENGOSUB410ELSEX=X+4
310 GOTO290
320 X=1
330 X=INSTR(X,A$,"ELSE"):IFX=0THEN360
340 IFVAL(MID$(A$,X+4))>
0THENGOSUB410ELSEX=X+4
350 GOTO330
360 PRINT#2,A$
370 NEXT
380 CLOSE:SOUND
4697,75:IFUD=1THENPRINT"UNLISTED LINE
390 END
400 X=X+1
410 X=X+3:Y=Y+1
420 M=VAL(MID$(A$,X+1))
430 R=-1
440 R=R+1
450 IFR>DTHENP$=" ****":UD=1:GOTO480
460 IFM=T(R,0)THENPP$=STR$(T(R,1))
:P$=MID$(PP$,2):GOTO480
470 GOTO440
480 IFY<X+4THEN520
490 C$=RIGHT$(STR$(M),2):LC=LEN(C$)
:Q=INSTR(X,A$,C$):C=Q+LC
500 A$=LEFT$(A$,X)+P$+MID$(A$,C)
510 RETURN
520 A$=LEFT$(A$,X)+P$
530 RETURN
```

Program Listing 4. Renumber utility.

Variable	Description
A$	Old file line input
C	Location to put remainder of line
C$	Remainder of line
D	Number of lines in program
F$	Name of file to renumber
FF$	Proper file name format to open file
H	Length of new line number
I	Increment amount
J	Length of old line number reference
K	Loop counter
LC	Length of remainder of line
M	Value of MID$
N	New line number
PP$	New line number reference
P$	Formatted new line number
Q$	Location of remainder of line
R	Array row number
T( )	Table (array) of old and new line numbers
UD	Indicate presence of undefined line number
V	Value of old line number
X	Location in line
Y	Length of old line
Z$	New file line output

Table 6. Renumber variables list.

The Year in Review

by Richard Ramella

This program produces a bar graph that displays data for a 12-month period on the X axis and accommodates up to 10 million units on the Y axis. It requires an 8K Model 100. The display fits comfortably on the screen.

The Program

When you run the program, you'll see the prompt "Enter title in 40 or fewer characters." It can be anything: 1983 Births at Enloe Hospital, Sales of the South Pacific, and so on. If you exceed the 40-character limit, you're told so and given another try.

Then you are asked to enter data for each month, from January to December. For each prompt in this section, type the number of units for that month and hit the enter key to see the next prompt. If you enter a number higher than 10 million, the program politely ends its participation in your scheme.

After you enter the December figure, the screen blanks and the program draws the bar graph.

At the left of the screen the prompt "Month?" appears. Answer it by typing the first three letters of any month in low-

ercase and the program displays the number for that month. To see a figure for another month, press the enter key. The screen goes blank and another prompt appears.

The strange letter groupings in lines 370–390 of Program Listing 5 turn into three-letter month abbreviations displayed vertically. The bar for each month builds upward to the right of the month.

The Y axis has 10 divisions on it. At the bottom left of the screen is a notation telling you what each of these 10 increments represents. The abbreviation "incr." is followed by either "tens," "hundreds," "thousands," "10 thous," "100 thous.," or "millions."

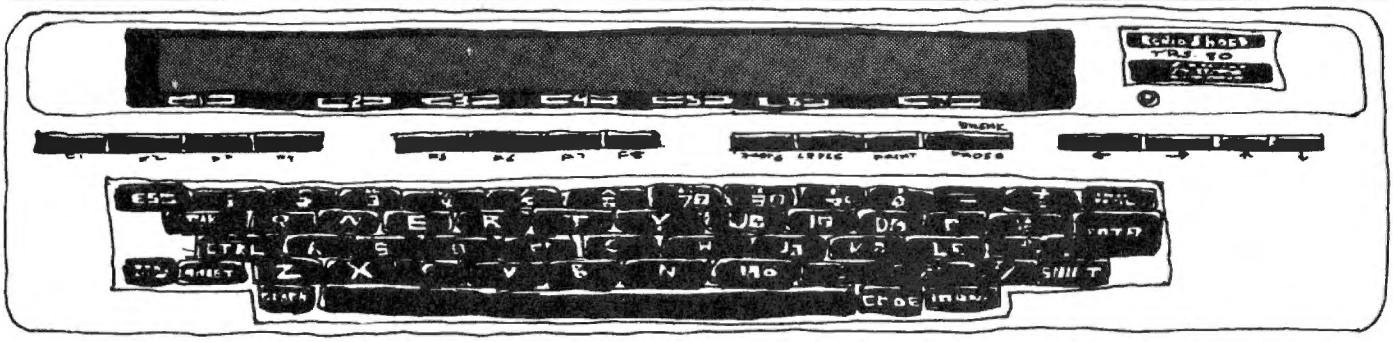
The program notes the largest number you enter and then scales down all the other numbers so the bars displayed are in proportion to each other.

I arbitrarily set a limit of 10 million units. If you have more than 10 million of something in any one month, you might represent your figures with decimals, for example, 300.200000 representing three hundred million, two hundred thousand. ■

Write to Richard Ramella at 1493 Mountain View Ave., Chico, CA 95926.

Program Listing 5. The Year in Review.

```
100 REM * Bar Graph * TRS-80 Model 100
8K * Richard Ramella
110 CLS
120 CLEAR 200
130 DIM B(12),B$(12)
140 DATA Jan., Feb., Mar., Apr., May.,
June., July., Aug., Sept., Oct., Nov.,
Dec.
150 FOR A=1 TO 12
160 READ B$(A)
170 NEXT A
180 M$=
"janfebmaraprmayjunjulaugsepoctnovdec"
190 PRINT "Enter title in 40 or fewer
characters"
200 INPUT A$
210 IF LEN(A$)>40 THEN PRINT "Title"LEN(
A$)-40"character too long. Try again?":
GOTO 190
220 CLS
230 FOR A=1 TO 12
240 PRINT B$(A)" figure";
250 INPUT B(A)
260 IF B(A)>10000000 THEN PRINT "I'm
sorry.  I only accept numbers up to 10
million (10000000)...": END
270 IF B(A)>Z THEN Z=B(A)
280 NEXT A
290 CLS
300 IF Z>1000000 THEN G=200000:
Z$="millions": ELSE IF Z>100000 THEN
G=20000: Z$="100 thous." ELSE IF Z>10000
THEN G=2000: Z$="10 thous." ELSE IF Z>
1000 THEN G=200: Z$="thousands" ELSE IF
Z>100 THEN G=20: Z$="hundreds" ELSE G=2:
Z$="tens"
310 FOR A=1 TO 12
320 B(A)=B(A)/G
330 NEXT A
340 PRINT @ 240,"incr:"Z$;
350 C=1
360 PRINT @ 0,A$
370 PRINT @ 216,"j f m a m j j a s o n d
";
380 PRINT @ 256,"a e a p a u u u e c o e
";
390 PRINT @ 296,"n b r r y n l g p t v c
";
400 T=92
410 F=13
420 FOR W=92 TO 238 STEP 2
430 PSET(W,F)
440 NEXT W
450 FOR W=13 TO 63
460 PSET(T,W)
470 IF L=0 OR L/5=INT(L/5) THEN FOR Q=T
TO T-3 STEP -1: PSET(Q,W): NEXT Q
480 L=L+1
490 NEXT W
500 C=1
510 FOR A=102 TO 242 STEP 12
520 FOR B=63 TO 63-B(C) STEP -1
530 FOR D=A TO A+4
540 PSET(D,B)
550 NEXT D
560 NEXT B
570 C=C+1
580 NEXT A
590 PRINT @ 80,SPACE$(14);
600 PRINT @ 80,"";
610 PRINT "month..."
620 L=0
630 INPUT R$
640 PRINT @ 80,SPACE$(14);
650 PRINT @ 120,SPACE$(14);
660 FOR A=1 TO 34 STEP 3
670 L=L+1
680 IF R$=MID$(M$,A,3) THEN PRINT @
80,R$;: PRINT @ 120,B(L)*G;: GOTO 700
690 NEXT A
700 IF INKEY$<>"" THEN PRINT @ 80,SPACE$
(14);: PRINT @ 120,SPACE$(14);: GOTO 590
ELSE 700
710 END
```



Nothing's Perfect

by Ken Barbier

Ah, the benefits of the Model 100: optional 24K bytes of battery back-up RAM, RS-232 serial port, built-in text editor, built-in modem, ability to upload into a larger computer, full-size keyboard, and so easy to carry. But does the computer have any flaws?

Run Speed

I keyed a little benchmark program calculating the cosine of one 240 times (Program Listing 6) into the 100, and got what I thought was a dead computer. It wasn't dead, but it was slow. It took 28 seconds to run a benchmark that takes less than four seconds on my 4 MHz Z80 homebuilt computer, and seven seconds on a TRS-80 Model I.

The 100 Basic computer functions in 14-digit double-precision calculations, and while that provides precise answers, it does not provide speed. Patching the benchmark program to force the variable X to single precision, and the counter I to integer produced a result 28 seconds later with six digits, not 14.

Manual Oversights

I spotted a couple of weaknesses in the generally excellent 100 user's manual. The Call statements in the sample programs on pp. 149, 199, and 201 reference machine-language subroutines contained in the Model 100 PROM. Call is documented, but PROM isn't.

The manual doesn't mention that the maximum number of files is limited to the 20 files displayed at sign-on. If you ask Text to create a twenty-first file, you get a beep and another "File to Edit?" prompt, not a warning that the directory is full.

The sample program on p. 199 uses the Basic PRINT@ function without fully explaining it. The inference you must draw is that PRINT 40 causes the next display to start 40 positions from the screen's first character spot.

The Basic initial program load function (IPL) lets you preset the computer to load and execute a program the next time you turn on the computer. But if you don't have Basic loaded when you turn the computer off, it powers up the menu instead of your IPL program.

If you ever turn the microcomputer off during the execution of a program, the program resumes once you restore power. This is handy if you use the 100 with an unattended controller of data-acquisition device powered from the optional ac adapter, but the user's manual unfortunately doesn't ever tell you this happens.

```
10 PRINT "Rickard Cosine Benchmark"
20 PRINT "START ";TIME$
30 BEEP
40 FOR I=1 TO 240
50 X=COS(1.0)
60 NEXT
70 BEEP
80 PRINT "STOP  ";TIME$
90 PRINT X
100 INPUT A$
110 MENU
```

Program Listing 6. Benchmark program.

Terminal Hang-ups

Don't use shortcuts with Telecom in the TERM mode. If you try to step through the procedures for calling another computer on the telephone without actually connecting the modem cable to the phone, you end up in limbo as soon as you press the TERM mode key. The computer is waiting to hear the modem tone from the other end of the phone link before it updates the function key display to that shown on p. 81 of the manual.

Try a dry run before you call another computer. Switch your Model 100 from ORIG to ANS (find the switch on the left) before stepping through the TERM procedures. This makes your computer act like the called machine instead of the caller, and you hear the modem tone as soon as you enter TERM. The computer hangs up at this point, since it's waiting for a call.

Use STAT to change from the modem operation to the RS-232 port to make a dry run all the way through the TERM mode. Enter STAT and key in 88NID. You can then fake an upload of a file from your computer through the serial port, even though there's nothing at the other end.

The computer remembers the STAT assignment, and won't revert to the modem port the next time you power up. Use STAT and the manual's table on p. 85 to restore modem operation.

The RS-232 Port

You can't connect a standard RS-232 data cable to the 100 because the cutout in the computer's case is too small to accommodate the connector shell. Worse, the serial port doesn't conform to RS-232 standard.

A table on p. 205 of the documentation implies that the Model 100 serial port uses the data send and receive signals on pins 2 and 3, and the handshaking signals on RS-232 connector pins 4, 5, 6, and 20. Unfortunately, the computer ignores the handshaking signals.

The Model 100 is configured as a terminal device (DTE) to be connected to a communications device (DCE). A DTE should assert the handshake line Data Terminal Ready (DTR, pin 20) when it is powered up, and Ready To Send (RTS, pin 4) when it wants to talk to the DCE.

Similarly, the communications device on the other end of the RS-232 cable (such as a modem), asserts Data Set Ready (DSR, pin 6) when the machine is turned on, and Clear To Send (CTS, pin 5) when it is ready to accept data. The DTE (Model 100, in this case), should stop sending data if the DCE is not ready (DSR, Not True), or is busy (CTS, Not Ready). The Model 100, however, ignores both DSR and CTS.

The 100 always asserts DTR when in the TERM mode, and does not use RTS at all. When the computer is used to upload

files to, or to download files from, another computer at higher baud rates, data can be lost.

I can connect the serial port to my big computer and upload text files to it at 9600 baud (see Sidebar: "Uploading Text to WordStar"), or I can use the Model 100 as a full duplex terminal on the other computer if I don't exceed a 300 baud rate. If I run at higher data rates, the Model 100 screen scroll takes too long, and data from my big computer to Model 100-as-terminal is lost.

If I hook up my Olympia daisy wheel typewriter/printer to the serial port of the Model 100 to use it as a 300 baud letter-quality printer, the 100 ignores the DSR signal, and sends data faster than the printer can print, garbaging the printout.

The Up-Side

The Model 100 is perfect for remote sites: programmers working in any language can use the 100 to key in, edit, and store their source programs wherever they are. The 14 digits of double-precision accuracy top the accuracy of the single-precision functions of other computers.

If you live in an area with power interruptions, you can avoid computer glitching by keying in text with the 100 running on batteries. The built-in calendar clock and modem provide numerous remote controller possibilities. ■

Ken Barbier can be reached at P.O. Box 1253, Borrego Springs, CA 92004.

Uploading Text to WordStar

The TRS-80 Model 100 built-in text editor, Text, stores data in document files (.DO) in a format incompatible with larger microcomputers running WordStar under CP/M. I had to find a simple method to upload Text files to WordStar.

If the Model 100 Telcom facility is used to upload files, it demands that you tell it how long a text line should be, and inserts hard carriage return (CR) characters into the text at the end of each line as the data is uploaded to the target computer (or modem, or printer).

WordStar, on the other hand, inserts soft end-of-lines consisting of a carriage return character (0DH in hexadecimal) with the eighth bit set on (8DH), followed by a line feed (LF) character (0AH). Only paragraph ends are marked with standard CR, LF (0DH, 0AH) sequences in WordStar.

Since WordStar gets confused by plain text with a CR at the end of each line, but no LF, it can't be used to reformat such files. Therefore, the Model 100 Telcom program can't upload files to WordStar. To upload text from the Model 100 to my WordStar-CP/M system, I had to write UPLOAD.BA, shown in Program Listing 7.

This program takes a Text document file named by the operator and sends it out through the serial port to a host computer without inserting CRs at line ends. Paragraph breaks are sent as they exist within a Text file, with a CR and LF, which is already WordStar-compatible. The end of the text file is signaled to the host computer by the CTRL Z character (1AH).

This last special character is defined in the program (see Listing 7) in line 30. Line 40 prompts the operator for the name of the file to send, which should be entered in the form FILE.DO without quotation marks. Line 50 then opens this file as input.

Output to the serial port is established in line 60 with the baud rate set at 9600, 8 data bits, no parity, 2 stop bits, and XON/XOFF disabled (see the manual for details on setting up the serial port).

The document file is then transmitted character by character by the program loop starting at line 100. When the end of the document file is reached, a CP/M-compatible terminator (EF$, 1AH, CTRL Z) is sent to the host computer, and the Model 100 returns to the menu display.

For this output to be properly received by a CP/M computer, the Model 100 serial port has to be connected to the host computer reader device (RDR:) serial port. Since no serial port handshaking signals are recognized by the Model 100, the text has to be sent in a continuous block.

To receive an uninterruptible input through the RDR:, the host computer inputs and buffers the text from the start to the end-of-file character, before writing it to the disk. This is accomplished under CP/M by instructing the Peripheral Interchange Program (PIP) to create a disk file consisting of reader device input buffered in memory until the end-of-file is received:

```
PIP TEXT.DOC=RDR:[B]
```

Once Text.DOC (or whatever file name you chose on the receive end) has been written to the disk by PIP, WordStar can then reformat the file and insert its own soft end-of-line characters. Invoke WordStar, select Text.DOC as a document file, and execute the WordStar global reformat with the command sequence:

```
CTRL Q, Q, CTRL B
```

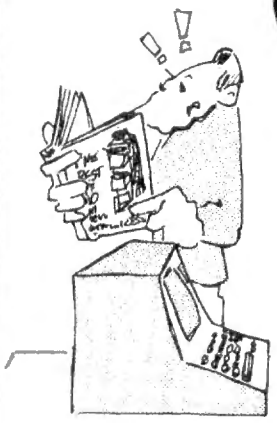
What started as a Model 100 Text file is now a WordStar-compatible document file.

A similar technique can be used to upload Text files to other word processors running under other operating systems. ■

```
 10 PRINT "TRS-80 Model 100 TEXT to WordStar"
 20 MAXFILES=2
 30 EF$=CHR$(26)
 40 INPUT "File to send:";FI$
 50 OPEN FI$ FOR INPUT AS 1
 60 OPEN "COM:88N2D" FOR OUTPUT AS 2
100 A$=INPUT$(1,1)
110 PRINT #2,A$;
120 IF EOF(1) THEN GOTO 1000
130 GOTO 100
1000 PRINT #2,EF$
1010 MENU
```

Program Listing 7. This program permits uploading Model 100 Text files to a host computer running WordStar under CP/M.

THE REST OF 80



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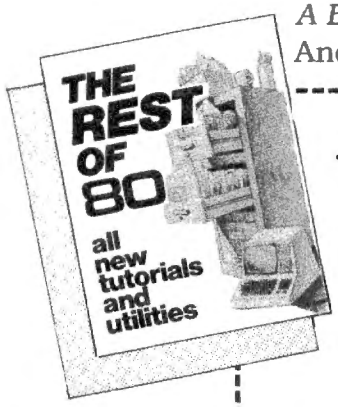

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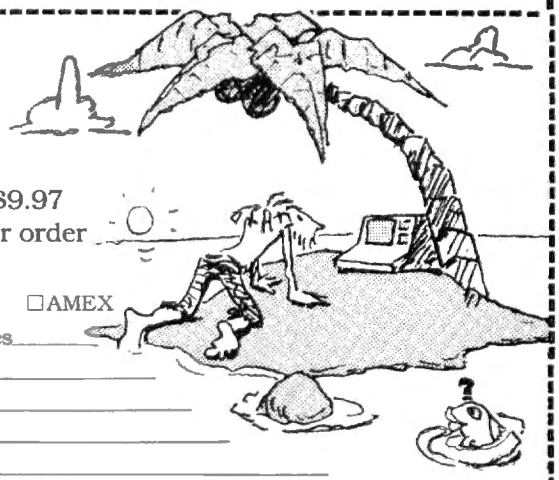

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Collegiate Capers

by Christopher Skapura

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Variable	Function
AB	Psychology lab flag
AL	Amount of alcohol in system
BA	Check if given psychology magazine
BO	Paid tuition flag
CM	Chemistry pass/fail check
CT	Count of items carried
C2	Item sort counter
DH	Frat house check
DN	College dean's mood
EX	Exchange book for I.D.
EN	English pass/fail check
E2	Exchange I.D. for book
FA	Financial aid flag
FM	Financial aid form complete
GT	Grade transcript check
IB	Inkblot check
MF	Manila folder/dean check
MN	Amount of money left
NM$	Character's name
NU	Concatenated input
PE	Phys. ed. pass/fail check
RR$(37)	Items in university
P$(26)	Location
PL	Location flag
P1$(26)	Obvious exits
PR	Opponent
Q	For. . . Next counter
QQ	Temporary variable
QS	Temporary variable
RE$	Input response
RG	Registration table flag
RS%(37,26)	Item, place array
SC	Present score
SI	Registered student flag
ST	Equipment theft check
TR$(8)	Array of items
TT	Specific item flag
U	For. . . Next counter
YN	Yes/No response

Table 1. Variables List

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Type "Look around" to get a description of your surroundings. "Inventory" or "Inv" produces a list of your supplies, and tells you if you're a freshman, sophomore, junior, or senior.

A few red herrings are included in the game. As in life, not everything is important to your goals.

How It Works

A 37- by 26-element array manipulates objects in the program. Specifically, 37 objects are spread out over 26 locations. If you get an object in location 10 (PL = 10) and drop it in location 12 (PL = 12), the array is changed to make the elements RS(36,10) equal zero

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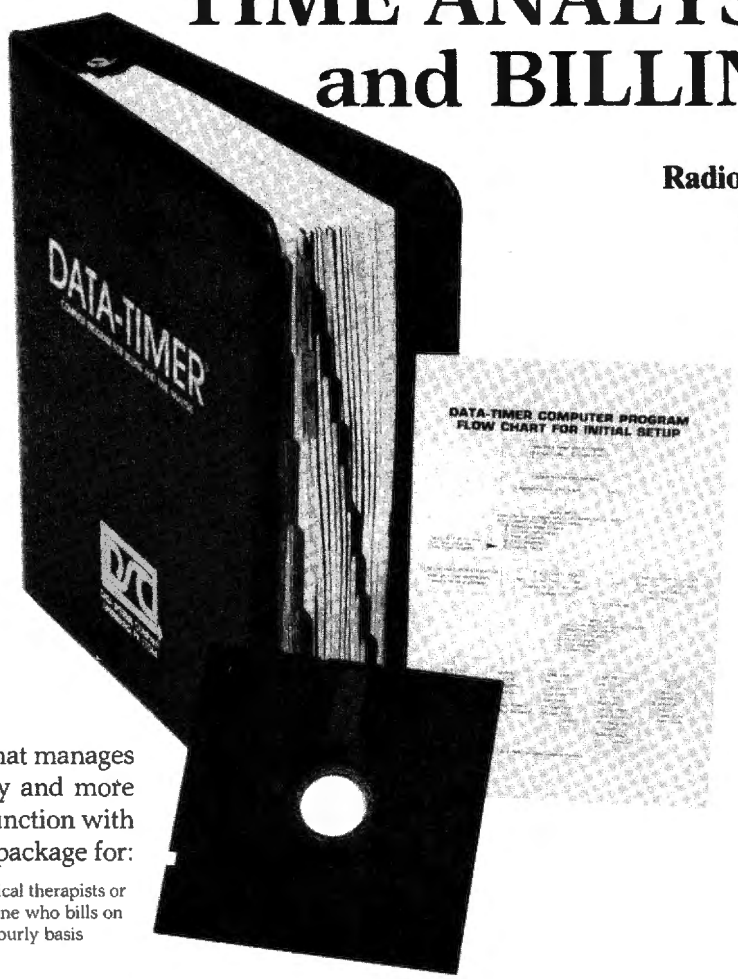

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Program Listing

```
0 CLS:INPUT"DO YOU WANT DIRECTIONS?";RE$:IFLEFT$(RE$,1)="Y"THENG
OSUB40000
1 CLS:PRINT"INTITIALIZING ...":CLEAR(250):RANDOM:CT=1:DIMRR$(37)
,P$(26),P1$(26),P2$(26),RS%(37,26),TR$(8):PL=1:GOTO32
2 FORQ=1TO750:NEXT:RETURN
3 FORQ=1TO1500:NEXT:RETURN
6 GEN=RND(6)+RND(6)+RND(6):RETURN
32 FORQ=1TO2:RS%(Q,2)=1:NEXT:FORQ=3TO5:RS%(Q,3)=1:NEXT:FORQ=5TO6
:RS%(6,Q)=1:NEXT:FORQ=10TO11:RS%(6,Q)=1:NEXT:RS%(6,14)=1:RS%(6,1
5)=1:RS%(6,18)=1:RS%(6,21)=1:RS%(6,24)=1:RS%(7,7)=1:RS%(8,8)=1
33 FORQ=9TO11:RS%(Q,11)=1:NEXT:FORQ=12TO14:RS%(Q,12)=1:NEXT:RS%(
15,13)=1
34 RS%(34,17)=1:RS%(26,23)=1:FORQ=16TO18:RS%(Q,16)=1:NEXTQ:RS%(1
9,17)=1:FORQ=20TO22:RS%(Q,19)=1:NEXTQ:RS%(23,20)=1:RS%(24,22)=1:
RS%(25,23)=1:RS%(27,25)=1:RS%(28,25)=1:FORQ=29TO31:RS%(Q,26)=1:N
EXTQ
36 FORQ=1TO37:READRR$(Q):NEXTQ
37 DATAI.D. CARD TABLE,REGISTRATION TABLE,HAM SANDWICH,BUTCHER K
NIFE,NAPKIN,NOTHING,SECRETARY,BURSAR,ODDBALL PSYCHOLOGIST,MANILL
A FOLDER,INKBLOT PAPER,ROOMFULL OF STUDENTS,DESKS AND CHAIRS,CLA
SS PROCTOR,TOILET
SINK,RECEPTIONIST
38 DATADESK,BOOK,LIBRARIAN,ENGLISH PROFESSOR,CHALK,EXAM BOOKLET,
TRASH CONTAINER,RECORDS KEEPER,COLLEGE DEAN,SHEEP SKIN,PHYS ED I
NSTRUCTOR,TRACK FOR JOGGING,BLUTO,BOTTLE OF GRAIN ALCOHOL,PLEDGE
 PIN,I.D. CARD,BURSAR'S RECEIPT
39 DATAPSYCHOLOGY TODAY,PAPER,GRADE TRANSCRIPT,TRANSCRIPT RECEIP
T
40 FORQ=1TO26:READP$(Q):READP1$(Q):NEXTQ
50 DATAEDGE OF FOREST,N S,REGISTRATION HALL,N W E,CAFETERIA,W
55 DATASTAIRWELL,UP DOWN E,STAIRWELL,DOWN E,HALLWAY,N S W,FINANC
IAL AID OFFICE,W,BURSAR'S OFFICE,N,STAIRWELL,E UP DOWN,HALLWAY,N
 E S W,PSYCHOLOGY LAB,S
60 DATACHEMESTRY LAB,N,LAVATORY,S,STAIRWELL,E UP DOWN
65 DATAHALLWAY,N E S W,STUDENT UNION ROOM,S,LIBRARY,N,HALLWAY,N
W S,ENGLISH CLASSROOM,S,STAIRWELL,UP DOWN E
70 DATAHALLWAY,W E S,RECORDS OFFICE,N,COLLEGE DEAN'S OFFICE,W,ST
```

Listing continues

and RS(36,12) equal one. The one indicates that object 36 is present in location 10, and the zero indicates object 36 is not present at location 10.

The subroutine in lines 500–510 checks what is or is not in each location. Lines 32–34 set up the initial objects and locations throughout the university.

The workhorse of the program begins at line 5700. Starting here, execution goes to a subroutine at line 3000 to check certain flags, returns to line 5700, makes sure that the values of certain variables are zero, and then prompts you for a two-word command.

Depending upon the input, your location in the program, and the value of variables that you set as you proceed through the game, the program branches outward.

A list of variables is included in Table 1. Because of the program's length, I used no remark statements, and included many multi-statement lines. ■

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Listing continued

```
AIRWELL,UP E,GYMNASIUM,W,FRAT HOUSE,N
80 GOSUB5220:GOTO5720
100 PRINT:PRINT"PLACE : ":PRINT:PRINTP$(PL):PRINT:PRINT"OBVIOUS
EXITS : ";P1$(PL):PRINT:PRINT"YOU CAN SEE :":GOSUB500:RETURN
119 FORQ=1TOCT-1:IFTR$(Q)=RR$(33)THENTT=11:NEXT:RETURNELSENEXT:R
ETURN
120 FORQ=1TOCT-1:IFTR$(Q)=RR$(35)THENTT=7
121 NEXT:RETURN
122 FORQ=1TOCT-1:IFTR$(Q)=RR$(37)THENTT=8
123 NEXT:RETURN
124 FORQ=1TOCT-1:IFTR$(Q)=RR$(36)THENTT=9:RETURNELSENEXT:RETURN
125 FORQ=1TOCT-1:IFTR$(Q)="I.D. CARD"THENTT=1
126 NEXTQ:RETURN
127 FORQ=1TOCT-1:IFTR$(Q)=RR$(10)THENTT=2
130 NEXTQ:RETURN
132 FORQ=1TOCT-1:IFTR$(Q)=RR$(34)THENTT=3
133 NEXT:RETURN
135 FORQ=1TOCT-1:IFTR$(Q)=RR$(18)THENTT=4
136 NEXT:RETURN
137 FORQ=1TOCT-1:IFTR$(Q)=RR$(31)THENTT=5
138 NEXT:RETURN
139 FORQ=1TOCT-1:IFTR$(Q)=RR$(30)THENTT=6:NEXT:RETURNELSENEXT:RE
TURN
140 PRINT"DON'T BE RIDICULOUS!":GOTO5700
200 IFSI<-100THENRG=1:RETURNELSERG=2:RETURN
290 IFPL=28THENQ=1:RETURNELSERETURN
400 PRINT:PRINT"THE ";RR$(PR);" SEES THAT YOU DON'T HAVE STUDENT
 IDENTIFICATION!":GOSUB2:PRINT"YOU ARE FIRMLY LED OUTSIDE OF THE
 UNIVERSITY":GOTO30000
405 PRINT"THE ";RR$(PR);" SEES THAT YOU ARE":PRINT"FIRMLY LED OU
T OF THE UNIVERSITY!":PRINT"YOU LOSE!!":GOTO30000
500 IFPL=1PRINT"THE UNIVERSITY ENTRANCE IS TO THE SOUTH AND THE
FOREST TO NORTH":RETURN
501 IFPL=17ANDAB=0THENFORQ=1TO33:IFRS%(Q,PL)=1THENPRINTRR$(Q):NE
XTELSENEXT
502 IFPL<>17THENFORQ=1TO37:IFRS%(Q,PL)=1THENPRINTRR$(Q):NEXTELSE
 NEXT
503 IFPL=17ANDAB=0THENFORQ=35TO37:IFRS%(Q,PL)=1THENPRINTRR$(Q):N
EXTELSENEXT
505 IFPL=12ANDCM=0PRINT:PRINT"THE PROCTER RUSHES UP TO YOU AS YO
U ENTER THE ROOM AND":PRINT"SAYS 'HURRY, HURRY! THE CHEMISTRY TE
ST IS ABOUT TO START!":PRINT"QUICKLY TAKE A SEAT!'"
507 IFPL=19ANDEN=0PRINT:PRINT"THE ";RR$(20);" TELLS YOU TO SIT":
PRINT"DOWN AND PREPARE FOR THE ENGLISH TEST."
508 IFPL=26ANDAL=2PRINT"BLUTO SAYS, 'IF YOU TAKE JUST ONE MORE S
LUG OF THAT ALCOHOL,":PRINT"MAYBE I CAN GIVE YOU SOMETHING..."
510 RETURN
600 IFCM<>100PRINT:PRINT"YOU OPEN UP THE TEST BOOKLET AND BEGIN
THE TEST...":GOSUB3
605 IFCM=100PRINT"YOU HAVE ALREADY TAKEN THE TEST, ";NM$:GOTO570
0
610 IFCM<>100THENCM=100:IFDH=100THENPRINT"WITH THE HELP OF THE C
HEAT SHEET, YOU BREEZE THROUGH THE":PRINT"TEST WITH NO PROBLEMS!
":CA=100:PRINT"YOU TURN IN YOUR TEST FORM AND RECEIVE AN 'A+' ON
 IT!":SC=SC+10:GOTO5700
620 IFDH<>100PRINT"THE ENTIRE TEST APPEARS TO BE WRITTEN IN A FO
RIEGN LANGUAGE!":GOSUB3:PRINT"YOU SPEND THE ALOTTED TIME ON THE
TEST BUT CAN'T":PRINT"ANSWER EVEN ONE QUESTION! YOU FAIL MISERAB
LY!":GOSUB3:PRINT"YOU ARE EXPELLED FROM THE UNIVERSITY!":GOTO300
00
700 IFBO=100ANDEX=0PRINT"THE ";RR$(16);" SAYS SHE NEEDS":PRINT"T
O HOLD YOUR STUDENT IDENTIFICATION IN EXCHANGE FOR THE BOOK.":GO
TO5700
710 IFBO<>100PRINT"THE ";RR$(16);" SAYS YOU MUST":PRINT"BE A REG
ISTERED STUDENT BEFORE SHE CAN HELP YOU.":GOTO5700
720 IFEX=100ANDBO=100ANDRS%(18,16)=1THENPRINT"THE ";RR$(16);" LE
TS YOU TAKE THE BOOK.":GOTO11030
730 IFBO=100ANDEX<>100ANDRS%(32,16)=1THENRE$=RR$(32):GOTO11030
735 IFE2=0ANDRE$=RR$(32)THENPRINT"THE ";RR$(16);" SAYS SHE WILL
EXCHANGE YOUR":PRINTRR$(32);" FOR THE BOOK.":GOTO5700
740 IFE2=100ANDRE$=RR$(32)PRINT"THE ";RR$(16);" GIVES YOU YOUR "
;RR$(32):EX=0:E2=0:GOTO11030
800 IFPL=2PRINT"YOU COMPLETE THE FORM. WHEN YOU HAND IT BACK":PR
INT"TO THE RECEPTIONIST, SHE SLIDES A PLASTIC CARD WITH STRANGE"
:PRINT"NUMBERS ON IT AT YOU.":FM=1:GOTO5700
805 RE$=RIGHT$(RE$,NU):GOSUB9000:IFPL=7ANDFA=0AND(RE$="FORMS"ORR
E$="FORM")THENPRINT"IT TAKES A WHILE":GOSUB2:PRINT"BUT YOU COMPL
ETE THEM!":PRINT"THE ";RR$(7);" GIVES YOU 2100 DOLLARS FOR YOUR
TUITION!":MN=MN+2100:FA=100:GOTO5720
807 IFPL=7ANDFA=100PRINT"YOU'VE ALREADY GOTTEN FINANCIAL AID!":G
OTO5720
810 IFPL=12ANDRE$="TEST"THEN600
899 PRINT"NO RESPONSE":GOTO5720
900 IFAL=0PRINT"AS YOU REACH FOR THE ";RR$(31);", BLUTO DROPS HI
S HAND":PRINT"OVER IT AND SAYS, 'NOT SO FAST! WE DON'T LET JUST
ANYONE PLEDGE":PRINT"DELTA HOUSE!'":PRINT:GOSUB3:PRINT"'FIRST YO
```

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```
U HAVE TO PROVE YOU'VE GOT WHAT IT TAKES!'":GOSUB3
910 IFAL=0PRINT:PRINT"BLUTO POINTS AT THE ";RR$(30);" AND":PRINT
"SAYS, 'CHUG IT.'":GOTO5700
920 IFAL=1PRINT"BLUTO SAYS, 'YOU CAN DO BETTER THAN THAT, CAN'T
YA?":PRINT"DRINK SOME MORE!":GOTO5700
930 IFAL=>2PRINT"'THATS THE SPIRIT,' BLUTO SAYS. 'GO AHEAD AND T
AKE THE PLEDGE":PRINT"PIN!'":RE$=RR$(31):GOSUB3:GOTO11030
999 PRINT"GET WHAT?":GOTO5700
1000 GOSUB9000:RE$=RIGHT$(RE$,NU)
1005 IFPL=2ANDFM<>100ANDRE$="FORM"PRINT"THE FORM IS TITLED 'STUD
ENT I.D. APPLICATION FORM":PRINT"AND ASKS FOR YOUR NAME, SEX AND
 AGE.":GOTO5700
1010 IFRE$=RR$(10)THENGOSUB127:IFTT=2PRINT"INSIDE THE ";RR$(10);
" IS A ANALYSIS OF THE COLLEGE DEAN!":PRINT:PRINT"THE REPORT CON
CLUDES THAT 'THE SUBJECT":PRINT"HAS STRONG DELUSIONS OF GRANDEUR
 AND EXHIBITS":PRINT"SCHIZOPHRENIC TENDENCIES."
1012 IFRE$=RR$(10)ANDTT=2PRINT:PRINT"HE ALSO HAS DISPLAYED TO TH
IS PSYCHOLOGIST A HIGHLY":PRINT"IRRATIONAL FEAR OF THESE CONCLUS
IONS BEING MADE PUBLIC.":GOTO5700
1015 IFRE$=RR$(10)THENGOSUB127:IFTT<>2THENPRINT"YOU HAVE TO GET
THE ";RR$(10);" BEFORE":PRINT"YOU CAN READ IT.":GOTO5700
1020 IFRE$=RR$(34)THENGOSUB132:IFTT=3THENPRINT"THE ";RE$;" IS FI
LLED WITH":PRINT"INCOMPREHENSIBLE, PSUEDO-SCIENTIFIC JARGON.":GO
TO5700
1025 IFPL=12ANDRE$="TEST"THENGOTO600
1030 IFRE$=RR$(18)GOSUB135:IFTT=4THENPRINT:PRINT"THE BOOK IS ENT
ITLED 'THE ROAD TO COMMENCEMENT'":GOSUB3:PRINT"IT LISTS THE FOLL
OWING STEPS TO ACHIEVE A":PRINT"LEVEL OF POWER TERMED 'GRADUATIO
N.":GOSUB3:PRINTTAB(10)"1. GET I.D. CARD AND REGISTER FOR CLASSE
S."
1035 IFRE$=RR$(18)ANDTT=4PRINTTAB(10)"2. PAY TUITION.":PRINTTAB(
10)"3. ACHIEVE PASSING GRADE IN ENGLISH, CHEMISTRY AND":PRINTTAB
(14)"PHYSCICAL EDUCATION.":PRINTTAB(10)"4. GET GRADE TRANSCRIPT.
":PRINTTAB(10)"5. TAKE PAPERWORK TO COLLEGE DEAN."
1040 IFRE$=RR$(18)ANDTT=4PRINTTAB(10)"6. HOPE COLLEGE DEAN IS I
N GOOD MOOD.":GOSUB3:GOTO5700
1042 IFRE$=RR$(18)GOSUB135:IFTT<>4PRINT"MAYBE YOU SHOULD GET IT
FIRST!":GOTO5700
1045 IFRE$=RR$(35)GOSUB120:IFTT=7THENPRINT"THE PAPER IS A CHEAT-
SHEET WITH":PRINT"ALL THE ANSWERS TO THE CHEMISTRY TEST ON IT!":
GOTO5700
1099 PRINT"THERE'S NOTHING HERE TO READ, ";NM$;".":GOTO5700
1500 PRINT"YOU'VE ALREADY COMPLETED YOUR BUSINESS THERE! MOVE AL
ONG!":GOTO5720
1525 GOSUB9000
1530 RE$=RIGHT$(RE$,NUM):IFPL=2AND(RE$="PLASTIC CARD"ORRE$="CARD
"ORRE$="I.D. CARD")THENGOSUB125:IFTT=1THENPRINT"THE CLERK GLANCE
S AT THE ";RE$;", WRITES,":PRINT"YOUR NAME DOWN ON A SHEET AND S
AYS 'REGISTRATION COMPLETE!":SI=-1000:GOTO5720ELSEGOTO2900
1532 IFPL=11GOSUB125:IFTT<>1PRINT"YOU DON'T HAVE A ";RR$(32):GOT
O5700
1534 IFRE$=RR$(32)GOSUB125:IFTT<>1PRINT"YOU DON'T HAVE A ";RR$(3
2):GOTO5700
1535 IFPL=11ANDOB<>100PRINT"THE ";RR$(9);" CHECKS HIS RECORDS":P
RINT"AND SAYS 'I'M SORRY, YOU MUST PAY YOUR TUITION BEFORE I CAN
":PRINT"HELP YOU!":GOTO5700
1540 IFPL=7AND(RE$="CARD"ORRE$="PLASTIC CARD"ORRE$=RR$(32))THENG
OSUB125:IFTT=1PRINT"THE ";RR$(7);" CROSS-REFERENCES YOUR CARD WI
TH HER RECORDS."ELSEPR=7:GOTO400
1545 IFPL=7ANDSI<-100PRINT"THE ";RR$(7);" SLIDES A THICK STACK O
F FORMS TO YOU.":GOTO5700ELSEIFPL=7ANDSI>=-100PRINT"THE ";RR$(7)
;" SAYS THAT YOU ARE NOT A REGISTERED STUDENT!":PR=7:GOTO405
1550 IFPL=23ANDRE$=RR$(32)PRINT"THE ";RR$(25);" SAYS, 'THATS NOT
":PRINT"GOOD ENOUGH, CHUMP!":GOSUB2:PRINT"GIVE IT TO ME!":GOTO57
00
1555 IFPL=23ANDRE$=RR$(33)PRINT"THE ";RR$(25);"'S HAND SHOOTS OU
T":PRINT"AND HE SAYS 'LET ME SEE THAT!":GOTO5700
1557 IFPL=23ANDRE$=RR$(37)THENPRINT"'GIVE IT TO ME, CHUMP!'":GOT
O5700
1560 IFPL=23ANDRE$=RR$(10)THENGOSUB127:IFTT=2PRINT"THE ";RR$(25)
;"'S FACE TURNS PALE!":GOSUB3:PRINT"HE SAYS : 'LOOK, I WILL BE F
AIR WITH YOU! IF ALL OF":PRINT"YOUR RECORDS ARE STRAIGHT, YOU CA
N HAVE THE DIPLOMA!":MF=100:GOTO5700
1599 PRINT"YOU SHOW IT BUT NOTHING HAPPENS.":GOTO5700
1600 IFPL<>2THEN PRINT"NO RESPONSE":GOTO5700
2200 FORQ=1TOCT:IFTR$(Q)=RR$(34)THENAB=100:NEXTELSENEXT
2202 IFPL=11ANDBA=500THENRE$=RR$(10):SC=SC+5:GOTO11030
2205 IFAB<>100PRINT"THE ";RR$(9);" STOPS YOU AS YOU":PRINT"REACH
 FOR THE ";RR$(10);" AND SAYS,":PRINT"THAT IS A CONFIDENTIAL FIL
E! I CAN'T LET YOU SEE IT":GOSUB2:PRINT"UNLESS ...":GOSUB2:PRINT
"YOU BRING ME A COPY OF THE MAGAZINE 'PSYCHOLOGY TODAY'"
2210 IFPL=11ANDAB<>100THEN5700
2230 IFPL=11ANDAB=100ANDBA<>500PRINT"THE ";RR$(9);"SAYS 'FIRST G
IVE ME THE MAGAZINE!":GOTO5700
2240 IFPL=11ANDBA=500THENRE$=RR$(10):SC=SC+5:GOTO11030
2500 GOSUB9000:RE$=RIGHT$(RE$,NU):IFPL=7ANDLEFT$(RE$,1)="Y"THEN2
550
```

Listing continues

Listing continued

```
2505 IFPL=7THEN10050
2510 IFPL=8THEN10075
2515 IFPL=11ANDIB=1PRINT"THE PSYCHOLOGIST MUMBLES APPROVINGLY AT
 YOUR RESPONSE":PRINT"AND HE SHOWS YOU ANOTHER INBLOT. 'AND THIS
 ONE?'":IB=2:GOTO5700
2517 IFPL=11ANDIB=2PRINT"'INTERESTING, INTERESTING. aND WHAT DO
YOU THINK OF THIS ONE?":IB=3:GOTO5700
2520 IFPL=11ANDIB=3PRINT"THE ";RR$(9);" FROWNS DISAPPOINTEDLY AN
D SAYS, 'ALAS, ":PRINT"YOU APPEAR RELATIVELY NORMAL. YOU HAVE NO
 NEED FOR THERAPY.'":IB=4:GOTO5700
2549 PRINT"NO RESPONSE":GOTO5720
2550 PRINT"THE ";RR$(7);" NODS HAPPILY AND ASKS TO SEE":PRINT"YO
UR STUDENT IDENTIFICATION.":PR=7:GOSUB125:IFTT=1THEN5700ELSE400
2600 PRINT"THE ";RR$(7);" GIVES YOU A THICK STACK OF FORMS TO CO
MPLETE":GOTO5700
2610 GOSUB9000:RE$=RIGHT$(RE$,NU):IFPL=8ANDMN>=2000ANDRE$="TUITI
ON"ANDBO<>100THENMN=MN-2000:PRINT"THE ";RR$(8);" TAKES YOUR MONE
Y AND SLIDES YOU A RECIEPT.":RS%(33,8)=1:BO=100:GOTO5700
2615 IFPL=22ANDMN>=10THENGOTO2700ELSEIFPL=22ANDMN<10PRINT"YOU DO
N'T HAVE ENOUGH MONEY TO DO THAT!":GOTO5700
2620 GOSUB3300:IFYN=100THEN5700ELSEIFPL=8AND(RE$="10 DOLLARS"ORR
E$="FOR GRADE TRANSCRIPT"ORRE$="FOR GRADE TRANSCRIPTS"ORRE$=RR$(
36)ORRE$="TRANSCRIPT FEE")THENPRINT"THE BURSAR SLIDES YOU A RECE
IPT.":RS%(37,8)=1:MN=MN-10:GT=1:SC=SC+7:GOTO5700
2625 PRINT"PAY WHAT, ";NM$;"?"
2630 GOTO5720
2700 PRINT"THE ";RR$(24);" SHAKES HER HEAD AND":PRINT"SAYS 'YOU
HAVE TO PAY FOR THE TRANSCRIPT AT THE BURSAR'S":PRINT"OFFICE. GE
T A transcript receipt FOR IT AND BRING IT BACK HERE":PRINT"AND
THEN I CAN LET YOU HAVE THE ";RR$(36):GOTO5700
2900 IFSI>1PRINT"THE CLERK YELLS, 'THIS PERSON IS NOT COOPERATIN
G! EXPEL HIM!"GOTO13800ELSEGOTO5700
2975 C2=1:FORQ=1TOCT-1
2980 IFTR$(Q)=""THENC2=C2ELSETR$(C2)=TR$(Q):C2=C2+1
2985 NEXT:CT=C2:FORQ=CTTO8:TR$(Q)="":NEXT:RETURN
3000 ST=0:IFAL=0RETURN
3005 FORQ=1TOCT-1:IFTR$(Q)=RR$(35)THENDH=100:NEXTELSENEXT
3010 IFAL>2Q=RND(10):IFQ=3CLS:PRINTCHR$(23)"YOU PASS OUT
FROM TOO
MUCH ALCOHOL!!!":GOSUB3:CLS:AL=1:Q=RND(CT-1):IFQ=0THEN5700ELSERE
$=TR$(Q):TR$(Q)="":FORU=1TO37:IFRE$=RR$(U)THENQQ=U:GOTO3090ELSEN
EXT
3020 IFST=1PRINT"WHEN YOU AWAKEN, YOU DISCOVER THAT SOME OF YOUR
":PRINT"EQUIPMENT HAS BEEN STOLEN!":GOSUB3:AL=1:ST=0:SC=SC+3:RET
URN
3050 RETURN
3089 PRINT"GLITCH.":GOTO5700
3090 IFQQ=0THEN5700
3095 Q=RND(26):QH=Q:RS%(QQ,Q)=1:ST=1:GOTO3020
3100 IFBO<>100PRINT"YOU HAVE TO PAY YOUR TUITION FIRST!":GOTO570
0
3105 IFGT=0AND(EN<3ORPE<>100ORCM<>100)PRINT"YOU HAVE TO FINISH T
HE ENTIRE CURRICULA FIRST!":GOTO5700
3110 IFGT=0PRINT"THE ";RR$(24);" SAYS 'THAT COSTS":PRINT"10 DOLL
ARS FOR THAT!'":GOTO5700
3115 IFGT<>100PRINT"THE ";RR$(24);" SAYS 'GIVE ME THE ";RR$(37):
GOTO5700
3120 IFGT=100PRINT"THE ";RR$(24);" GIVES YOU THE ";RR$(36):RS%(3
6,22)=1:RE$=RR$(36):GT=500:SC=SC+3:GOTO11030
3149 PRINT"GET WHAT?":GOTO5700
3300 IFMN<10ANDPL=8AND(RE$="10 DOLLARS"ORRE$="FOR GRADE TRANSCRI
PT"ORRE$="FOR GRADE TRANSCRIPTS"ORRE$=RR$(36)ORRE$="TRANSCRIPT")
PRINT"YOU DON'T HAVE THAT MUCH MONEY!":GOSUB2:YN=100
3305 IFGT=1PRINT"YOU ALREADY DID THAT!":YN=100:RETURN
3310 RETURN
3400 IFCT>5PRINT"DROP SOMETHING FIRST!!!":QQ=100
3410 RETURN
3500 IFDN=0THENPRINT"THE ";RR$(25);" CHUCKLES. 'HEH HEH!":PRINT"
YOU DIDN'T THINK IT'D BE THAT EASY, DIDJA?'":GOSUB3
3505 IFBO<>100PRINT"YOU HAVEN'T EVEN PAID YOUR TUITION YET!":GOT
O5700
3510 GOSUB3:PRINT:IFCM=100ANDEN>=3ANDPE=100THEN3520ELSEPRINT"YOU
 HAVEN'T EVEN GONE THROUGH THE CURRICULA YET!!!":GOTO5700
3520 IFDN=0PRINT"'FIRST OF ALL, LET ME SEE YOUR STUDENT IDENTIFI
CATION!":GOTO5700
3530 IFDN=1PRINT"NOW GIVE ME YOUR GRADE TRANSCRIPT!":GOTO5700
3540 IFDN=2PRINT"AGAIN THE DEAN STANDS IN YOUR WAY!":GOSUB3:PRIN
T::PRINT"'HMM...WE SEEM TO HAVE TEMPORARILLY LOST YOUR RECORDS!"
:GOSUB3:PRINT"DO YOU HAVE ANY PROOF THAT YOU PAID YOUR TUITION?"
:GOTO5700
3550 IFDN>2ANDMF=0PRINT"THE ";RR$(25);" FROWNS DISGUSTEDLY.":GOS
UB3:PRINT"HE SAYS 'I DON'T LIKE YOUR FACE!":PRINT:GOSUB2:PRINT"Y
OU'VE GOT ALL THE PAPERWORK, BUT I'M NOT GOING":PRINT"TO GIVE YO
U THE DIPLOMA!":GOSUB3:PRINT"TOUGH LUCK, KIDDO! HEH, HEH":GOTO57
00
3555 IFDN>2ANDMF=100PRINT"MUMBLING ANGRILY, THE ";RR$(25):PRINT"
STANDS ASIDE AND SAYS, 'TAKE IT, THEN!'":RE$=RR$(26):PRINT"'YOU
HAVE WON ...":SC=SC+50:GOTO11030
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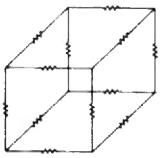

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™TRS80 color

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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```
3599 PRINT"GET WHAT?":GOTO5700
3600 CLS:PRINT:PRINT"YOU MOVE AWAY FROM THE UNIVERSITY!"
3605 FORQ=1TOCT-1:IFTR$(Q)=RR$(26)PRINT:PRINT"YOU HAVE GOTTEN TH
E TREASURED DIPLOMA!!":PRINT:PRINT"YOU WIN!!!":PRINT:PRINT"WOULD
 YOU LIKE TO TRY AGAIN?":GOTO3650ELSENEXT
3610 PRINT:PRINT"BUT YOU DON'T HAVE THE DIPLOMA!":PRINT:PRINT"YO
U LOSE!":PRINT:PRINT"WOULD YOU LIKE TO TRY AGAIN?"
3650 CH$=INKEY$:IFCH$="Y"ORCH$="N"THEN3660ELSE3650
3660 IFCH$="Y"THENRUNELSEEND
5220 CLS:PRINT@79,"CHARACTER'S ATTRIBUTES":GOTO5230
5230 PRINT:PRINT"STATUS :";:IFSC<10THENPRINT"INCOMING FRESHMAN"E
LSEIFSC>=10ANDSC<20PRINT"SOPHOMORE"ELSEIFSC>=20ANDSC<30PRINT"JUN
IOR"ELSEIFSC>=30ANDSC<40PRINT"JUNIOR"ELSEIFSC>=40ANDSC<50PRINT"S
TUCK-UP SENIOR"ELSEIFSC>70PRINT"GRADUATE!"
5235 PRINT:PRINT"PLACE : ANYSTATE UNIVERSITY":PRINT
5245 PRINT"TOTAL DOLLARS - ";MN
5246 PRINT@577,"EQUIPMENT: ";:IFCT=1PRINT@769,"NOTHING"ELSEFORQ=
1TOCT:PRINTTR$(Q),:NEXT
5247 IFNM$=""THEN5250ELSEPRINT@512,"CHARACTER'S NAME - ";NM$
5248 PRINT@577,"EQUIPMENT :";:IFCT=1PRINT@769,"NOTHING"ELSEFORQ=
1TOCT:PRINTTR$(Q),:NEXTQ:GOSUB2:RETURN
5249 GOSUB3:RETURN
5250 PRINT@833,"WHAT DO YOU NAME THIS CHARACTER?"
5251 INPUT NM$:IFLEN(NM$)>12PRINT"MAXIMUM OF 12 CHARACTERS, PLEA
SE!":GOTO5251ELSEGOTO5247
5290 GEN=RND(6)+RND(6)+RND(6):IFGEN=18THENGEN=GEN+RND(6)ELSEGEN=
GEN:RETURN
5500 GOTO5720
5700 QQ=0:GOSUB3000:YN=0:TT=0:Q=RND(350):PRINT"COMMAND ?":INPUTR
E$:GOTO5900ELSEGOTO5900
5720 QQ=0:GOSUB3000:YN=0:TT=0:Q=RND(350):GOSUB290:GOSUB100:PRINT
"COMMAND ?":INPUTRES$
5730 GOTO5900
5750 IFPL=1AND(RE$="S"ORRE$="N")THEN5855
5755 IFPL=2AND(RE$="N"ORRE$="W"ORRE$="E")THEN5857
5760 IFPL=3ANDRE$="W"THENPL=PL-1:GOTO5720
5765 IFPL=4AND(RE$="U"ORRE$="UP"ORRE$="D"ORRE$="DOWN"ORRE$="E")T
HEN5861
5768 IFPL=5AND(RE$="E"ORRE$="D"ORRE$="DOWN")THEN5863
5770 IFPL=6AND(RE$="N"ORRE$="S"ORRE$="W")THEN5868
5772 IFPL=7ANDRE$="W"THENPL=10:GOTO5720
5774 IFPL=8ANDRE$="N"THENPL=6:GOTO5720
5776 IFPL=9AND(LEFT$(RE$,1)="U"ORLEFT$(RE$,1)="D"ORRE$="E")THEN5
870
5778 IFPL=10AND(RE$="N"ORRE$="S"ORRE$="W"ORRE$="E")THEN5872
5780 IFPL=11ANDRE$="S"THENPL=10:GOTO5720
5782 IFPL=12ANDRE$="N"THENPL=10:GOTO5720
5784 IFPL=13ANDRE$="S"THENPL=6:GOTO5720
5786 IFPL=14AND(RE$="E"ORLEFT$(RE$,1)="U"ORLEFT$(RE$,1)="D")THEN
5874
5788 IFPL=15AND(RE$="N"ORRE$="S"ORRE$="E"ORRE$="W")THEN5876
5790 IFPL=17ANDRE$="N"THENPL=15:GOTO5720
5792 IFPL=16ANDRE$="S"THENPL=15:GOTO5720
5794 IFPL=18AND(RE$="N"ORRE$="W"ORRE$="S")THEN5878
5796 IFPL=19ANDRE$="S"THENPL=18:GOTO5720
5798 IFPL=20AND(LEFT$(RE$,1)="U"ORLEFT$(RE$,1)="D"ORRE$="E")THEN
5880
5800 IFPL=21AND(RE$="S"ORRE$="W"ORRE$="E")THEN5882
5802 IFPL=22ANDRE$="N"THENPL=21:GOTO5720
5804 IFPL=23ANDRE$="W"THENPL=21:GOTO5720
5806 IFPL=24ANDLEFT$(RE$,1)="U"THENPL=20:GOTO5720
5808 IFPL=24ANDRE$="E"THENPL=25:GOTO5720
5810 IFPL=25ANDRE$="W"THENPL=24:GOTO5720
5812 IFPL=26ANDRE$="N"THENPL=18:GOTO5720
5850 PRINT:PRINT"YOU CANNOT GO THAT DIRECTION!":GOTO5720
5855 IFRE$="N"THENGOTO3600ELSEPL=PL+1:GOTO5720
5857 IFRE$="N"THENPL=PL-1:GOTO5720ELSEIFRE$="E"THENPL=PL+1:GOTO5
720ELSEPL=PL+2:GOTO5720
5859 IFRE$="W"THENPL=1:GOTO5720ELSEIFRE$="U"THENPL=5:GOTO5720ELS
EPL=9:GOTO5720
5861 IFPL=4AND(RE$="U"ORRE$="UP")THENPL=5:GOTO5720ELSEIFRE$="D"O
RRE$="DOWN"ANDPL=4THENPL=9:GOTO5720ELSEIFRE$="E"ANDPL=4THENPL=2:
GOTO5720
5863 IFLEFT$(RE$,1)="D"THENPL=4:GOTO5720ELSEIFLEFT$(RE$,1)="E"TH
ENPL=6:GOTO5720
5868 IFRE$="N"ANDPL=6THENPL=13:GOTO5720ELSEIFRE$="S"ANDPL=6THENP
L=8:GOTO5720ELSEIFRE$="W"ANDPL=6THENPL=5:GOTO5720
5870 IFLEFT$(RE$,1)="U"ANDPL=9THENPL=4:GOTO5720ELSEIFPL=9ANDLEFT
$(RE$,1)="D"THENPL=14:GOTO5720ELSEIFPL=9ANDRE$="E"THENPL=10:GOTO
5720
5872 IFPL=10ANDRE$="N"THENPL=11:GOTO5720ELSEIFPL=10ANDRE$="S"THE
NPL=12:GOTO5720ELSEIFPL=10ANDRE$="W"THENPL=9:GOTO5720ELSEIFPL=10
ANDRE$="E"THENPL=7:GOTO5720
5874 IFPL=14AND(LEFT$(RE$,1)="U")THENPL=9:GOTO5720ELSEIFPL=14AND
(LEFT$(RE$,1)="D")THENPL=20:GOTO5720ELSEIFPL=14ANDRE$="E"THENPL=
15:GOTO5720
5876 IFPL=15ANDRE$="N"THENPL=16:GOTO5720ELSEIFPL=15ANDRE$="S"THE
NPL=17:GOTO5720ELSEIFPL=15ANDRE$="W"THENPL=14:GOTO5720ELSEIFPL=1
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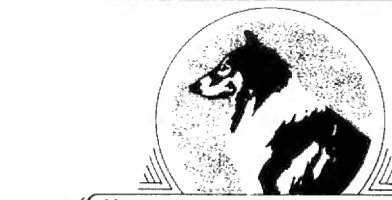

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```
5ANDRE$="E"THENPL=18:GOTO5720
5878 IFPL=18ANDRE$="N"THENPL=19:GOTO5720ELSEIFPL=18ANDRE$="W"THE
NPL=15:GOTO5720ELSEIFPL=18ANDRE$="S"THENPL=26:GOTO5720
5880 IFPL=20ANDLEFT$(RE$,1)="U"THENPL=14:GOTO5720ELSEIFPL=20ANDL
EFT$(RE$,1)="D"THENPL=24:GOTO5720ELSEIFPL=20ANDRE$="E"THENPL=21:
GOTO5720
5882 IFPL=21ANDRE$="S"THENPL=22:GOTO5720ELSEIFPL=21ANDRE$="W"THE
NPL=20:GOTO5720ELSEIFPL=21ANDRE$="E"THENPL=23:GOTO5720
5899 PRINT"YOU CAN'T GO IN THAT DIRECTION!":GOTO5720
5900 IFRE$="N"ORRE$="S"ORRE$="W"ORRE$="E"ORRE$="UP"ORRE$="DOWN"O
RRE$="U"ORRE$="D"THEN5750
5910 IFLEFT$(RE$,4)="SHOW"THENNU=LEN(RE$)-5:GOTO1525ELSEIFLEFT$(
RE$,7)="PRODUCE"THENNU=LEN(RE$)-8:GOTO1525
5920 IFRE$="LOOK"ORRE$="LOOK AROUND"THEN5720
5930 IFLEFT$(RE$,4)="DROP"THENNU=LEN(RE$)-5:GOTO16000
5940 IFLEFT$(RE$,3)="EAT"THENNU=LEN(RE$)-4:GOTO15500
5945 IFLEFT$(RE$,3)="SAY"THENNU=LEN(RE$)-4:GOTO2500
5950 IFLEFT$(RE$,3)="PAY"THENNU=LEN(RE$)-4:GOTO2610
5955 IFLEFT$(RE$,4)="GIVE"THENNU=LEN(RE$)-5:GOTO20500
5960 IFLEFT$(RE$,3)="SIT"THENNU=LEN(RE$)-4:GOTO20000
5965 IFLEFT$(RE$,4)="OPEN"THENNU=NU-5:GOTO21000
5970 IFRE$="RAISE HAND"THENGOTO22000
5975 IFLEFT$(RE$,4)="CHUG"THENNU=LEN(RE$)-5:GOTO22500ELSEIFLEFT$
(RE$,5)="DRINK"THENNU=LEN(RE$)-6:GOTO22500
5985 IFLEFT$(RE$,3)="JOG"ORLEFT$(RE$,3)="RUN"THEN23000
6000 IFLEFT$(RES$,8)="APPROACH"THENNUM=LEN(RES$)-9:GOTO10000ELSE
IFLEFT$(RES$,4)="GOTO"THENNUM=LEN(RES$)-5:GOTO10000ELSEIFLEFT$(R
ES$,5)="GO TO"THENNUM=LEN(RES$)-6:GOTO10000ELSEIFLEFT$(RES$,7)="
LOOK AT"THENNUM=LEN(RES$)-8:GOTO10000
6002 IFLEFT$(RE$,7)="EXAMINE"THENNU=LEN(RE$)-8:GOTO10000
6005 IF(LEFT$(RES$,8)="FILL OUT"ORLEFT$(RE$,8)="COMPLETE")ANDFM<
>100THEN800
6006 IFLEFT$(RE$,8)="FILL OUT"ORLEFT$(RE$,8)="COMPLETE"THENNU=LE
N(RE$)-9:GOTO805
6010 IFLEFT$(RES$,7)="PICK UP"THENNUM=LEN(RES$)-9:GOTO11000ELSEI
FLEFT$(RES$,3)="GET"THENNUM=LEN(RES$)-4:GOTO11000
6015 IFLEFT$(RE$,4)="READ"THENNUM=LEN(RE$)-5:GOTO1000
6020 IFRE$="FLUSH TOILET"ANDPL=13THENPRINT"THE TOILET FLUSHES":G
OTO5700
6025 IFRE$="STAND UP"THENPRINT"YOU'RE STANDING.":GOTO5700
6060 IFLEFT$(RE$,4)="TAKE"THENNU=LEN(RE$)-5:GOTO21500ELSEIFLEFT$
(RE$,5)="BEGIN"THENNU=LEN(RE$)-6:GOTO21500
6150 IFRES$="INVENTORY"ORRES$="INV"ORRES$="INVEN"THENGOSUB5220:G
OTO5720
6160 IFLEFT$(RE$,5)="THROW"THENNU=LEN(RE$)-6:GOTO31000
6999 PRINT:PRINT"I DON'T KNOW HOW TO ";RE$:GOTO5700PRINT":GOTO57
20
9000 IFNUM<=0GOTO5720
9010 RETURN
10000 GOSUB9000
10010 RES$=RIGHT$(RE2$,NUM)
10015 IF(PL=2ANDRE$=RR$(1)ANDFM<>100)PRINT"YOU REACH THE ";RR$(1
);" AND A":PRINT"BORED LOOKING RECEPTIONIST SLIDES A FORM AND A"
:PRINT"PENCIL AT YOU.":GOTO5700
10020 IF(PL=2ANDRE$=RR$(1)ANDFM=100)THEN1500
10025 IFPL=2ANDSI>1THEN2900ELSEIFPL=2ANDRE$=RR$(2)ANDSI>=0THENPR
INT"THE CLERK BEHIND THE DESK DEMANDS TO SEE YOUR":PRINT" STUDEN
T IDENTIFICATION!":SI=SI+1:GOTO5700
10030 IFPL=2ANDRE$=RR$(2)ANDSI<-100THENPRINT"YOU HAVE COMPLETED
YOUR BUSINESS THERE! MOVE ALONG!":GOTO5720
10050 IFPL=7PRINT"THE ";RR$(7);" ASKS IF YOU":PRINT"WANT FINANCI
AL AID.":GOTO5700
10075 IFPL=8ANDBO<>100PRINT"THE ";RR$(8);" GLANCES UP AT YOU AND
":PRINT"SAYS 'YOU OWE US 2000 DOLLARS FOR THIS TERM'S TUITION!":
IFMN>=2000THEN5700ELSEGOSUB3:PRINT:PRINT"THE ";RR$(8);" SEES THA
T YOU DO NOT HAVE THE MONEY!":PR=8:GOTO405
10080 IFPL=8ANDBO<>100THENGOSUB125:IFTT<>1THENPRINT"THE ";RR$(8)
;"ASKS FOR YOUR STUDENT IDENTIFICATION!":GOSUB3:PR=8:GOTO400
10085 IFPL=8ANDBO=100THENPRINT"NOW THAT YOU'VE PAID YOUR TUITION
, THE BURSAR HAS":PRINT"LOST INTEREST IN YOU.":GOTO5720
10100 IFPL=11AND(RE$=RR$(9)ORRE$="PSYCHOLOGIST"ORRE$=RR$(11))AND
BO=100PRINT"THE ";RR$(9);" ASKS YOU TOO HAVE A SEAT.":IB=1:GOTO5
700
10102 IFPL=11ANDBO<>100PRINT"THE ";RR$(9);" ASKS TO SEE YOUR STU
DENT IDENTIFICATION!":GOSUB125:IFTT=1THENGOTO1535ELSEPRINT"THE "
;RR$(9);" SAYS THAT YOU MUST HAVE IDENTIFICATION":PRINT"BEFORE H
E CAN HELP YOU":GOTO5700
10105 IFPL=11ANDRE$=RR$(10)ANDAB<>100PRINT"THE ";RR$(9);" BLOCKS
 YOUR PATH!":PRINT"AND YOU CANNOT GET TO IT.":GOTO5700
10125 IFPL=12ANDBO<>100THENPRINT"THE MAN CHECKS HIS CLASS":PRINT
"ROSTER AND SAYS 'YOU MUST PAY YOUR TUITION BEFORE I CAN":PRINT"
ADMIT YOU TO CLASS!":GOTO5700
10130 IFPL=12AND(RE$=RR$(12)ORRE$=RR$(13))THENGOTO140ELSEIFPL=12
ANDRE$=RR$(14)THENPRINT"THE ";RR$(14);" ASKS YOU TO SIT DOWN!":G
OTO5700
10150 IFPL=13ANDRE$="TOILET"THENPRINT"SCRATCHED ON THE WALL BY T
HE TOILET IS INDECIPHERABLE  MESSAGE :":GOSUB3:PRINT:PRINT"
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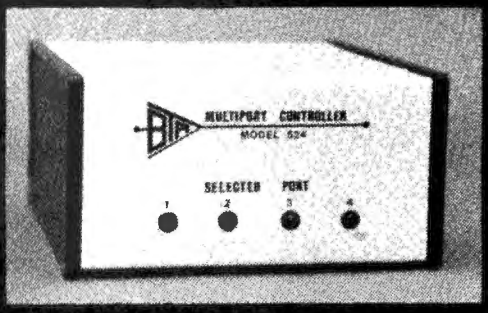

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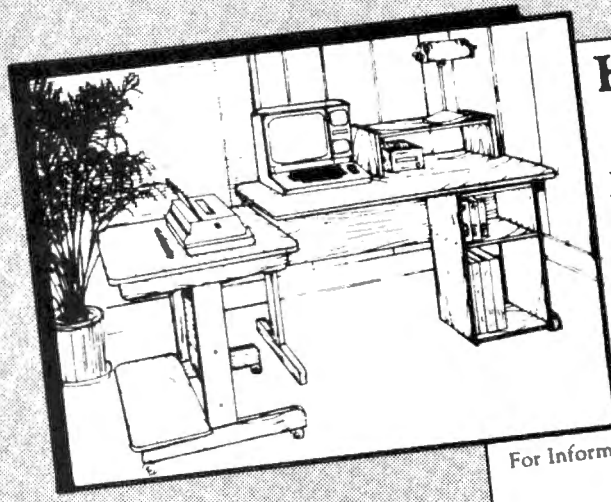

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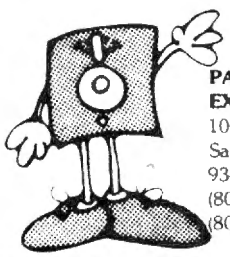

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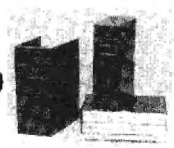

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iF PRO Is tHe OpPOsiTe Of CON":PRINT"     TheN wHAT is tHE oPPos
ItE oF PROGRESS?":PRINT:GOTO5700
10155 IFPL=13ANDRE$="SINK"THENPRINT"THE SINK APPEARS TO BE NORMA
L.":GOTO5700
10175 IFPL=26ANDRE$=RR$(29)PRINTRR$(29);" SAYS, 'YOU KNOW WHAT I
 AM...?'":GOSUB3:PRINT"'...A ZIT!!!'";PRINT"AND HE SPITS HALF-CH
EWED FOOD ALL OVER YOU!":GOTO5700
10180 IFPL=26ANDRE$=RR$(30)PRINT"BLUTO SAYS, 'THATS GOOD STUFF!'
":GOTO5700
10185 IFPL=26ANDRE$=RR$(31)PRINT"THE ";RR$(31);" HAS THE INITIAL
S 'DH' ON IT.":GOTO5700
10200 IFPL=25ANDRE$=RR$(27)ANDPE<>100PRINT"THE ";RR$(27);" LOOKS
 AT YOU AND":PRINT"SAYS, 'ANOTHER WIMP!'":GOSUB2:PRINT:PRINT"'TO
 PASS PHYS ED, YOU GOTTA JOG 40 LAPS AROUND THE TRACK.'::GOSUB2:
PRINT"THAT'S 5 MILES. IF YA CAN'T DO IT, YA DON'T PASS.'":GOTO57
00
10210 IFPL=25ANDRE$=RR$(27)ANDPE=100PRINT"'GET LOST, KID! YOU'VE
 ALREADY PASSED PHYS ED!'":GOTO5700
10225 IFPL=22ANDRE$=RR$(24)THENPRINT"THE ";RR$(24);" LOOKS AT YO
U EXPECTANTLY.":GOTO5700
10230 IFPL=17ANDRE$=RR$(19)PRINT"THE ";RR$(19);" IGNORES YOU.":G
OTO5700
10235 IFPL=16ANDRE$=RR$(16)PRINT"THE ";RR$(16);" LOOKS AT YOU EX
PECTANTLY.":GOTO5700
10240 IFPL=16ANDRE$=RR$(17)PRINT"THE ";RR$(17);" LOOKS LIKE A NO
RMAL ";RR$(17):GOTO5700
10245 IFPL=16ANDRE$=RR$(18)PRINT"THE ";RR$(18);" SITS FACE DOWN
ON THE ";RR$(17):GOTO5700
10250 IFPL=25ANDRE$=RR$(28)PRINT"YOU ARE AT THE ";RR$(28):GOTO57
00
10255 IFPL=23ANDRE$=RR$(25)PRINT"THE ";RR$(25);" LOOKS AT YOU WI
TH DISGUST.":GOTO5700
10260 IFPL=23AND(RE$="DIPLOMA"ORRE$=RR$(26))PRINT"YOU APPROACH T
HE ";RR$(26):GOTO5700
10275 IFRE$=RR$(23)PRINT"THE ";RR$(23);" IS OVERFLOWING WITH GAR
BAGE.":GOTO5700
10280 IFRE$=RR$(20)ANDPL=19PRINT"THE ";RR$(20);" SAYS 'SIT DOWN!
'":GOTO5700
10285 IFRE$=RR$(21)ORRE$=RR$(23)ANDPL=19ORRE$=RR$(22)ANDPL=19PRI
NT"YOU APPROACH THE ";RE$:GOTO5700
10290 IFRE$=RR$(13)PRINT"YOU APPROACH THE ";RR$(13):GOTO5700
10295 IFRE$=RR$(3)ANDPL=3ORRE$=RR$(4)ANDPL=3ORRE$=RR$(5)ANDPL=3P
RINT"YOU APPROACH THE ";RE$:GOTO5700
10999 GOTO19999
11000 GOSUB9000:GOSUB2975
11010 RE2$=RIGHT$(RE2$,NUM)
11015 IF(PL=2ANDFM=1AND(RE$="CARD"ORRE$="PLASTIC CARD"))THEN1850
0
11016 IFPL=11ANDRE$=RR$(11)THENPRINT"THE ";RR$(9);" GRABS THE ";
RR$(11):PRINT"AWAY FROM YOU AND SAYS, 'THESE ARE MINE.'":GOTO570
0
11017 IFPL=11ANDRE$=RR$(10)THEN2200ELSEIFPL=12ANDRE$="TEST"THEN
PRINT"YOU CANNOT TAKE A TEST FORM OUT OF THE CLASSROOM!":GOTO570
0
11020 IFRE$=RR$(1)ORRE$="TOILET"ORRE$="SINK"ORRE$=RR$(16)ORRE$=R
R$(17)ORRE$=RR$(14)ORRE$=RR$(13)ORRE$=RR$(12)ORRE$=RR$(7)ORRE$=R
R$(8)ORRE$=RR$(9)ORRE$=RR$(2)ORRE$=RR$(6)ORRE$=RR$(19)ORRE$=RR$(
20)ORRE$=RR$(24)ORRE$=RR$(25)ORRE$=RR$(27)THENGOTO140
11021 IFRE$=RR$(28)ORRE$=RR$(29)THEN140
11022 IFPL=16ANDRE$=RR$(18)THEN700ELSEIFPL=16ANDRE$=RR$(32)THEN7
30
11023 IFPL=26ANDRE$=RR$(31)THEN900
11025 IFPL=22ANDRE$=RR$(36)ANDGT<>500THEN3100
11027 IFPL=23ANDRE$=RR$(26)ORRE$="DIPLOMA"THEN3500
11028 IFPL=8ANDGT<>1ANDRE$=RR$(37)THENPRINT"THE BURSAR SAYS 'THA
T WILL BE 10 DOLLARS, PLEASE.":GOTO5700
11030 GOSUB3400:IFQQ=100THEN5700ELSEYN=0:FORQ=1TO37:IFRE$=RR$(Q)
ANDRS%(Q,PL)=1THENYN=1:Q5=Q:Q=37
11035 NEXTQ:IFYN=1THEN18500ELSEPRINT"WHERE DO YOU SEE THAT?":GOT
O5720
11999 GOTO19999
13800 PRINT"YOU ARE ESCORTED OUT OF THE UNIVERSITY!":GOTO30000
15499 GOTO19999
15500 GOSUB9000:RE$=RIGHT$(RE$,NU)
15505 YN=0:IFRE$=RR$(3)THENFORQ=1TOCT:IFTR$(Q)=RR$(3)THENPRINT"Y
OU HAVE EATEN THE HAM SANDWICH.":TR$(Q)="":GOSUB2975:Q=CT+1:NEXT
Q:GOTO5720ELSENEXTQ:PRINT"MAYBE YOU SHOULD GET IT FIRST.":GOTO14
0
15999 GOTO19999
16000 GOSUB9000:RE$=RIGHT$(RE$,NU):GOSUB2975
16010 YN=0:FORQ=1TOCT:IFRE$=TR$(Q)THENYN=1:Q4=Q:Q=CT+1
16020 NEXTQ:IFYN=1THENFORQ=1TO37:IFRE$=RR$(Q)THENPRINT"YOU DROP
THE ";RE$:RS%(Q,PL)=1:TR$(Q4)="":GOTO5720ELSENEXTQ
16030 IFYN=0PRINT"YOU DON'T HAVE A ";RE$:GOTO5720
18499 GOTO19999
18500 GOSUB3400:IFQQ=100THEN5700ELSEPRINT:PRINT"THE MOST YOU CAN
 CARRY AT ANY TIME IS 5 ITEMS":PRINT:PRINT"YOU ARE PRESENTLY CAR
```

Listing continues

Listing continued

```
RYING ";CT-1;"ITEMS.":PRINT:PRINT"DO YOU  CARRY THE ";RE$;" WITH
 YOU?"
18505 CH$=INKEY$:IFCH$="Y"ORCH$="N"THEN18510ELSE18505
18507 IFQ5>0THEN18600
18510 IFCH$="N"THENGOTO5720
18515 IFRE$="PLASTIC CARD"ORRE$="CARD"THENTR$(CT)="I.D. CARD":CT
=CT+1:GOSUB5220:PM=100:GOTO5720
18520 IFRE$=RR$(3)THENTR$(CT)=RR$(3):CT=CT+1:RS%(3,PL)=0:GOSUB52
20:GOTO5720ELSEIFRE$=RR$(4)THENTR$(CT)=RR$(4):RS%(4,PL)=0:CT=CT+
1:GOSUB5220:GOTO5720ELSEIFRE$=RR$(5)THENTR$(CT)=RR$(5):RS%(5,PL)
=0:CT=CT+1:GOSUB5220:GOTO5720
18600 RS%(Q5,PL)=0:TR$(CT)=RR$(Q5):CT=CT+1:GOSUB5220:Q5=0:Q4=0:G
OTO5720
18999 GOTO19999
19999 PRINT:PRINT"I DON'T SEE A ";RE$;" HERE!":GOTO5720
20000 GOSUB9000:RE$=RIGHT$(RE$,NU):IFPL=11ANDAB<>100PRINT"THE ";
RR$(9);"SHOVES THE ";RR$(11):PRINT" AT YOU AND ASKS 'WHAT DOES T
HIS SUGGEST TO YOU?":IB=1:GOTO5700
20010 IF(PL=12ORPL=19)ANDBO<>100PRINT"WHILE YOU FIND A CHAIR, TH
E MAN CHECKS HIS";PRINT"CLASS ROSTER. HE SAYS 'YOU MUST PAY YOUR
 TUITION BEFORE I":PRINT"CAN ADMIT YOU TO CLASS!":GOTO5700
20015 IFPL=12ANDBO=100PRINT"THE ";RR$(14);" SAYS YOU MAY BEGIN":
PRINT"THE TEST WHEN YOU'RE READY.":GOTO5700
20020 IFPL=19ANDBO=100PRINT"THE ";RR$(20);" SAYS 'RAISE YOUR HAN
D WHEN":PRINT"YOU'RE READY TO BEGIN.":GOTO5700
20499 PRINT"YOU SIT DOWN.":GOTO5700
20500 GOSUB9000:RE$=RIGHT$(RE$,NU):IFPL=11THENFORQ=1TOCT:IFTR$(Q
)=RR$(34)THENAB=100:TR$(Q)="":BA=500:NEXTELSENEXT
20505 IFPL=11ANDAB=100ANDRE$=RR$(34)THENPRINT"THE ";RR$(9);" GRE
EDILY GRABS THE MAGAZINE AND SAYS ":PRINT"'THANK YOU! THE FOLDER
 IS YOURS IF YOU WANT IT.'":GOTO5700
20510 IFPL=16ANDRE$=RR$(32)THENFORQ=1TOCT-1:IFTR$(Q)=RR$(32)THEN
EX=100:Q=CT+1:SC=SC+3:PRINT"THE ";RR$(16);" TAKES YOUR ";RR$(32)
:RE$=RR$(32):NEXT:GOTO16010ELSENEXT
20515 IFPL=16ANDRE$=RR$(18)THENFORQ=1TOCT-1:IFTR$(Q)=RR$(18)THEN
E2=100:Q=CT+1:PRINT"THE ";RR$(16);" TAKES BACK THE BOOK.":RE$=RR
$(18):NEXT:GOTO16010ELSENEXT
20520 IFPL=22THENGOSUB122:IFTT=8THENGT=100:PRINT"THE ";RR$(24);"
 TAKES THE ";RR$(37):FORQ=1TOCT-1:IFTR$(Q)=RR$(37)THENTR$(Q)="":
NEXT:GT=100:GOTO5700ELSENEXT:GT=100:GOTO5700
20525 IFPL=23ANDRE$=RR$(32)ANDDN=0THENGOSUB125:IFTT=1PRINT"THE "
;RR$(25);" TAKES YOUR ";RR$(32):PRINT"AND CASUALLY POCKETS IT. H
E GRINS AT YOU.":DN=1:FORQ=1TOCT-1:IFTR$(Q)=RR$(32)THENTR$(Q)=""
:NEXT:GOTO5700ELSENEXT:GOTO5700
20530 IFPL=23ANDRE$=RR$(36)ANDDN=1THENGOSUB124:IFTT=9PRINT"THE "
;RR$(25);" TAKES YOUR ";RR$(36);",":PRINT"CRUMPLES IT INTO A TIG
HT BALL AND EATS IT!":DN=2:FORQ=1TOCT-1:IFTR$(Q)=RR$(36)THENTR$(
Q)="":NEXT:GOTO5700ELSENEXT:GOTO5700
20535 IFPL=23ANDRE$=RR$(33)ANDDN=2THENGOSUB119:IFTT=11PRINT"THE
";RR$(25);"SWEARS ANGRILY AND TEARS":PRINT"THE ";RR$(33);" INTO
TINY PIECES!":DN=3:FORQ=1TOCT-1:IFTR$(Q)=RR$(33)THENTR$(Q)="":Q=
CT+1:NEXT:GOTO5700ELSENEXT:GOTO5700
20540 IFPL=23ANDRE$=RR$(10)THEN1540
20599 PRINT"GIVE WHAT?":GOTO5700
21000 GOSUB9000:RE$=RIGHT$(RE$,NU):IFRE$=RR$(34)THEN1010
21010 IFRE$=RR$(18)THEN1010
21499 PRINT"READ WHAT?":GOTO5700
21500 GOSUB9000:RE$=RIGHT$(RE$,NU):IFPL=12ANDRE$="TEST"THEN600
21999 PRINT"TAKE WHAT, ";NM$;"?":GOTO5700
22000 IFEN>0PRINT"YOU CAN ONLY TAKE THIS TEST ONCE, ";NM$:GOTO57
20
22003 IFPL<>19THENPRINT"YOUR HAND IS RAISED":GOTO5700
22005 CLS:PRINT"THE ";RR$(20);" SAYS 'THERE WILL BE NO":PRINT"IN
TERRUPTIONS DURING THE COURSE OF THIS TEST.":GOSUB3:PRINT:PRINT"
THE TEST CONSISTS OF 5 QUESTIONS. YOU MAY ANSWER 2 OF":PRINT"THE
M INCORRECTLY AND STILL PASS. OTHERWISE, YOU FAIL AND WILL"
22010 PRINT"BE EXPELLED FROM THE UNIVERSITY.":PRINT:PRINT"QUESTI
ON NUMBER 1 :":PRINTTAB(3)"enter THE ADJECTIVE IN THE FOLLOWING
SENTENCE?":PRINT:PRINT"The water was perfectly transparent.":PRI
NT:INPUTRE$
22015 IFRE$="TRANSPARENT"ORRE$="transparent"THENEN=EN+1
22020 CLS:PRINT"'QUESTION NUMBER 2 :":PRINT:PRINT"THIS IS MULTIP
LE CHOICE. INPUT THE number OF THE CORRECT ANSWER.":GOSUB3:PRINT
:PRINT"WHO IS THE AUTHOR OF SHAKESPEARE'S Taming of the Shrew?":
PRINT
22025 PRINTTAB(10)"1. CHARLES DICKENS":PRINTTAB(10)"2. JOHN STEI
NBECK":PRINTTAB(10)"3. HENRY DAVID THOREAU":PRINTTAB(10)"4. ISAA
C ASIMOV":PRINTTAB(10)"5. NONE OF THE ABOVE"
22030 INPUTRE:IFRE<1ORRE>5THEN22030
22035 IFRE=5THENEN=EN+1
22040 CLS:PRINT"'QUESTION NUMBER 3:":PRINT:PRINT"ANSWER TRUE OR
FALSE.":GOSUB3:PRINT:PRINT"A COMPLEMENT IS THE OPPOSITE OF AN IN
SULT."
22045 PRINT"?"
22050 CH$=INKEY$:IFCH$="T"ORCH$="F"THEN22055ELSE22050
22055 IFCH$="F"THENEN=EN+1
22060 CLS:PRINT"QUESTION NUMBER 4 :":PRINT:PRINT"ENTER THE WORD
```

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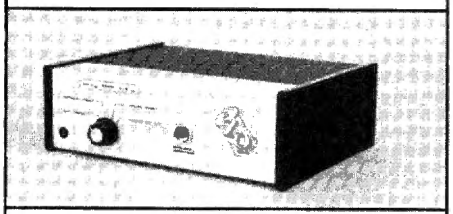

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Listing continued

```
THAT IS SPELLED INCORRECTLLY.":PRINT:PRINTTAB(10)"OCTOPUS":PRINT
TAB(10)"SKEPTICISM":PRINTTAB(10)"RECIPROCAL":PRINTTAB(10)"CLANDE
STINE":PRINTTAB(10)"PRECURSOR"
22065 INPUTRE$:IFRE$="INCORRECTLLY"THENEN=EN+1
22070 CLS:PRINT"AND FINALLY, BY number, RESPOND TO THIS QUESTION
 TRUTHFULLY :":GOSUB3:PRINT:PRINT"WHAT DO YOU THINK OF THE ";RR$
(20);"?":PRINT:PRINTTAB(10)"1. HE'S GREAT!!!":PRINTTAB(10)"2. HE
'S AVERAGE.":PRINTTAB(10)"3. DEFINITELY INFERIOR."
22075 INPUTRE:IFRE>3ORRE<1THEN22075
22080 IFRE=1THENEN=EN+1
22085 IFRE=3THENEN=EN-1
22100 CLS:PRINT"THE ";RR$(20);" TABULATES YOUR SCORE WHILE YOU W
AIT.":GOSUB3
22105 GOSUB137:IFTT=5THENPRINT"THE ";RR$(20);" NOTICES YOUR ";RR
$(31):PRINT"AS HE CORRECTS YOUR PAPER AND ARBITRARILY LOWERS YOU
R GRADE BY ONE."
22110 IFEN=5PRINT"YOU ANSWERED EVERY QUESTION CORRECTLY!":SC=SC+
10:GOTO5700
22115 IFEN<5PRINT"YOU ANSWERED ";EN;" OUT OF 5 QUESTIONS CORRECT
LY."
22120 IFEN=>3PRINT"YOU PASS!":GOSUB3:SC=SC+10:GOTO5700ELSEPRINT"
YOU'VE FAILED!":GOSUB3:PRINT"YOU ARE EXPELLED!":GOTO30000
22499 GOTO5700
22500 GOSUB9000:RE$=RIGHT$(RE$,NU):IFRE$="ALCOHOL"ORRE$="GRAIN A
LCOHOL"ORRE$=RR$(30)THENYN=10:GOSUB139:IFTT=6THEN22510ELSEPRINT"
MAYBE YOU SHOULD GET THE ";RR$(30);" BEFORE YOU DRINK IT.":GOTO5
700
22510 IFYN=10ANDTT=6ANDAL=0THENAL=1:PRINT"YOU PUT THE ";RR$(30);
" TO":PRINT"YOUR MOUTH AND DRINK.":PRINT:GOSUB2:PRINT"IT BURNS I
TS WAY INTO YOUR STOMACH!":GOTO5700
22520 IFYN=10ANDTT=6ANDAL=1THENAL=2:PRINT"YOU SLOSH DOWN ANOTHER
 GULP OF THE ALCOHOL AND HICCOUGH":PRINT"VIOLENTLY!":GOSUB2:PRIN
T"YOU'RE BEGINNING TO FEEL VERY LIGHT-HEADED.":GOTO5700
22530 IFYN=10ANDTT=6ANDAL=2THENAL=3:PRINT"YOU CHUG DOWN ANOTHER
HUGE DRAFT OF THE HELLISH LIQUID":PRINT"AND BEGIN TO FEEL NAUSEA
TED!":GOSUB3:IFPL=26PRINT"BLUTO GRINS AND SLIDES A PIECE OF GRUB
BY LOOKING":PRINT"PAPER AT YOU.":RS%(35,26)=1:GOSUB3:GOTO5700
22540 IFYN=10ANDTT=6ANDAL=3THENAL=4:PRINT"YOU EMPTY THE BOTTLE!"
:PRINT"YOU ARE COMPLETELY AND TOTALLY DRUNK!":PRINT"THE ROOM SWI
RLS CHAOTICALLY AROUND YOU!":FORQ=1TOCT-1:IFTR$(Q)=RR$(30)THENTR
$(Q)="":NEXT:GOTO5700ELSENEXT:GOTO5700
22999 PRINT"DRINK WHAT, ";NM$;"?":GOTO5700
23000 IFPL<>25THEN140
23005 IFPE=100PRINT"YOU HAVE ALREADY PASSED PHYS ED!":GOTO5700
23010 PRINT"YOU BEGIN JOGGING...":GOSUB3:FORQQ=0TO30STEP5:PRINTQ
Q;" LAPS ...":GOSUB2:NEXT:IFAL>0PRINT"THE ALCOHOL YOU DRANK HAS
TAKEN TOO MUCH OUT OF YOU!":GOSUB2:PRINT"YOU COLLAPSE, EXHAUSTED
!":GOTO30000
23020 IFAL=0PRINT"35 LAPS...":GOSUB2:PRINT"40 LAPS!!!":PRINT:PRI
NT"YOU MADE IT!!!":PE=100:SC=SC+5:GOTO5700
30000 PRINT:PRINT"YOU LOSE!"
30050 PRINT"WOULD YOU LIKE ANOTHER GAME?":INPUTR$:IFLEFT$(R$,1)=
"Y"THEN0
30060 IFR$="N"END
30070 GOTO30050
31000 GOSUB9000:RE$=RIGHT$(RE$,NU)
31010 FORQ=1TOCT-1:IFRE$=TR$(Q)THENYN=1:Q4=Q
31015 NEXTQ
31020 IFYN=1THENPRINT"YOU THROW THE ";RE$:GOSUB2:PRINT"IT BOUNCE
S HARMLESSLY ACROSS THE FLOOR.":FORQ=1TO37:IFRE$=RR$(Q)THENRS%(Q
,PL)=1:TR$(Q4)="":GOTO5700ELSENEXTQ
31030 IFYN=0PRINT"YOU DON'T HAVE A ";RE$:GOTO5700
40000 YN=1:GOTO40030
40010 PRINT@933,"PRESS '/' TO CONTINUE"
40020 CH$=INKEY$:IFCH$="/"THENRETURNELSE40020
40030 CLS:PRINTCHR$(23)"
         P A P E R   C H A S E
               A LESSON IN
               FRUSTRATION
                BY CHRIS SKAPURA":FORQ=1TO2500:NEXT:CLS
40040 CLS:PRINT:PRINT"THE PLACE : ANYSTATE UNIVERSITY, U.S.A.":P
RINT:PRINT"THE TIME : THE NOT SO UNREAL FUTURE.":PRINT"(IT MIGHT
 EVEN BE TODAY)"
40050 PRINT:PRINT"THE SCENARIO : YOU ARE ABOUT TO ENTER A STRANG
E AND SOMETIMES":PRINT"UNBELIEVABLE ENVIRONMENT. AS AN INCOMING
FRESHMAN TO THE":PRINT"PRESTIGIOUS ANYSTATE U., YOU HAVE BUT ONE
 GOAL ..."
40060 GOSUB40010:CLS:PRINT:PRINT:PRINT"... YOU MUST SEEK OUT, DI
SCOVER AND ATTAIN THAT LEGENDARY":PRINT"ARTIFACT, THE college di
ploma!":PRINT:PRINT"AND AS AN INCOMING FRESHMAN, YOU KNOW NOTHIN
G ABOUT THE":PRINT"UNIVERSITY SAVE WHAT YOU DISCOVER INSIDE OF I
TS"
40070 PRINT"CONFINES":PRINT:PRINT:PRINT"WHAT YOU DO KNOW A LITTL
E ABOUT IS YOURSELF ...":GOSUB40010:CLS:PRINT:PRINT"YOU ARE THE
TYPICAL COLLEGE FRESHMAN. YOUR NOT THE THE TYPICAL":PRINT"COLLEG
E FOOTBALL PLAYER. AS SUCH, YOU ARE FORCED"
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Listing continues

Listing continued

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40080 PRINT"TO RELY ON YOUR BRAINS, AND NOT YOUR BRAWN.":PRINT:P
RINT:PRINT"BRUTE FORCE IS SELDOM, IF EVER, AN OPTION.":PRINT:PRI
NT"SO YOU MUST GET THE DIPLOMA-TALISMAN THROUGH PERSISTANCE AND"
:PRINT"INTELLIGENCE.":PRINT:PRINT"THERE WILL OF COURSE BE SOME"
40090 PRINT"OBSTACLES ...":GOSUB40010:CLS:PRINT:PRINT"... FOR IN
STANCE, YOU KNOW VIRTUALLY NOTHING OF THE NATURAL":PRINT"SCIENCE
S. THEY MAY BE A PROBLEM. BUT YOU FEEL FAIRLY CONFIDENT":PRINT"A
BOUT YOUR COMMAND OF LANGUAGES."
40100 PRINT:PRINT"PHYSICALLY, YOU ARE NO PUTZ, BUT AGAIN YOU'RE
NO HERCULES.":PRINT:PRINT"ALL YOU CAN DO IS WHAT ALL OTHER COLLE
GE FRESHMAN DO ...":GOSUB40010:CLS:PRINTCHR$(23)"
                GO TO SCHOOL
                    AND

                HAVE FUN!"
40110 FORQ=1TO1000:NEXT:CLS:PRINT:PRINT"... AND NOW, A LITTLE AB
OUT THE PROGRAM :":PRINT:PRINT:PRINT"THE PROGRAM IS WRITTEN TO A
CCEPT NATURAL LANGUAGE RESPONSES,":PRINT"TYPICALLY IN 2-WORD SEN
TENCES.":PRINT:PRINT"STATEMENTS SUCH AS 'GOTO DESK' OR 'SAY HELL
O'"
40120 PRINT"ARE TYPICAL.":PRINT:PRINT"THERE ARE, HOWEVER, 2 EXCE
PTIONS TO THIS RULE ...":GOSUB40010:CLS:PRINT:PRINT"THE EXCEPTIO
NS TO 2-WORD SENTENCES :":PRINT:PRINT"1.) MOVEMENT. TO TRAVEL TH
ROUGH THE UNIVERSITY, SIMPLY ENTER":PRINT"THE FIRST LETTER OF TH
E"
40130 PRINT"INTENDED DIRECTION.":PRINT"   (S FOR SOUTH, N FOR NO
RTH ETC)":PRINT"2.) OBJECTS IN THE UNIVERSITY MAY REQUIRE 3 OR M
ORE":PRINT"WORD SENTENCES.":PRINT"    FOR INSTANCE, YOU MAY HAVE
 TO 'GOTO BULLETIN BOARD' OR":PRINT"    'GET CHEMISTRY BOOK'."
40140 GOSUB40010:CLS:PRINT:PRINT"... AND FINALLY, SOME KEY WORDS
 :":PRINT:PRINT"'LOOK AROUND' OR 'LOOK' WILL DISPLAY THE CONDITI
ONS OF YOUR":PRINT"IMMEDIATE ENVIRONMENT.":PRINT:PRINT"'INVENTOR
Y' OR 'INV' WILL DISPLAY ALL OF THE ITEMS YOU POSSESS"
40150 PRINT:PRINT"THE REST OF THE WORDS YOU WILL HAVE TO DISCOVE
R FOR YOURSELF..."
40160 GOSUB40010:CLS:PRINT:PRINT"AND NOW, ON WITH THE GAME ...":
PRINT:PRINT:PRINT:PRINT"          (GOOD LUCK, YOU POOR SLOB!)"
40170 PRINT:PRINT"PRESS '/' TO BEGIN GAME, '@' TO REREAD."
40180 CH$=INKEY$:IFCH$="/"ORCH$="@"THEN40190ELSE40180
40190 IFCH$="@"THEN40000ELSERETURN
50003 CT=5:EN=4:CM=100:PE=100:TR$(1)=RR$(32):TR$(2)=RR$(33):TR$(
3)=RR$(10):TR$(4)=RR$(36):PL=23:GOTO5700
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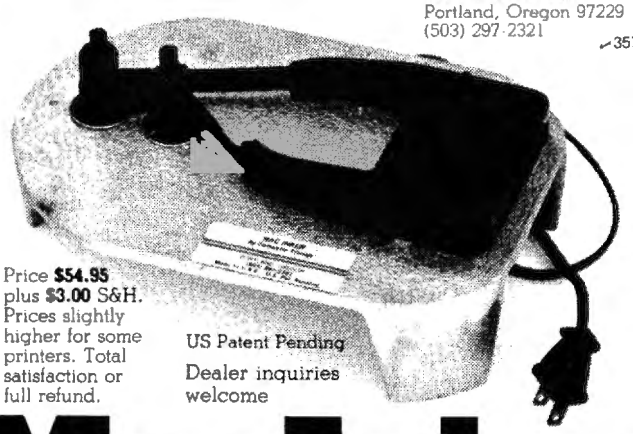

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Attack of the TRS-80

by Hollie H. Satterfield

A lunar colony is depending on you to deliver its inhabitants from a deranged Model I.

Attack of the TRS-80 is a graphics-filled adventure game with a difference: you need strategy and luck, rather than pure logic, to complete it. Attack runs on Models I and III with at least 16K of RAM. Model I owners should make the changes listed in Table 1.

The game is set in a lunar colony where a deranged Model I has taken over the land and its electronic inhabitants. Your mission is to locate and destroy the nefarious TRS-80. Deadly robots patrol the corridors trying to stop you. The colonists have been temporarily evacuated, and you are their only hope.

Essential to victory is your suspension of disbelief—the ability to believe the unbelievable. Each time you are injured in this game you can take the wound or you can use suspension-of-disbelief points; to win, however, you can't use more than 75 of these points, or your adventure would be too unbelievable. Also, you can receive only six wounds, and you must maintain an alertness factor above zero.

A map is randomly generated for each game, and you must choose items to take on your mission (some might be useless). The same rooms appear in every game, but the items found in each room change. Since the rooms are randomly arranged, you might run into some rooms more than once. Make a map of the colony as you play.

The game uses slightly less than 16K. POKE in the graphics using the string-packing technique in Program Listing 1. (For details on this procedure, see "The STRING$'s the Thing," *80 Micro*, June/July 1982, p. 298.) Instead of spaces in lines 499–501 and 10000–

```
1000 XA=PEEK(16416):XB=PEEK(16417):PRINT@0,"CARRYING"H"ITEMS.
  ALERTNESS:"A"SUSPENSION OF DISBELIEF: "DB;:POKE16416,XA:POKE16417,
  XB:IFDB>75 OR A<1 THEN 60000
1010 PRINT"CARRYING"H"ITEMS. ALERTNESS:"A" SUSPENSION OF
  DISBELIEF:"DB:IFDB>75 OR A<1 THEN 60000 ELSE RETURN
```

From line 695 on, change every GOSUB 1000 to GOSUB 1010
Add GOSUB 1000 to line 540 after CLS
Change GOSUB 1010 in line 330 to GOSUB 1000
Remove POKE16916, 0 from line 10007

Table 1. Model I owners must make these changes to Program Listing 2.

Lines	Description
10–40	Instructions.
60–520	Initialize variables and let you choose your provisions. Data includes robot names and strengths in line 140, map set-up in 140–170, rooms in 190–320, provisions in 380 and 410, and objects and their locations in 480 and 490.
540–579	Print room descriptions and determine if robots are present.
580–645	Decipher your commands and refer to lines 650–910. Compare line 645 to the data in 515 to see which verbs go to which lines.
1000	Updates your points. Locations 16416 and 16417 contain the current cursor position.
2000–2230	Line 575 refers to these if special decisions are required in certain rooms.
2240–10013	Explain your final combat against the TRS-80 when you reach that room.
10100–16100	Contain combat routines and "charts"; yours are in lines 15000–15800, and the robots' are in lines 16000–16050.

Table 2. Description of Lines in Program Listing 2.

The Key Box

Model I and III
16K RAM
Cassette Basic

10006, you can use numbers or letters for easier counting. It doesn't matter, because these positions are replaced by characters POKEd in by the program.

After running the program, delete everything except lines 499–501 and 10000–10006. Type Program Listing 2 "on top" of the remaining lines (typing the listings separately and merging them is difficult). Model III owners will see the graphics characters in the remains of Listing 1, while Model I owners will see token words substituted for the characters; both versions work equally well. Table 1 explains the program's lines.

This program was inspired by, and loosely based on, *Return of the Stainless Steel Rat*, a board game published by Simulations Publications Inc., which is no longer in business. ■

Contact Hollie H. Satterfield at 416 Starmont Drive, Danville, VA 24540.

Program Listing 1

```
0 'ATTACK OF THE TRS-80     LISTING 1
   BY HOLLIE SATTERFIELD
   ADDITIONAL GRAPHICS BY MARTIN JOSEPH
5 'DATA FOR ROBOT #1
10 DATA128,128,160,184,174,157,180,144,26,8,8,8,8,8,8,8,8,180,180,
186,147,131,131,163,181,184,184,26,8,8,8,8,8,8,8,170,130,164,32,
170,149,26,8,8,8,8,8,8,138,188,140,141,190,133,26,8,8,8,8,8,130,
131,129,130,131,129
15 'ROBOT #2
20 DATA128,136,152,157,152,26,8,8,8,8,160,134,151,164,26,8,8,8,8,8
,160,135,166,166,134,165,26,8,8,8,8,8,169,152,137,184,129
25 'ROBOT #3
30 DATA168,151,131,171,148,131,175,191,159,131,26,8,8,8,8,8,8,8,8,
8,8,188,159,159,143,172,140,140,143,26,8,8,8,8,8,8,8,191,183,132
,87,170,26,8,8,8,8,8,8,135,157,153,153,187,26,8,8,8,8,143,190,190,14
2,26,8,8,8,138,133
35 'ROBOT #4
40 DATA128,139,183,179,179,187,135,26,8,8,8,8,8,8,8,188,188,142,14
3,143,141,188,188,26,8,8,8,8,8,8,8,8,191,138,181,128,128,186,133,1
91,26,8
50 DATA8,8,8,8,8,8,8,131,160,187,148,168,183,144,131,26,8,8,8,8,8,
8,8,186,133,130,129,138,181,26,8,8,8,8,8,8,143,128,128,128,128,143
55 'ROBOT #5
60 DATA128,128,160,174,164,26,8,8,8,8,8,144,128,160,159,181,128,12
8,144,26,8,8,8,8,8,8,8,130,164,134,152,146,164,134,26,8,8,8,8,8,
8,160,135,130,130,165,26,8,8,8,8,8,137,128,128,128,136,129
65 'ROBOT #6
70 DATA128,128,160,142,164,128,152,141,144,26,8,8,8,8,8,8,8,176,17
9,172,131,156,179,176,26,8,8,8,8,8,8,8,8,8,168,131,166,164,128,131
,128,152,153,131,148,26
80 DATA8,8,8,8,8,8,8,8,8,8,8,130,164,128,137,153,176,166,134,128,1
52,129,26,8,8,8,8,8,8,8,8,160,142,140,141,144,26,8,8,8,8,8,134,128
,128,128,137
499 R$(1)="      (68 SPACES)
           ":R$(2)="      (37 SPACES)                    "
500 R$(3)="      (69 SPACES)
            ":R$(4)="      (84 SPACES)
                                                "
501 R$(5)="      (59 SPACES)
    ":R$(6)="      (93 SPACES)
                                          "
510 DIMA$(16)
515 'POKING GRAPHICS FOR ROBOTS #1-6
520 FORN=1TO6:X=PEEK(VARPTR(R$(N))+2)*256+PEEK(VARPTR(R$(N))+1):FO
RT=0TOLEN(R$(N))-1:READJ:CS=CS+J:POKEX+T,J:NEXTT,N
525 'CS = CHECKSUM
530 IFCS=33979THENFORX=1TO16:READA$(X):NEXT:CS=0:ELSEPRINT"DATA ER
ROR IN LINES 10-80.":STOP
535 'POKING GRAPHICS FOR ROBOT #7
540 FORN=1TO16:X=PEEK(VARPTR(A$(N))+2)*256+PEEK(VARPTR(A$(N))+1):F
ORT=0TOLEN(A$(N))-1:READJ:CS=CS+J:IFJ<32THENREADQ:CS=CS+Q:FORI=0TO
J:POKEX+T+I,Q:NEXTI:T=T+J:NEXTT,N
550 POKEX+T,J:NEXTT,N:IFCS<>21430THENPRINT"DATA ERROR IN LINES 101
00-10180"
10000 DATA"   (19 SPACES)      ","   (25 SPACES)           ","   (2
8 SPACES)           ","   (29 SPACES)              "
10002 DATA"   (30 SPACES)                ","   (31 SPACES)
        ","   (32 SPACES)                  ","   (32 SPACES)
          "
10004 DATA"   (32 SPACES)                  ","   (31 SPACES)
        ","   (28 SPACES)                  ","   (28 SPACES)
      "
10006 DATA"   (29 SPACES)                ","   (29 SPACES)
     ","   (29 SPACES)                ","   (29 SPACES)
    "
10095 'DATA FOR ROBOT #7
10100 DATA12,32,170,131,171,151,131,149,6,32,160,152,134,2,131,171
```

Listing 1 continues

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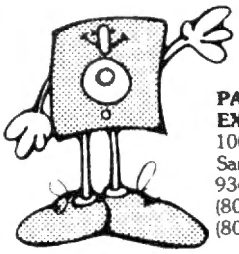

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Listing 1 continued

```
,32,170,149,32,151,2,131,137,164,144
10110 DATA3,32,160,152,134,129,4,32,170,32,170,149,32,149,4,32,130
,137,164,144,2,32,152,129,7,32,170,32,170,149,32,149,7,32,130,164
10120 DATA32,32,150,9,32,170,32,170,149,32,149,9,32,169,32,154,10,
32,170,32,170,149,32,149,10,32,165
10130 DATA168,133,32,160,8,176,186,176,186,181,176,181,8,176,144,3
2,138,144,170,32,32,154,23,32,165,32,32,149
10140 DATA170,144,32,141,23,140,142,32,160,149
10150 DATA32,130,137,140,188,5,32,9,176,5,32,188,140,134,129,3,32,
170,4,32,168,141,7,140,142,148,4,32,149
10160 DATA3,32,149,3,32,160,183,9,179,187,144,3,32,170,2,32,160,13
3,3,32,158,11,140,173,3,32,138,144
10170 DATA2,32,170,3,32,186,13,179,181,3,32,149,2,32,150,2,32,168,
141,13,140,142,148,2,32,169
10180 DATA2,32,181,2,176,183,15,179,187,2,176,186
```

Program Listing 2

```
0 'ATTACK OF THE TRS-80          LISTING 2
   by Hollie Satterfield
10 CLS:PRINT@20,"ATTACK OF THE TRS-80!":PRINT:PRINT"    The coloni
sts of Moonbase II have been forced to flee for
their lives. A deranged Model I microcomputer has infiltrated
the colony's central computer and has taken over the base and"
20 PRINT"all of its electronic inhabitants. Your mission: Find the
 Model
I and destroy it while avoiding the deadly robots which now
patrol the station.":PRINT
30 PRINT"    Type in verb + noun commands to do whatever you wish.
 You
may use the following verbs: N,S,E,W (to move in any direction),GE
T (to retrieve something),TAKE (to take a pill),DROP,DRINK,"
40 PRINT"LOOK,and INVENTORY. You are dead if you receive more than
 6
wounds or if your alertness rating drops to 0,and you lose if
you use more than 75 Suspension of Disbelief points. Good luck!"
60 CLEAR85:FORX=1TO6:READN$(X),CR(X):NEXT:D$(0)="NORTH":D$(1)="SOU
TH":D$(2)="EAST":D$(3)="WEST":CP=15:DIMR(30),Y(30),D(30,3),C$(15),
A$(49),A(28),OB(49),WP(30)
140 FORX=1TO30:FORY=0TO3:READD(X,Y):NEXTY,X:DATAMAIDBOT,0,HANDYMAN
,4,GARCON,3,SECURIBOT,5,CARGOBOT,2,GUARDIAN,3,,6,2,,,7,3,1,,,4,2,,
9,5,3,,,,,1,10,,
150 DATA2,,,,,12,,,4,13,,,6,14,11,,,,12,10,8,,13,11
160 DATA9,,,12,10,19,,,,20,16,,,21,17,15,,22,,16,,,19,,14
170 DATA23,,18,15,24,,,,16,,,,17,26,,,19,27,,,,20,,25,,,29,26,24,22,
,,25,23,,28,,,,29,27,25,,30,28,,,,29
190 C$(1)="A WEAPONRY SHOP.":C$(2)="A HUGE SUITE DONE IN EARLY GRE
EK DECOR,WITH
RED VELVET CARPETING AND UPHOLSTERY,A SMALL SWIMMING POOL,AN
EXTENSIVE MOOD LIGHTING SYSTEM,AND A ZERO GRAVITY BED CHAMBER.
200 C$(3)="The Pizza Palace,A RESTAURANT. UNFORTUNATELY,
LARGE QUANTITIES OF TOMATO SAUCE,PEPPERONI,AND ANCHOVIES WILL BEOF
 NO HELP TO YOU IN YOUR QUEST.
210 C$(4)="WHAT MUST HAVE BEEN A MAJOR BATTLE SITE BEFORE
THE COLONISTS EVACUATED. SHRAPNEL AND SHATTERED CONCRETE BLOCKS AR
E SCATTERED AROUND.":C$(5)="A SMALL AUDITORIUM. THE WORDS 'GO BACK
!' ARE
SPRAY PAINTED IN LARGE LETTERS ON THE WALL.
250 C$(6)="A RANSACKED SALOON. ALMOST EVERYTHING YOU CAN
SEE IS BATTERED OR SMASHED.":C$(8)="A PHARMACY. SHELVES HERE ARE F
ILLED WITH
HUNDREDS OF BOTTLES FILLED WITH MULTICOLORED PILLS. THE BOTTLES AR
E MARKED IN SOME UNKNOWN LANGUAGE.
260 C$(7)="AN ELECTRICIAN'S SHOP. MANGLED ELECTRICAL
EQUIPMENT IS EVERYWHERE.":C$(9)="A COMMUNICATIONS ROOM. ALL OF THE
 VARIOUS
SPEAKERS,MICROPHONES,AND SCREENS,HOWEVER,HAVE BEEN SMASHED.
270 C$(15)="SPLASH! THIS MUST HAVE BEEN THE CHILDREN'S WARD,AS A B
UCKET OF
WATER WAS BALANCED OVER THE DOOR. YOU ARE SOAKED AND ANY LASERS YO
U HAVE ARE SHORT-CIRCUITED.
280 C$(11)="The Cigar Box,A TOBACCO STORE WITH EVERY KIND
OF TOBACCO IMAGINABLE: TOBACCO FOR SMOKING,CHEWING,SNORTING,
DRINKING,AND FOR SEASONING FOOD. YUCCH.
290 C$(12)="AN EMPTY SPACECRAFT HANGAR. ELECTRONIC LAUGHTERECHOES
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320 C$(10)="A FAIRLY LARGE NOVELTY SHOP. ON THE COUNTER IS A BOWL
OF CHOCOLATE-COVERED INSECTS.":C$(14)="THE ROOM IS MARKED AS AN EX
ECUTIVE OFFICE. SEVERAL DIPLOMAS AND OTHER CERTIFICATES HANG ABOVE
 THE MESSY DESK.
330 A$=INKEY$:PRINT@978,"Press any key to continue";:A=20:GOSUB790
:CLS:GOSUB1010
```

Listing 2 continues

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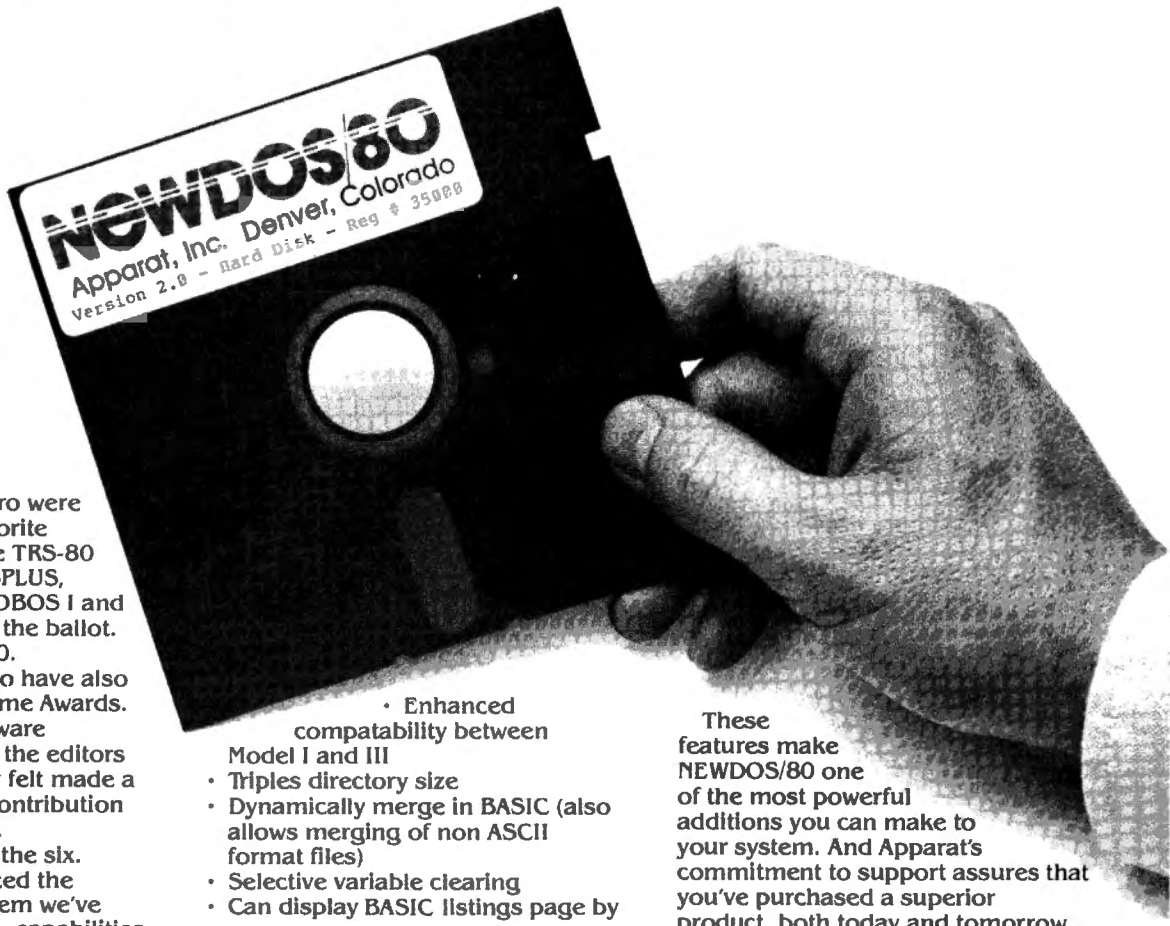

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The editors of 80 Micro have also awarded their Hall of Fame Awards. From among every software package on the market, the editors picked only six that they felt made a lasting and significant contribution to the TRS-80 computer. NEWDOS/80 was one of the six.

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Listing 2 continued

```
360 PRINT"  You must wear a vacuum suit. Here are the 4 types of s
uits,
and their corresponding Suspension of Disbelief cost. #1 is a
regular suit, #2 reflects laser blasts, #3 deflects bullets,and #4
 does both.
370 FORX=1TO4:READA$(X),A(X):PRINTX;" "A$(X);A(X):NEXT
380 DATA VACUUM,5,REFLECTIVE,7,BODARMOR,7,REFLECBOD,10,LASER PISTO
L #1,3,LASER RIFLE #1,5,PISTOL #1,3,RIFLE #1,5,LASER RECHARGE #1,1
,LASER RECHARGE #2,1,LASER RIFLE RECHARGE #1,2,LASER RIFLE RECHARG
E #2,2,PISTOL AMMO #1,1,PISTOL AMMO #2,1
390 INPUT"Which do you want";B:IFB<1ORB>4THEN390ELSEOB(B)=-1:H=H+1
:DB=DB+A(B):GOSUB1000
400 CLS:Y=64:FORX=5TO28:READA$(X),A(X):PRINT@Y,X-4;" "A$(X);A(X):Y
(X)=Y:Y=Y+32:NEXT:FORX=29TO49:READA$(X),OB(X):NEXT
410 DATARIFLE AMMO #1,2,RIFLE AMMO #2,2,SCOTCH,1,WINE,1,BOTBLASTER
,3,PAIN PILLS #1,2,PEP PILLS,2,EXPL GRENADE,2,SILVER KEY,2,ATARI J
OYSTICK,1,BLUE INSULATED GLOVES,1,GAS GRENADE,1,SMOKE GRENADE,2,GO
LF CLUB,1
430 PRINT"You may now choose 8 other items. Think carefully about
your
choices. Press any key to begin choosing.";:GOSUB790:PRINT@832,CHR
$(31);:FORX=1TO8:B=0
460 PRINT@896,;:INPUT"Which item";B:IFB<1ORB>26THENPRINT@896,"
          ";:GOTO460ELSEIFOB(B+4)<>0THEN465ELSEOB(B+4)=-1:DB=DB+A(
B+4):H=H+1:GOSUB1000:PRINT@896,"                    ";:PRINT@Y(B+4),"
";:GOTO470
465 PRINT@896,"You already have it!";:FORY=1TO200:NEXTY:PRINT@896,
"                    ";:GOTO460
470 NEXT
480 DATARIFLE #2,1,RIFLE #3,1,LASER RIFLE #2,1,LASER RIFLE #3,4,LA
SER PISTOL #2,1,LASER PISTOL #3,1,RIFLE AMMO #3,1,RIFLE AMMO #4,1,
LASER RECHARGE #3,1,LASER RECHARGE #4,1,LASER RIFLE RECHARGE #3,1,
LASER RIFLE RECHARGE #4,1,PAIN PILLS #2,2,PAIN PILLS #3,2
490 DATA5-IRON,14,GOLF BALL,14,WHISKEY,6,VODKA,6,INSULATED GLOVES,
7,HUMIDOR,11,ASH TRAY,11
510 FORX=1TO30:R1=RND(15):R(X)=R1:NEXT
515 FORX=1TO10:READVB$(X):NEXT:DATAN,S,E,W,GET,DRO,DRI,TAK,INV,LOO
520 PRINT@977,"Press any key to begin game";:GOSUB790
540 CLS:IFCP=5THENGOTO10000ELSEPRINT:IFR(CP)<14THENPRINT"YOU HAVE
ENTERED ";
550 PRINTC$(R(CP)):NR=0
560 R1=RND(6):IFR1>5THENR1=RND(3):PRINT"WARNING: ROBOTS APPROACHIN
G!":FORX=1TO750:NEXT:CLSELSE575
570 FORX=1TOR1:RB(X)=RND(6):NR=NR+1:NEXT:PRINT@64,R$(RB(1));:PRINT
@448,N$(RB(1));:IFNR>1THENPRINT@89,R$(RB(2));:PRINT@473,N$(RB(2));
:IFNR>2THENPRINT@115,R$(RB(3));:PRINT@500,N$(RB(3));
572 PRINT:GOSUB15000:FORX=1TO500:NEXT:GOTO540
575 IFR(CP)=8THEN2000ELSEIFR(CP)=15THEN2100ELSEIFR(CP)=10THEN2200E
LSEIFR(CP)=13THEN2150
576 B=0:PRINT"IMPORTANT VISIBLE ITEMS: ";:FORX=1TO49:IFOB(X)=R(CP)
THENPRINTA$(X)"  ";:B=1
577 NEXTX:IFB=0THENPRINT"NONE.";
578 PRINT:PRINT"EXITS: ";:FORX=0TO3:IFD(CP,X)<>0THENPRINTD$(X)"  "
;
579 NEXTX:PRINT
580 PRINT:INPUT"COMMAND";CO$:VB=0:NO=0:VB$="":NO$=""
590 LC=LEN(CO$):IFLC<4THENVB$=CO$:GOTO620
600 FORX=1TOLC:A$=MID$(CO$,X,1):IFA$<>" "THENVB$=VB$+A$:NEXTX
610 IFLEN(VB$)=LEN(CO$)THENNO=0ELSENO$=RIGHT$(CO$,LC-X)
615 VB$=LEFT$(VB$,3)
620 FORX=1TO10:IFVB$=VB$(X)THENVB=X:ELSENEXT
630 FORX=1TO49:IFNO$=A$(X)THENNO=XELSENEXT
640 IFVB=0THENPRINT"WHAT?":GOTO580
645 ONVBGOTO650,650,650,650,850,900,670,700,800,750
650 IFD(CP,VB-1)=0THENPRINT"YOU CAN'T GO THAT WAY!":GOTO580
652 IFRND(10)<>1THEN668ELSEPRINT"THE DOOR IS ELECTRIFIED!"
655 IFOB(25)=-1OROB(47)=-1THENPRINT"YOUR INSULATED GLOVES PROTECT
YOU,HOWEVER.":GOTO665
660 PRINT"YOU ARE WOUNDED!":GOSUB11520
665 FORX=1TO1000:NEXT
668 CP=D(CP,VB-1):GOTO540
670 IFNO=17ORNO=18ORNO=45ORNO=46THEN680ELSEPRINT"ARE YOU NUTS?":GO
TO580
680 IFOB(NO)=-1THEN695
690 PRINT"YOU DON'T HAVE ANY!":GOTO580
695 OB(NO)=0:H=H-1:PRINT"O.K. YOUR ALERTNESS IS INCREASED BY 2 POI
NTS.":A=A+2:GOSUB1000:GOTO580
700 IFNO<>20ANDNO<>21ANDNO<>41ANDNO<>42THENPRINT"TRY 'GET'.":GOTO5
80
710 IFNO=20ORNO=41ORNO=42THENIFOB(NO)=-1THENPRINT"O.K. ONE WOUND I
S CURED IF YOU HAVE ANY.":OB(NO)=0:H=H-1:GOSUB1000:IFW>0THENW=W-1:
GOTO580ELSE580
720 IFOB(NO)=-1THENOB(NO)=0:PRINT"O.K. YOUR ALERTNESS IS INCREASED
 BY 2 POINTS.":H=H-1:A=A+2:GOSUB1000:GOTO580
730 PRINT"YOU DON'T HAVE ANY!":GOTO580
750 IFR(CP)<14THENPRINT"YOU HAVE ENTERED ";
755 PRINTC$(R(CP)):GOTO576
760 XA=1:RETURN
770 XA=2:RETURN
```

Listing 2 continues

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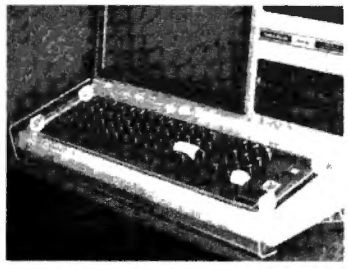

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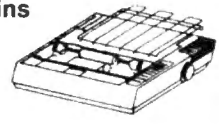

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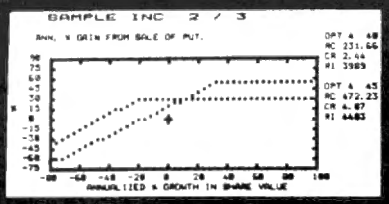

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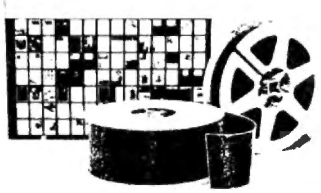

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Listing 2 continued

```
780 XA=3:RETURN
790 A$=INKEY$:IFA$=""THEN790ELSERETURN
800 B=0:PRINT"YOU ARE CARRYING:":FORX=1TO49:IFOB(X)=-1THENPRINTA$(
X):B=1
810 NEXT
820 IFB=0PRINT"NOTHING!"
830 GOTO580
850 IFNO=0PRINT"GET WHAT?":GOTO580
860 IFH=9PRINT"YOU CAN'T CARRY ANY MORE!":GOTO580
870 IFOB(X)=R(CP)THENOB(X)=-1:PRINT"O.K.":H=H+1:GOSUB1000:GOTO580:
ELSEPRINT"IT'S NOT HERE!":GOTO580
900 IFNO=0PRINT"DROP WHAT?":GOTO580
910 IFOB(X)=-1THENOB(X)=R(CP):PRINT"O.K.":H=H-1:GOSUB1000:GOTO580:
ELSEPRINT"YOU DON'T HAVE IT!":GOTO580
1000 XA=PEEK(16416):XB=PEEK(16417):PRINT@8,H;:PRINT@29,A;:PRINT@59
,DB;:POKE16416,XA:POKE16417,XB:IFDB>75ORA<1THEN60000
1001 RETURN
1010 PRINT@0,"CARRYING"H"ITEMS.  ALERTNESS:"A"  SUSPENSION OF DISB
ELIEF:"DB:POKE16916,1:RETURN
2000 INPUT"WILL YOU TRY ONE OF THE PILLS";A$:IFLEFT$(A$,1)="Y"THEN
R1=RND(3):ON RND(3)GOTO2010,2020,2030ELSEPRINT"O.K.":GOTO576
2010 PRINT"IT'S A PAIN PILL. ONE WOUND IS CURED IF YOU HAVE ANY.":
IFW>0THENW=W-1
2015 GOTO576
2020 PRINT"IT'S A PEP PILL.YOUR ALERTNESS LEVEL IS INCREASED BY TW
O POINTS.":A=A+2:GOSUB1000:GOTO576
2030 PRINT"IT'S AN HALLUCINOGEN. THAT'LL TEACH YOU TO TAKE STRANGE
 PILLS.  YOUR ALERTNESS LEVEL IS REDUCED TWO POINTS.":A=A-2:GOSUB1
000:GOTO576
2100 IFOB(5)=-1THENOB(5)=0:H=H-1
2110 IFOB(6)=-1THENOB(6)=0:H=H-1
2120 FORX=31TO34:IFOB(X)=-1THENOB(X)=0:H=H-1
2130 NEXTX:GOSUB1000:GOTO576
2150 INPUT"WILL YOU INVESTIGATE FURTHER";A$:IFLEFT$(A$,1)="Y"THENR
1=RND(6)+RND(6)ELSE576
2160 IFR1>ATHENPRINT"THE BED IS EQUIPPED WITH AN AUTOMATIC MASSAGE
 MACHINE WHICH
GRABS YOU AND PUMMELS YOU WILDLY. THE RESULT:":GOSUB11510:GOTO576E
LSEPRINT"NOTHING SPECIAL HERE.":GOTO576
2200 INPUT"WILL YOU TRY ONE";A$:IFLEFT$(A$,1)="Y"THENR1=RND(3):ONR
1GOTO2210,2220,2230ELSEPRINT"CHICKEN.":GOTO576
2210 PRINT"IT CONTAINS AN AWARENESS HEIGHTENING DRUG. YOUR ALERTNE
SS IS
INCREASED BY ONE POINT.":A=A+1:GOSUB1000:GOTO576
2220 PRINT"IT WAS YUMMY.":GOTO576
2230 PRINT"IT GIVES YOU A MILDLY UPSET STOMACH. YOUR ALERTNESS LEV
EL IS
REDUCED BY ONE POINT.":A=A-1:GOSUB1000:GOTO576
2240 A$=INKEY$:IFA$=""THENRETURNELSE10010
10007 POKE16916,0:FORX=1TO16:READA$:PRINTA$;:IFX<>16THENPRINT:NEXT
X
10008 PRINT@489,"YOU HAVE ENTERED THE";:PRINT@552,"DEADLY COMPUTER
 ROOM!!!";:PRINT@935,"PRESS ANY KEY TO CONTINUE";:PRINT@1005,"TO Y
OUR DOOM!";
10009 FORX=15814TO15833:POKEX,188:POKEX-2,32:GOSUB2240:NEXT:FORX=1
TO20:NEXT:FORX=15833TO15814STEP-1:POKEX,188:POKEX+2,32:GOSUB2240:N
EXT:FORX=1TO20:NEXT:GOTO10009
10010 CLS:FORX=1TO5:RB(X)=RND(6):NR=NR+1:NEXT:PRINT@64,R$(RB(1));:
PRINT@448,N$(RB(1));:PRINT@89,R$(RB(2));:PRINT@473,N$(RB(2));:PRIN
T@115,R$(RB(3));:PRINT@500,N$(RB(3));:PRINT@588,R$(RB(4));:PRINT@9
72,N$(RB(4));:PRINT@614,R$(RB(5));:PRINT@998,N$(RB(5));
10012 PRINT@2,"THE DESTRUCTION OF THESE 5 ROBOTS WILL DESTROY THE
TRS-80.";:FORX=640TO896STEP64:READA$:PRINT@X,A$;:NEXT:DATAPRESS,AN
Y,KEY,TO,START
10013 GOSUB790:CLS:GOSUB1010:GOTO15000
10100 IFOB(20)=-1THENW=W-1:OB(20)=0:PRINT"YOUR PAIN PILLS SAVE YOU
!":RETURN
10110 FORX=41TO42:IFOB(X)=-1THENW=W-1:OB(X)=0:PRINT"YOUR PAIN PILL
S SAVE YOU!":RETURNELSENEXTX
10120 GOTO60000
10750 HH=4-CR(RB(N)):R1=RND(6):IFHH<1THENHH=1
10755 IFOB(28)=-1OROB(43)=-1THENPRINT"YOUR GOLF CLUB HELPS YOU!":H
H=HH+1
10760 ONHH+4GOSUB10800,10805,10805,10810,10815,10820,10825,10830,1
0830,10835,10835,10840
10765 ONXAGOSUB12500,12510,12520
10770 GOTO16000
10800 GOTO760
10805 IFR1<6THEN760ELSE770
10810 IFR1<5THEN760ELSE770
10815 IFR1<4THEN760ELSEIFR1<6THEN770ELSE780
10820 IFR1<3THEN760ELSEIFR1<6THEN770ELSE780
10825 IFR1=1THEN760ELSEIFR1<5THEN770ELSE780
10830 IFR1<4THEN770ELSE780
10835 IFR1<3THEN770ELSE780
10840 IFR1=1THEN770ELSE780
11000 R1=RND(6)+RND(6)
11005 IF(OB(2)=-1OROB(4)=-1)AND(WP=3ORWP=4)THENR1=R1-3
```

Listing 2 continues

Listing 2 continued

```
11010 IF(OB(3)=-1OROB(4)=-1)AND(WP=5ORWP=6)THENR1=R1-3
11015 IFR1<1THENR1=1
11020 ONWPGOSUB11100,11105,11110,11115,11120,11125
11025 ONXAGOSUB12500,12510,12520
11030 GOTO16000
11100 PRINT"GAS AND SMOKE HAVE NO EFFECT ON ROBOTS YOU MORON.":OB(
NO)=0:GOTO760
11105 OB(22)=0:IFR1<5ORR1=6THEN760ELSEIFR1=8THEN770ELSE780
11110 IFR1=4ORR1=7ORR1=10THENWP(NO-4)=1
11111 IFR1<6THEN760ELSEIFR1=6THEN770ELSE780
11115 IFR1=4ORR1=7ORR1=10THENWP(NO-4)=1
11116 IFR1<4THEN760ELSEIFR1<7THEN770ELSE780
11120 IFR1=7THENWP(NO-4)=1
11121 IFR1<5THEN760ELSEIFR1<7THEN770ELSE780
11125 IFR1=3ORR1=4ORR1=7ORR1=9ORR1=10THENWP(NO-4)=1
11126 IFR1=1THEN760ELSEIFR1<6THEN770ELSE780
11500 PRINT"NO EFFECT.":RETURN
11510 PRINT"STUN. ";:INPUT"DO YOU WANT TO (1) TAKE THE EFFECT OF T
HE BLAST OR
(2) EXPEND 2 SUSPENSION OF DISBELIEF PTS.";B:IFB=1THENA=A-1ELSEIFB
=2THENDB=DB+2ELSE11510
11515 PRINT"O.K.":GOSUB1000:RETURN
11520 PRINT"DIRECT HIT. ";:INPUT"DO YOU WANT TO (1)TAKE THE EFFECT
 OF THE BLAST
OR (2)EXPEND 5 SUSPENSION OF DISBELIEF PTS.";B:IFB=1THEN11522ELSEI
FB=2THENDB=DB+5:PRINT"O.K.":GOTO11525ELSE11520
11522 A=A-2:W=W+1:PRINT"YOU NOW HAVE"W"WOUND";:IFW>1THENPRINT"S."E
LSEPRINT"."
11525 GOSUB1000:RETURN
11750 HH=CR(RB(N))-4:R1=RND(6):IFHH<1THENHH=1
11760 ONHH+4GOSUB10800,10805,10805,10810,10815,10820,10825,10830,1
0830,10835,10835,10840
11765 ONXAGOSUB11500,11510,11520:RETURN
12000 R1=RND(6)+RND(6)
12005 IFR1<7THEN760ELSEIFR1=7THEN770ELSE780
12010 ONXAGOSUB11500,11510,11520:RETURN
12500 PRINT"THE "N$(RB(N))" IS UNAFFECTED.":RETURN
12510 PRINT"THE "N$(RB(N))" IS STUNNED.":CR(RB(N))=CR(RB(N))-.5:RE
TURN
12520 PRINT"THE "N$(RB(N))" IS BLOWN APART!":RB(N)=0:RETURN
15000 FORX=1TO600:NEXT:FORN=1TONR:IFRB(N)<>0THEN15010ELSENEXT:IFCP
=5THEN50000ELSEPRINT"ROBOTS DESTROYED!":RETURN
15010 IFQ=0THENIFCR(RB(N))>ATHEN15995
15020 Q=1:PRINT"YOU ATTACK!
15025 PRINT"INVENTORY: ":FORX=1TO49:IFOB(X)=-1THENPRINTA$(X)"  ";
15030 NEXT:PRINT
15035 INPUT"(1)WEAPONS OR (2)HAND-TO-HAND COMBAT";B:IFB=1THEN15040
ELSEIFB=2THEN10750ELSE15035
15040 WP=0:INPUT"WHICH WEAPON";A$:FORX=1TO49:IFA$(X)=A$THENNO=XELS
ENEXTX:PRINT"WHAT?":GOTO15040
15045 IFNO=26ORNO=27THENWP=1ELSEIFNO=22THENWP=2
15050 IFNO=5ORNO=33ORNO=34THENWP=3
15055 IFNO=6ORNO=31ORNO=32THENWP=4
15060 IFNO=7THENWP=5
15065 IFNO=8ORNO=29ORNO=30THENWP=6
15070 IFNO=19THEN15800
15075 IFWP=0THENPRINT"WHAT?!?":GOTO15040
15077 IFOB(NO)<>-1THENPRINT"YOU DON'T HAVE THAT!":GOTO15025
15080 IFWP(NO-4)=1THENPRINT"YOUR WEAPON IS OUT OF AMMUNITION."ELSE
11000
15085 ONWP-2GOTO15090,15095,15100,15105
15090 FORX=9TO10:IFOB(X)=-1THEN15120ELSENEXTX
15092 FORX=37TO38:IFOB(X)=-1THEN15120ELSENEXTX
15093 GOTO15110
15095 FORX=11TO12:IFOB(X)=-1THEN15120ELSENEXTX
15097 FORX=39TO40:IFOB(X)=-1THEN15120ELSENEXTX
15098 GOTO15110
15100 FORX=13TO14:IFOB(X)=-1THEN15120ELSENEXTX
15103 GOTO15110
15105 FORX=15TO16:IFOB(X)=-1THEN15120ELSENEXTX
15107 FORX=35TO36:IFOB(X)=-1THEN15120ELSENEXTX
15110 PRINT"AND YOU HAVE NO AMMO. TRY ANOTHER WAY.":GOTO15035
15120 IFWP(NO-4)=1THENWP(NO-4)=0:OB(X)=0:PRINT"I HAVE RELOADED IT
FOR YOU.":H=H-1:GOSUB1000
15125 GOTO11000
15800 PRINT"THE BOTBLASTER EXPLODES IN YOUR HAND!":OB(NO)=0:H=H-1:
GOSUB11520:GOTO16000
16000 FORN=1TONR:IFRB(N)<>0THEN16010ELSENEXT:GOTO16100
16010 PRINT"THE "N$(RB(N))" ATTACKS!
16020 IFD<4GOSUB11750ELSEGOSUB12000
16040 IFW>6THENGOSUB10100
16050 NEXT
16100 FORN=1TONR:IFRB(N)<>0THEN15000ELSENEXT:IFCP=5THEN50000ELSEPR
INT"ROBOTS DESTROYED!":RETURN
50000 CLS:PRINT@411,"YOU WIN!":PRINT@467,"THE MOONBASE IS SAVED!!"
:GOTO50000
60000 CLS:PRINT@392,"YOU HAVE EXCEEDED YOUR LIMITS!  YOU ARE DEAD!
":PRINT@467,"THE MOONBASE IS DOOMED!":GOTO60000
```


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Maxwell's Demon

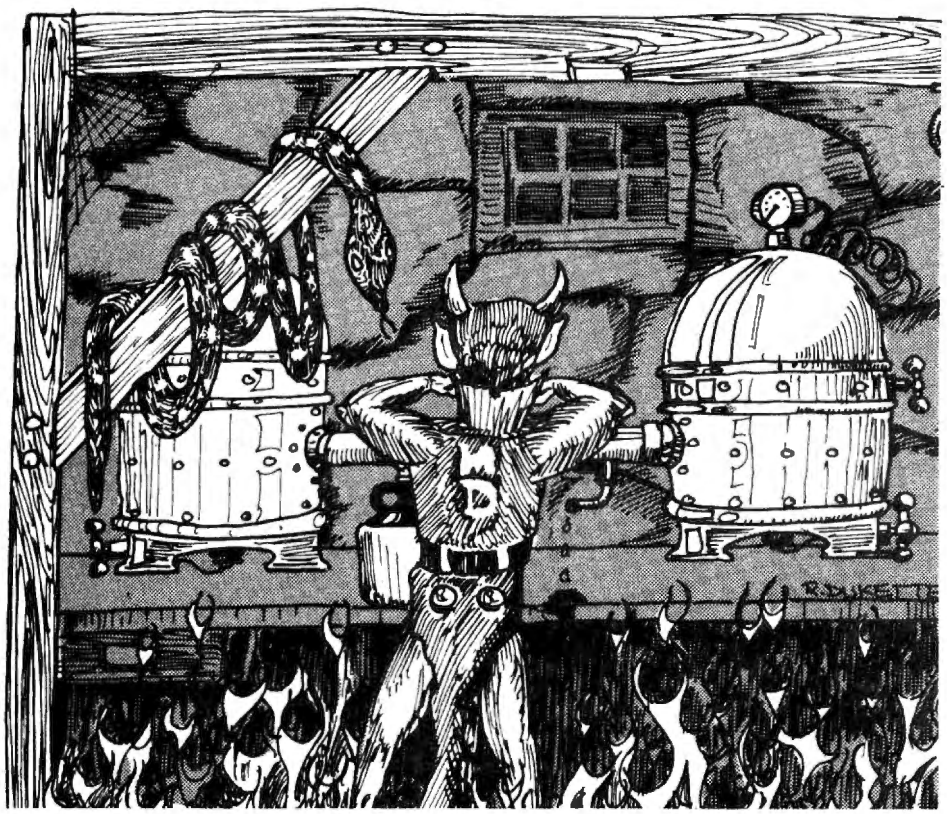
by Lee Morgenstern

Learn something about Maxwell's Hypothesis while you try to keep the hot and cold molecules separated in this physics-based game.

The hottest debate in physics in 1871 centered around James Clerk Maxwell's theory of thermodynamics. Maxwell hypothesized that if you manipulate a valve between two containers filled with gas at identical temperatures so that fast-moving molecules accumulate in one container and slow-moving molecules in the other, the temperature difference created produces useful energy.

But Maxwell's theory seemed to violate the second law of thermodynamics, which states that in a closed system, you can't create order from chaos. When Maxwell first described his hypothesis, it sparked a great deal of debate in the scientific community. However, the hardware necessary to test his hypothesis wasn't available, so the theory could be debated but never proved or disproved. As such, it was a thought experiment only.

Today, computers make thought experiments obsolete. With the help of your Model I/III, you can demonstrate Maxwell's theory visually. It also makes an entertaining game.



The Game

Maxwell's Demon, as the game is called, is so named because the concept of a controllable valve, while central to Maxwell's idea, did not exist in his time. Instead, Maxwell proposed that a supernatural being—a demon—maintained the temperature difference between containers.

In this game, you are Maxwell's demon, the force that separates fast-moving molecules from slow-moving molecules. These hot and cold molecules are depicted on the screen as large H and C characters.

There are six levels of play. The lowest level has four slow-moving molecules, and the highest has 12 fast-moving molecules. The space bar opens and closes the valve separating the two compartments and the break key lets you exit from the game or select a new playing level.

Program Design

The program is written in Assembly language for fast animation. Data tables drive most of the logic for animating the molecules.

Data-driven logic makes the program simple to understand and makes program modification easier since it reduces processing time.

A data base containing all possible

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situations, such as the positions of an animated figure, increases processing speed and improves animation quality.

The idea of referring to a table of precalculated values is not new. Techniques to do so have existed for a long time, but were impractical due to the amount of memory required. Since memory is less expensive today, such techniques are now feasible. The following program provides an example of one of these techniques.

Data Structure

The tables in this program are two-dimensional arrays. The first dimension points to a list of starting addresses for lists in the second dimension. Each list in the second dimension contains the actual table entries.

The first table in the program listing, the move table, uses pixel position and move direction as the two indexes. MOVX, the first list, consists of the addresses MOV0 through MOV5, which correspond to the six pixel positions. MOV0 through MOV5 are the second dimension lists; they are indexed by move direction, and contain the final entries.

The program accesses an entry in the table by following these steps:

(1) Load the DE registers with the first index.

(2) Load the HL registers with the address of the first list.

(3) Add DE to HL.

(4) Reload DE with the 2 bytes addressed by HL. This is the starting address of the proper second list.

(5) Load HL with the second index.

(6) Add DE to HL.

(7) Load the table entry bytes addressed by HL.

Data Tables

The move table, MOVX, determines how to move a molecule. It handles eight move directions including up left, up right, down left, and down right in each of two ways. The first way moves one pixel up or down and one pixel left or right. The other way moves one pixel up or down and two pixels left or right. The indexes of MOVX are pixel position (zero through five) and move direction (zero through seven). There are two values in each entry: the new pixel position and the video address offset.

The wall table, WALLX, determines how to bounce a molecule off a wall. The indexes of WALLX are move direction (zero through seven) and wall number (zero, 2, 4, 6). The entries in the table are new move directions.

The hot table, HOTX, and cold

Program Listing

```
                00100 ;MAXWELL'S DEMON
                00110 ; BY LEE MORGENSTERN, MAY, 1982
                00120 ;
7000            00130         ORG     7000H
                00140 ;
                00150 ;MOVE TABLE - INDEXED BY PIXEL AND MOVE DIRECTION
                00160 ; OUTPUTS NEW PIXEL AND VIDEO ADDRESS OFFSET
7000 0C70       00170 MOVX    DEFW    MOV0
7002 1C70       00171         DEFW    MOV1
7004 2C70       00172         DEFW    MOV2
7006 3C70       00173         DEFW    MOV3
7008 4C70       00174         DEFW    MOV4
700A 5C70       00175         DEFW    MOV5
                00180 ;               UL    UR    DL    DR  UL    UR    DL    DR
700C 05         00190 MOV0    DEFB    5
700D BF         00191         DEFB    191
700E 05         00192         DEFB    5
700F C0         00193         DEFB    192
7010 04         00194         DEFB    4
7011 FF         00195         DEFB    255
7012 04         00196         DEFB    4
7013 00         00197         DEFB    0
7014 02         00198         DEFB    2
7015 BF         00199         DEFB    191
7016 02         00200         DEFB    2
7017 C1         00201         DEFB    193
7018 01         00202         DEFB    1
7019 FF         00203         DEFB    255
701A 01         00204         DEFB    1
701B 01         00205         DEFB    1
701C 03         00206 MOV1    DEFB    3
701D FF         00207         DEFB    255
701E 03         00208         DEFB    3
701F 00         00209         DEFB    0
7020 05         00210         DEFB    5
7021 FF         00211         DEFB    255
7022 05         00212         DEFB    5
7023 00         00213         DEFB    0
7024 00         00214         DEFB    0
7025 FF         00215         DEFB    255
7026 00         00216         DEFB    0
7027 01         00217         DEFB    1
7028 02         00218         DEFB    2
7029 FF         00219         DEFB    255
702A 02         00220         DEFB    2
702B 01         00221         DEFB    1
702C 04         00222 MOV2    DEFB    4
702D FF         00223         DEFB    255
702E 04         00224         DEFB    4
702F 00         00225         DEFB    0
7030 03         00226         DEFB    3
7031 3F         00227         DEFB    63
7032 03         00228         DEFB    3
7033 40         00229         DEFB    64
7034 01         00230         DEFB    1
7035 FF         00231         DEFB    255
7036 01         00232         DEFB    1
7037 01         00233         DEFB    1
7038 00         00234         DEFB    0
7039 3F         00235         DEFB    63
703A 00         00236         DEFB    0
703B 41         00237         DEFB    65
703C 02         00238 MOV3    DEFB    2
703D C0         00239         DEFB    192
703E 02         00240         DEFB    2
703F C1         00241         DEFB    193
7040 01         00242         DEFB    1
7041 00         00243         DEFB    0
7042 01         00244         DEFB    1
7043 01         00245         DEFB    1
7044 05         00246         DEFB    5
7045 BF         00247         DEFB    191
7046 05         00248         DEFB    5
7047 C1         00249         DEFB    193
7048 04         00250         DEFB    4
7049 FF         00251         DEFB    255
704A 04         00252         DEFB    4
704B 01         00253         DEFB    1
704C 00         00254 MOV4    DEFB    0
704D 00         00255         DEFB    0
704E 00         00256         DEFB    0
704F 01         00257         DEFB    1
7050 02         00258         DEFB    2
7051 00         00259         DEFB    0
7052 02         00260         DEFB    2
7053 01         00261         DEFB    1
7054 03         00262         DEFB    3
7055 FF         00263         DEFB    255
7056 03         00264         DEFB    3
7057 01         00265         DEFB    1
7058 05         00266         DEFB    5
7059 FF         00267         DEFB    255
705A 05         00268         DEFB    5
705B 01         00269         DEFB    1
705C 01         00270 MOV5    DEFB    1
705D 00         00271         DEFB    0
705E 01         00272         DEFB    1
705F 01         00273         DEFB    1
7060 00         00274         DEFB    0
7061 40         00275         DEFB    64
7062 00         00276         DEFB    0
7063 41         00277         DEFB    65
```

Listing continues

Listing continued

```
7064 04        00278          DEFB    4
7065 FF        00279          DEFB    255
7066 04        00280          DEFB    4
7067 01        00281          DEFB    1
7068 03        00282          DEFB    3
7069 3F        00283          DEFB    63
706A 03        00284          DEFB    3
706B 41        00285          DEFB    65
               00250 ;
               00260 ;WALL TABLE - INDEXED BY WALL(L,R,U,D) AND MOVE DIRECTION
               00270 ; OUTPUTS NEW MOVE DIRECTION
706C 7470      00289 WALLX    DEFW    WALLL
706E 7C70      00290          DEFW    WALLR
7070 8470      00291          DEFW    WALLU
7072 8C70      00292          DEFW    WALLD
               00290 ;                UL UR DL DR UL UR DL DR
7074 01        00300 WALLL    DEFB    1
7075 01        00301          DEFB    1
7076 03        00302          DEFB    3
7077 03        00303          DEFB    3
7078 05        00304          DEFB    5
7079 05        00305          DEFB    5
707A 07        00306          DEFB    7
707B 07        00307          DEFB    7
707C 00        00310 WALLR    DEFB    0
707D 00        00311          DEFB    0
707E 02        00312          DEFB    2
707F 02        00313          DEFB    2
7080 04        00314          DEFB    4
7081 04        00315          DEFB    4
7082 06        00316          DEFB    6
7083 06        00317          DEFB    6
7084 02        00320 WALLU    DEFB    2
7085 03        00321          DEFB    3
7086 02        00322          DEFB    2
7087 03        00323          DEFB    3
7088 06        00324          DEFB    6
7089 07        00325          DEFB    7
708A 06        00326          DEFB    6
708B 07        00327          DEFB    7
708C 00        00330 WALLD    DEFB    0
708D 01        00331          DEFB    1
708E 00        00332          DEFB    0
708F 01        00333          DEFB    1
7090 04        00334          DEFB    4
7091 05        00335          DEFB    5
7092 04        00336          DEFB    4
7093 05        00337          DEFB    5
               00340 ;
               00350 ;HOT MOLECULE GRAPHICS - INDEXED BY PIXEL
7094 A070      00360 HOTX     DEFW    HOT0
7096 A870      00361          DEFW    HOT1
7098 B070      00362          DEFW    HOT2
709A B870      00363          DEFW    HOT3
709C C070      00364          DEFW    HOT4
709E C870      00365          DEFW    HOT5
70A0 3F        00370 HOT0     DEFB    3FH
70A1 0C        00371          DEFB    0CH
70A2 3F        00372          DEFB    3FH
70A3 00        00373          DEFB    00H
70A4 00        00374          DEFB    00H
70A5 00        00375          DEFB    00H
70A6 00        00376          DEFB    00H
70A7 00        00377          DEFB    00H
70A8 3C        00380 HOT1     DEFB    3CH
70A9 30        00381          DEFB    30H
70AA 3C        00382          DEFB    3CH
70AB 00        00383          DEFB    00H
70AC 03        00384          DEFB    03H
70AD 00        00385          DEFB    00H
70AE 03        00386          DEFB    03H
70AF 00        00387          DEFB    00H
70B0 30        00390 HOT2     DEFB    30H
70B1 00        00391          DEFB    00H
70B2 30        00392          DEFB    30H
70B3 00        00393          DEFB    00H
70B4 0F        00394          DEFB    0FH
70B5 03        00395          DEFB    03H
70B6 0F        00396          DEFB    0FH
70B7 00        00397          DEFB    00H
70B8 2A        00400 HOT3     DEFB    2AH
70B9 1D        00401          DEFB    1DH
70BA 2E        00402          DEFB    2EH
70BB 15        00403          DEFB    15H
70BC 00        00404          DEFB    00H
70BD 00        00405          DEFB    00H
70BE 00        00406          DEFB    00H
70BF 00        00407          DEFB    00H
70C0 28        00410 HOT4     DEFB    28H
70C1 34        00411          DEFB    34H
70C2 38        00412          DEFB    38H
70C3 14        00413          DEFB    14H
70C4 02        00414          DEFB    02H
70C5 01        00415          DEFB    01H
70C6 02        00416          DEFB    02H
70C7 01        00417          DEFB    01H
70C8 20        00420 HOT5     DEFB    20H
70C9 10        00421          DEFB    10H
70CA 20        00422          DEFB    20H
70CB 10        00423          DEFB    10H
70CC 0A        00424          DEFB    0AH
70CD 07        00425          DEFB    07H
70CE 0B        00426          DEFB    0BH
70CF 05        00427          DEFB    05H
               00430 ;
```

Listing continues

table, COLDX, each contain the graphics bits for the molecules in each of the six pixel positions. Figure 1 shows the H graphics in each of the pixel positions.

The molecule control variables, H0 through H5 and C0 through C5, contain parameters that maintain the current status of the molecules. The data in the HC table initializes the values. Each list consists of the pixel position, video address, move direction, and molecule type.

There are three more tables that contain program control parameters. Each is indexed by the playing level. The molecule update table, LEVELX, contains pointers to active molecule update sequences. The molecule update count table, FIGCTX, contains the length of the molecule update list. The molecule timing table, TIMX, contains the time delays between molecule updates.

"The program begins by disabling interrupts and setting the stack pointer to the highest point in a 16K memory."

Program Control

The program begins by disabling interrupts and setting the stack pointer to the highest point in a 16K memory.

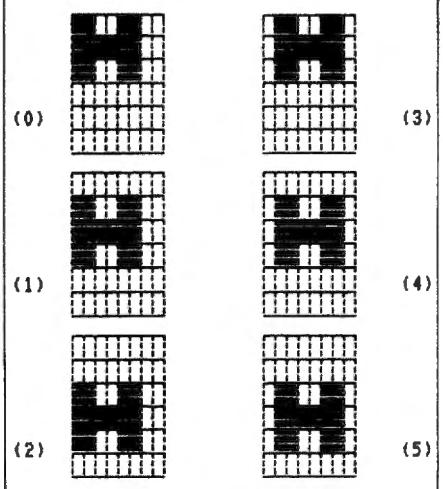

Fig. 1. Pixel Positions for Hot Molecule Graphic.

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Listing continued

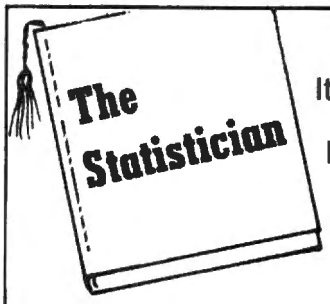
```
                00440 ;COLD MOLECULE GRAPHICS - INDEXED BY PIXEL
70D0 DC70       00450 COLDX   DEFW    COLD0
70D2 E470       00451         DEFW    COLD1
70D4 EC70       00452         DEFW    COLD2
70D6 F470       00453         DEFW    COLD3
70D8 FC70       00454         DEFW    COLD4
70DA 0471       00455         DEFW    COLD5
70DC 3F         00460 COLD0   DEFB    3FH
70DD 33         00461         DEFB    33H
70DE 33         00462         DEFB    33H
70DF 00         00463         DEFB    00H
70E0 00         00464         DEFB    00H
70E1 00         00465         DEFB    00H
70E2 00         00466         DEFB    00H
70E3 00         00467         DEFB    00H
70E4 3C         00470 COLD1   DEFB    3CH
70E5 0C         00471         DEFB    0CH
70E6 0C         00472         DEFB    0CH
70E7 00         00473         DEFB    00H
70E8 03         00474         DEFB    03H
70E9 03         00475         DEFB    03H
70EA 03         00476         DEFB    03H
70EB 00         00477         DEFB    00H
70EC 30         00480 COLD2   DEFB    30H
70ED 30         00481         DEFB    30H
70EE 30         00482         DEFB    30H
70EF 00         00483         DEFB    00H
70F0 0F         00484         DEFB    0FH
70F1 0C         00485         DEFB    0CH
70F2 0C         00486         DEFB    0CH
70F3 00         00487         DEFB    00H
70F4 2A         00490 COLD3   DEFB    2AH
70F5 37         00491         DEFB    37H
70F6 33         00492         DEFB    33H
70F7 11         00493         DEFB    11H
70F8 00         00494         DEFB    00H
70F9 00         00495         DEFB    00H
70FA 00         00496         DEFB    00H
70FB 00         00497         DEFB    00H
70FC 28         00500 COLD4   DEFB    28H
70FD 1C         00501         DEFB    1CH
70FE 0C         00502         DEFB    0CH
70FF 04         00503         DEFB    04H
7100 02         00504         DEFB    02H
7101 03         00505         DEFB    03H
7102 03         00506         DEFB    03H
7103 01         00507         DEFB    01H
```

Listing continues

Before starting any animation, the program calls four routines to set the scene: DMSG displays the opening message containing the name of the program and a list of the playing levels, GETLV reads the keyboard and inputs a playing level from the operator, Setup sets up the playing level parameters and initializes the locations of the molecules, and BRD draws the playing area on the screen.

Demon then executes a loop that updates the location and movement of each active molecule. FIGCNT contains the number of passes to be made through this loop. FIGX points to a list containing the molecule control variable addresses in the sequence to be updated. Notice that each active hot molecule appears twice in the list and each active cold molecule appears once. This causes the hot molecules to be moved twice as fast as the cold ones.

For each pass through this loop, Demon updates a molecule by calling four routines. Each routine requires that the IX register contain the address of the molecule control variable list. Wall controls the animation of the wall bouncing—it checks for wall contact, and if any occurs, it changes the move



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direction in the control variable list for that molecule.

REM removes the molecule graphics from the screen. Move calculates the next screen location for the molecule, and Add redraws the molecule graphics at the new location.

When Demon finishes with the molecule update loop, it calls the Open routine to control the opening or closing of the partition. It then executes a time delay before restarting the loop. During this delay, any wall contact produces a beeping sound through the cassette port. When the time delay is finished, the loop is repeated unless the break key is pressed. The break key restarts the entire program, letting the operator select a new playing level.

At slow playing levels, Demon calls the Open routine in the middle of the molecule update loop. This provides better response time for the operator.

"During this delay, any wall contact produces a beeping through the cassette port."

Routines

The MSG routine clears the screen and displays the opening message with the name of the program and a list of the playing levels. MSG scans the message text and transfers each character to the video memory. There are two control characters that MSG processes differently: The dollar sign indicates a carriage return and an asterisk signals the end of the message.

The GETLVL routine reads the memory-mapped keyboard byte for the number keys to determine the playing level selected. It loops until it detects a bit set, indicating a depressed key. It then shifts and counts the bits to find the key and the corresponding playing level.

The Setup routine establishes control parameters based on the selected playing level. The parameters consist of the number-of-molecules updates, FIGCNT; the time delay between updates, TIMING; and the molecule update list pointer, FIGX. Setup then performs a block move from HC to H0 to

Listing continued

```
7104 20          00510 COLD5   DEFB    20H
7105 30          00511         DEFB    30H
7106 30          00512         DEFB    30H
7107 10          00513         DEFB    10H
7108 0A          00514         DEFB    0AH
7109 0D          00515         DEFB    0DH
710A 0C          00516         DEFB    0CH
710B 04          00517         DEFB    04H
                 00520 ;
                 00530 ;MOLECULE UPDATE SEQUENCE - INDEXED BY PLAYING LEVEL
710C 1871        00540 LEVELX  DEFW    L1
710E 2471        00541         DEFW    L2
7110 2471        00542         DEFW    L2
7112 3C71        00543         DEFW    L4
7114 3C71        00544         DEFW    L4
7116 3C71        00545         DEFW    L4
7118 A672        00550 L1      DEFW    H0
711A C472        00551         DEFW    H5
711C CA72        00552         DEFW    C0
711E A672        00553         DEFW    H0
7120 C472        00554         DEFW    H5
7122 E872        00555         DEFW    C5
7124 A672        00560 L2      DEFW    H0
7126 AC72        00561         DEFW    H1
7128 CA72        00562         DEFW    C0
712A BE72        00563         DEFW    H4
712C C472        00564         DEFW    H5
712E D072        00565         DEFW    C1
7130 A672        00566         DEFW    H0
7132 AC72        00567         DEFW    H1
7134 E272        00568         DEFW    C4
7136 BE72        00569         DEFW    H4
7138 C472        00570         DEFW    H5
713A E872        00571         DEFW    C5
713C A672        00572 L4      DEFW    H0
713E AC72        00573         DEFW    H1
7140 CA72        00574         DEFW    C0
7142 B272        00575         DEFW    H2
7144 B872        00576         DEFW    H3
7146 D072        00577         DEFW    C1
7148 BE72        00578         DEFW    H4
714A C472        00579         DEFW    H5
714C D672        00580         DEFW    C2
714E A672        00581         DEFW    H0
7150 AC72        00582         DEFW    H1
7152 DC72        00583         DEFW    C3
7154 B272        00584         DEFW    H2
7156 B872        00585         DEFW    H3
7158 E272        00586         DEFW    C4
715A BE72        00587         DEFW    H4
715C C472        00588         DEFW    H5
715E E872        00589         DEFW    C5
                 00590 ;
                 00600 ;MOLECULE UPDATE TIMING - INDEXED BY PLAYING LEVEL
7160 60          00610 TIMX    DEFB    96
7161 30          00611         DEFB    48
7162 0C          00612         DEFB    12
7163 08          00613         DEFB    8
7164 04          00614         DEFB    4
7165 01          00615         DEFB    1
                 00620 ;
                 00630 ;MOLECULE UPDATE COUNT - INDEXED BY PLAYING LEVEL
7166 06          00640 FIGCTX  DEFB    6
7167 0C          00641         DEFB    12
7168 0C          00642         DEFB    12
7169 12          00643         DEFB    18
716A 12          00644         DEFB    18
716B 12          00645         DEFB    18
                 00650 ;
716C 4D          00660 MSG     DEFM    'MAXWELL'
     41 58 57 45 4C 4C
7173 27          00670         DEFB    27H
7174 53          00680         DEFM    'S DEMON$'
     20 44 45 4D 4F 4E 24
717C 24          00690         DEFM    '$ENTER PLAYING LEVEL:$'
     45 4E 54 45 52 20 50 4C
     41 59 49 4E 47 20 4C 45
     56 45 4C 3A 24
7192 24          00700         DEFM    '$1.  4 SLOW MOLECULES'
     31 2E 20 20 34 20 53 4C
     4F 57 20 4D 4F 4C 45 43
     55 4C 45 53
71A7 24          00710         DEFM    '$2.  8 SLOW MOLECULES'
     32 2E 20 20 38 20 53 4C
     4F 57 20 4D 4F 4C 45 43
     55 4C 45 53
71BC 24          00720         DEFM    '$3.  8 MEDIUM MOLECULES'
     33 2E 20 20 38 20 4D 45
     44 49 55 4D 20 4D 4F 4C
     45 43 55 4C 45 53
71D3 24          00730         DEFM    '$4. 12 MEDIUM MOLECULES'
     34 2E 20 31 32 20 4D 45
     44 49 55 4D 20 4D 4F 4C
     45 43 55 4C 45 53
71EA 24          00740         DEFM    '$5. 12 FAST MOLECULES'
     35 2E 20 31 32 20 46 41
     53 54 20 4D 4F 4C 45 43
     55 4C 45 53
71FF 24          00750         DEFM    '$6. 12 SUPER FAST MOLECULES*'
     36 2E 20 31 32 20 53 55
     50 45 52 20 46 41 53 54
     20 4D 4F 4C 45 43 55 4C
     45 53 2A
                 00760 ;
721B 4C          00770 PROMPT  DEFM    'LEVEL X - '
     45 56 45 4C 20 58 20 2D
```

Listing continues

Listing continued

```
      20
7225 50          00780          DEFM    'PRESS SPACE BAR TO OPEN DOOR - '
     52 45 53 53 20 53 50 41
     43 45 20 42 41 52 20 54
     4F 20 4F 50 45 4E 20 44
     4F 4F 52 20 2D 20
7244 50          00790          DEFM    'PRESS BREAK TO EXIT'
     52 45 53 53 20 42 52 45
     41 4B 20 54 4F 20 45 58
     49 54
                 00800 ;
0001             00810 DOOR     DEFS    1       ;Z=DOOR OPEN, NZ=DOOR CLOSED
0001             00820 LEVEL    DEFS    1       ;PLAYING LEVEL (0-5)
0001             00830 TIMING   DEFS    1       ;TIME DELAY INBETWEEN UPDATES
0001             00840 FIGCNT   DEFS    1       ;MOLECULE UPDATE COUNT
0002             00850 FIGX     DEFS    2       ;MOLECULE LIST POINTER
0001             00860 WALLF    DEFS    1       ;NZ=WALL CONTACT,Z=NO CONTACT
                 00870 ;
725E 00          00880 HC       DEFB    0       ;H0 PIXEL
725F A73C        00890          DEFW    3CA7H   ;VIDEO ADDRESS
7261 00          00900          DEFB    0       ;MOVE DIRECTION
7262 9470        00910          DEFW    HOTX    ;GRAPHICS POINTER
7264 00          00920          DEFB    0       ;H1
7265 033E        00930          DEFW    3E03H
7267 01          00940          DEFB    1
7268 9470        00950          DEFW    HOTX
726A 00          00960          DEFB    0       ;H2
726B 333F        00970          DEFW    3F33H
726D 02          00980          DEFB    2
726E 9470        00990          DEFW    HOTX
7270 00          01000          DEFB    0       ;H3
7271 0F3E        01010          DEFW    3E0FH
7273 07          01020          DEFB    7
7274 9470        01030          DEFW    HOTX
7276 02          01040          DEFB    2       ;H4
7277 7B3D        01050          DEFW    3D7BH
7279 04          01060          DEFB    4
727A 9470        01070          DEFW    HOTX
727C 02          01080          DEFB    2       ;H5
727D 5B3D        01090          DEFW    3D5BH
727F 06          01100          DEFB    6
7280 9470        01110          DEFW    HOTX
7282 00          01120          DEFB    0       ;C0
7283 0F3D        01130          DEFW    3D0FH
7285 00          01140          DEFB    0
7286 D070        01150          DEFW    COLDX
7288 00          01160          DEFB    0       ;C1
7289 333F        01170          DEFW    3F33H
728B 01          01180          DEFB    1
728C D070        01190          DEFW    COLDX
728E 00          01200          DEFB    0       ;C2
728F 033E        01210          DEFW    3E03H
7291 02          01220          DEFB    2
7292 D070        01230          DEFW    COLDX
7294 00          01240          DEFB    0       ;C3
7295 A73C        01250          DEFW    3CA7H
7297 04          01260          DEFB    4
7298 D070        01270          DEFW    COLDX
729A 00          01280          DEFB    0       ;C4
729B 0F3E        01290          DEFW    3E0FH
729D 05          01300          DEFB    5
729E D070        01310          DEFW    COLDX
72A0 00          01320          DEFB    0       ;C5
72A1 333F        01330          DEFW    3F33H
72A3 07          01340          DEFB    7
72A4 D070        01350          DEFW    COLDX
                 01360 ;
                 01370 ;MOLECULE CONTROL VARIABLES
0006             01380 H0       DEFS    6
0006             01390 H1       DEFS    6
0006             01400 H2       DEFS    6
0006             01410 H3       DEFS    6
0006             01420 H4       DEFS    6
0006             01430 H5       DEFS    6
0006             01440 C0       DEFS    6
0006             01450 C1       DEFS    6
0006             01460 C2       DEFS    6
0006             01470 C3       DEFS    6
0006             01480 C4       DEFS    6
0006             01490 C5       DEFS    6
                 01500 ;
                 01510 ;START OF PROGRAM
72EE F3          01520 DEMON    DI                      ;DISABLE INTERRUPTS
72EF 310080      01530          LD      SP,8000H        ;SET STACK POINTER
72F2 CD4B73      01540          CALL    DMSG            ;DISPLAY OPENING MESSAGE
72F5 CD7973      01550          CALL    GETLV           ;GET PLAYING LEVEL
72F8 CD8E73      01560          CALL    SETUP           ;SET UP INITIAL LOCATIONS
72FB CDBE73      01570          CALL    BRD             ;DISPLAY PLAYING BOARD
72FE 2A5B72      01580 DEMON1   LD      HL,(FIGX)       ;MOLECULE LIST POINTER
7301 3A5A72      01590          LD      A,(FIGCNT)      ;NO. OF MOLECULE UPDATES
7304 47          01600          LD      B,A             ;
7305 C5          01610 DEMON2   PUSH    BC              ;
7306 E5          01620          PUSH    HL              ;
7307 5E          01630          LD      E,(HL)          ;MOLECULE CONTROL LIST
7308 23          01640          INC     HL              ;
7309 56          01650          LD      D,(HL)          ;
730A DD210000    01660          LD      IX,0            ;
730E DD19        01670          ADD     IX,DE           ;
7310 CD2174      01680          CALL    WALL            ;REFLECT FIGURE OFF WALL
7313 CDB274      01690          CALL    REM             ;REMOVE FIGURE
7316 CDE274      01700          CALL    MOVE            ;MOVE FIGURE
7319 CD1175      01710          CALL    ADD             ;ADD FIGURE
731C 3A5872      01720          LD      A,(LEVEL)       ;
731F FE02        01730          CP      2               ;
7321 DC3F75      01740          CALL    C,OPEN          ;OPEN/CLOSE DOOR
```

Listing continues

initialize the molecule locations and move directions.

The BRD routine draws the playing area on the screen. It stores a one into the door status flag (DOOR) indicating a closed door. It displays the playing level and operating instructions on the last line of the screen.

The Wall routine deflects molecules after a wall contact by changing the move direction appropriately. It also takes into account a corner contact,

"The Wall routine deflects molecules after a wall contact by changing the move direction appropriately."

where the molecule can touch two walls simultaneously.

The Wall routine checks for a wall contact by extracting the X and Y coordinates of the molecule location and then comparing these values to the known locations of the walls. Figure 2 shows the pixel positions where wall

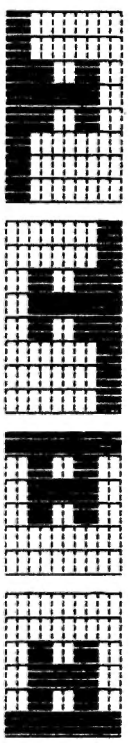

Fig. 2. Possible Pixel Positions for Wall Contacts.

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Listing continued

```
7324 3A5972    01750          LD      A,(TIMING)      ;DELAY BETWEEN UPDATES
7327 47        01760          LD      B,A             ;
7328 3A5D72    01770          LD      A,(WALLF)       ;
732B C5        01780 DEMON3   PUSH    BC              ;
732C EE03      01790          XOR     3               ;
732E D3FF      01800          OUT     (255),A         ;BEEP WHEN WALL CONTACT
7330 0640      01810          LD      B,40H           ;
7332 10FE      01820          DJNZ    $               ;
7334 C1        01830          POP     BC              ;
7335 10F4      01840          DJNZ    DEMON3          ;CONTINUE DELAY LOOP
7337 E1        01850          POP     HL              ;
7338 C1        01860          POP     BC              ;
7339 23        01870          INC     HL              ;
733A 23        01880          INC     HL              ;
733B 10C8      01890          DJNZ    DEMON2          ;CONTINUE UPDATE LOOP
733D CD3F75    01900          CALL    OPEN            ;OPEN/CLOSE DOOR
7340 3A4038    01910          LD      A,(3840H)       ;BREAK KEY?
7343 E604      01920          AND     4               ;
7345 CAFE72    01930          JP      Z,DEMON1        ;CONTINUE IF NOT BREAK
7348 C3EE72    01940          JP      DEMON           ; ELSE START PROGRAM OVER
               01950 ;
               01960 ;DISPLAY OPENING MESSAGE
734B 21003C    01970 DMSG     LD      HL,3C00H        ;CLEAR SCREEN
734E 11013C    01980          LD      DE,3C01H        ;
7351 01FF03    01990          LD      BC,1023         ;
7354 3620      02000          LD      (HL),20H        ;
7356 EDB0      02010          LDIR                    ;
7358 116C71    02020          LD      DE,MSG          ;MESSAGE ADDRESS
735B 21003C    02030          LD      HL,3C00H        ;VIDEO ADDRESS
735E 1A        02040 DMSG1    LD      A,(DE)          ;GET MESSAGE CHARACTER
735F FE2A      02050          CP      '*'             ;
7361 C8        02060          RET     Z               ;RETURN IF END OF MESSAGE
7362 FE24      02070          CP      '$'             ;
7364 CA6D73    02080          JP      Z,DMSG3         ;JUMP IF CARRIAGE RETURN
7367 77        02090          LD      (HL),A          ;STORE CHARACTER IN VIDEO
7368 13        02100          INC     DE              ;
7369 23        02110          INC     HL              ;
736A C35E73    02120          JP      DMSG1           ;NEXT CHARACTER
736D 13        02130 DMSG3    INC     DE              ;
736E 7D        02140          LD      A,L             ;COMPUTE NEXT LINE ADDR
736F E6C0      02150          AND     0C0H            ;
7371 6F        02160          LD      L,A             ;
7372 014000    02170          LD      BC,64           ;
7375 09        02180          ADD     HL,BC           ;
7376 C35E73    02190          JP      DMSG1           ;START NEXT LINE
               02200 ;
               02210 ;GET PLAYING LEVEL
7379 3A1038    02220 GETLV    LD      A,(3810H)       ;KEYBOARD NUMERIC KEYS
737C E67E      02230          AND     7EH             ;MASK FOR KEYS 1-6
737E CA7973    02240          JP      Z,GETLV         ;LOOP UNTIL 1-6 PRESSED
7381 0F        02250          RRCA                    ;
7382 0E00      02260          LD      C,0             ;
7384 0C        02270 GETLV1   INC     C               ;
7385 0F        02280          RRCA                    ;
7386 30FC      02290          JR      NC,GETLV1       ;LOOP UNTIL KEY FOUND
7388 0D        02300          DEC     C               ;
7389 79        02310          LD      A,C             ;
738A 325872    02320          LD      (LEVEL),A       ;SAVE PLAYING LEVEL
738D C9        02330          RET                     ;
               02340 ;
               02350 ;SET UP PLAYING LEVEL PARAMTERS
               02360 ; AND INITIAL FIGURE LOCATIONS AND MOVE DIRECTIONS
738E 3A5872    02370 SETUP    LD      A,(LEVEL)       ;
7391 4F        02380          LD      C,A             ;
7392 0600      02390          LD      B,0             ;
7394 216671    02400          LD      HL,FIGCTX       ;
7397 09        02410          ADD     HL,BC           ;
7398 7E        02420          LD      A,(HL)          ;
7399 325A72    02430          LD      (FIGCNT),A      ;NO. OF MOLECULE UPDATES
739C 216071    02440          LD      HL,TIMX         ;
739F 09        02450          ADD     HL,BC           ;
73A0 7E        02460          LD      A,(HL)          ;
73A1 325972    02470          LD      (TIMING),A      ;DELAY BETWEEN UPDATES
73A4 79        02480          LD      A,C             ;
73A5 87        02490          ADD     A,A             ;
73A6 4F        02500          LD      C,A             ;
73A7 210C71    02510          LD      HL,LEVELX       ;
73AA 09        02520          ADD     HL,BC           ;
73AB 5E        02530          LD      E,(HL)          ;
73AC 23        02540          INC     HL              ;
73AD 56        02550          LD      D,(HL)          ;
73AE ED535B72  02560          LD      (FIGX),DE       ;MOLECULE UPDATE LIST
73B2 014800    02570          LD      BC,72           ;SET MOLECULE VARIABLES
73B5 215E72    02580          LD      HL,HC           ;
73B8 11A672    02590          LD      DE,H0           ;
73BB EDB0      02600          LDIR                    ;
73BD C9        02610          RET                     ;
               02620 ;
               02630 ;DRAW BOARD
73BE 21003C    02640 BRD      LD      HL,3C00H        ;CLEAR SCREEN W/GRAPHICS
73C1 11013C    02650          LD      DE,3C01H        ;
73C4 01FF03    02660          LD      BC,1023         ;
73C7 3680      02670          LD      (HL),80H        ;
73C9 EDB0      02680          LDIR                    ;
73CB 21003C    02690          LD      HL,3C00H        ;DRAW TOP WALL
73CE 11013C    02700          LD      DE,3C01H        ;
73D1 013F00    02710          LD      BC,63           ;
73D4 3683      02720          LD      (HL),83H        ;
73D6 EDB0      02730          LDIR                    ;
73D8 21803F    02740          LD      HL,3F80H        ;DRAW BOTTOM WALL
73DB 11813F    02750          LD      DE,3F81H        ;
73DE 013F00    02760          LD      BC,63           ;
73E1 36B0      02770          LD      (HL),0B0H       ;
73E3 EDB0      02780          LDIR                    ;
73E5 21003C    02790          LD      HL,3C00H        ;DRAW LEFT WALL
73E8 3EBF      02800          LD      A,0BFH          ;
```

Listing continues

contacts are possible. For the left and right walls, the molecule must be in pixel positions zero, 1, or 2. Only pixel positions 1 and 4 can contact the upper wall. For the down wall, only pixel positions 2 and 5 can make contact.

If Wall finds that a molecule is at a wall with the right pixel position, it calls CONTC to change the move direction unless the wall is the partition and the door is open. If the Y coordinate of the molecule is within range of the door, Wall makes no change to the move direction and lets the molecule continue through.

Wall handles a corner contact by first processing the left or right wall move change and then recalling CONTC for the upper or lower wall.

CONTC finds the new move direction for a molecule contacting a wall. It requires that the E register contain the wall number zero, 2, 4, or 6 (corresponding to left, right, up, or down). It uses this wall number, along with the move direction. CONTC stores the new move direction in the molecule control variable list by way of the IX register.

The REM routine removes the molecule graphics from the screen. It performs two loops, each processing four graphics characters. To avoid too much interference with an overlapping molecule, it masks out the graphics bits rather than storing blanks. REM uses the pixel position and the type of molecule to index into the proper table to find the graphics characters.

The Move routine calculates the next location and pixel position for a molecule. It indexes into the move table to find the next pixel position and video address offset. It then adds this offset to the current video address and stores it into the molecule control list.

The Add routine redraws a molecule on the screen. It performs a logical OR of the graphics bits with the video memory bits for each graphics character and prevents any blanking of an overlapping molecule or wall.

The Open routine opens or closes the door in response to the space bar. If the space bar is pressed and the door is closed, it blanks out the door on the screen. If the space bar is not pressed, it draws the door on the screen. It also redraws the partition each time in case it is overwritten by a passing molecule. ■

Contact Lee Morgenstern at 14358 Dyer St., Sylmar, CA 91324.

Listing continued

```
73EA 114000    02810          LD      DE,64           ;
73ED 060F      02820          LD      B,15            ;
73EF 77        02830 BRD1     LD      (HL),A          ;
73F0 19        02840          ADD     HL,DE           ;
73F1 10FC      02850          DJNZ    BRD1            ;
73F3 213F3C    02860          LD      HL,3C3FH        ;DRAW RIGHT WALL
73F6 060F      02870          LD      B,15            ;
73F8 77        02880 BRD2     LD      (HL),A          ;
73F9 19        02890          ADD     HL,DE           ;
73FA 10FC      02900          DJNZ    BRD2            ;
73FC 211F3C    02910          LD      HL,3C1FH        ;DRAW MIDDLE PARTITION
73FF 1B        02920          DEC     DE              ;
7400 060F      02930          LD      B,15            ;
7402 77        02940 BRD3     LD      (HL),A          ;
7403 23        02950          INC     HL              ;
7404 77        02960          LD      (HL),A          ;
7405 19        02970          ADD     HL,DE           ;
7406 10FA      02980          DJNZ    BRD3            ;
7408 3E01      02990          LD      A,1             ;INDICATE DOOR CLOSED
740A 325772    03000          LD      (DOOR),A        ;
740D 211B72    03010          LD      HL,PROMPT       ;DISPLAY PROMPT AT BOTTOM
7410 11C23F    03020          LD      DE,3FC2H        ;
7413 013C00    03030          LD      BC,60           ;
7416 EDB0      03040          LDIR                    ;
7418 3A5872    03050          LD      A,(LEVEL)       ;DISPLAY PLAYING LEVEL
741B C631      03060          ADD     A,31H           ;
741D 32C83F    03070          LD      (3FC8H),A       ;
7420 C9        03080          RET                     ;
               03090 ;
               03100 ;REFLECT OFF WALL
               03110 ; INPUT IX POINTING TO PIXEL,VIDEO ADDR,MOVE DIRECTION
               03120 ; OUTPUT NEW MOVE DIRECTION IF WALL CONTACT
7421 AF        03130 WALL     XOR     A               ;
7422 325D72    03140          LD      (WALLF),A       ;INDICATE NO WALL CONTACT
7425 DD6E01    03150          LD      L,(IX+1)        ;GET FIGURE VIDEO ADRESS
7428 DD6602    03160          LD      H,(IX+2)        ;
742B 7D        03170          LD      A,L             ;EXTRACT COORDINATES
742C 1100C4    03180          LD      DE,-3C00H       ;
742F 19        03190          ADD     HL,DE           ;
7430 29        03200          ADD     HL,HL           ;
7431 29        03210          ADD     HL,HL           ;H = Y COORDINATE
7432 E63F      03220          AND     3FH             ;
7434 6F        03230          LD      L,A             ;L = X COORDINATE
7435 DD7E00    03240          LD      A,(IX)          ;GET PIXEL POSITION
7438 FE03      03250          CP      3               ;
743A D26F74    03260          JP      NC,WALL1        ;JUMP IF HALF POSITION
743D 7D        03270          LD      A,L             ;GET X COORDINATE
743E 1E00      03280          LD      E,0             ;INDICATE LEFT WALL
7440 FE01      03290          CP      1               ;
7442 CA6C74    03300          JP      Z,WALL2         ;JUMP IF WALL CONTACT
7445 FE21      03310          CP      33              ;
7447 CA5974    03320          JP      Z,WALL3         ;JUMP IF PARTITION CONT
744A 1E02      03330          LD      E,2             ;INDICATE RIGHT WALL
744C FE1C      03340          CP      28              ;
744E CA5974    03350          JP      Z,WALL3         ;JUMP IF PARTITION CONT
7451 FE3C      03360          CP      60              ;
7453 CA6C74    03370          JP      Z,WALL2         ;JUMP IF WALL CONTACT
7456 C36F74    03380          JP      WALL1           ;CHECK UP, DOWN WALLS
7459 3A5772    03390 WALL3    LD      A,(DOOR)        ;GET DOOR STATUS
745C A7        03400          AND     A               ;
745D C26C74    03410          JP      NZ,WALL2        ;JUMP IF CLOSED
7460 7C        03420          LD      A,H             ;GET Y COORDINATE
7461 FE06      03430          CP      6               ;
7463 DA6C74    03440          JP      C,WALL2         ;JUMP IF TOO HIGH
7466 FE08      03450          CP      8               ;
7468 D26C74    03460          JP      NC,WALL2        ;JUMP IF TOO LOW
746B C9        03470          RET                     ;ALLOW PASSAGE THRU DOOR
746C CD9774    03480 WALL2    CALL    CONTC           ;CHANGE MOVE DIRECTION
               03490                                  ;CONTINUE IF CORNER
746F DD7E00    03500 WALL1    LD      A,(IX)          ;GET PIXEL POSITION
7472 FE01      03510          CP      1               ;
7474 CA7C74    03520          JP      Z,WALL1A        ;JUMP IF MIDDLE PIXEL
7477 FE04      03530          CP      4               ;
7479 C28574    03540          JP      NZ,WALL1B       ;JUMP IF NOT MIDDLE PIXEL
747C 7C        03550 WALL1A   LD      A,H             ;GET Y COORDINATE
747D 1E04      03560          LD      E,4             ;INDICATE UPPER WALL
747F FE00      03570          CP      0               ;
7481 CA9374    03580          JP      Z,WALL4         ;JUMP IF WALL CONTACT
7484 C9        03590          RET                     ;
7485 FE02      03600 WALL1B   CP      2               ;
7487 CA8D74    03610          JP      Z,WALL1C        ;JUMP IF BOTTOM PIXEL
748A FE05      03620          CP      5               ;
748C C0        03630          RET     NZ              ;RET IF NOT BOTTOM PIXEL
748D 7C        03640 WALL1C   LD      A,H             ;GET Y COORDINATE
748E 1E06      03650          LD      E,6             ;INDICATE DOWN WALL
7490 FE0D      03660          CP      13              ;
7492 C0        03670          RET     NZ              ;RET IF NO WALL CONTACT
7493 CD9774    03680 WALL4    CALL    CONTC           ;GET NEW MOVE DIRECTION
7496 C9        03690          RET                     ;
               03700 ;
               03710 ;GET NEW WALL REFLECTION MOVE DIRECTION
               03720 ; INPUT IX POINTING TO PIXEL,VIDEO ADDR,MOVE DIR
               03730 ; INPUT E=WALL NUMBER (0,2,4,6) (L,R,U,D)
               03740 ; OUTPUT NEW MOVE DIRECTION
7497 E5        03750 CONTC    PUSH    HL              ;
7498 3E01      03760          LD      A,1             ;
749A 325D72    03770          LD      (WALLF),A       ;INDICATE WALL CONTACT
749D 1600      03780          LD      D,0             ;
749F 216C70    03790          LD      HL,WALLX        ;GET WALL TABLE ADDRESS
74A2 19        03800          ADD     HL,DE           ;COMPUTE WALL LIST
74A3 4E        03810          LD      C,(HL)          ;GET MOVE DIR LIST ADDR
74A4 23        03820          INC     HL              ;
74A5 46        03830          LD      B,(HL)          ;
74A6 DD6E03    03840          LD      L,(IX+3)        ;GET MOVE DIRECTION
74A9 2600      03850          LD      H,0             ;
```

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Listing continued

```
74AB 09       03860          ADD     HL,BC           ;
74AC 7E       03870          LD      A,(HL)          ;GET NEW MOVE DIRECTION
74AD DD7703   03880          LD      (IX+3),A        ;STORE
74B0 E1       03890          POP     HL              ;
74B1 C9       03900          RET                     ;
              03910 ;
              03920 ;REMOVE FIGURE
              03930 ; INPUT IX POINTING TO PIXEL,VIDEO ADDR,MOVE DIR,FIGURE
74B2 DD7E00   03940 REM      LD      A,(IX)          ;GET PIXEL
74B5 87       03950          ADD     A,A             ;
74B6 5F       03960          LD      E,A             ;
74B7 1600     03970          LD      D,0             ;
74B9 DD6E04   03980          LD      L,(IX+4)        ;GET FIGURE POINTER
74BC DD6605   03990          LD      H,(IX+5)        ;
74BF 19       04000          ADD     HL,DE           ;
74C0 5E       04010          LD      E,(HL)          ;GET GRAPHICS POINTER
74C1 23       04020          INC     HL              ;
74C2 56       04030          LD      D,(HL)          ;
74C3 DD6E01   04040          LD      L,(IX+1)        ;GET VIDEO ADDRESS
74C6 DD6602   04050          LD      H,(IX+2)        ;
74C9 0604     04060          LD      B,4             ;
74CB 1A       04070 REM1     LD      A,(DE)          ;GET VIDEO CHARACTER
74CC 2F       04080          CPL                     ;
74CD A6       04090          AND     (HL)            ;MASK OUT FIGURE
74CE 77       04100          LD      (HL),A          ;STORE VIDEO
74CF 23       04110          INC     HL              ;
74D0 13       04120          INC     DE              ;
74D1 10F8     04130          DJNZ    REM1            ;CONTINUE FIRST LINE LOOP
74D3 013C00   04140          LD      BC,60           ;
74D6 09       04150          ADD     HL,BC           ;COMPUTE NEXT LINE ADDR
74D7 0604     04160          LD      B,4             ;
74D9 1A       04170 REM2     LD      A,(DE)          ;GET VIDEO CHARACTER
74DA 2F       04180          CPL                     ;
74DB A6       04190          AND     (HL)            ;MASK OUT FIGURE
74DC 77       04200          LD      (HL),A          ;
74DD 23       04210          INC     HL              ;
74DE 13       04220          INC     DE              ;
74DF 10F8     04230          DJNZ    REM2            ;CONTINUE SECOND LINE
74E1 C9       04240          RET                     ;
              04250 ;
              04260 ;MOVE FIGURE
              04270 ; INPUT IX POINTING TO PIXEL,VIDEO ADDR,MOVE DIR
              04280 ; OUTPUT NEW PIXEL,NEW VIDEO ADDR
74E2 2670     04290 MOVE     LD      H,MOVX<-8       ;MOVE TABLE
74E4 DD7E00   04300          LD      A,(IX)          ;GET PIXEL
74E7 87       04310          ADD     A,A             ;
74E8 6F       04320          LD      L,A             ;
74E9 5E       04330          LD      E,(HL)          ;GET MOVE POINTER
74EA 23       04340          INC     HL              ;
74EB 56       04350          LD      D,(HL)          ;
74EC EB       04360          EX      DE,HL           ;
74ED DD7E03   04370          LD      A,(IX+3)        ;GET MOVE DIRECTION
74F0 87       04380          ADD     A,A             ;
74F1 5F       04390          LD      E,A             ;
74F2 1600     04400          LD      D,0             ;
74F4 19       04410          ADD     HL,DE           ;
74F5 7E       04420          LD      A,(HL)          ;GET NEW PIXEL
74F6 DD7700   04430          LD      (IX),A          ;SAVE IN VARIABLE LIST
74F9 23       04440          INC     HL              ;
74FA 6E       04450          LD      L,(HL)          ;GET VIDEO ADDR OFFSET
74FB 2600     04460          LD      H,0             ;
74FD CB7D     04470          BIT     7,L             ;
74FF 2802     04480          JR      Z,MOVE1         ;
7501 26FF     04490          LD      H,0FFH          ;
7503 DD5E01   04500 MOVE1    LD      E,(IX+1)        ;GET CURRENT VIDEO ADDR
7506 DD5602   04510          LD      D,(IX+2)        ;
7509 19       04520          ADD     HL,DE           ;COMPUTE NEW VIDEO ADDR
750A DD7501   04530          LD      (IX+1),L        ;SAVE IN VARIABLE LIST
750D DD7402   04540          LD      (IX+2),H        ;
7510 C9       04550          RET                     ;
              04560 ;
              04570 ;ADD FIGURE
              04580 ; INPUT IX POINTING TO PIXEL,VIDEO ADDR,MOVE DIR,FIGURE
7511 DD7E00   04590 ADD      LD      A,(IX)          ;GET PIXEL
7514 87       04600          ADD     A,A             ;
7515 5F       04610          LD      E,A             ;
7516 1600     04620          LD      D,0             ;
7518 DD6E04   04630          LD      L,(IX+4)        ;GET FIGURE POINTER
751B DD6605   04640          LD      H,(IX+5)        ;
751E 19       04650          ADD     HL,DE           ;
751F 5E       04660          LD      E,(HL)          ;GET GRAPHICS POINTER
7520 23       04670          INC     HL              ;
7521 56       04680          LD      D,(HL)          ;
7522 DD6E01   04690          LD      L,(IX+1)        ;GET VIDEO ADDRESS
7525 DD6602   04700          LD      H,(IX+2)        ;
7528 0604     04710          LD      B,4             ;
752A 1A       04720 ADD1     LD      A,(DE)          ;GET VIDEO CHARACTER
752B B6       04730          OR      (HL)            ;ADD FIGURE
752C 77       04740          LD      (HL),A          ;STORE VIDEO
752D 23       04750          INC     HL              ;
752E 13       04760          INC     DE              ;
752F 10F9     04770          DJNZ    ADD1            ;CONTINUE FIRST LINE LOOP
7531 013C00   04780          LD      BC,60           ;
7534 09       04790          ADD     HL,BC           ;COMPUTE NEXT LINE ADDR
7535 0604     04800          LD      B,4             ;
7537 1A       04810 ADD2     LD      A,(DE)          ;GET VIDEO CHARACTER
7538 B6       04820          OR      (HL)            ;ADD FIGURE
7539 77       04830          LD      (HL),A          ;STORE VIDEO
753A 23       04840          INC     HL              ;
753B 13       04850          INC     DE              ;
753C 10F9     04860          DJNZ    ADD2            ;CONTINUE SECOND LINE
753E C9       04870          RET                     ;
              04880 ;
              04890 ;OPEN/CLOSE DOOR
753F 3EBF     04900 OPEN     LD      A,0BFH          ;RESTORE PARTITION
```

Listing continues

Listing continued

```
7541 32DF3C   04910          LD      (3CDFH),A       ;
7544 32E03C   04920          LD      (3CE0H),A       ;
7547 321F3D   04930          LD      (3D1FH),A       ;
754A 32203D   04940          LD      (3D20H),A       ;
754D 325F3D   04950          LD      (3D5FH),A       ;
7550 32603D   04960          LD      (3D60H),A       ;
7553 325F3E   04970          LD      (3E5FH),A       ;
7556 32603E   04980          LD      (3E60H),A       ;
7559 329F3E   04990          LD      (3E9FH),A       ;
755C 32A03E   05000          LD      (3EA0H),A       ;
755F 32DF3E   05010          LD      (3EDFH),A       ;
7562 32E03E   05020          LD      (3EE0H),A       ;
7565 3A5772   05030          LD      A,(DOOR)        ;GET DOOR STATUS
7568 A7       05040          AND     A               ;
7569 CA7775   05050          JP      Z,OPEN3         ;JUMP IF DOOR OPEN
756C 3A4038   05060          LD      A,(3840H)       ;GET SPACE BAR STATUS
756F E680     05070          AND     80H             ;
7571 CA7D75   05080          JP      Z,OPEN2         ;JUMP IF NOT PRESSED
7574 C39775   05090          JP      OPEN1           ;JUMP IF PRESSED
7577 3A4038   05100 OPEN3    LD      A,(3840H)       ;GET SPACE BAR STATUS
757A E680     05110          AND     80H             ;
757C C0       05120          RET     NZ              ;RET IF SPACE BAR PRESSED
757D 3E95     05130 OPEN2    LD      A,095H          ;CLOSE DOOR
757F 325772   05140          LD      (DOOR),A        ;
7582 329F3D   05150          LD      (3D9FH),A       ;
7585 32DF3D   05160          LD      (3DDFH),A       ;
7588 321F3E   05170          LD      (3E1FH),A       ;
758B 3EAA     05180          LD      A,0AAH          ;
758D 32A03D   05190          LD      (3DA0H),A       ;
7590 32E03D   05200          LD      (3DE0H),A       ;
7593 32203E   05210          LD      (3E20H),A       ;
7596 C9       05220          RET                     ;
7597 3E80     05230 OPEN1    LD      A,080H          ;OPEN DOOR
7599 329F3D   05240          LD      (3D9FH),A       ;
759C 32A03D   05250          LD      (3DA0H),A       ;
759F 32DF3D   05260          LD      (3DDFH),A       ;
75A2 32E03D   05270          LD      (3DE0H),A       ;
75A5 321F3E   05280          LD      (3E1FH),A       ;
75A8 32203E   05290          LD      (3E20H),A       ;
75AB AF       05300          XOR     A               ;
75AC 325772   05310          LD      (DOOR),A        ;
75AF C9       05320          RET                     ;
              05330 ;
72EE          05340          END     DEMON
00000 TOTAL ERRORS
```


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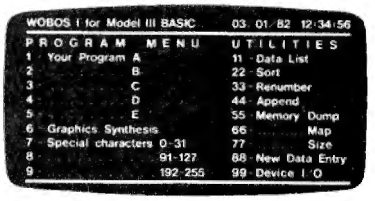

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  CCF
  JR NZ,$+5 ", etc
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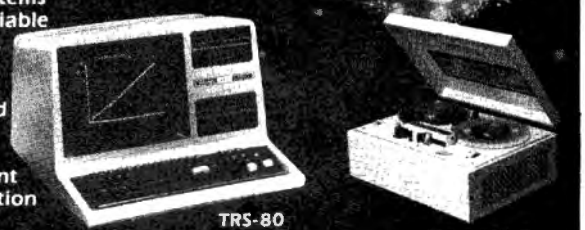

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Remember "Kings and Catapults"? Well, now you can enjoy that same kind of action on your Color Computer with this exciting variation.

As an avid Dungeons & Dragons player and a semi-accomplished adventure fanatic, I was intrigued by William C. Adams' fantasy role-playing game, "Kings and Catapults" (*80 Micro*, February 1982, p. 232).

Adams' program was written for the Model I or III. Since there are few adventure programs available for the Color Computer, I decided to try my hand at converting his program to Extended Color Basic. After many hours editing and reediting it, I believe I've come up with a reasonable facsimile, and added a few surprises along the way (see Program Listing 1).

The Game

Like its predecessor, Kings and Castles is a one- or two-player game in which each participant takes the role of a king. Each king commands a large army of fierce warriors, a kingdom of civilians, an arsenal of cannon, and a number of infiltrators available for hire. Players can also acquire a catapult

The Key Box

Color Computer
16K RAM
Extended Color Basic

which, if used properly, inflicts substantial damage.

At the start of every war, each king has a large sum of money, which he uses to pay his troops, buy cannon, or hire infiltrators (at $10,000 each). Infiltrators are potentially the most deadly weapons at your disposal. If they survive the opposing king's guards, they'll strike the king down, making you the victor.

You can also claim victory if your opponent's castle loses all of its vulnerable spots (hit points), or if you destroy all of his warriors. However, additional men can be recruited from the civilian ranks.

On occasion, your father (who is also a very powerful king) ships you aid in the form of money, warriors, cannon, civilians, catapults, or, if you're fortunate, a sampling of each.

The first ruler to overcome his opponent five times becomes the victor, and is deemed the monarch of both kingdoms.

Significant Changes

On the surface, Kings and Castles appears almost identical to its predecessor, but there are several significant changes.

The opponents' names, accompanied by their ranks, appear in a scoreboard at the top of each title screen. This lets you know when you can afford to live dangerously and when it's time to infiltrate to save your skin.

Catapults are fired either at your opponent's men or his castle.

The computer (in a one-player game) is now an extremely worthy opponent. In Kings and Catapults, it selected options unavailable to it, such as attempting to infiltrate when it had no spies left, causing it to lose a turn. This happened with alarming regularity, as the computer's moves were chosen by an 'X = RND (4)' statement. In addition, it was unable to buy cannon when all its cannon were destroyed, or to hire civilians when its warriors were decimated. The latter often caused the computer to lose entire wars, making for an extremely boring game.

In this version, however, the computer chooses its options more methodically. It fires cannon or catapults at your warriors or castle, not randomly but according to what causes you to lose more quickly. It no longer stupidly advances troops into battle with only 200 men left. It infiltrates when necessary, hires civilians when warriors are becoming an endangered species, and purchases cannon when supplies run out.

Program Listing 1. Kings and Castles.

```
5 CLS:PRINT@160," I'M SETTING UP A SERIES OF BAT-TLEFIELDS WITH
A RANDOM SEED GE-NERATOR, INDICATED BY THE NUM-  BERS AT LOWER R
IGHT. WHEN THEY  STOP, WE'LL BEGIN. IT WILL BE A FEW MOMENTS, SO
 PLEASE BEAR WITHME....."
10 'RNDGEN DEVISED BY CRAIG TOOKER, COL'S OH
15 X=TIMER
20 IFX>10000THENX=X/10:GOTO20
25 FORZ=1TOX:Y=RND(RND(X)):PRINT@505,Z;:NEXTZ
30 'BY GARY MICHAELS, COLUMBUS, OH 43229, 614/476-0578
35 CLEAR(100):CLS:PRINT"KINGS AND CASTLES":PRINT:PRINT" THE SCEN
E IS SOMEWHERE IN THE  DAMP, FOGGY REGION WHICH IS NOW KNOWN AS
SCOTLAND, SOMETIME IN  THE MIDDLE AGES.":GOSUB815
40 PRINT:SOUND180,10:INPUT" WHO SHALL BE THE NORTHERN KING?(UP T
O EIGHT LETTERS)";N$:PRINT:SOUND220,10:INPUT" AND THE RULER OF T
HE SOUTHERN  KINGDOM? (TYPE IN computer IF  YOU WISH TO WAR AGA
INST ME)";S$
45 IFS$="COMPUTER"THENGOSUB765:GOSUB765:PRINT@483,"*I WELCOME TH
E CHALLENGE*";:GOSUB765:GOSUB765
50 ER=0:WR=0
55 GOSUB545:M5=0:M=RND(30000):M=M+150000:NM=M:SM=M
60 R=0:R1=0
65 X=RND(10000):NW=X+20000:X=RND(10000):SW=X+20000:N=RND(10000):
N=N+20000:S=RND(10000):S=S+20000:CN=500:CS=500
70 NC=RND(10000):SC=RND(10000):I=RND(5):I1=RND(5)
75 X=RND(100):IFX<25THEN NS=1ELSE NS=0
80 X=RND(100):IFX<25THEN SS=1ELSE SS=0
85 GOSUB725:CLS:PRINT@2,N$;:PRINT@18,S$;
90 Q=0
95 IF NM<=0THEN NM=0ELSE NM=NM
100 IF SM<=0THEN SM=0ELSE SM=SM
105 IFNW<=0THEN NW=0ELSE NW=NW:IFSW<=0THEN SW=0ELSE SW=SW:IF NC<
=0THEN NC=0ELSE NC=NC
110 IF SC<=0THEN SC=0ELSE SC=SC
115 PRINT@32,"**************  ************** ":T$="*":PRINT@0,T$
;:PRINT@11,WR;:PRINT@11,T$;:PRINT@13,T$;:PRINT@16,T$;:PRINT@27,E
R;:PRINT@27,T$;:PRINT@29,T$;
120 PRINT@96,"$"NM:PRINT@112,"$"SM
125 PRINT@128,"WAR'RS:";:IFNW<=0THEN465ELSEPRINTNW;:PRINT@144,"W
AR'RS:";:IFSW<=0THEN470ELSEPRINTSW;:PRINT@160,"HIT PTS:";:IFN<=0
THEN550ELSEPRINTN;:PRINT@176,"HIT PTS:";:IFS<=0THEN555ELSEPRINTS
;
130 IFCN<=0THENCN=0
135 IFCS<=0THENCS=0ELSE140
140 PRINT@192,"CANNON:"CN:PRINT@208,"CANNON:"CS:PRINT@224,"CIV'L
NS:";:IFNC<=0THENNC=0:PRINTNC;:GOTO145ELSEPRINTNC
145 PRINT@240,"CIVILIANS:";SC;
150 PRINT@256,"SPIES:";I:PRINT@272,"SPIES:";I1:IFNS>=1THENPRINT@
288,"CATAPULTS:";NS
155 IFSS>=1THENPRINT@304,"CATAPULTS:";SS
160 IFT=0THENT=1:PRINT@480,N$"'S TURN";:GOTO165ELSEIFT=1THENT=0:
PRINT@480,S$"'S TURN";:IFS$="COMPUTER"THENPRINT@499,"DONT RUSH M
E";:GOTO285ELSE285
165 PRINT@352,"F)IRE CAN.  A)DVANCE  C)ATAPULT H)IRE CIV.  B)UY
CAN. I)NFILTRT R)ELEASE WARRIORS":SOUND180,1
170 A$=INKEY$:IFA$=""THEN170ELSECLS:GOSUB435:GOSUB475:GOSUB670:I
FA$="F"THEN175ELSEIFA$="A"THEN215ELSEIFA$="C"THEN225ELSEIFA$="H"
THEN245ELSEIFA$="B"THEN265ELSEIFA$="I"THEN560ELSEIFA$="R"THEN190
ELSE165
175 CLS:PRINT"CANNON FIRED"
180 IFCN<=0THENPRINT"NO CANNON LEFT, SIR":CN=0:GOTO540ELSEPRINT"
FIRE AT HIS C)ASTLE OR HIS M)EN":PRINT
185 A$=INKEY$:IFA$="C"THENPRINT"CASTLE":GOSUB760:GOTO195ELSEIFA$
="M"THENPRINT"MEN":GOSUB760:GOTO210ELSE185
190 CLS:PRINT"RELEASING WARRIORS":PRINT:PRINT"HOW MANY TO LET GO
?":INPUT A:IF A>NW THEN190ELSE NW=NW-A:GOSUB775:PRINT"THEY'RE ON
 THEIR WAY HOME!":GOTO540
195 V=RND(3):IFV=1THENPRINT"WAY OFF!":GOTO540ELSED=RND(5000):S=S
-D:PRINT"BOOM!!":PRINTS$" LOST"D"HIT POINTS!":D=RND(100):CS=CS-D
:PRINT"AS WELL AS"D"CANNON":D=RND(99)
200 SC=SC-D:PRINT"AND";D"CIVILIANS":IFSS<1THENGOTO540ELSED=RND(1
0):IFD<4THENPRINT"***AND YOUR CATAPULT!***":SS=SS-1:IFSS<1THENSS
=0:GOTO540ELSEGOTO540
205 GOTO540
210 V=RND(3):IFV=1THENPRINT"YOU HIT A FIELD!":GOTO540ELSED=RND(5
000):SW=SW-D:PRINTS$" LOST"D"MEN!":IFD>3000THEND=RND(3000):NW=NW
-D:PRINT"BUT "N$"'S WARRIORS WERE TOO";:PRINT@192,"CLOSE TO "S$"
'S TROOPS.":PRINTN$" LOST"D"MEN.":GOTO540ELSEGOTO540
215 CLS:PRINT"TROOPS ADVANCED":PRINT:GOSUB800
220 D=RND(4500):SW=SW-D:PRINTS$" LOST"D"MEN, AND":D=RND(4500):NW
=NW-D:PRINTN$" LOST"D"OF HIS":PRINT"WARRIORS IN THIS BATTLE.":GO
TO540
225 CLS:PRINT"CATAPULT FIRED":IFNS<1THENPRINT:PRINT"YOU DON'T HA
VE ONE!":GOTO540ELSEPRINT"FIRE AT HIS C)ASTLE OR HIS M)EN?"
230 A$=INKEY$:IFA$="C"THENPRINT"CASTLE":GOSUB760:GOTO235ELSEIFA$
="M"THENPRINT"MEN":GOSUB760:GOTO240ELSE230
235 X=RND(10):IFX=5THENPRINT"IT BACKFIRED!":D=RND(1000):N=N-D:PR
INTN$" LOST"D"HIT POINTS!":GOTO540ELSEX=RND(2):IFX=2THENPRINT"NO
```

Listing 1 continues

Listing 1 continued

```
T EVEN CLOSE!":GOTO540ELSED=RND(11000):S=S-D:PRINTS$"'S CASTLE L
OST"D"HIT POINTS!":GOTO540
240 X=RND(3):IFX<3THENPRINT"YOU MISSED!":GOTO540ELSED=RND(11000)
:SW=SW-D:PRINTS$" LOST"D"OF HIS WARRIORS!":GOTO540
245 CLS:PRINT"HIRING CIVILIANS":PRINT
250 IFNC=0THENPRINT"NO ONE LEFT TO RECRUIT":GOTO540
255 PRINT"HOW MANY DO YOU NEED?"
260 INPUT A:IF A>NC THENPRINT"THERE ARE ONLY"NC"!":GOTO540ELSE N
C=NC-A:NW=NW+A:GOSUB785:PRINT"THEY'RE HEADING FOR THE FRONT!":GO
TO540
265 CLS:PRINT"BUYING CANNON":PRINT
270 GOSUB780:PRINT"A LOUD HORN IS BLOWN BELOW. ONE OF THE MERCHA
NTS ASKS HOW MANY  YOU WOULD LIKE?"
275 X=RND(100):PRINT"CANNON COST $";X"EACH"
280 INPUTA:A1=A:A1=A1*X:IFA1>NM THENPRINT"YOU DON'T HAVE ENOUGH
GOLD, SIR!":GOTO540ELSEPRINT"THE CANNONSMITH IS LOADING YOUR WAG
ONS!":NM=NM-A1:CN=CN+A:GOTO540
285 PRINT@352,"F)IRE CAN.  A)DVANCE  C)ATAPULT H)IRE CIV.  B)UY
CAN. I)NFILTRT R)ELEASE WARRIORS":SOUND220,1
290 IFS$="COMPUTER"THENGOSUB815:GOSUB505:GOTO300ELSEA$=INKEY$:IF
A$=""THEN290ELSECLS:GOSUB505:GOSUB670:IFA$="F"THEN320ELSEIFA$="A
"THEN365ELSEIFA$="C"THEN375ELSEIFA$="H"THEN395ELSEIFA$="B"THEN41
5ELSEIFA$="I"THEN580ELSEIFA$="R"THEN295ELSE285
295 IFS$="COMPUTER"THEN290ELSECLS:PRINT"RELEASING WARRIORS":PRIN
T:PRINT"HOW MANY ARE LEAVING?":INPUT A:IF A>SW THEN295ELSE SW=SW
-A:GOSUB775:PRINT"THEY'RE GLAD TO GO HOME!":GOTO540
300 IF NS>=1AND SW<11000AND SC>=1THEN310ELSEIFSW<8000AND SC>=1TH
EN310ELSEIF CS<1AND SM>4999THEN315ELSEIF NS>=1AND SW<11000AND SM
>9999AND I1>=1THEN580ELSEIFSW<8000AND SM>9999AND I1>=1THEN580ELS
EIF NS>=1AND S<11000AND SM>9999AND I1>=1THEN580ELSE305
305 IF S<8000AND SM>9999AND I1>=1THEN580ELSEIF NW<3000AND SW>600
0THEN365ELSEIF SS>=1THEN375ELSEIF CS>=1THEN320ELSE365
310 IFSW<11000THEN D=11000:X=D-SW:IFSC>X THENCLS:PRINT"HIRING"X"
CIVILIANS":SW=11000:SC=SC-X:GOSUB785:GOTO540ELSEIFSW<8000ANDSC>5
0THENCLS:PRINT"HIRING"SC"CIVILIANS":GOSUB785:SW=SW+SC:SC=0:GOTO5
40ELSE315
315 IFCS<1ANDSM>5000THEND=RND(50):A1=D*100:CS=CS+100:SM=SM-A1:CL
S:PRINT"BUYING 100 CANNON AT $"D"EACH.":GOSUB780:GOTO540
320 CLS:PRINT"CANNON FIRED"
325 IFCS<=0THENPRINT"YOU HAVE NONE LEFT":GOTO540ELSEPRINT"AT HIS
 M)EN OR HIS C)ASTLE?":PRINT
```

Listing 1 continues

A legend now appears at the top of the screen notifying you and your opponent which option the other has chosen. (Previously it was difficult, especially when battling against the computer, to ascertain just how your men or castle were destroyed.)

Floods and plagues, which occur from time to time and inflict a tremendous amount of damage, now cannot occur when either king has fewer than 10,000 warriors or hit points, so battles must be decided by head-to-head combat. Although this is unrealistic, you'd be surprised at how tedious it was previously to lose battles because of a devastating plague. This was particularly annoying to the Northern ruler, because if both kings' castles were wiped out, the Northern king always lost.

Infiltrators must fight a minimum of two guards to kill the opposing king—it was much too simple to fell a lone guard in Kings and Catapults.

Sound effects are added to each phase of the battles. They include "We're In The Money" for payday, "Taps" for either king's demise, "Jaws" for floods, "The Love Boat Theme" when fathers ship aid, the Wizard of Oz's guard song ("Ohh-ee-

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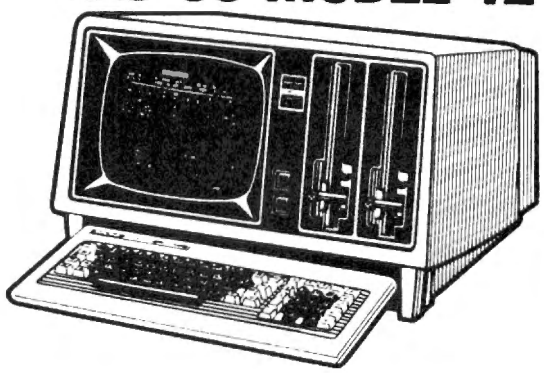

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Listing 1 continued

```
330 IFS$="COMPUTER"THEN335ELSEA$=INKEY$:IFA$=""THEN330ELSEIFA$="
C"THEN340ELSEIFA$="M"THEN355
335 IF N<NW THEN340ELSE355
340 PRINT"CASTLE":GOSUB760:V=RND(3):IFV=1THENPRINT"WAY OFF!":GOT
O540ELSED=RND(5000):N=N-D:PRINT"BOOM!":PRINTN$" LOST"D"HIT POINT
S!":D=RND(100):CN=CN-D:PRINT"AS WELL AS"D"CANNON":D=RND(99)
345 NC=NC-D:PRINT"AND";D"CIVILIANS":IFNS<1THENGOTO540ELSED=RND(1
0):IFD<4THENPRINT"***HE HIT YOUR CATAPULT!***":NS=NS-1:IFNS<1THE
NNS=0ELSE NS=NS:GOTO540ELSE540
350 GOTO540
355 PRINT"MEN":GOSUB760:V=RND(3):IFV=1THENPRINT"YOU HIT A FIELD!
":GOTO540ELSED=RND(5000):NW=NW-D:PRINTN$" LOST"D"MEN!":IFD>3000T
HEND=RND(3000):SW=SW-D:PRINT"BUT "S$"'S WARRIORS WERE TOO";:PRIN
T@192,"CLOSE TO "N$"'S TROOPS.":PRINTS$" LOST"D"MEN."
360 GOTO540
365 CLS:PRINT"TROOPS ADVANCED":PRINT:GOSUB800
370 D=RND(4500):NW=NW-D:PRINTN$" LOST"D"MEN, AND";D=RND(4500):SW
=SW-D:PRINTS$" LOST"D"OF HIS TROOPS":PRINT"IN THIS BATTLE.":GOTO
540
375 IFS$="COMPUTER"ANDSS<1THEN290ELSECLS:PRINT"CATAPULT FIRED":I
FSS<1THENPRINT:PRINT"YOU DON'T HAVE ONE":GOTO540ELSEPRINT"FIRE A
T HIS C)ASTLE OR HIS M)EN?"
380 IFS$="COMPUTER"AND N<NW THENPRINT"CASTLE":GOSUB760:GOTO385EL
SEIFS$="COMPUTER"THENPRINT"MEN":GOSUB760:GOTO390ELSEA$=INKEY$:IF
A$="C"THENPRINT"CASTLE":GOSUB760:GOTO385ELSEIFA$="M"THENPRINT"ME
N":GOSUB760:GOTO390ELSE380
385 X=RND(10):IFX=5THENPRINT"IT BACKFIRED!":D=RND(1000):S=S-D:PR
INTS$" LOST"D"HIT POINTS!":GOTO540ELSEX=RND(2):IFX=2THENPRINT"NO
T EVEN CLOSE!":GOTO540ELSED=RND(11000):N=N-D:PRINTN$"'S CASTLE L
OST"D"HIT POINTS!":GOTO540
390 X=RND(3):IFX<3THENPRINT"YOU MISSED!":GOTO540ELSED=RND(11000)
:NW=NW-D:PRINTN$" LOST"D"OF HIS WARRIORS!":GOTO540
395 CLS:PRINT"HIRING CIVILIANS":PRINT
400 IFSC<=0THENPRINT"NO ONE LEFT, SIR":GOTO540
405 PRINT"HOW MANY DO YOU WANT?"
410 INPUTA:IFA>SC THENPRINT"YOU ONLY HAVE"SC"CIVILIANS!":GOTO540
ELSESC=SC-A:SW=SW+A:GOSUB785:PRINT"THEY'RE DONNING THEIR ARMOR!"
:GOTO540
415 PRINT"BUYING CANNON":PRINT
420 GOSUB780:PRINT"A TRUMPET'S BLARE COMES UP FROM THE VILLAGE.
THE CANNONSMITH    WANTS TO KNOW HOW MANY?"
```

Listing 1 continues

oh, Ee-ohh-oh") for troop advances, and "You're In The Army Now" for hiring civilians.

I have also included a random seed generator. Since the Color Computer doesn't have one built in, each time the game loaded from tape, the first status listing gave the same number of warriors, castle hit points, and civilians. North's father would always bring aid on his second turn, and it was always $23,302.

Fortunately, a friend at a local Radio Shack store came to my rescue, writing the 'RNDGEN' subroutine that appears in lines 5–25. This subroutine replaces a Random routine found in Model I or III programs. Without it, this program is useless.

Possible Modifications For 32K Users

As this program uses all but about 500 bytes of the 16K Color Computer's memory, further changes are all but impossible for those with that system. But 32K owners may want to make these relatively simple modifications.

Playing this game with female friends might elicit comments like, "Why does it always call me 'him'?" The remedy is to insert a question at the beginning of

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Listing 1 continued

```
425 X=RND(100):PRINT"CANNON COST $"X"EACH."
430 INPUTA:A1=A:A1=A1*X:IFA1>SM THENPRINT"NOT ENOUGH CASH ON HAN
D!":GOTO540ELSEPRINT"THEY'VE BEEN ADDED TO YOUR ARSE-NAL!":SM=SM
-A1:CS=CS+A:GOTO540
435 M5=M5+2:IFM5=12THENCLS:PRINT"PAYDAY!":GOSUB795:PRINT"$2.00 P
ER WARRIOR IS BEING DE-  DUCTED.":PRINT:M5=0:P=NW*2:P1=SW*2:NM=N
M-P:SM=SM-P1:IFNM<=0AND SM<=0THEN450ELSEIFNM<=0THEN445ELSEIF SM<
=0THEN440ELSEGOTO535ELSERETURN
440 X=RND(2):IFX=1THEND=RND(SW):SW=SW-D:PRINTD;"OF ";S$"'S MEN H
AVE DIED OF STARVATION":GOTO535ELSED=RND(SW):SW=SW-D:NW=NW+D:PRI
NTD;"OF "S$"'S MEN JOINED "N$"'S ARMY. HE CAN'T PAY THEM!":GOTO5
35
445 X=RND(2):IFX=1THEND=RND(NW):NW=NW-D:PRINTD;"OF "N$"'S MEN JU
ST PERISHED FROM HUNGER":GOTO535ELSED=RND(NW):NW=NW-D:SW=SW+D:PR
INTD;"OF "N$"'S MEN SWITCHED SIDES- "N$" CAN'T PAY THEM!":GOTO53
5
450 X=RND(2):IFX=1THEND=RND(NW):NW=NW-D:PRINTD"OF "N$"'S MEN JUS
T DIED OF STARVATION- HE CAN'T PAY THEM!":GOTO455ELSEPRINTN$" CA
N'T PAY HIS MEN, BUT THEY REMAIN LOYAL!":GOTO455
455 X=RND(2):IFX=1THEND=RND(SW):SW=SW-D:PRINTD"OF "S$"'S MEN HAV
E DIED FROM MALNUTRITION- HE CAN'T PAY THEM!":GOTO535ELSEPRINTS$
" CAN'T PAY HIS MEN, BUT THEY REMAIN LOYAL!":GOTO535
460 PRINT:PRINT:INPUT"PRESS <ENTER>...";A:RETURN
465 CLS:PRINT"SORRY, "N$".":GOSUB770:PRINT:PRINT" YOUR WARRIORS
HAVE ALL BEEN    KILLED. YOUR CASTLE HAS BEEN TA-KEN OVER BY "S$
"'S TROOPS.":Y=2:GOTO615
470 CLS:PRINT"SORRY, "S$".":GOSUB770:PRINT:PRINT" ALL OF YOUR WA
RRIORS ARE DEAD. YOUR CASTLE HAS BEEN OCCUPIED BY"N$"'S FORCES."
:Y=1:GOTO615
475 X=RND(100):IFX>15THENRETURNELSE R=R+1:IF R>7 THENRETURNELSEC
LS:PRINT@12,"**AHOY**":GOSUB790:PRINT:PRINTN$"'S FATHER JUST BRO
UGHT-":P=RND(7)
480 IFP=1THENX=RND(100):CN=CN+X:PRINTX;C$:GOTO535ELSEIFP=2THENX=
RND(10000):NW=NW+X:PRINTX;W$:GOTO535ELSEIFP=3THENNS=NS+1:PRINT"A
";D$:GOTO535ELSEIFP=4THENX=RND(20000):N=N+X:PRINT"A CASTLE REPAI
R CREW- HE NOW HAS";N;H$:GOTO535
485 IFP=5THENX=RND(30000):NM=NM+X:PRINTM$;"$";X:GOTO535ELSEIFP=6
THENX=RND(10000):NC=NC+X:PRINTX;E$:GOTO535ELSEIFP=7THEN490
490 C5=RND(500):W5=RND(30000):NS=NS+1:H5=RND(30000):M8=RND(30000
):E5=RND(10000):CN=CN+C5:NW=NW+W5:N=N+H5:NM=NM+M8:NC=NC+E5:PRINT
C5;C$
495 PRINTW5;W$:PRINT" 1";D$:PRINT" A CASTLE REPAIR CREW WHICH RE
S- TORES";H5;H$:PRINT" $";M8:PRINTE5;E$:X=RND(5):PRINT" AND";X;"
SPIES!":I=I+X
500 GOTO535
505 X=RND(100):IFX>15THENRETURNELSEIFS$="COMPUTER"AND Q>=1THENGO
TO300ELSE R1=R1+1:IF R1>7 THENRETURNELSECLS:PRINT@12,"**AHOY**":
GOSUB790:PRINT:PRINTS$"'S FATHER JUST BROUGHT-":Q=Q+1:P=RND(7)
510 IFP=1THENX=RND(100):CS=CS+X:PRINTX;C$:GOTO535ELSEIFP=2THENX=
RND(10000):SW=SW+X:PRINTX;W$:GOTO535ELSEIFP=3THENSS=SS+1:PRINT"O
NE";D$:GOTO535ELSEIFP=4THENX=RND(20000):S=S+X:PRINT"A CASTLE REP
AIR CREW- IT NOW HAS";S;H$:GOTO535
515 IFP=5THENX=RND(30000):IF SM<=0THEN SM=X ELSE SM=SM+X:PRINTM$
,"$";X:GOTO535ELSEIFP=6THENX=RND(10000):SC=SC+X:PRINT X;E$:GOTO5
35ELSEIFP=7THEN520
520 C5=RND(500):W5=RND(30000):SS=SS+1:H5=RND(30000):D=RND(30000)
:E5=RND(10000):CS=CS+C5:SW=SW+W5:S=S+H5:IF SM<=0THEN SM=D ELSE S
M=SM+D:SC=SC+E5
525 PRINT C5;C$:PRINTW5;W$:PRINT" ONE";D$:PRINT" A CASTLE REPAIR
 CREW WHICH RES- TORES";H5;H$:PRINT" $";D :PRINTE5;E$:X=RND(5):P
```

Listing 1 continues

Micro Force II

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101

Listing 1 continued

```
RINT" AND";X;"SPIES!":I1=I1+X
530 GOTO535
535 PRINT:PRINT:INPUT"PRESS <ENTER>...";A:RETURN
540 PRINT:PRINT:INPUT"PRESS <ENTER>...";A:GOTO85
545 C$=" CANNON ":W$= "WARRIORS ":D$=" CATAPULT ":H$=" HIT POINT
S ":M$=" MONEY ":E$=" CIVILIANS ":RETURN
550 CLS:PRINT"SORRY, "N$".":GOSUB770:PRINT:PRINT" YOUR CASTLE HA
S BEEN LEVELED BYKING "S$". YOU ARE FLEEING!":Y=2:GOTO615
555 CLS:PRINT"SORRY, "S$".":GOSUB770:PRINT:PRINT" YOUR CASTLE HA
S BEEN DEMOLISHEDBY KING "N$". YOU'VE LOST.":Y=1:GOTO615
560 CLS:PRINT"INFILTRATING":PRINT:GOSUB765:GOSUB765:GOSUB765
565 IFNM<10000THENPRINT"YOU DON'T HAVE ENOUGH MONEY!":GOTO540
570 IFI<=0THENPRINT"THEY'RE DEAD!":GOTO540ELSEX4=RND(5):IFX4=1TH
EN570ELSEI=I-1:GOSUB810:PRINT"HE HAS TO FIGHT"X4"GUARDS.":NM=NM-
10000:FORX2=1TOX4:X3=RND(2)
575 IFX3<>1THENGOSUB805:SOUND1,30:PRINT"THE GUARDS KILLED HIM!":
GOTO540ELSEGOSUB805:GOSUB765:PRINT"ONE DOWN!":NEXTX2:GOSUB805:GO
SUB755:PRINT:PRINT"HE MADE IT!!":GOSUB810:GOTO600
580 CLS:PRINT"INFILTRATING":PRINT:GOSUB765:GOSUB765:GOSUB765
585 IFSM<10000THENPRINT"NOT ENOUGH CASH ON HAND!":GOTO540
590 IFI1<=0THENPRINT"THEY'RE DEAD!":GOTO540ELSEX4=RND(5):IFX4=1T
HEN590ELSEI1=I1-1:GOSUB810:PRINT"HE HAS TO FIGHT"X4"GUARDS.":SM=
SM-10000:FORX2=1TOX4:X3=RND(2)
595 IFX3<>1THENGOSUB805:SOUND1,30:PRINT"THE GUARDS KILLED HIM!":
GOTO540ELSEGOSUB805:GOSUB765:PRINT"ONE DOWN!":NEXTX2:GOSUB805:GO
SUB755:PRINT:PRINT"HE MADE IT!!":GOSUB810:GOTO605
600 CLS:PRINT@160, "********************************";PRINT "
   ";N$"'S INFILTRATOR":PRINT "      KILLED KING "S$"!!":PRINT:P
RINT"********************************":GOSUB770:Y=1:GOTO615
605 CLS:PRINT@160,"********************************";PRINT"
 ";S$"'S INFILTRATOR":PRINT"      KILLED KING "N$"!!":PRINT:PRIN
T"********************************":GOSUB770:Y=2:GOTO615
610 RETURN
615 GOSUB815:WB$="(0) WATERBOY FOR A SHEPHERD.":SA$="(1) CUSTER'
S STRATEGIC ADVISOR.":JL$="(2) JERRY LEWIS IN A WAR MOVIE.":NB$=
"(3) BONAPARTE AT WATERLOO.":GW$="(4) WASHINGTON AT VALLEY FORGE
.":LB$="(5) LOUIS XIV, THE BLOODLORD."
620 CLS
625 GOSUB740:PRINTN$;"'S RANK IS NOW:" :IFWR=0THENPRINTWB$ELSEIF
WR=1THENPRINTSA$ELSEIFWR=2THENPRINTJL$ELSEIFWR=3THENPRINTNB$ELSE
IFWR=4THENPRINTGW$ELSEIFWR=5THENPRINTLB$
630 IFWR=0THENSOUND10,10ELSEIFWR=1THENSOUND50,10ELSEIFWR=2THENSO
UND100,10ELSEIFWR=3THENSOUND150,10ELSEIFWR=4THENSOUND200,10ELSEI
FWR=5THENGOSUB765:GOTO660ELSE635
635 PRINT:PRINTS$"'S RANK IS NOW:" :IFER=0THENPRINTWB$ELSEIFER=1
THENPRINTSA$ELSEIFER=2THENPRINTJL$ELSEIFER=3THENPRINTNB$ELSEIFER
=4THENPRINTGW$ELSEIFER=5THENPRINTLB$
640 IFER=0THENSOUND10,10ELSEIFER=1THENSOUND50,10ELSEIFER=2THENSO
UND100,10ELSEIFER=3THENSOUND150,10ELSEIFER=4THENSOUND200,10ELSEI
FER=5THENGOSUB765:GOTO665ELSE645
645 IFER<5THENGOSUB735:GOTO650
650 PRINT:PRINT"WANT ANOTHER GAME?":INPUT"IT CAN BE ANY TWO PLAY
ERS...";A$:IFA$=""THEN650ELSEIFA$="Y"THEN655ELSEEND
655 PRINT:INPUT" PRESS enter TO KEEP THE SAME   PLAYERS AND RANK
S.              IF YOU'D LIKE TO BEGIN AGAIN   WITH NEW BATTLER
S, SIMPLY TYPE  THE WORD new...";A$:IFA$="NEW"THEN35ELSE55
660 PRINT:PRINTS$"'S RANK ENDS AT":PRINT"RANK ("ER").":PRINT:PRI
NTN$" HOWEVER, HAS RISEN FAR":PRINT@224,"ABOVE KINGMANSHIP AND H
AS BEEN  GIVEN COMMAND OF THE ENTIRE     COUNTRY!!!":GOSUB765:GO
SUB765:GOSUB765:GOSUB765:END
665 PRINT:PRINTS$", HOWEVER, HAS RISEN FAR":PRINT@224,"ABOVE KIN
GMANSHIP AND HAS BEEN  GIVEN CONTROL OF THE ENTIRE     COUNTRY!!
":GOSUB765:GOSUB765:GOSUB765:GOSUB765:GOSUB765:END
670 IFNW<10000OR N<10000OR SW<10000OR S<10000THENRETURN:ELSEX=RN
D(1000):IFX>=500ANDX<=515THEN675ELSEX=RND(1000):IFX>=500ANDX<=51
5THEN700ELSERETURN
675 CLS:SOUND1,5:FORX=1TO10:NEXT:SOUND10,5:FORX=1TO10:NEXT:SOUND
1,5:FORX=1TO10:NEXT:SOUND10,5:FORX=1TO10:NEXT:SOUND1,5:FORX=1TO1
0:SOUND10,5:PRINT"TORRENTIAL RAINS CAUSE FLOODING!"
680 GOSUB810:D=RND(10000):NW=NW-D:PRINTN$" LOST-":PRINTD"MEN":D=
RND(10000):N=N-D:PRINTD"HIT POINTS":D=RND(250):CN=CN-D:PRINTD"CA
NNON"
685 D=RND(1000):NC=NC-D:PRINTD"CIVILIANS"
690 GOSUB810:PRINTS$" LOST-":D=RND(10000):SW=SW-D:PRINTD"MEN":D=
RND(10000):S=S-D:PRINTD"HIT POINTS":D=RND(250):CS=CS-D:PRINTD"CA
NNON"
695 SC=SC-D:PRINTD"CIVILIANS":GOTO535:RETURN
700 GOSUB810:CLS:SOUND50,3:FORX=1TO10:NEXT:SOUND50,3:FORX=1TO10:
NEXT:SOUND50,3:SOUND10,20:PRINT"DRUDGERY! THE FOOD HAS SPOILED!
THERE IS A PLAGUE!":PRINT:GOSUB810
705 PRINTN$" LOST-":D=RND(10000):NW=NW-D:PRINTD"MEN":D=RND(10000
):N=N-D:PRINTD"HIT POINTS":D=RND(1000):NC=NC-D:IFNC<=0THENNC=0EL
SE NC=NC
710 PRINTD"CIVILIANS":GOSUB810
715 PRINTS$" LOST-":D=RND(10000):SW=SW-D:PRINTD"MEN":D=RND(10000
):S=S-D:PRINTD"HIT POINTS":D=RND(1000):SC=SC-D:PRINTD"CIVILIANS"
:GOTO535
720 GOTO540
725 IFNW<=0THEN465ELSEIFN<=0THEN550ELSE730
730 IFSW<=0THEN470ELSEIFS<=0THEN555ELSERETURN
735 GOSUB815:RETURN
740 IFY=1THENWR=WR+1ELSEIFY=2THENER=ER+1:RETURN
745 IFY=2THENER=ER+1ELSEER=ER:RETURN
750 GOTO650
755 FORL=55TO255STEP2:SOUND1,1:NEXT:RETURN
760 FORL=30TO1STEP-2:SOUND1,1:NEXT:SOUND1,10:RETURN
765 FORL=100TO150STEP5:SOUND1,1:NEXT:RETURN
770 SOUND1,10:FORX=1TO10:NEXT:SOUND1,5:SOUND70,20:FORX=1TO50:NEX
T:SOUND1,10:SOUND70,5:SOUND110,15:FORL=110TO1STEP-11:SOUND1,3:NE
XT:SOUND1,30:RETURN
775 SOUND100,5:SOUND130,2:FORX=1TO20:NEXT:SOUND130,9 :SOUND151,5
:FORX=1TO20:NEXT:SOUND151,5:SOUND179,2:FORX=1TO10:NEXT:SOUND179,
30:RETURN
780 SOUND100,10:SOUND130,5 :SOUND150,10:FORX=1TO20:NEXT:SOUND150
,2:SOUND179,30:RETURN
785 SOUND1,5 :SOUND70,3:FORX=1TO30:NEXT:SOUND70,3:SOUND110,5:SOU
ND1,2:SOUND70,30:RETURN
790 SOUND118,5:SOUND154,10:SOUND118,10:FORX=1TO95:NEXT:SOUND134,
4:SOUND154,4:SOUND144,4:SOUND134,4:SOUND154,4:SOUND144,5:SOUND13
4,5:FORX=1TO35:NEXT:SOUND71,10:SOUND99,25:RETURN
795 SOUND125,4:SOUND149,9:SOUND125,2:SOUND136,5:SOUND149,25:RETU
RN
800 SOUND25,10:SOUND90,10:SOUND25,6:GOSUB805:SOUND25,3:SOUND90,1
5:SOUND25,5:RETURN
805 FORX=1TO250:NEXTX:RETURN
810 FORX=1TO500:NEXTX:RETURN
815 FORX=1TO2000:NEXT:RETURN
```

Program Listing 2. Instructions

```
5 PMODE3,1:PCLS:SCREEN1,1
10 DRAW"BM12,156U100L5U10R10D5R10U5R10D5R10U5R10D5R10U5R10D10L5D
100BM20,51E22F22BM42,29U20R20G3F3L20":PAINT(42,35),8,8:PAINT(63,
50),8,8:PAINT(22,50),8,8:PAINT(45,11),3,8
15 CIRCLE(42,66),10,8,1,.5,1:DRAW"BM32,66D15R20U15":PAINT(42,66)
,3,8
20 FORX=1TO500:NEXT
25 DRAW"BM182,156U100L5U10R10D5R10U5R10D5R10U5R10D5R10U5R10D10L5
D100BM190,51E22F22BM212,29U20R20G3F3L20BM202,66D15R20U15":CIRCLE
(212,66),10,8,1,.5,1:PAINT(214,10),3,8:PAINT(212,35),8,8:PAINT(1
92,50),8,8:PAINT(233,50),8,8:PAINT(212,66),3,8
30 FORX=1TO500:NEXT
35 DRAW"BM72,79R10D5R10U5R10D5R10U5R10D5R10U5R10D5R10U5R10D5R10U
5R10BM112,126D30R30U30":CIRCLE(127,126),15,8,1,.5,1:PAINT(127,12
6),8,8:FORX=1TO500:NEXT:DRAW"BM0,156R255D25L255U25":PAINT(127,17
5),2,8
40 FORX=1TO2000:NEXT:PAINT(0,0),3,8:FORX=1TO2000:NEXT:PAINT(0,0)
,8,1:FORX=1TO2000:NEXT:PAINT(8,47),8,2:PAINT(2,170),3,8:FORX=1TO
500:NEXT
45 PAINT(0,0),3,3:DRAW"BM16,16D30BM16,31R15E15G15F15BM56,16D30BM
66,46U30F30U30BM116,36R20D10L30U30R30D5BM176,16L30D10R30D20L30":
FORX=1TO500:NEXT:DRAW"BM16,92U15E15F15D15BM16,77R30BM56,92U30F30
U30BM96,92U30R15BM96,92R15":CIRCLE(111,77),15,8,1,.75,.25
50 FORX=1TO500:NEXT
55 DRAW"BM42,108L26D30R26BM50,138U17E13F13D17BM110,108L26D10R26D
20L26BM118,108R26BM131,108D30BM152,108D30R26BM206,108L20D30R26BM
209,123L23BM246,108L26D10R26D20L26BM50,123R26":FORX=1TO500:NEXT:
DRAW"BM57,170F10E10F10E10F10E10F10E10F10E10F10E10"
60 DRAW"BM57,170F21BM197,170G21":PAINT(127,185),4,8:CIRCLE(127,1
80),40,4,.5 ,.5,1:PAINT(127,175),1,8:DRAW"BM125,163U9L5U4R5U5R4D
5R5D4L5D9":PAINT(127,155),4,8:FORX=1TO2000:NEXT
65 GOTO75
70 FORL=99TO255STEP2:SOUNDL,1:NEXT:RETURN
75 CLS:PRINT@43,"K I N G S":PRINT@109,"A N D":PRINT@169,"C A S T
 L E S":GOSUB70:PRINT@257," A FANTASY ROLE-PLAYING ADVEN-  TURE
GAME WHICH PITS TWO KINGS  AND THEIR KINGDOMS AGAINST ONE  ANOTH
ER.":GOSUB115
80 FORL=200TO255:SOUNDL,1:PRINT@420,"*BY GARY SMITH MICHAELS*":N
EXT:FORL=200TO255:SOUNDL,1:PRINT@453,"*PREPARE TO DO BATTLE*":NE
XT
85 'BY GARY MICHAELS, 4561 BRIDGEWOOD CT., COLUMBUS, OH 43229, (
614) 476-0578; INITIAL IDEA FROM 'KINGS AND CATAPULTS', BY WILLI
AM C. ADAMS, FROM 2/82 ISSUE OF '80 MICROCOMPUTING
90 GOTO120
95 SOUND1,10:SOUND30,5 :SOUND70,10:SOUND110,20:FORX=1TO50:NEXT:S
OUND110,5 :FORX=1TO20:NEXT:SOUND110,10:SOUND90,10:SOUND70,5 :SOU
ND90,10:SOUND70,10:SOUND30,5 :SOUND70,15
100 FORX=1TO500:NEXT:RETURN
105 PRINT:PRINT:INPUT"PRESS <ENTER>...";A:RETURN
110 INPUT"PRESS <ENTER>...";A:RETURN
115 FORX=1TO2000:NEXT:RETURN
120 CLS:PRINT" WELCOME TO 'KINGS AND CASTLES'" :PRINT@64," RULER
S, YOU WILL EACH BEGIN    WITH A KINGDOM, A LARGE AMOUNT  OF MON
EY, SEVERAL THOUSAND WAR- RIORS, 500 CANNON, AND A CIVI-  LIAN P
OPULATION."
125 PRINT" YOUR AMBITION IS TO DEMOLISH   YOUR OPPONENT BY DESTR
OYING HIS CASTLE'S HIT POINTS OR HIS WAR- RIORS, OR BY KILLING T
HE KING   HIMSELF.":GOSUB105
130 CLS:PRINT" YOU ACCOMPLISH THIS BY ADVAN-  CING YOUR TROOPS I
NTO BATTLE,   FIRING CANNON, OR BY UNLEASHING YOUR CATAPULT, IF
YOU'RE FORTU- NATE ENOUGH TO ACQUIRE ONE."
135 PRINT" AT THE START OF THE WAR, YOU   HAVE A NUMBER OF ALLIE
D INFIL-  TRATORS AT YOUR DISPOSAL, AT A  COST OF $10,000 EACH,
WHO WILL  SEEK OUT THE OPPOSING KING AND  KILL HIM -- if THEY EL
UDE THE   KING'S PROTECTORS.":GOSUB105
140 CLS:PRINT" EACH OF YOUR WARRIORS IS PAID  $2 EACH PAYDAY FOR
 FIGHTING.     SHOULD YOU FIND THAT YOU NEED  MORE SOLDIERS, HIR
E CIVILIANS ATTHE SAME RATE. REMEMBER, YOU PAYNOTHING UNTIL PAYD
AY."
145 PRINT" IF, AT ANY TIME, YOU HAVE MORE WARRIORS THAN YOU CAN
AFFORD TO PAY, THEY CAN BE RELEASED AND   SENT HOME."
150 PRINT" IF YOUR CANNON ARSENAL SHOULD  DIMINISH, MORE ARE AVA
ILABLE FORPURCHASE.":GOSUB105
155 CLS:PRINT" YOUR FATHERS ARE BOTH VERY POW-ERFUL KINGS AND, S
INCE EACH ONE WANTS HIS SON TO WIN THE WAR,   FROM TIME TO TIME
THEY WILL SENDGIFTS OF MONEY, WARRIORS, REPAIRCREWS, CANNON, CIV
ILIANS, SPIES,CATAPULTS, OR SOME OF EACH."
160 PRINT" HOWEVER, THE BATTLES ARE NOT   WITHOUT THEIR NATURAL
HAZARDS,  AS FLOODS AND PLAGUES OCCUR NOW AND THEN. THESE CAN BE
 DEVASTA- TING, SO TRY NOT TO HAVE TOO FEWWARRIORS AT ANY TIME."
:GOSUB105
165 CLS:PRINT@224," **YOU'D BEST DON YOUR ARMOUR**   **I THINK I
 HEAR BAGPIPES!**" :GOSUB100:GOSUB95
170 CLS:PRINT" WHEN YOU SEE THE 'OK', PRESS   THE POWER OFF BUTT
ON -- not the reset button -- AND THEN PRESS  IT AGAIN TO POWER
UP AND TYPE INTHE FOLLOWING...":PRINT@160," YOU MAY WANT TO WRIT
```

Listing 2 continues

the program that asks which gender each player is, and have the computer change each affected statement accordingly, so that king becomes queen, he becomes she, and so on.

Modify the program so that firing cannon at your opponent's warriors also knocks out a few of his cannon, as it does when you fire at his castle.

When you fire your catapult at the opposing king's castle and he has a catapult, you should be able to destroy it. Perhaps you can use a statement like the one found in the 'Fire Cannon At Castle' lines.

Add statements that allow fathers to send aid only when it is needed. That way, he wouldn't bring you 30,000 warriors when you really need a castle repair crew.

Calculate the number of opponent warriors killed according to which army is stronger. That way, if your troops are larger than those of your opponent, you stand a better chance of destroying him by advancing your troops.

"Infiltrators must fight a minimum of two guards to kill the opposing king. . . ."

The last is the most obvious—add graphics to the program. Artistic graphics would add immensely to the fun.

Entering and Loading the Programs

Due to the memory size of the 16K computer, the instructions are given in a separate program, which includes a colorful graphics display (see Program Listing 2). Again, if you have 32K or more, you can add this program to the main program. If you own the basic 16K computer, you can dispense with it altogether, if desired, but it includes the complete loading instructions which save you the trouble of referring back to this article.

Enter and load the instructions program as usual. CSAVE the program on tape (or disk if you have 32K). Turn your computer off and then on again. It is important that you follow the above directions carefully. Do not attempt to simply type in 'NEW' or use a delete statement. They will not work.

The main "Kings and Castles" program does not fit into the 16K Color Computer's normal memory even with a PCLEAR 1 statement because it uses approximately 14,100 bytes. So type in the following before attempting to enter or load the program:

POKE25,6 (ENTER)
POKE27,6 (ENTER)
POKE29,6 (ENTER)
POKE31,6 (ENTER)

These instructions work in Color Computers with Basic 1.0 and the newer Basic 1.1. I've been told the following can be used in 1.1 machines in place of all those POKE statements, but I can't confirm or deny it:

POKE25,6 (ENTER)
NEW (ENTER)

". . . it is advisable to wipe out your opponent's castle as soon as possible."

Strategies for Battles

Except for infiltrators, catapults are the most powerful weapons on the battlefield. They destroy up to 10,999 warriors or castle hit points. The computer uses it when it has one, as you should.

Catapults are always located in castles. The only way to destroy them is to fire cannon at the castle. In light of the above statistics, it is advisable to wipe out your opponent's catapult as soon as possible.

Cannon kill up to 4,999 men, or take out an equal number of hit points. They also destroy up to 100 opposing cannon, so five good hits on your opponent's castle can send him to the cannonsmith, wasting one of his turns. Additional cannon cost from $1 to $99, depleting his cash reserve and possibly stopping him from using an infiltrator later.

Payday comes around every 12th turn, during which each warrior is paid $2 from his king's coffers. So if you have 25,000 men, payday costs you

Listing 2 continued

```
E THIS DOWNON YOUR TAPE. IGNORE THIS IF YOUHAVE A 32K COCO."
175 PRINT@298,"POKE 25,6  <ENTER>":PRINT@330,"POKE 27,6  <ENTER>
":PRINT@362,"POKE 29,6  <ENTER>":PRINT@394,"POKE 31,6  <ENTER>":
PRINT
180 GOSUB110:CLS:PRINT" THIS SETS ASIDE 14631 BYTES OF MEMORY. Y
OU must TURN POWER OFF AND ON AGAIN BEFORE ENTERING    POKE STAT
EMENTS.":PRINT" DON'T JUST TYPE 'NEW' OR USE A DELETE STATEMENT,
 AS YOU WILL BE REWARDED WITH A ?SN ERROR WHEN YOU RUN";
185 PRINT" THE PROGRAM.":PRINT" IF YOU DO GET THE SYNTAX ERROR,T
YPE IN THE FOLLOWING:            'PRINTPEEK(PEEK(25)*256)'
THE NUMBER PRINTED WILL PROBAB-LY BE 170, BUT IF IT'S ANY NUM- B
ER GREATER THAN 0, TYPE THIS:":PRINT
190 GOSUB110:CLS:PRINT@5,"'POKEPEEK(25)*256,0'":PRINT:PRINT" MAN
Y THANKS TO CHROMASETTE MAG-AZINE FOR THAT LITTLE TIDBIT.":PRINT
@160," OK, TURN ME OFF AND ON, ENTER  THOSE POKE STATEMENTS, CLO
AD THEMAIN PROGRAM, AND RUN IT.":PRINT:GOSUB110
195 END
```

Line	Description
5–25	Random seed generator
30–45	Introduction and set players' strings
50–110	Initialize variables
115	Scoreboard display
120–155	Status display
160	Determines and prints whose turn
165	North's option display
170	North's INKEY routine
175–280	Carry out all of North's options but infiltration
285	South's option display
290	South's INKEY routine
295	South's 'release warriors' option
300–315	Determine computer's move in one-player game
320–430	Carry out balance of South's options but infiltration
435	Checks for payday; if so, $2 per warrior is paid
440–455	Determine how men react if their king cannot pay them
465	North loses due to lack of warriors
470	South loses due to lack of warriors
475–500	North's father possibly sends aid
505–530	South's father possibly sends aid
535–540	'Press enter to continue' subroutines
545	String data for status reports
550	North loses due to lack of hit points
555	South loses due to lack of hit points
560–575	North's infiltration routine
580–595	South's infiltration routine
600	North's infiltrator kills Southern king
605	South's infiltrator kills Northern king
615	String data for ranks
620–630	Check for, display, and sound North's rank
635–645	Check for, display, and sound South's rank
650–655	Another game?
660–665	Display message if either king has won five battles
670	Determines if there is a plague or flood
675–695	Flood subroutine
700–720	Plague subroutine
725–730	Check for either king not having enough warriors or hit points to continue
740–745	Determine rank values
755	Sound: Infiltrator killed a king
760	Sound: Cannon or catapult fired
765	Sound: Infiltrating
770	Sound: "Taps"—A king is dead
775	Sound: "Happy Days Are Here Again"—Releasing warriors
780	Sound: Buying cannon
785	Sound: "You're In The Army Now"—Hiring civilians
790	Sound: "The Love Boat Theme"—Father shipped aid
795	Sound: "We're In The Money"—Payday
800	Sound: Guard song from "Wizard of Oz"—Advancing troops
805–815	For. . .Next loops

Table 1. Kings and Castles line descriptions.

Langley-St.Clair Gets Mail

From unsolicited letters of testimonial

I recently purchased your amber CRT for my Model III with anti-glare features. I seldom write regarding products I've purchased for the computer, but I felt that your product warranted a short note. I am extremely happy with my new CRT. The color is great, and easy on the eyes, as you claimed. Your documentation was excellent. I am by no means electronically inclined, but I had no problem with the installation.

Just wanted you to know that I would recommend your product to anyone interested in upgrading their CRT. Thank you for your excellent service also.

A.P.
New Monmouth, NJ

I have got my Orange CRT installed in my computer and it sure is a good tube. Now after looking at the screen for 8 hours my eyes aren't falling out. Thank you very much for all the trouble you had to go through with my order. This tube works fine, and after a little getting used to the color I like it a lot better than green and 100% better than B/W. Your company is sure wonderful to do business with. You can be sure I will tell anybody that is looking for a replacement CRT where to get one. Also tell Donna thanks for all the help she gave me...she was right about the color; it is a lot better to look at once you get used to it. Again, thank you very much.

K.L.
Saginaw, MI

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$50,000. You begin with over $120,000 so money is usually not a factor unless you run out of cannon or elect to use an infiltrator.

While cannon or catapults are not guaranteed to hit their targets—you can hit a field or your weapon might backfire—advancing troops into battle is a sure killer. It's a little risky, as you and your opponent always lose men, up to 4,999 in fact. So you don't want to opt for troop action if you're low on men, especially if you have no civilians left to hire. But it's an excellent option if your opponent is down to 500 men and you have 10,000.

"... you don't want to opt for troop action if you're low on men..."

I like to save my infiltrators until I'm in deep trouble. Although they can win the game for you on the first move, they are much more useful when you're down to 1,000 warriors and 760 hit points. They're your last hope for victory when you're down.

One Final Note

Due to space considerations, there are no remark statements in the programs, but each line is covered in the line descriptions (see Table 1). Don't add additional spaces between characters in the main program. ■

Write to Gary Michaels at 4561 Bridgewood Court, Columbus, OH 43229.

Variable	Description
N$	Northern king
S$	Southern king
WR	North's current rank
ER	South's current rank
M5	Determines payday
M	Initial money amount for both kings
NM	North's current money amount
SM	South's current money amount
NW	North's warriors
SW	South's warriors
N	North's hit points
S	South's hit points
CN	North's cannon
CS	South's cannon
NC	North's civilians
SC	South's civilians
I	North's infiltrators
I1	South's infiltrators
NS	North's catapults
SS	South's catapults
T	Monitors whose turn it is
P	North's pay figure
P1	South's pay figure
Y=1	North wins a battle
Y=2	South wins a battle
C$	Cannon
W$	Warriors
D$	Catapult
H$	Hit points
M$	Money
E$	Civilians
WB$	Rank (0)
SA$	Rank (1)
JL$	Rank (2)
NB$	Rank (3)
GW$	Rank (4)
LB$	Rank (5)
R	Number of times North's father has brought aid this game
R1	Number of times South's father has brought aid this game

Table 2. Kings and Castles variables list.

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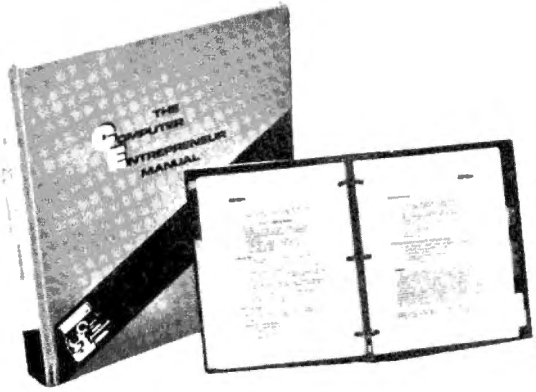

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Strip Blackjack

by Stephen Mills

Strip blackjack adapts the concept of strip poker to computer blackjack. The result is more interesting than either. The program shows off the graphics and sound capabilities of the TRS-80, as well as the computing power of 16K memory.

The stakes involved are real, personal, and legal in most places. Finally, the game is protracted enough to give players a sense of involvement that strip poker doesn't provide.

The rules of play are similar to casino blackjack. The computer acts as both bank and dealer. A player's stakes are chips allotted by the computer for each article of clothing worn. As dealer, the computer always draws last, draws on 16 points, stands on 17, and wins preemptively with 21 points on the deal.

If you find that strip poker has lost its charm, liven up your next party with a new hit game.

The game observes the five-card rule; if a player has five cards totaling 21 or less, he wins automatically, as if a blackjack were drawn on the deal.

An option is available to include jokers in the deck. If the computer draws a joker, all bets are lost; if a player draws one, the program randomly decides the consequences. A player can win or lose the round automatically, or receive extra chips from the computer. There is also the less likely possibility of losing practically everything on a joker.

Betting is more structured than in conventional blackjack. The computer awards a specific number of chips for each article of clothing. It maintains each player's clothing in a hierarchical order, with clothing worth the least number of chips, like shoes and sweaters, at the upper level and undergarments at the bottom level.

Players can bet only according to this hierarchy. That is, shoes and sweater chips are bet first, undergarment chips last.

A player's bet can range anywhere from zero chips to the total number of chips a piece of clothing is worth. So, if a player is wearing a sweater, he can bet

Continues on p. 258

Table 1. Program Description

10–75	Packed string graphics
85–140	General initialization
150–240	Instructions
250–370	Initialization of game parameters
380–750	Main playing loop
380–450	Betting; cards are dealt into array
460–610	Individual player interactive processing
620–640	End-of-round display
650–700	Dealer's activities

Table 1 continues

The Key Box

Model I and III
32K RAM
Cassette Basic
Audio Amplifier Optional

Table 1 continued

710–750	End of play; results and internal maintenance
	Subroutines
770	Home cursor; video maintenance
780–920	Player entry and stakes setting
930–960	Player level informational routine
970–1030	Dealer's cards display
1040	Clears the on-screen instructions
1050	Displays play instructions
1060	INKEY$ subroutine
1070	The current level of player Y is returned as S
1100	Displays card image
1110–1140	Convert numeric card values to display form
1150–1260	Extra chip round
1280–1300	Player X loses one level
1310–1320	Find next valued level of player X
1340–1360	Random selection of one card
1370–1380	Shuffling—initialize card matrix
1390	Executes card selection routine and stores it in player's hand
1400–1480	Player's joker processing
1490–1520	Deck display
1520	Clears hands
1530–1570	Review contents of hands
1580–1600	Video paging routine
1610–1660	Process individual clothing questions and responses
1670	Title display
1680–1730	Clothing query block for items common to both sexes
1740–1760	Recompute current betting level
1770–1920	Sound subroutines
1930	Evaluation of card points
1940–1960	Error traps
2000–2040	Chip equalization option routine

System Modifications

Multiple USR Functions

Disk Basic and some tape operating system enhancements provide multiple USR functions. To provide for this, change line 30 from:

```
POKE16526,PEEK(Z+1):POKE16527,
PEEK(Z+2)
```

to:

```
DEFUSR4=Z!
```

Change all occurrences of USR to USR4 in lines 1770–1920.

Cassette Sound

You can produce sound through an amplifier or a modified cassette system. The latter method requires turning on the cassette system relay. Program Listing 2 supports the former technique, and does not operate the cassette relay latch.

You must make some changes to provide operation of the relay on the Model I. In line 100, one of the data elements is a space. The interpreter reads this as a numeric value of zero. Change the space to 4.

In line 1400, find POKEZ!+32,8. Replace the 8 with a 12. In lines 1480 and 1880, find POKEZ! + 32,0 and change the zero to 4.

Memory Differences

This program will run on memory in 16K, although you should probably delete the instruction section in lines 140–240. The presence of any operating system utilities could make a critical difference.

You can adjust this to some extent by modifying the amount of string space reserved in line 120. An optional 650 bytes allow the maximum number of players, but you can do with less.

Another possibility is to add lines that delete 10–85 (90 and 95 are available). You must enter Run again after the graphics display. ■

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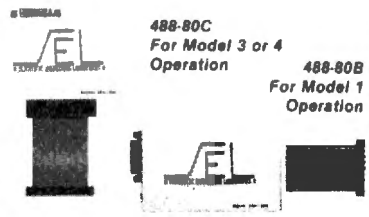

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Continued from p. 256

up to 3 points, the total allotment for sweaters. Whenever a player loses all the chips for a given level, he must sacrifice the associated apparel.

Winnings are always kept separate and are always bet and lost first.

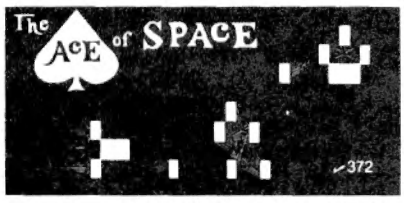
Sequence of Play

The game begins with a full-screen display, followed by an option to display instructions. The computer then asks if you have sound capability. This requires attaching the cassette AUX plug to a speaker. This program provides a variety of interesting sound effects. If you do not use sound, the program skips the sound subroutines to circumvent tedious time delays.

The computer prompts for the number of players, the number of decks to use, and the number of jokers to add. You are allowed up to 10 players or you can play solitaire. The default is one for the number of decks and zero for the number of jokers.

The option for a fast or slow game follows. This decision affects the number of chips allocated for each player's clothing.

The program asks each player for name, sex, and clothing worn. The clothing interview consists of yes/no



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Integer Variables

C1	Numeric value for the rank of a card (1 = ace, 13 = king)
C2	Suit code for a card
F	Freeze-play flag, used with one of the joker effects
LS	Long/slow game flag used by the chip allocation algorithm to compute value
N	Used to construct the betting ranks table of player Y during initialization interview; 2nd-dimension pointer for arrays B and V
ND	Number of decks in play
PC	Number of players
PO	Players out. Tallied each round to check for an end-of-game condition. If not, the tally is continued during rounds to decide whether dealer must draw
PS	Position on CRT used for PRINT@
R	Remaining cards in shuffled deck
S	A flag used for making special adjustments to the B and V arrays
T	Total point value of a group of cards
T1	Dealer's total
TA	Total number of aces possessed
X	A miscellaneous local variable, sometimes used to identify a player (see text)
Y	Loop variable usually identifying the player being processed
ZD	Flag for the use of sound

Single-Precision Variables

X!	Loop variables for fractional decrementing
Z!	PEEK/POKE address pointer

String Variables

A	Item name during initialization interview
AS	His or Her depending on SX(Y)
B	Player's name (same as B(Y,0)) or other temporary functions
BB	A screen width graphics bar
BC	— separator
BD	Deck or Decks depending on ND
CB$	Graphic representation of the bottom edge of a playing card
CM$	The middle of a card
CT$	The top of a card
N$	The display format of a card's rank
S$	The display format of a card's suit
Z7$	String where data for the sound routine is stored
ZD$	String in which the machine-language sound USR routine is stored

Arrays and Matrices

B(PC,10)	String array. B(Y,0) is the player's name; other second-dimension elements are names of items worn
C(PC,4,1)	Card hands. First dimension is the player (dealer = zero). Second dimension is card number. Third dimension is rank (zero) and suit (one) of card
CL(PC)	Pointer to the player's active betting level
D(13,4)	Deck of cards by rank and suit; zero elements are not used
I$(12)	String array of packed graphics
SX(PC)	Sex code (zero = Female; one = Male)
T(PC)	Carries player's point total from play to end-of-round results; can carry special values indicating no play, joker, and so on
V(PC,10)	Value of items in the B array. The second-dimension zero element stores winnings
W(PC)	The wager each player makes on the round

Table 2. Variables and Arrays

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1. ATN, EXP, COS, SIN, LOG, TAN, and exponentiation. (However, subroutines are included in the manual for these functions.)
2. ERROR, ON ERROR GOTO, ERL, ERR RESUME.
3. No direct commands like AUTO, EDIT, LIST, LLIST ETC, although these commands may be used when writing programs.
4. Others NOT supported: CDBL, CINT, CSNG, DEFFN, FIX, FRE.
5. Normal CASSETTE I/O. (ZBASIC supports it's own SPECIAL CASSETTE I/O statements.)
6. SOME BASIC COMMANDS MAY DIFFER IN ZBASIC. For instance, END jumps to DOS READY, STOP jumps to BASIC READY etc
7. MEMORY REQUIREMENTS: to approximate the largest BASIC program that can be compiled in your machine (at one time), enter BASIC and type: PRINT (MEM-6500)/2. Remember, you can merge compiled programs together to fill memory.

ZBASIC 2.2 SPEED COMPARISON DEMO

To help give you an idea how fast compiled programs are, we have included this demo program:

ZBASIC 2.2 DEMO PROGRAM

Time to compile and run complete program	**:0 MIN. 2 SEC.**
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BASIC Program size (WITHOUT VARIABLES)	**: 895 BYTES**
ZBASIC Program size (WITHOUT VARIABLES)	**:2733 BYTES**

(Remember that the ZBASIC program includes an 1879 byte subroutine package.) Program shown exactly as compiled and run in BASIC and ZBASIC.

```
10 '========= ZBASIC 2.2 EXAMPLE PROGRAM AND TIME TEST========
20 CLS:CLEAR100:DEFINT A-X:DEFSTR Z:DIM AA(64,24),Z(50):RANDOM
30 AA=100:BB=-1000:CC=3:DD=-3:EE=-9999:ST$="START TIME "+TIME$
40 FOR I=1TO127STEP2 :FOR J=47TO1STEP-3:XX=POINT(I,J):SET(I,J)
50 XX=(I-J)/CC*(7+I+J) :XX=ABS(INT(RND(I*J)-AA)+7) :RESET(I,J)
60 XX=PEEK(I+J) :POKE15360+I+J,J :OUT255,J AND (3*J):XX=INP(I)
70 AB$=STR$(I+J) :BA$=LEFT$(AB$,2) :AA(I/2,J/2)=VAL(BA$)+AA*3
80 BA$=BA$+RIGHT$(BA$,RND(3)) :XX=INSTR(1,BA$,"9"):XX=SQR(I*J)
90 BA$=MID$(BA$,2,2) :MID$(BA$,1,1)=Z :IF XX THEN 100 ELSE CLS
100 IF LEN(BA$))3 OR SGN(XX)=1 AND ASC(BA$)=32 THEN PRINT"+++";
110 IFPOS(0)>62 THEN TRON:TROFF:PRINT ELSE XX=NOT(RND(99))+100
120 A$=INKEY$:IF A$="Y" OR A$="y" AND I)120 THEN PRINT"TRUE.."
130 RESTORE :READA,C,Z(J),D:GOSUB170:GOSUB170:GOSUB170:GOTO210
140 NEXT :PRINT"*";:NEXTI:CLS:PRINT@512,ST$,"STOP TIME ";TIME$
150 STOP'============== END OF MAIN TEST LOOP ================
160 DATA 12345,-1,"TEST",-9999
170 ON RND(6) GOTO 180,190,200,180,190,200
180 RETURN
190 RETURN
200 RETURN
210 ON RND(9) GOSUB 180,190,200,180,190,200,180,190,200
220 GOTO140
```

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Program Listing 1

```
10 DIMI$(12):'STRIP BLACKJACK by S. Mills
15 I$(0)="
          "
20 I$(1)="
          "
25 I$(2)="
          "
30 I$(3)="
          "
35 I$(4)="
          "
40 I$(5)="
          "
45 I$(6)="
          "
50 I$(7)="
          "
55 I$(8)="
          "
60 I$(9)="
          "
65 I$(10)="
          "
70 I$(11)="
          "
75 I$(12)="
          "
80 V-88477:W=1:X=1:Y=1:Z=1:FORX=0TO12:Y=PEEK(VARPTR(I$(X))+1)+PEEK
(VARPTR(I$(X))+2)*256
85 FORZ=0TO63:READW:POKE2+Y,W:V=V-W
90 NEXTZ,X:IFV<>0THENPRINT"Checksum error - data incorrect.":END
95 FORX=0TO12:PRINTI$(X);:NEXTX:DELETE75-155:END
100 DATA168,191,159,143,143,143,143,143,143,143,143,143,143,143,14
3,143,143,143,191,189,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32
,32,32,32,160,156,140,140,180,32,32,32,32,32,32,32,32,32,32,32,32,
32,32,32,32,32,32,32,32,32,170,191,149,168,185,32,32,32,32
105 DATA32,176,176,176,176,176,176,176,176,191,191,176,176,176,176
,176,176,176,176,176,32,32,32,32,32,32,32,32,168,151,32,32,130,129
,176,184,180,176,144,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,
32,170,191,149,162,162,32,32,32,32,170,191,151,131,163,131
110 DATA131,131,167,183,183,183,135,131,131,131,131,131,171,191,14
9,32,32,32,32,32,32,32,32,131,140,180,144,32,184,135,32,160,144,32
,32,32,128,131,128,160,144,32,32,32,32,32,32,32,32,170,191,149,130
,135,32,32,160,176,170,191,149,168,186,32,32,32,170,132,141
115 DATA149,35,32,32,32,32,32,170,191,149,32,32,32,32,32,138,183,1
76,32,160,186,135,170,149,32,160,158,131,171,144,168,183,32,160,15
9,131,131,189,32,32,32,32,32,32,170,191,149,32,32,32,32,191,191,19
1,191,149,160,180,32,176,176,172,163,163,172,35,32,32,32,32
120 DATA32,170,191,149,32,32,32,32,32,32,32,131,131,131,129,32,32,
131,131,131,32,32,32,131,129,130,187,135,131,131,131,129,32,32,32,
32,32,32,32,170,191,149,32,32,32,32,130,175,191,191,149,128,129,128,1
49,157,147,189,179,182,163,141,172,32,32,32,170,191,149,32
125 DATA32,32,136,188,156,140,140,188,144,136,188,156,128,32,32,32
,32,160,188,144,142,133,184,156,140,172,176,136,188,156,128,172,15
```

Listing 1 continues

questions based on the player's sex. Typical and atypical (long underwear and corsets) apparel is included, but if the description does not seem appropriate, a player can press the = key at an analogous level and enter a more satisfactory description.

Your answers affect the course of the interview; for example, a woman wearing a dress is not asked about pants. The program reviews your responses and allows corrections.

After the interviews, the program displays a comparative table of the players' stakes. The totals will vary, but the chip allocation algorithm produces roughly equivalent totals for each sex's typical casual attire.

Play proceeds through rounds typical

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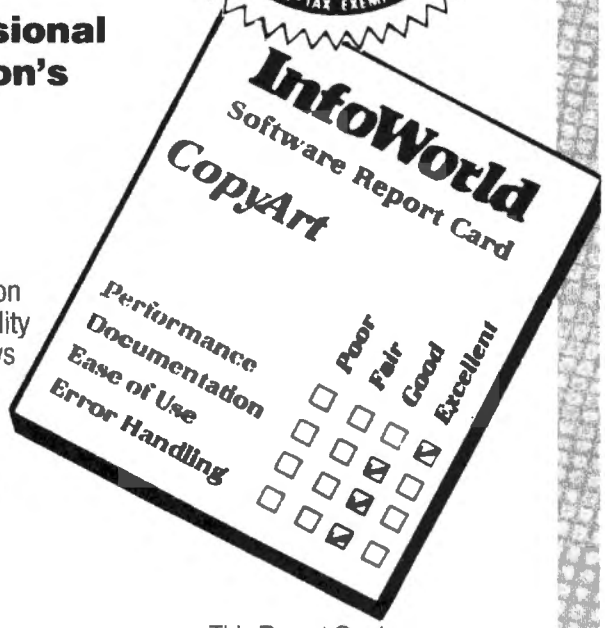

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Listing 1 continued

```
6,170,191,149,32,32,32,32,128,32,171,191,149,32,32,32,151,183,166,
132,191,136,137,187,186,32,32,32,170,191,149,32,32,32,128
130 DATA191,181,176,176,159,133,32,191,149,32,32,32,32,184,183,176
,187,180,32,191,149,32,32,32,32,191,181,184,135,128,170,191,149,32
,32,32,32,32,32,170,191,149,32,32,32,141,172,185,155,179,175,178,1
74,170,32,160,32,170,191,149,32,32,32,128,191,149,32,32,191
135 DATA149,32,191,149,32,32,176,128,191,149,32,170,191,32,191,149
,32,160,176,128,191,149,130,173,144,170,191,149,32,32,32,32,32,32,
170,191,149,32,32,32,32,32,35,141,177,177,141,131,131,32,139,129,1
70,191,149,32,32,32,130,131,131,131,131,131,32,130,131,131
140 DATA131,131,131,130,131,131,32,131,131,129,130,131,131,131,128
,130,131,131,128,131,131,130,143,143,143,143,143,143,143,143,175,1
91,149,32,32,32,32,32,35,170,172,136,149,32,32,32,151,133,170,191,
149,32,32,32,32,32,32,128,128,136,188,156,32,32,160,188,144
145 DATA32,128,184,156,140,172,180,136,188,156,128,172,156,132,32,
32,32,32,32,32,128,32,32,32,32,32,32,170,191,181,176,176,176,176,1
76,184,187,187,187,185,176,176,176,177,176,186,191,149,32,32,32,32
,32,32,32,32,128,191,149,128,184,183,176,187,180,128,191,149
150 DATA32,32,32,32,191,181,184,135,128,32,32,32,32,32,32,32,128,3
2,32,32,32,32,32,32,130,131,131,131,131,131,131,131,131,131,131,13
1,131,131,131,131,131,131,131,32,32,32,32,32,32,168,180,128,128,19
1,149,128,191,149,32,170,191,128,191,149,32,160,176,128,191
155 DATA149,130,173,144,32,32,32,32,32,32,32,32,32,32,32,32,32,32,
32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,32,
32,32,32,32,128,131,131,131,131,32,130,131,131,128,131,131,129,130
,131,131,131,129,130,131,131,128,131,131,32,130,131,32,32
```

Program Listing 2

```
10 DIMI$(12):'STRIP BLACKJACK by S. Mills
80 CLS:FORX=0TO4:PRINTLEFT$(I$(X),30):NEXTX:PRINTI$(5):PRINT@371,"
  ";:PRINT@384,I$(6);:FORX=7TO12:PRINTI$(X);:NEXT
85 PRINTCHR$(28);:FORX=0TO600:NEXTX:FORX=0TO5:PRINTI$(X);:NEXT:FOR
X=0TO300:NEXTX:PRINT@912,"A Sympatanekromenoi Adult game":FORX=1TO
2000:NEXTX
100 DATA205,127,10,203,124,221,33,183,127,40,7,221,117,252,221,116
```

Listing 2 continues

of blackjack. Each player has a turn at the keyboard, with a display that shows the dealer's cards, the players' cards, and the stakes.

Between rounds, players can examine the cards remaining in the deck, or review the hands of the current round. The rounds can continue until all but one player has lost everything.

Theory and Strategy

Ordinary blackjack is a tug-of-war to shift the available resources, the chips, to your advantage. In strip blackjack, you try to control a process of erosion.

During a game, a player's stakes are limited to the clothing value, so the opportunity to place a large bet is rare. Winning a few chips does not usually increase the potential bet, since the next bet is restricted to the winnings themselves.

Other factors further increase the likelihood of a player losing. The dealer always wins on jokers; a player might lose. Also, winnings are good only for buffering your losses and for making immediate claims against another player. Winnings cannot increase indefinitely. The net result of winning more than 10 chips is to reduce, not increase, the total number of chips in play.

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In ordinary blackjack, a player wins by gaining some of the dealer's resources. The wins and losses of other players are irrelevant to your game. In this game, although you play cards and bet against the dealer, wins and losses are meaningful only in relation to the other players.

Since playing is virtually guaranteed to erode everyone's stakes, each player is competing for the best status in relation to the others. Winning is simply losing more slowly.

Playing strategy—when to draw and when to stand—is identical to casino blackjack. You do have the option of reviewing the available cards. Since a good blackjack player attempts to keep track of this anyway, use the option; it eases the strain on your memory.

Betting strategy is different. You are betting against the other players, so try to minimize your losses and maximize theirs. I recommend very conservative betting of your fundamental resources.

The procedure for betting chips won (extra chips) is variable. There is little point in gambling for the extra chip round when the other players are betting from a two- or three-chip rank. If they are at a more valued rank that you can eliminate by accumulating more than 10 extra chips, bet heavily off the extra chip rank.

The Program

The program's graphics display uses packed graphics strings to decrease memory requirements and provide fast execution. When you key in the program, you can either skip the graphics and go straight to Program Listing 2 for the substance of the program, or create the packed graphics array by transcribing and running Program Listing 1, then adding the remainder, Listing 2.

Listing 1 conceals the graphics in its data statements and POKEs them into the empty I$ array. Packed graphics look strange when you list the program; the interpreter sees the graphics values as Basic statement tokens and translates them accordingly. Lines 15–75 of strip blackjack always resemble the chaos you get after a bad CLOAD.

The machine-language USR subroutine for the sound effects is not packed in. The program carries it in the form of data statements (lines 100–110). No memory is ever protected for this subroutine; at run time it resides in the string storage area.

This is safe because the string variables used are defined before any other strings, and never redefined. This assures that they will always reside at the

Listing 2 continued

```
,253,201,221,117,254,221,116,255,219,255,230, ,95,221,86,251,221,7
0,253,221,78,252,43,124,181,40,6,253,227,253,227,24,15
110 DATA221,102,255,221,110,254,122,7,7,87,230,3,179,211,255,3,120
,177,32,225,123,211,255,201
120 CLEAR650:DEFINTC-Z:DEFSTRA-B:X=73:Y=5:Z=24:PC=0:Z!=0:ZD$=STRIN
G$(X,Z!):Z7$=STRING$(Y,Z):Z=VARPTR(ZD$):Z!=PEEK(Z+1)+PEEK(Z+2)*256
:IFZ!>32767THENZ!=Z!-65536
130 FORX=Z! TOZ!+72:READY:POKEX,Y:NEXTX:POKE16526,PEEK(Z+1):POKEZ!
+7,PEEK(Z+1):POKE16527,PEEK(Z+2):POKEZ!+8,PEEK(Z+2):Z!=PEEK(VARPTR
(Z7$)+1)+PEEK(VARPTR(Z7$)+2)*256:IFZ!>32767THENZ!=Z!-65536
140 BB=STRING$(64,140):BC="---
":DIMD(13,4):GOSUB1670:INPUT"DO YOU NEED TO READ THE RULES";A:IFLE
FT$(A,1)<>"Y"THEN250
150 PRINT@256,"STRIP BLACKJACK IS QUITE SIMILAR TO BLACKJACK, BUT
INCLUDES SOMESPECIAL RULES.  THE COMPUTER DEALS AND MANAGES ALL AC
COUNTS.  ATTHE BEGINNING OF EACH GAME, EVERY PLAYER MUST BUY CHIPS
 FROM ME.";
160 PRINT"THE NUMBER OF CHIPS A PLAYER GETS DEPENDS ON WHAT THAT P
LAYER ISWEARING.  I'LL FIX A PRICE ON EACH ARTICLE OF CLOTHING.  P
LAYERSMAY BEGIN WITH DIFFERENT BANKROLLS."
170 PRINTBC"YOUR CLOTHES ARE RANKED FROM 'OUTER' TO 'INNER'.  DURI
NG A GAME,THE CHIPS YOU BET ALWAYS APPLY TO THE OUTERMOST ARTICLE;
 YOU CANBET AS MANY CHIPS AS YOU HAVE REMAINING FOR THAT ITEM.":GO
SUB1580
180 PRINT@256,CHR$(31)"YOU MAY ALSO HAVE EXTRA CHIPS WHICH YOU'VE
WON FROM THE DEALER--THESE ALWAYS COUNT AS 'THE CURRENT RANK' AND
ARE BET FIRST.":PRINTBC"IF YOU LOSE ALL CHIPS AT THE CURRENT RANK
(EXCEPT FOR 'EXTRAS'),YOU MUST SACRIFICE THAT ITEM."
190 PRINTBC"YOU CANNOT ACCUMULATE MORE THAN 10 'EXTRA' CHIPS; ANYO
NE WINNINGTHAT MANY EXTRA CHIPS IMMEDIATELY CLAIMS ONE ARTICLE OF
CLOTHINGFROM ANOTHER PLAYER, AND CASHES IN 10 CHIPS.":GOSUB1580
200 PRINT@256,CHR$(31)"THE DEALER PAYS OFF DOUBLE TO A PLAYER GETT
ING '21' ON THE FIRSTTWO CARDS.  A PLAYER DRAWING 5 CARDS TOTALLIN
G '21' OR LESS IS AWINNER AUTOMATICALLY.  THE DEALER BEATS LOWER S
CORES AND TIES."
210 PRINTBC"INSTEAD OF 'DOUBLING', A PLAYER MAY 'GO DOWN', TAKING
1 CARD ANDBETTING ALL CHIPS ON THE CURRENT RANK.  A WINNER GETS TH
E NUMBEROF CHIPS REMAINING ON THE CURRENT ITEM.":PRINTBC"TO 'GO DO
WN' THE PLAYER MUST HAVE AN ACE OR A PAIR.":GOSUB1580
220 PRINT@256,CHR$(31)"THE GAME CAN BE PLAYED WITH 'JOKERS' (UP TO
 2 PER DECK).  JOKERSIN THE DEALER'S HAND ARE AN AUTOMATIC WIN (LI
KE '21').  BUT IN APLAYER'S HAND THEY HAVE WILD AND UNPREDICTABLE
RESULTS."
230 PRINTBC"THE GAME USES SOUND EFFECTS, SO PUT THE CASSETTE'S 'AU
X' PLUG INA SPEAKER JACK.":GOSUB1580:PRINT@256,CHR$(31)"NEXT I MUS
T ASK ABOUT THE PLAYER'S NAMES, WHAT THEY ARE WEARING,AND HOW THEY
 WANT TO PLAY.":PRINTBC"IF YOU FIND THAT MY ";CHR$(34);
240 PRINT"CLOTHING"CHR$(34)" QUESTIONS DO NOT REALLY SUIT YOURATTI
RE,  REDO THE SERIES AND PRESS THE '=' KEY WHEN THE QUERY ISCLOSES
T IN LEVEL AND FUNCTION. THEN SUBSTITUTE A DIFFERENT NAME,SUCH AS
'BATHROBE' FOR 'DRESS', OR 'OVERALLS' FOR 'PANTS'.
250 PRINTBC"ARE YOU USING SOUND?":GOSUB1590:IFQ$="Y"THENZD=1:GOSUB
1880
260 INPUT"---
How many players";PC:IFPC<1THEN260ELSEIFPC>10THENPRINTPC"is too ma
ny for a well-paced game.":GOTO260
270 X=1:DIMC(PC,4,1),B(PC,10),W(PC),T(PC),SX(PC),CL(PC):IFPC>6THEN
PRINTBC"THAT'S A BIG GAME!  I RECOMMEND MULTIPLE DECKS.":X=4
280 ND=X:INPUT"---
HOW MANY CARD DECKS";ND:IFND<1OR ND >6THENPRINTBC"YOU CANNOT HAVE"
;ND;"DECKS!":GOTO280
290 IFND=1THENBD="DECK."ELSEBD="DECKS."
300 INPUT"---
HOW MANY JOKERS";J:IFJ<1THENJ=0:PRINT"JOKER OPTION NOT USED."ELSEI
FJ>ND*2THENPRINTBC"TOO MANY FOR"ND;BD:GOTO300
310 PRINTBC"<F>AST OR <S>LOW GAME?":GOSUB1590:IFQ$="F"THENLS=1ELSE
IFQ$="S"THENLS=2ELSE310
320 GOSUB18/0:CT$=CHR$(190)+STRING$(11,131)+CHR$(189):CM$=CHR$(191
)+CHR$(203)+CHR$(191):CB$=CHR$(175)+STRING$(11,176)+CHR$(159):Y=1:
IFPC=1THENA="SOLITAIRE"ELSEA="FIRST"
330 GOSUB780:IFPC=1THEN370ELSEFORY=2TO PC:A="NEXT":GOSUB780:NEXTY
340 GOSUB1880:GOSUB1670:PRINT"A REVIEW OF THE PLAYERS AND THEIR ST
AKES:":PRINTBC" ## RANKS","CHIPS","PLAYER'S NAME
 -- -----","------","-------- ----"
350 FORX=1TO PC:U=0:W=U:FORY=0TO9:IFY=0ORV(X,Y)>0THENU=U+V(X,Y):W=
W-(Y>0):ELSEY=10
360 NEXTY:CL(X)=U:PRINTUSING"**#";X;:PRINTUSING"  ##";W;:PRINTTAB(
16)USING"###";U;:PRINTTAB(36)B(X,0):NEXTX:PRINTBB;:GOSUB1580:GOSUB
2000:IFQ$="Y"THEN340
370 RANDOM:ONERRORGOTO1940:GOSUB1670:PRINT"The game begins."
380 IFR<PC*3.6THENGOSUB1370
390 F=0:PO=F:FORY=0TOPC:CL(Y)=0:GOSUB1530:IFY>0THENGOSUB1070:IFCL(
Y)=10THENPO=PO+1
400 NEXTY:IFPO>PC-1+(PC>1)THENCLS:PRINT@394,CHR$(23);"The game is
over.
":END
410 GOSUB930:GOSUB1870:FORY=1TOPC:PRINT@64,CHR$(30);:T(Y)=0:Z=CL(Y
):IFZ=10THENPRINT@2,B(Y,0)" IS OUT OF THE GAME.";:GOSUB1870:FORT=1
TO100:NEXTT:GOTO450ELSEW=V(Y,CL(Y))
```

Listing 2 continues

Listing 2 continued

```
420 GOSUB770:V=1:PRINTB(Y,0)" HAS";W;"CHIPS.  BET";:INPUTV:IFV>WTH
ENPRINTV;"EXCEEDS YOUR CURRENT RANK!";:GOTO420
430 IFV<0THENPRINTV;"IS AN INVALID BET.";:GOSUB1870:GOTO420ELSEW(Y
)=V
440 IFV>0THENT=0:X=T:TA=T:T1=T:GOSUB1390:X=1:GOSUB1390
450 NEXTY:T=0:TA=T:GOSUB1340:C(0,0,0)=C1:C(0,0,1)=C2:GOSUB1340:C(0
,1,0)=C1:C(0,1,1)=C2
460 GOSUB970:IFT>0THEN470ELSET(0)=21:T1=0:GOTO620
470 T(0)=T:T1=TA:FORY=1TOPC:IFW(Y)=0ORCL(Y)=10THEN610ELSEPRINT@29,
CHR$(191);STRING$(33,143);CHR$(191);:PRINT@37," ";B(Y,0);"'S CHIPS
 ";:Z=93:FORX=0TO9:IFV(Y,X)=0THEN490ELSEA=B(Y,X):IFX=0THENA="WINNI
NGS"
480 PRINT@Z,CHR$(191);" ";A;:PRINT@Z+34,CHR$(191);:Z=Z+64:IFV(Y,X)
<23THENPRINT@Z-51,STRING$(V(Y,X),136);ELSEPRINT@Z-51,STRING$(21,14
0);
490 NEXTX:PRINT@Z,CHR$(143);STRING$(33,140);CHR$(143);:PRINT@677,C
HR$(93);"- ";B(Y,0);"'S HAND";:PRINT@579,"YOUR BET: ";STRING$(W(Y)
,136);:TA=0:T=TA
500 C1=C(Y,0,0):C2=C(Y,0,1):PS=642:GOSUB1090:C1=C(Y,1,0):C2=C(Y,1,
1):PS=647:GOSUB1090
510 IFC(Y,0,0)=0ORC(Y,1,0)=0THEN1400
520 IFT=11ANDTA=1THEN580ELSECC=1
530 IFF=1THENFORL=1TO300:NEXTL:GOTO570ELSEGOSUB1050:IFA="S"THEN570
ELSEIFA="H"THEN560
540 IFCC>1OR(C(Y,0,0)<>C(Y,1,0)AND TA=0)THENGOSUB1040:GOSUB1850:PR
INT"YOU CAN'T 'GO DOWN'!";:FORU=0TO800:NEXTU:GOTO530
550 W(Y)=V(Y,CL(Y)):PRINT@725,"D";:PRINT@789,"O";:PRINT@853,"W";:P
RINT@917,"N";:PS=663:X=3:GOSUB1390:GOSUB1090:IFC1=0THEN1400ELSEFOR
U=0TO999:NEXTU:GOTO570
560 CC=CC+1:PS=PS+6:X=CC:GOSUB1390:GOSUB1090:IFC1=0THEN1400ELSEIFT
>21THENT=99:GOTO570ELSEIFCC=4THENT=21:GOSUB1040:PRINT"5-CARD ADVAN
TAGE!";:GOSUB1800:FORX=1TO399:NEXTX:GOTO570ELSE530
570 GOSUB1930:IFT<22THEN600ELSEGOSUB1040:PRINT"  -- BUSTED! --";:G
OSUB1850:T(Y)=-1:PO=PO+1:FORX=1TO999:NEXTX:GOTO600
580 PRINT@808,"<< BLACKJACK >>";:GOSUB1900:FORU=1TO699:NEXTU
590 V(Y,0)=V(Y,0)+W(Y):GOSUB1150:V(Y,0)=V(Y,0)-W(Y):T(Y)=22:PO=PO+
1:T1=0
600 POKEZ1+32,0:GOSUB970
610 NEXTY
620 Z=240:PRINT@100,"PLAYER","TOTAL";:PRINT@164,"------","-----";:
FORY=1TOPC:IFCL(Y)=10THEN650ELSEPRINT@Z-12,B(Y,0);
630 IFT(Y)=22THENPRINT@Z," BJ";ELSEIFT(Y)=-1THENPRINT@Z,"BUST";ELS
EIFT(Y)<0THENPRINT@Z,"***";ELSEPRINT@Z,T(Y);
640 Z=Z+64
650 NEXTY:PRINT@Z-12,STRING$(19,95);:IFPO<PC,PRINT@Z+52,"Dealer dr
aws on 16";:PRINT@Z+116,"-- stands on 17.";:C1=C(0,0,0):C2=C(0,0,1
):PS=130:GOSUB1090
660 X=2:PS=578:T=T(0):TA=T1:Y=0
670 T(0)=T:T1=T:FORU=1TOTA:IFTA>0ANDT1+10<22THENT1=T1+10
680 NEXTU:IFPO=PCTHEN710ELSEPRINT@24,T1;"TOTAL.";:IFT1<17THENPRINT
@PS+7,"Draws";ELSEIFX=2THENPRINT@PS+7,"Stands";
690 IFX>4ORT1>21THEN700ELSEFORU=0TO399:NEXTU:IFT1<17THENPRINT@24,T
1;:GOSUB1390:GOSUB1090:IFC1=0THENT1=21ELSEPS=PS+7:X=X+1:GOTO670
700 IFT1>21THENPRINT@10,"*   DEALER IS BUSTED!   *";:GOSUB1870:T1=
0ELSEIFX>4THENPRINT@10,"* DEALER WINS ON 5 CARDS *";:T1=22:GOSUB18
00
710 FORZ=-200TO175:NEXTZ:PRINT@112,"RESULTS";:PRINT@Z,"-------";:F
ORY=1TOPC
720 A=CHR$(8)+".":IFCL(Y)=10THEN725ELSEZ=Z+64:IFW(Y)<0THENPRINT@Z,
"Jokered";ELSEIFT(Y)>T1 THENPRINT@Z,"wins";W(Y);A;:V(Y,0)=V(Y,0)+W
(Y):ELSEPRINT@Z,"Loses";W(Y);A;:V(Y,CL(Y))=V(Y,CL(Y))-W(Y)
725 W(Y)=0:NEXTY:IFPC>6THENGOSUB1880:GOSUB1580
730 PRINT@576,CHR$(31);:FORY=1TOPC:IFCL(Y)<10THENGOSUB1150:IFV(Y,C
L(Y))<1THENX=Y:Z=CL(Y):GOSUB1270
740 NEXTY:GOSUB1880:X=FRE(Q$):PRINT@960,"PRESS: 1=EXAMINE ";BD;"
2=REVIEW HANDS.  ANY KEY TO PLAY.";:GOSUB1590:IFQ$="1"THENGOSUB149
0ELSEIFQ$="2"THENGOSUB1540:GOSUB1580
750 GOTO380
770 PRINT@0,CHR$(30);CHR$(191)" ";:RETURN
780 B="":PRINTBC"NAME OF ";A;:INPUT" PLAYER";B:IFB=""THENPRINTBC"Y
OU MUST ENTER SOMETHING.":GOTO780ELSEIFLEN(B)>11THENPRINTBC"LET'S
KEEP IT UNDER 12 CHARACTERS!":GOTO780
790 B(Y,0)=B:PRINTBC"SEX OF PLAYER (M/F)?"
800 GOSUB1590:IFQ$="M"THENSX(Y)=1:AS=" HIS ":ELSEIFQ$="F"THENAS="
HER "ELSE800
810 GOSUB1670:PRINTB;", PRESS 'Y' OR 'N' IN RESPONSE TO"CHR$(222)"
THE FOLLOWING QUESTIONS:"
820 U=0:T=U:S=T:X=U:N=1:V=2:A="SHOES":GOSUB1610:V=3:A="A SWEATER":
GOSUB1610:IFQ$="N"THENA="A JACKET":GOSUB1610
830 IFSX(Y)=1THEN900ELSEA="PANTYHOSE":V=3:GOSUB1610:IFQ$="Y"THENX=
N-1ELSEA="STOCKINGS":GOSUB1610:IFQ$="Y"THENX=-1ELSEA="TIGHTS":V=3:
GOSUB1610:IFQ$="Y"THEN X=N-1
840 V=7:A="A DRESS":GOSUB1610:IFQ$="Y"THENT=1ELSEA="A BLOUSE":V=5:
GOSUB1610:A="A SKIRT":V=6:GOSUB1610:IFQ$="Y"THENT=2
850 IFT=0THENGOSUB1680ELSEA="A SLIP":V=8:GOSUB1610:IFQ$="N"THENGOS
UB1660
860 IFT<3ANDX<0THENA="A GARTER BELT":V=2:GOSUB1610:IFQ$="N"THENA="
A CORSET":GOSUB1610
870 IFT<>3THENA="A BRA":V=8:GOSUB1610:A="PANTIES":GOSUB1610:IFQ$="
```

Listing 2 continues

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top of available memory, unmoved by the interpreter's string storage reallocation routines.

The FRE(Q$) forces reallocation at the end of every round of play. This prevents interruption of the graphics during play, which use CHR$ and STRING$ in the preference to set and reset.

The program lines are densely coded for speed and RAM economy. The functional breakdown by line number (Table 1) and the variable and array table (Table 2) should help in understanding and customizing the program. In the nature of this program, execution is almost constantly in a For...Next loop, performing functions for each of the players.

The variable Y is normally the loop variable identifying the current player. In cases where a subroutine can be called for another player while the Y loop is still active (for example, 1310–1320), the variable X is used. See the sidebar, "System Modifications," for the changes required for different system configurations. ■

Write to Stephen Mills at the Division of Business, Pfeiffer College, Misenheimer, NC 28109.

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Listing 2 continued

```
N"THENGOSUB1660
880 IFX>0AND(T=4ORT=5)THENA=B(Y,S):W=V(Y,S):V(Y,S)=V(Y,X):B(Y,S)=B
(Y,X):B(Y,X)=A:V(Y,X)=W
890 GOTO910
900 A="SOCKS":V=2:GOSUB1610:A="A SHIRT":V=5:GOSUB1610:A="A T-SHIRT
":V=3:GOSUB1610:GOSUB1680:A="UNDERWEAR":V=8:GOSUB1610:IFQ$="N"THEN
GOSUB1660
910 B(Y,N)="":V(Y,N)=0:CL(Y)=1:PRINTBB:PRINTB"'S STAKES TOTAL";U;"
CHIPS:
---
ITEM","VALUE","ITEM","VALUE
----","-----","----","-----":FORX=1TON-1:PRINTB(Y,X),:PRINTUSING"
##";V(Y,X);:PRINT" ",:NEXTX:PRINT:PRINTBC"ANY CORRECTIONS?"
920 GOSUB1590:IFQ$="Y"THENA="THE SAME":GOTO780ELSERETURN
930 GOSUB1670:PRINTBB;" ##  CURRENT ITEM   PLAYER"CHR$(210)"CHIPS
 --  ------------  ------"CHR$(210)"-----":FORY=1TOPC
940 Z=CL(Y):IFZ=10THENZ=0:A=CHR$(143)+"  NAKED!  "+CHR$(143)ELSEIF
Z=0THENA="EXTRA CHIPS"ELSEA=B(Y,Z)
950 W=V(Y,Z):PRINTUSING" ##  ";Y;:PRINTA;TAB(20)B(Y,0);TAB(41);STR
ING$(W,138)
960 NEXTY:PRINTBB;:RETURN
970 CLS:PRINT@10,"DEALER SHOWS:";:PRINT@130,CHR$(190);STRING$(10,1
91);CHR$(189):PRINT@194,STRING$(12,191):PRINT"  ";STRING$(12,191):
PRINT"  ";STRING$(12,191):PRINT"  ";STRING$(12,191):PRINT"  ";CHR$
(175);STRING$(10,191);CHR$(159):PRINTSTRING$(29,95)
980 C1=C(0,1,0):C2=C(0,1,1):PS=143:GOSUB1110:GOSUB1100
990 C1=C(0,0,0):C2=C(0,0,1):GOSUB1110
1000 IFC(0,0,0)=0ORC(0,1,0)=0THENPRINT@9,"** WILD CARD! **":GOSUB1
800:GOTO1030
1010 IFC(0,1,0)>9ANDC(0,0,0)=1THEN1030
1020 IFC(0,0,0)>9ANDC(0,1,0)=1THEN1030ELSERETURN
1030 PRINT@24,"*  BLACKJACK  **":GOSUB1880:PO=PC:PS=130:T(0)=0:T=
0:T1=0:GOTO1100
1040 PRINT@739,CHR$(214);:PRINT@808,CHR$(200);:PRINT@872,"       "
;:PRINT@936,CHR$(200);:PRINT@739," ";:RETURN
1050 PRINT@739,"---- INSTRUCTIONS ----";:PRINT@808,"<H>IT ME";:PRI
NT@872,"<S>TAND";:PRINT@936,"<D>OWN";:GOSUB1880
1060 A=INKEY$:IFA="H"ORA="D"ORA="S"THEN1600ELSE1060
1070 S=CL(Y):IFV(Y,S)>0THENRETURN
1080 V(Y,S)=0:S=S+1:IFV(Y,S)>0ORS=10THENCL(Y)=S:RETURNELSE1080
1090 GOSUB1110
1100 PRINT@PS,CT$;:PRINT@PS+64,CM$;:PRINT@PS+128,CM$;:PRINT@PS+192
,CM$;:PRINT@PS+256,CM$;:PRINT@PS+320,CB$;:PRINT@PS+65,N$;:PRINT@PS
+130,S$;:RETURN
1110 IFC1=0THENN$="JOKER":S$="*****":C2=0:TA=-99:RETURN
1120 IFC2=1THENS$="C "ELSEIFC2=2THENS$="H "ELSEIFC2=3THENS$="S "EL
SES$="D "
1130 IFC1=1THENN$=" A":TA=TA+1:ELSEIFC1=11THENN$=" J "ELSEIFC1=12T
HENN$=" Q "ELSEIFC1=13THENN$=" K "ELSEN$=STR$(C1)
1140 IFC1<10THENN$=N$+" ":T=T+C1:RETURNELSET=T+10:RETURN
1150 IFV(Y,0)<11THENRETURN'CLAIM ARTICLE FROM ANOTHER PLAYER
1160 PRINTB(Y,0);" HAS";V(Y,0)"EXTRA CHIPS.":PRINT:PRINT:GOSUB1900
1170 V=0:FORX=1TOPC:GOSUB1890:IFSX(X)=1THENA=" HIS "ELSEA=" HER "
1180 GOSUB1740:PRINTUSING"##. ";X;:IFX=YTHENGOSUB1230ELSEIFZ=10PRI
NTB(X,0)" ? ? ? !"ELSEPRINT"MAKE ";B(X,0)" TAKE OFF";A;B(X,Z);"."
1190 NEXTX:PRINTBC"MAKE SELECTION 1 TO";PC;
1200 INPUTX:IFX<1ORX>PCTHENPRINT@64,"TRY AGAIN";:GOSUB1870:GOTO120
0
1210 IFX=YTHENGOSUB1250:Z=V+1:PRINTBC"OKAY, ";B(Y,0);", ";:GOSUB12
30:GOSUB1800ELSEGOSUB1740:GOSUB1280:GOSUB1820
1220 V(Y,0)=V(Y,0)-10:RETURN
1230 IFZ>1THENV=Z-1:PRINT"RECLAIM YOUR OWN ";B(Y,V);"."ELSEPRINT"S
ACRIFICE CHIPS."
1240 RETURN
1250 IFV>0THENV(Y,V)=5:IFCL(Y)>VTHENCL(Y)=V
1260 RETURN
1270 IFCL(X)=0THENRETURNELSEZ=CL(X)
1280 V(X,Z)=0:PRINTB(X,0);" - - - TAKE OFF YOUR ";:PRINTB(X,Z)"!!
---"
1290 GOSUB1820:IFZ<10U=Z+1:IFU>9 OR V(X,U)=0THENV(X,0)=0:U=10:PRIN
T"GET NAKED!":CL(X)=0:PRINTBC;:GOSUB1820
1300 IFCL(X)>0THENCL(X)=U:RETURNELSERETURN
1310 U=CL(X)+1
1320 IFU=11THENRETURNELSEIFV(X,U)=0THENU=U+1:GOTO1320
1340 C1=RND(R+D(0,0)):IFC1<=D(0,0)THENC1=0:C2=0:D(0,0)=D(0,0)-1:RE
TURN
1350 C1=RND(13):C2=RND(4):IFD(C1,C2)=0THEN1340
1360 R=R-1:D(C1,C2)=D(C1,C2)-1:IFR>PC*3THENRETURNELSEGOSUB770
1370 PRINTBC"SHUFFLING";ND;BD:D(0,0)=J:R=52*ND+J
1380 FORK=1TO4:GOSUB1760:FORL=1TO13:D(L,K)=ND:NEXTL,K:RETURN
1390 GOSUB1340:C(Y,X,0)=C1:C(Y,X,1)=C2:RETURN
1400 FORU=1TO299:NEXTU:CLS:POKEZ1+32,8:PRINT@146,CHR$(23)"* JOKER
*":PRINTBC;B(Y,0):PRINTBC;:L=RND(100)
1410 IFL>4THEN1440ELSEFORL=10TO1STEP-1:IFV(Y,L)=0THENNEXTL:GOTO145
0
1420 PRINT"STRIP TO YOUR ";B(Y,L)"!":IFL>1THENFORK=1TOL-1:V(Y,K)=0
:NEXTK:GOSUB1820
1430 GOTO1480
1440 IFL<50PRINT"AUTOMATIC BLACKJACK!":GOSUB1900:GOTO590
```

Listing 2 continues

Listing 2 continued

```
1450 IFL<65THENPRINT"YOU LOSE THIS ROUND.":GOTO1480
1460 IFL<75THENPRINT"FREEZE ALL HANDS":F=1:GOSUB1880:FORL=1TO999:N
EXTL:GOTO530
1470 L=RND(15):V(Y,0)=V(Y,0)+L:PRINT"YOU GET";L;"EXTRA CHIPS.":GOS
UB1900:IFV(Y,0)>10THENPRINT"YOU WILL BE ABLE TO PLAY"CHR$(204)"THE
 'EXTRA CHIP' ROUND."
1480 FORL=1TO600:NEXTL:W(Y)=-1:PO=PO+1:T(Y)=-2:GOTO600
1490 CLS:PRINT@74,"CARDS REMAINING IN YOUR";ND;BD
1500 PRINT"RANKS       CLUBS       HEARTS       SPADES       DIAMO
NDS"
1510 FORC1=1TO13:GOSUB1110:PRINT" "N$;:FORX=1TO4:PRINTTAB(X*13);ST
RING$(D(C1,X),132);:NEXTX:PRINT:NEXTC1:IFJ>0THENPRINT@10,"YOU HAVE
";D(0,0)"OUT OF";J;"JOKERS LEFT.";
1520 GOSUB1880:FORX=0TO1999:NEXTX:RETURN
1530 FORX=0TO4:C(Y,X,0)=-1:C(Y,X,1)=-1:NEXTX:RETURN
1540 GOSUB1670:A=STRING$(9,140)+CHR$(188):PRINTTAB(12)CHR$(188);:F
ORX=0TO4:PRINTA;:NEXTX:PRINT"  ";:FORY=1TOPC:IFC(Y,0,0)<0THEN1550E
LSEPRINTB(Y,0);:GOSUB1560
1550 NEXTY:Y=0:PRINT"DEALER";:GOSUB1560:A=STRING$(9,140)+CHR$(143)
:PRINTTAB(12)CHR$(143);:FORX=1TO5:PRINTA;:NEXTX:RETURN
1560 PRINTTAB(12)CHR$(191);"  ";:FORX=0TO4:IFC(Y,X,0)=-1THENN$="
  ":S$=" "ELSEC1=C(Y,X,0):C2=C(Y,X,1):IFC1=0THENN$="JOKER":S$=""EL
SEGOSUB1110
1570 PRINTN$;S$;"  ";CHR$(191);"  ";:NEXTX:RETURN
1580 PRINT@974,"<PRESS ANY KEY FOR NEXT PAGE>";
1590 Q$=INKEY$:IFQ$=""THEN1590ELSEIFZD=0THENRETURN
1600 POKEZ1,4:G=USR(-399):G=USR(ASC(Q$)AND15):RETURN
1610 W=LS*V:PRINTBC"ARE YOU WEARING ";A;" (Y/N) ?"
1620 GOSUB1590:IFQ$="N"THENRETURNELSEIFQ$="="THEN1650ELSEIFQ$<>"Y"
THEN1620
1630 IFLEFT$(A,2)="A "THENA=RIGHT$(A,LEN(A)-2)
1640 PRINT"I'LL ALLOW "B;W;"CHIPS FOR";AS;A".":V(Y,N)=W:B(Y,N)=A:N
=N+1:U=U+W:RETURN
1650 INPUT"WHAT IS EQUIVALENT ARTICLE";Q$:IFLEN(Q$)<4THEN1650ELSEI
FLEN(Q$)>11THENPRINT"* BRIEFLY * ";:GOTO1650ELSEA=Q$:GOTO1630
1660 IFN<3THENRETURNELSEU=U+.4*(V(Y,N-1)):W=V(Y,N-1)*1.4:PRINTBC"I
N THAT CASE, I'LL INCREASE ";B"'S STAKE FOR"AS:PRINTB(Y,N-1)" TO"W
"CHIPS.":V(Y,N-1)=W:RETURN
1670 CLS:PRINT@148,"*- Strip Blackjack -*":PRINT:RETURN
1680 A="PANTS":V=6:GOSUB1610:IFQ$="Y"THENT=5:S=N-1:GOTO1730
1690 A="SHORTS":V=5:GOSUB1610:IFQ$="Y"THENT=4:S=N-1:GOTO1730
1700 A="A SWIMSUIT":V=9:GOSUB1610:IFQ$="Y"THENT=3:RETURN
1710 A="SLEEPWEAR":V=8:GOSUB1610:IFQ$="Y"THENT=5:RETURN
1720 PRINTBC"I ASSUME "B" IS EITHER SCANTILY CLAD . . .
 ","OR HAS UNUSUAL ATTIRE.":IFN<2THENPRINTB" GETS 5 'EXTRA' POINTS
--":PRINTTAB(14)"THEN EVERYTHING COMES OFF!":A="???":W=5:GOTO1640E
LSEGOTO1660
1730 A="LONGJOHNS":V=2:GOTO1610
1740 IFCL(X)>0THENZ=CL(X):RETURNELSEZ=1
1750 IFV(X,Z)=0ANDZ<10THENZ=Z+1:GOTO1750ELSERETURN
1760 IFZD=0THENRETURN
1770 G=USR(-89):FORX!=18TO23STEP.2:POKEZ1,62
1780 G=USR(CINT(X!)):G=USR(24)
1790 NEXTX!:FORX!=1TO150:NEXTX!:RETURN
1800 IFZD=0THENRETURN
1810 L=USR(-50):POKEZ1,17:FORG=1TO4:FORL=10TO1STEP-1:L=USR(L):NEXT
L:FORL=1TO10:L=USR(L):NEXTL,G:RETURN
1820 IFZD=0THENRETURN
1830 POKEZ1,102:K=USR(-140):FORL=10TO3STEP-1:K=USR(L):NEXTL:K=USR(
-1000):K=USR(2)
1840 L=USR(-100):FORL=0TO80:NEXTL:FORG=10TO1STEP-1:G=USR(G):NEXTG:
FORG=1TO15:L=USR(G):NEXTG:RETURN
1850 IFZD=0THENRETURN
1860 POKEZ1,RND(257)-1:G=USR(-1400):G=USR(16):G=USR(0):G=USR(16):G
=USR(0):G=USR(18):G=USR(0):G=USR(15):G=USR(0):G=USR(-7000):G=USR(1
8):G=USR(23):RETURN
1870 IFZD=1THENG=USR(-99):FORG=13TO3STEP-1:G=USR(G):NEXTG:RETURN
1880 POKEZ1+32,0:IFZD=0THENRETURNELSEPOKEZ1,24:FORG=1TORND(20):K=U
SR(RND(8)*-100):K=USR(RND(11)):NEXTG:RETURN
1890 IFZD=0THENRETURNELSEG=USR(-100):X=USR(X):RETURN
1900 IFZD=0THENRETURN
1910 POKEZ1,27:GOSUB1920:FORK=1TO110:NEXTK
1920 K=USR(-3500):K=USR(13):K=USR(-6500):K=USR(11):K=USR(-1550):K=
USR(13):K=USR(-3500):K=USR(12):K=USR(-8500):K=USR(11):RETURN
1930 T(Y)=T:IFTA>0ANDT+10<22THENT=T+10:TA=TA-1:GOTO1930ELSERETURN
1940 IFERR<>16THEN1950ELSEIFU>9THENU=10:RESUME
1950 IFERR=10THENRESUMENEXT
1960 ONERRORGOTO0:RESUME
2000 A=" ":Q$=A:F=CL(1):T=F:FORX=1TOPC:IFF>CL(X)THENF=CL(X)ELSEIFT
<CL(X)THENT=CL(X)
2010 NEXTX:X!=(F/T):IFX!>.8THENRETURNELSEIFX!>.7THENA=" MODERATELY
 "ELSEIFX!<.5THENA=" VERY "
2020 GOSUB1670:PRINT"THERE IS A";A;"WIDE DISTRIBUTION OF CHIPS FRO
M";F;"TO";T,"AMONG THE";PC;"PLAYERS.":PRINT:PRINT"YOU CAN USE THE
'EQUALITY' OPTION TO RE-EVALUATE CLOTHING ITEMS FOR A MORE UNIFORM
 CHIP TOTAL.":PRINT
2030 PRINT"DO YOU WANT TO USE THE EQUALITY OPTION?":GOSUB1590:IFQ$
="N"THENRETURNELSEIFQ$<>"Y"THEN2030
2040 FORY=1TOPC:F=T:X!=T/CL(Y):FORX=1TO9:V(Y,X)=V(Y,X)*X!:F=F-V(Y,
X):NEXTX:V(Y,0)=F:NEXTY:RETURN
```


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✓See List of Advertisers on Page 323

Light Cycle

by Donald David

Light Cycle is a fast-paced, action-packed Model III game for one or two players. It is derived from a program called Boa by Jeff Myers (*80 Microcomputing*, May 1981, p. 294).

In Light Cycle, each player uses four keys to maneuver a beam of light around the screen. As the beam travels, it leaves a trail of light. Try to shade as much of the screen as possible with light. The first beam to hit a wall, obstacle, or the other player's beam loses.

Try to shade all of your Model III screen white. Obstacles and a maze make it tougher.

After you play Light Cycle, the percentage of the screen shaded white appears at the bottom of the screen.

Four levels of difficulty challenge your reflexes. The screen for the first level contains no obstacles—it is straightforward and fairly simple.

Levels 2 and 3 each contain randomly placed obstacles, level 3 more than level 2. You can pass through some of these obstacles. If you want to increase or decrease the number of obstructions, change the For...Next loop in lines 8070, 8080, 9270, and 9280.

The fourth level is a circuitous maze. Try to get through it! ■

Program Listing

```
0 REM * * * * * * * * * * * LIGHT CYCLE * * * * * * * * * * *
1 REM * BY DONALD DAVID-990 NORTH AVE.-DEERFIELD ILL. 60015 *
2 REM *   ORIGINAL PROGRAM CREATED BY JEFF MEYERS - 'BOA'    *
3 REM *   FROM 80 MICROCOMPUTING MAY 1981 PAGE 294           *
4 REM * * * * * * * * * * * * * * * * * * * * * * * * * * * *
5 CLEAR1000:DEFINTA-Z:DIM P(150):DIM C(150):PO=26:CZ=0:CP=1:CN=-1:
KT=15010:KN=15009:KF=15004:K0=15360:GOSUB9000
10 GOSUB900:GOSUB8000:GOSUB950:P=2*P0+6:Q=3*Q0+4:SET(P,Q):SET(P+CP
,Q):R=2*R0-CP:S=3*S0+4:SET(R,S):SET(R-CP,S):C=2
13 P1=CP:Q1=CZ:R1=CN:S1=CZ
100 ' A  INPUT
120 IFPEEK(KF)AND4THENQ1=CN:P1=CZ:GOTO200
130 IFPEEK(KF)AND2THENP1=CN:Q1=CZ:GOTO200
140 IFPEEK(KF)AND128THENP1=CP:Q1=CZ:GOTO200
150 IFPEEK(KN)AND2THENQ1=CP:P1=CZ
200 P=P+P1+P1:Q=Q+Q1:IFPOINT(P,Q)ORPOINT(P+CP,Q)THEN300
210 SET(P,Q):SET(P+CP,Q):C=C+CP:GOTO500
300 ' B WINS
310 BS=BS+CP:W$="B":GOTO730
500 ' B INPUT
510 IFPEEK(KT)AND2THENR1=CZ:S1=CN:GOTO600
520 IFPEEK(KT)AND4THENR1=CN:S1=CZ:GOTO600
530 IFPEEK(KT)AND8THENR1=CP:S1=CZ:GOTO600
540 IFPEEK(KT)AND32THENS1=CP:R1=CZ
600 R=R+R1+R1:S=S+S1:IFPOINT(R,S)ORPOINT(R-CP,S)THEN700
610 SET(R,S):SET(R-CP,S):C=C+CP:GOTO100
700 ' A WINS
710 AS=AS+CP:W$="A"
```

Listing continues

Donald David can be reached at 990 North Ave., Deerfield, IL 60015.

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Model I and III
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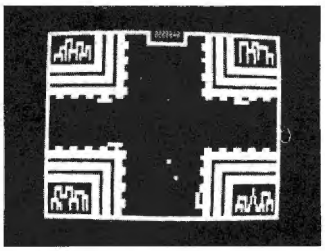


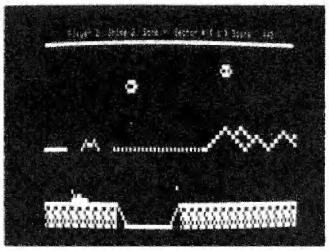
Stronghold

By Ken Olson and Larry Chow

Using all the skill you can muster, protect your city by moving your shield and stopping the bombs. From every angle, bombs will destroy the cities outer shielding until it reaches the city itself. If the city is hit, you and all your people will be destroyed. You can catch the bombs and launch them at opposing cities, or just worry about saving yourself.

One or two player action with sound and split second graphics that'll amaze the eye and ear.

Tape..... $22.95 Disk..... $25.95



Moon Rover

By Scott Watson

When we first landed on the moon, scientist found it to be a dead planet. So we preceded to build our first LUNAR STATION.

But the moon was inhabited, and they're not as friendly as E.T.. On the ground and in the air they're attacking! Just keep moving and hope that you are not stopped or that you don't fall into a crater before earth forces can arrive.

With fantastic sound and truly excellent graphics, MOON ROVER will provide hours upon hours of exciting play.

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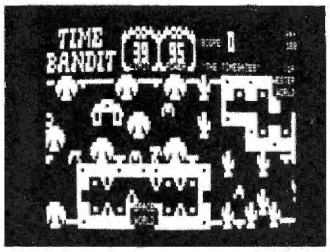

Time Bandit

By Bill Dunlevy

With TIME BANDIT, you virtually create your own game. You can choose from more than TWENTY places during the entire game. And each place has more than 15 distinct variations and levels of difficulty; this means over 300 variations in all!

Unbelievable speed, ultra crisp graphics (including scrolling maps and full animation), amazing sound, high scores that save to disk or cassette, voice (disk versions) -- it's all here! The conquest of time and space awaits you. TIME BANDIT the latest game by Bill Dunlevy.

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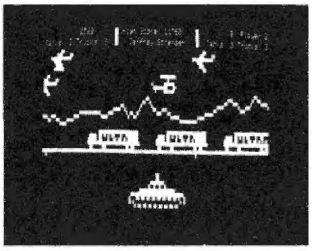


Convoy

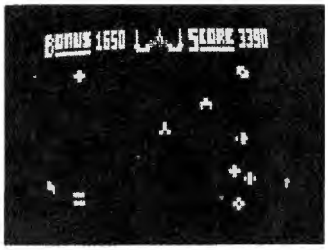
by Philip Mackenzie and Jeffery Sorensen

From the creaters of DEMON SEED comes a great new game that promises to keep you on the edge of your seat.. CONVOY!!!

A convoy of trucks has been assigned to move food rations for the troops in the field. You must protect the convoy, utilizing the firepower of the armies new super tank, from enemy fighter planes and helicopters seeking to block and destroy the convoy. As planes come rocketing down, destroy their bombs and send them to the ground in flames. At first, the fighters may seem to ignore you, but watch out!!! As your skill grows, they'll call out reinforcements that'll directly attack and destroy your tank. You'll feel and see the spectacular battlescenes, you'll hear the planes as they dive into the road, and you'll react like you've never reacted before!

CONVOY.. Can you take the challenge?

Tape ..... $22.95 Disk $25.95



Fury

By Doug Frayer

In the background you hear the sirens blare! As your heart fills with dread you know what the sound means! The planet's been INVADED, the merciless Monnierian have arrived!

With all the other young pilots, you rush down the corridor, strapping on your suit and straightening you head gear. As the top closes on your fighter and the dials light up, you see the controller waving you on. This is it! This is the moment that decides your worth as a pilot! You better be quick and you better be ready! So with a reassuring whisper, you take a firm grasp on the controls and prepare yourself for the battle of a lifetime.

Written by the thrice acclaimed Doug Frayer (Author of CYBORG and JOVIAN) FURY combines strategy and three wave patterns to the traditional space fight. Allowing one or two players, sound and graphics are used to their utmost and the disk version even talks!

Tape ..... $22.95 Disk $25.95

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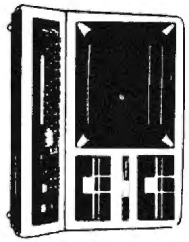

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Listing continued

```
720 ' END ROUTINE
730 GOSUB950
745 PRINT@1006,"SCREEN";
750 PRINT"";:PRINTUSING"###";INT(100*C/2530+.5);:PRINT"%";
752 PRINT"  FULL";
760 H$=INKEY$:IFH$=""THEN760ELSEIFASC(H$)<>13THEN760
770 RESTORE:CLS:GOSUB9250:GOTO10
900 ' PLAYER'S BOXES
902 A$=CHR$(191)+CHR$(191)+CHR$(191)
920 P0=2:Q0=6:R0=59:S0=6
930 CLS:RETURN
950 ' SCORE ROUTINE
952 PRINT@961,"SCORE";
954 PRINT"   A";A$;:PRINT"   B";B$;
956 RETURN
8000 ' EDGE ROUTINE
8010 FOR X0=K0TO15423:POKEX0,131:NEXT
8020 FORR=0TO15:POKEK0+64*R,191:POKEK0+64*R+63,191:NEXT
8040 Z=K0+64:C9=0
8050 FOR N=1TO127:SET(N,44):NEXT N
8060 POKE 15868,166:POKE 15811,153
8065 IF H$="1"THEN RETURN
8070 IF H$="2"THENFOR N=1TO12:POKE P(N),162:NEXT N:FOR N=0TO127:SE
T(N,0):NEXT N:FOR N=0TO47:SET(0,N):SET(127,N):NEXT N:RETURN
8080 IF H$="3"THEN FOR N=1TO19:POKE P(N),C(N):NEXT N:FOR N=0TO127:
SET(N,0):NEXT N:FOR N=0TO47:SET(0,N):SET(127,N):NEXT N:RETURN
8085 IF H$="4"THEN FOR N=12TO32:SET(N,23):NEXT N:FOR N=37TO51:SET(
N,23):NEXT N:FOR N=12TO51:SET(N,21):NEXT N:FOR N=11TO21:SET(51,N):
NEXT N
8090 FOR N=23TO33:SET(32,N):SET(37,N):NEXT N
8100 FOR N=23TO33:SET(51,N):NEXT N
8101 FOR N=115TO69STEP-1:SET(N,23):NEXT N:FOR N=115TO92STEP-1:SET(
N,21):NEXT N:FOR N=87TO69STEP-1:SET(N,21):NEXT N
8110 FOR N=12TO21:SET(92,N):SET(87,N):NEXT N
8120 FOR N=11TO21:SET(12,N):NEXT N
8130 FOR N=12TO35:SET(N,11):NEXT N
8140 FOR N=23TO33:SET(12,N):NEXT N
8150 FOR N=51TO100:SET(N,33):NEXT N
8155 FOR N=69TO100:SET(N,28):NEXT N
8160 FOR N=23TO28:SET(69,N):NEXT N
8170 FOR N=12TO32:SET(N,33):NEXT N
8180 FOR N=17TO27:SET(60,N):NEXT N
8190 FOR N=12TO21:SET(69,N):NEXT N
8200 FOR N=69TO80:SET(N,12):NEXT N
8210 FOR N=23TO28:SET(100,N):NEXT N
8999 RETURN
9000 '  INSTRUCTIONS
9003 CLS:GOSUB9400:PRINT
9010 PRINT"TWO PLAYERS USE THE KEYS BELOW TO MANUEVER THEIR CYCLES
 AROUND   THE SCREEN. THE FIRST PLAYER WHO RUNS INTO SOMETHING LOS
ES."
9100 PRINTTAB(8)"PLAYER A  - ";CHR$(153);TAB(46)"PLAYER B - ";CHR$
(166)
9130 U$=CHR$(91):D$=CHR$(92):L$=CHR$(93):R$=CHR$(94)
9140 F$=L$+" Q  KEY  W  "+R$:S$=L$+" J  KEY  K  "+R$
9160 PRINTTAB(12)U$;TAB(50)U$
9170 PRINTTAB(12)"2";TAB(50)"I"
9200 PRINTTAB(6)F$;TAB(44)S$
9210 PRINTTAB(12)"A";TAB(50)"M"
9220 PRINTTAB(12)D$;TAB(50)D$
9230 PRINT" A SOLITAIRE VERSION CAN BE PLAYED BY OPERATING BOTH CY
CLES (!)  AND TRYING TO MAXIMIZE THE %AGE SCORE SEEN AT THE LOWER
RIGHT."
9250 PRINTTAB(5);"* HIT 1-BEGINNER 2-INTERMEDITE 3-ADVANCED 4-EXPE
RT *"
9270 FOR N=1TO19:P(N)=15430+RND(814):NEXT N
9280 FOR X=1TO19:C(X)=129+RND(62):NEXT X
9290 H$=INKEY$:IF H$<"1"OR H$>"4"THEN9290ELSERETURN
9399 ' PRINT WORD LIGHT CYCLE
9400 W$=CHR$(191):V$=CHR$(189)
9500 X$=W$+"  "+W$+W$+"  "+W$+W$+W$+W$+W$+" "+W$+"   "+W$+" "+W$+W
$+W$+W$+W$
9510 Y$=W$+"  "+W$+W$+"  "+W$+"   "+CHR$(176)+" "+W$+CHR$(140)+CHR
$(140)+CHR$(140)+W$+"   "+W$
9520 Z$=W$+CHR$(188)+" "+W$+W$+"  "+W$+CHR$(188)+CHR$(188)+CHR$(18
8)+CHR$(191)+" "+W$+"   "+W$+"   "+W$
9522 Z1$="    "+W$+W$+W$+W$+W$+" "+W$+"    "+W$+" "+W$+W$+W$+W$+" "+W
$+"  "+W$+W$+W$+W$
9524 Z2$="      "+W$+"     "+CHR$(139)+CHR$(176)+CHR$(176)+CHR$(13
5)+"  "+W$+"    "+W$+"  "+W$+CHR$(176)
9526 Z3$="      "+W$+CHR$(188)+CHR$(188)+CHR$(188)+"   "+W$+W$+"
 "+W$+CHR$(188)+CHR$(188)+CHR$(188)+" "+W$+CHR$(188)+" "+W$+CHR$(1
88)+CHR$(188)+CHR$(188)
9532 PRINT@0," ";:PRINTTAB(5);X$;Z1$:PRINTTAB(5);Y$;Z2$:PRINTTAB(5
);Z$;Z3$
9540 RETURN
```

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The Key Box

Model I and III
16K RAM
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Maze Chase

by Leonard Karr

Maze Chase is an action game similar to Pac-Man; bad guys pursue a player through a maze. If they catch him, he loses. In this game, the player wins by catching a moving asterisk before his opponents catch him. It's a chase within a chase. The asterisk is not cooperative. It does its best to evade you.

Use the numeric keypad to control your token. If you don't have a keypad or you want to use different keys, make two changes in the program. First, change the instructions in lines 3070–3100 to specify the keys you want to use. Second, in lines 2110–2140, replace the numbers in quotation marks in the statements 'IF L$ = "#"...' with the characters of the keys you're using.

In this maze game, you are hunter and hunted. Try to catch the asterisk before enemies catch you!

Each game starts with a different maze. You cannot memorize patterns to guarantee a win. Sometimes the maze makes a win easy for you, sometimes for your enemies.

There are three levels of play. At the first level, only two bad guys pursue

Variables used to draw maze:

K, J	Counters in For...Next loops
B$	Black Square
W$	White square (not used)
M$	Solid white line 63 spaces long
AL	Location of path above or below starting position
BL	Location of path square as maze is drawn
CL	Random move, up, down, or forward
DL	Path location when path moves up or down
PL	Path location when drawing corners of maze

Variables in movement phase of program:

PI	Movement increment for player
TI	Movement increment for asterisk
AI	Movement increment for bad guy A
BI	Movement increment for bad guy B
CI	Movement increment for bad guy C
DI	Movement increment for bad guy D
AL	Location on video screen of bad guy A
BL	Location on video screen of bad guy B
CL	Location on video screen of bad guy C
DL	Location on video screen of bad guy D
PL	Location on video screen of player
TL	Location on video screen of asterisk
EL	Location on video screen of capture point
PX	Player's location on X axis
PY	Player's location on Y axis
BX	Bad guy B's location on X axis
BY	Bad guy B's location on Y axis
AX	Bad guy A's location on X axis
AY	Bad guy A's location on Y axis
H	Level of play
K, J	Counters in For...Next loops
LL	Count of player losses
WW	Count of player wins
S	Start of computer memory of video screen
B$	Used to flash capture point
W$	Used to flash capture point

Table 1. List of Variables

Program Listing

```
1 '*************************************************
2 '*          MAZE CHASE FOR LEVEL 2 TRS-80        *
3 '*          BY LEONARD KARR    MAY 1982          *
4 '*          1436 VILLAGE ROAD                    *
5 '*          CHARLESTON, SC  29407                *
6 '*************************************************
8 DEFINTA-O,R,S
10 CLEAR 200
20 RANDOM
30 S=15360
100 GOTO 3000 'INSTRUCTIONS AND GAME START
200 'SUBROUTINE TO CREATE BLACK & WHITE BLOCKS FOR DRAWING MAZE
210 B$=CHR$(128)+CHR$(128)+CHR$(128)
220 W$=CHR$(191)+CHR$(191)+CHR$(191)
230 M$=STRING$(63,191)
240 RETURN
250 ' DRAW MAZE SUBROUTINE
255 FOR K=0 TO 15
260   PRINT@(K*64),M$ :NEXT
280 FORK=3TO11STEP2
290  AL=2
300  BL=K*64
310  FORJ=1TO9
320    BL=BL+3
330    PRINT@BL,B$;
340    CL=RND(3)
350    IF CL=2THEN450
```

Listing continues

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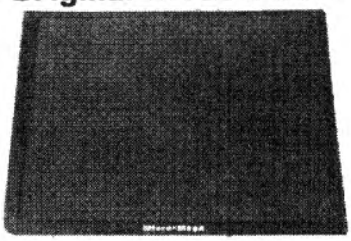

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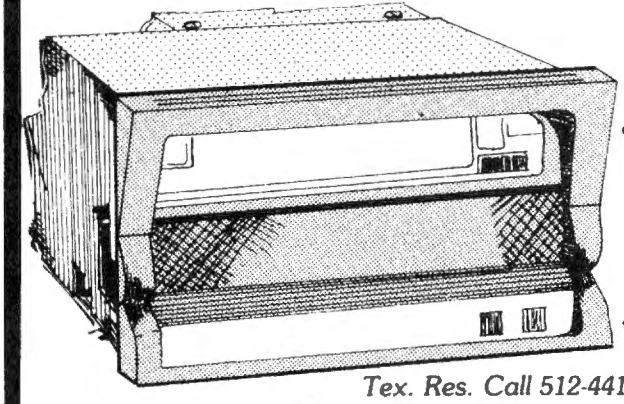

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```
360     IF(CL=1)AND(AL=1) THEN450
370     IF(CL=3)AND(AL=3) THEN450
380     IF(CL=1)THEN DL=BL-64:BL=DL-64:AL=AL-1:GOTO400
390     DL=BL+64:BL=DL+64:AL=AL+1
400     PRINT@BL,B$;:PRINT@DL,B$;
450     BL=BL+3: PRINT@BL,B$;
460     NEXT J
470   NEXT K
480 'DRAW CORNERS AND SIDES
490   FOR K=1TO13
500     PRINT@(K*64+3),B$;
510     PRINT@(K*64+57),B$;
520     NEXT
530 FOR K=1TO2
540   PI=K*3
550   PRINT@(67+PI),B$;
560   PRINT@(112+PI), B$;
570   PRINT@(835+PI), B$;
580   PRINT@(835+PI), B$;
590   PRINT@(880+PI), B$;
600   PRINT@(195+PI), B$;
610   PRINT@(240+PI), B$;
620   PRINT@(707+PI), B$;
630   PRINT@(752+PI), B$;
640   NEXT K
650 PRINT@137,B$;
660 PRINT@179,B$;
670 PRINT@777,B$;
680 PRINT@819,B$;
700 PRINT@976,"MAZE CHASE  BY LEONARD KARR";
710 RETURN
1000 IF AY<PY THEN IFAX<=PX THEN 1150 ELSE 1140
1010 IF AY>PY THEN IF AX<=PX THEN 1170 ELSE 1130
1020 IF AX>PX THEN 1140
1100 IFPEEK(S+AL+3)<>191AND AI<>-3THEN AI=3:AX=AX+1:GOTO 1200
1110 IFPEEK(S+AL-64)<>191ANDAI<>64THENAI=-64:AY=AY+1:GOTO1200
1120 IFPEEK(S+AL-3)<>191ANDAI<>3THEN AI=-3:AX=AX-1:GOTO 1200
1130 IFPEEK(S+AL+64)<>191ANDAI<>-64THENAI=64:AY=AY-1:GOTO1200
1140 IFPEEK(S+AL-3)<>191ANDAI<>3THENAI=-3:AX=AX-1:GOTO1200
1150 IFPEEK(S+AL-64)<>191ANDAI<>64THENAI=-64:AY=AY+1:GOTO1200
1160 IFPEEK(S+AL+3)<>191ANDAI<>-3THENAI=3:AX=AX+1:GOTO1200
1170 IFPEEK(S+AL+64)<>191ANDAI<>-64THENAI=64:AY=AY-1:GOTO1200
1180 GOTO 1100
1200 PRINT@AL,B$;:AL=AL+AI:PRINT@AL,HA$;
1220 IF AL=PL THEN EL=AL: GOTO2600
1280 IF CL+64=PL THEN CI=64:GOTO 1400
1290 IF CL-3=PL THEN CI=-3:GOTO 1400
1300 IF PEEK(S+CL+CI)<>191 THEN  1400
1310  IF ABS(CI)=64 THEN ON RND(2) GOTO 1360,1370
1320  ON RND(2) GOTO 1330,1340
1330    IF PEEK(S+CL-64)<>191 THEN CI=-64:GOTO 1400
1340    IF PEEK(S+CL+64)<>191 THEN CI=64:GOTO 1400
1350    IF PEEK(S+CL-64)<>191 THEN CI=-64:GOTO 1400
1360    IF PEEK(S+CL+3)  <>191 THEN CI=3: GOTO 1400
1370    IF PEEK(S+CL-3)<> 191 THEN CI=-3: GOTO 1400
1380    IF PEEK(S+CL+3)  <>191 THEN CI=3: GOTO 1400
1400 PRINT@CL,B$;:CL=CL+CI:PRINT@CL,HC$;
1410 IF CL=PL THEN EL=CL:GOTO 2600
1490 IF DL+3=PL THEN DI=3:GOTO 1600
1500 IF DL+64=PL THEN DI=64: GOTO 1600
1510  IF  PEEK(S+DL+DI)<>191 THEN 1600
1520  IF ABS(DI)=64 THEN ON RND(2) GOTO 1570,1580
1530  ON RND(2) GOTO 1540,1550
1540     IF PEEK(S+DL-64)<>191 THEN DI=-64:GOTO 1600
1550     IF PEEK(S+DL+64)<>191 THEN DI=64: GOTO 1600
1560     IF PEEK(S+DL-64)<>191 THEN DI=-64:GOTO 1600
1570     IF PEEK(S+DL+3)  <>191 THEN DI=3:  GOTO 1600
1580     IF PEEK(S+DL-3)  <>191 THEN DI=-3: GOTO 1600
1590     IF PEEK(S+DL+3)  <>191 THEN DI=3:  GOTO 1600
1600 PRINT@DL,B$;:DL=DL+DI:PRINT@DL,HD$;
1610 IF DL=PL THENEL=DL:GOTO2600
1790 IFPL=BL THEN PRINT@BL,HB$;:EL=BL:GOTO2600
1800 IF BX<PX THEN IF BY<=PY THEN 1900 ELSE 1970
1810 IF BX>PX THEN IF BY<=PY THEN 1940 ELSE 1930
1830 IF BY>PY THEN 1930 ELSE 1910
1900 IFPEEK(S+BL+3)<>191ANDBI<>-3THENBI=3:BX=BX+1:GOTO2000
1910 IFPEEK(S+BL-64)<>191ANDBI<>64THENBI=-64:BY=BY+1:GOTO2000
1920 IFPEEK(S+BL-3)<>191ANDBI<>3THENBI=-3:BX=BX-1:GOTO2000
1930 IFPEEK(S+BL+64)<>191ANDBI<>-64THENBI=64:BY=BY-1:GOTO2000
1940 IFPEEK(S+BL-3)<>191ANDBI<>3THENBI=-3:BX=BX-1:GOTO2000
1950 IFPEEK(S+BL-64)<>191ANDBI<>64THENBI=-64:BY=BY+1:GOTO2000
1960 IFPEEK(S+BL+3)<>191ANDBI<>-3THENBI=3:BX=BX+1:GOTO2000
1970 IFPEEK(S+BL+64)<>191ANDBI<>-64THENBI=64:BY=BY-1:GOTO2000
1980 GOTO 1900
2000 PRINT@BL,B$;:BL=BL+BI:PRINT@BL,HB$;
2010 IF BL=PL THEN EL=BL:GOTO 2600
2100 L$=INKEY$
2110 IF L$="8"ANDPEEK(S+PL-64)<>191THENPI=-64:PY=PY+1:GOTO 2200
```

Listing continues

you, but the game moves faster than at the other two levels. Three enemies chase you at Level 2, and at Level 3 you must avoid four bad guys.

Keep in mind that all creatures (the player, bad guys, and asterisk) move at the same speed. As long as you make no mistakes and press the right key at the right moment, you cannot be caught from behind (nor can you catch the asterisk from behind). To win, you must maneuver until the asterisk moves toward you on a path without a turnoff.

You can reverse direction or remain immobile during play. The asterisk and enemies must move left, right, or forward. The maze never contains a dead end that could trap them.

Once you figure out your opponents' movements and a couple of the game's idiosyncrasies, you can win most games. If you want to increase difficulty, allow bad guy B to reverse direction. Change lines 1790–2010 by omitting the second condition ('and BI <> #') of the If statements. This makes him harder to avoid and quickly puts him on your tail.

The bad guys use two different strategies to find you. Two of them move more or less randomly and check to see if you're next to them. The other two bad guys know where you are and always attempt to move toward you. Once they get within two squares of you, you can't lose them. They follow you until the end of the game.

The asterisk moves just enough to avoid you, but not enough to escape every time. It spends a lot of time in the corners, but quickly runs out unless you approach it correctly.

The asterisk and the smart bad guys use a similar means of movement. The program analyzes the relative positions of the player and the bad guy or asterisk, and branches to the line with the best movement strategy (+3 units for right, −3 for left, −64 for up, and +64 for down) for that situation. The program tests the move to see if it sends the creature into a wall or reverses his direction of movement.

If the move is legal, the move increment is set and the program branches to the line that makes the move. If the best move is illegal, the test fails and the program continues to the next line that contains the second best move for the situation. If this move is illegal, the test again fails and the program continues to fall through until it finds a legal move.

Since no maze ever contains a dead end, there is always a legal move. Test lines are grouped together to reduce the amount of coding. Each best move uses the other possible moves as alternatives.

Listing continued

```
2120 IF L$="4"ANDPEEK(S+PL-3)<>191THENPI=-3:PX=PX-1: GOTO 2200
2130 IF L$="2"ANDPEEK(S+PL+64)<>191THENPI=64:PY=PY-1:GOTO 2200
2140 IF L$="6"ANDPEEK(S+PL+3)<>191THENPI=3: PX=PX+1:GOTO 2200
2150 PI=0
2200 PRINT@PL,B$;:PL=PL+PI:PRINT@PL,P$;
2210 IF PL=TL THEN EL=PL:GOTO 2600
2290 IF INT(TL/64)=INT(PL/64)THEN2340
2300 IF TL/64-INT(TL/64)=PL/64-INT(PL/64)THEN2320
2310 IF PL<TLTHEN2330ELSE2350
2320 IF PEEK(S+TL-3)<>191ANDTI<>3THENTI=-3:GOTO2380
2330 IF PEEK(S+TL+3)<>191ANDTI<>-3THENTI=3:GOTO2380
2340 IF PEEK(S+TL+64)<>191ANDTI<>-64THENTI=64:GOTO2380
2350 IF PEEK(S+TL-64)<>191ANDTI<>64THENTI=-64:GOTO2380
2370 GOTO2320
2380 PRINT@TL,B$;:PRINT@TL+TI,T$;:TL=TL+TI
2390 IF TL=PLTHENEL=TL:PRINT@EL,P$;:GOTO2600
2395 ON H GOTO 1490,1280,1000
2399 'SUBROUTINE TO CREATE MEN
2400 ON H GOTO 2410,2430,2460
2410 HB$=CHR$(153)+CHR$(179)+CHR$(166):BL=451:BX=1:BY=7
2420 HD$=CHR$(166)+CHR$(140)+CHR$(153):DL=195:GOTO2520
2430 HB$=CHR$(166)+CHR$(140)+CHR$(153):BL=579:BX=1:BY=5
2440 HC$=HB$:CL=195
2450 HD$=CHR$(153)+CHR$(179)+CHR$(166):DL=707:GOTO2520
2460 HA$=CHR$(153)+CHR$(179)+CHR$(166):AL=451:AX=1:AY=7
2470 HB$=HA$:BL=579:BX=1:BY=5
2480 HC$=HA$:CL=195
2490 HD$=HA$:DL=707
2520 P$=CHR$(140)+CHR$(179)+CHR$(140):PL=249:PX=19:PY=11
2530 T$=" * ":TL=131
2540 RETURN
2600 FOR K=1TO10
2620      PRINT @(EL-67),B$+B$+B$;
2630      PRINT @(EL+61),B$+B$+B$;
2640      PRINT@(EL-3),B$;
2650      PRINT@(EL+3),B$;
2670    FOR J=1 TO 30:NEXT
2680     PRINT@(EL-67),W$+W$+W$;
2690     PRINT@(EL+61),W$+W$+W$;
2700     PRINT@(EL-3),W$;
2710     PRINT@(EL+3),W$;
2720   FORJ=1 TO 30:NEXT
2730 NEXT K
2750 IFTL<>PLTHENLL=LL+1:PRINT@976,"SORRY YOU LOSE.     ";:GOTO 290
0
2760 WW=WW+1:PRINT@976,"   YOU WIN!!!!!!!!     ";
2900 INPUT"PLAY AGAIN";A$
2920 IF LEFT$(A$,1)<>"Y"THEN 5500
2925 PRINT@976," SELECT LEVEL (1, 2, OR 3)";:INPUT H
2926 IF H<1 OR H>3 THEN 2925
2940 GOSUB 2400
2950 GOTO 5020
3000 CLS
3010 PRINT:PRINT"              >>>>>INSTRUCTIONS<<<<<<"
3020 PRINT:PRINT"     THIS IS YOU: ";CHR$(140)+CHR$(179)+CHR$(140)
3030 PRINT"     THESE ARE THE BADGUYS:    "CHR$(153)+CHR$(179)+CHR$(
166);"  ";CHR$(166)+CHR$(140)+CHR$(153)
3040 PRINT"     THIS IS WHAT YOU'RE TRYING TO CATCH:  *"
3050 PRINT:PRINT"THE OBJECT OF THE GAME IS TO CATCH THE * BEFORE T
HE"
3060 PRINT"BADGUYS CATCH YOU.  TO MOVE:"
3070 PRINT"       '8' MOVES YOU UP"
3080 PRINT"       '2' MOVES YOU DOWN"
3090 PRINT"       '4' MOVES YOU TO THE LEFT"
3100 PRINT"       '6' MOVES YOU TO THE RIGHT"
4010 PRINT"SELECT LEVEL OF PLAY (1,2 OR 3).";
4020 INPUT H:IF H<1 OR H>3 THEN 4010
5000 GOSUB 200 'CREATE BLACK & WHITE BLOCKS TO DRAW MAZE
5020 'PROGRAM BRANCHES HERE FOR ALL GAMES AFTER FIRST
5030 GOSUB 250 'DRAW MAZE
5040 PI=-3:TI=3:CI=3:DI=3:AI=3:BI=3 'INITIAL MOVEMENTS
5050 GOSUB 2400 'CREATE MEN
5100 ON H GOTO 5130,5120,5110
5110 PRINT@AL,HA$;
5120 PRINT@CL,HC$;
5130 PRINT@DL,HD$;
5140 PRINT@BL,HB$;
5150 PRINT@PL,P$;
5160 PRINT@TL,T$;
5170 FOR K=1TO300:NEXT 'PAUSE BEFORE STARTING GAME
5200 GOTO 2395
5500 CLS:PRINTCHR$(23)
5510 PRINT:PRINT:PRINT:IFLL=0THENPRINT"EGAD!! I WAS SKUNKED!!!":PR
INT
5520 PRINT"     YOU WON ";WW;" GAME(S)."
5530 PRINT"     I WON ";LL;" GAME(S)."
5540 PRINT:PRINT:PRINT
6000 END
```

The maze-drawing routine is in two parts in lines 200–700. The first part creates the strings needed for part two, drawing the maze. You can copy this routine as is for other games as long as you enter each part as a subroutine and don't change the string variables (see Table 1).

If you want to increase the number of pathways, add these lines:

```
270  FOR T = 1 TO 2 (Any variable can replace T)
475  NEXT T
```

This causes the program to loop through the path-drawing subroutine twice.

The non-string variable names in the maze-drawing routine bear no relationship to the function of the variables. I used variables from the game's move instructions to reduce the total number of variables and thus gain some speed.

Don't despair if you find the game difficult at first. Once you start to move around the maze without missing a turn, you can defeat your enemies. ■

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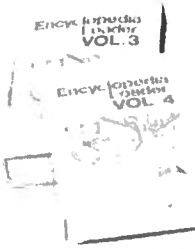

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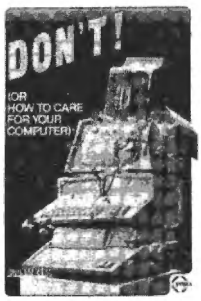

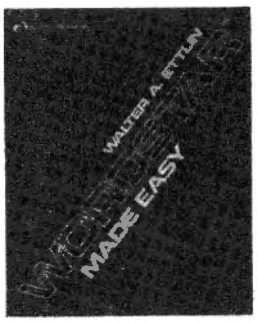

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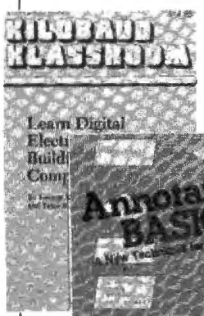

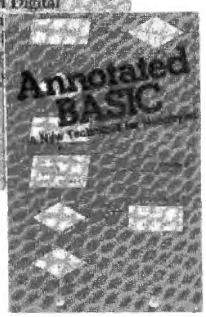

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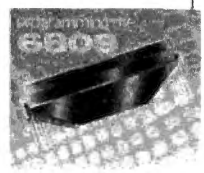

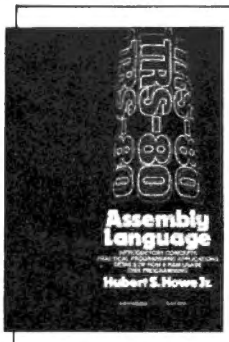

Z80

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6809 MICROCOMPUTER PROGRAMMING AND INTERFACING—by Andrew C. Staugaard, Jr. Getting involved with Tandy's new Color Computer? If so, this new book from the Blacksburg Group will allow you to exploit the awesome power of the machine's 6809 microprocessor. Detailed information on processor architecture, addressing modes, register operation, data movement, arithmetic logic operations, I/O and interfacing is provided, as well as a review section at the end of each chapter. Four appendices are included covering the 6809 instruction set, specification sheets of the 6809 family of processors, other 6800 series equipment and the 6809/6821 Peripheral Interface Adapter. This book is a must for the serious Color Computer owner. BK1215 $13.95.*

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THE BASIC HANDBOOK—SECOND EDITION—by David Lien. This book is unique. It is a virtual ENCYCLOPEDIA of BASIC. While not favoring one computer over another, it explains over 250 BASIC words, how to use them and alternate strategies. If a computer does not possess the capabilities of a needed or specified word, there are often ways to accomplish the same function by using another word or combination of words. That's where the HANDBOOK comes in. It helps you get the most from your computer, be it a "bottom-of-the-line" micro or an oversized monster. BK1174 $19.95.*

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MOD III ROM COMMENTED—Soft-Sector marketing, 1981. This book is not an instruction course on machine language, but rather an information source that you can use time and time again for writing your own program or patching old Mod I machine language programs. It contains an explanation of ROMs in the latest machine from Tandy, with most every location of the 14K ROMs listed, with comments. BK1235 $22.50.

THE CUSTOM TRS-80 AND OTHER MYSTERIES—by Dennis Kitsz. More than 300 pages of TRS-80 customizing information. With this book you'll be able to explore your computer like never before. Want to turn an 8 track into a mass storage unit? Individual reverse characters? Replace the BASIC ROMs? Make Music? High speed, reverse video, Level I and Level II? Fix it if it breaks down? All this and much, much more. Even if you have never used a soldering iron or read a circuit diagram, this book will teach you how! This is the definitive guide to customizing your 80! BK1218 $29.95.*

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TRS-80 DISK AND OTHER MYSTERIES—by Harvard C. Pennington. This is the definitive work on the TRS-80 Model I disk system. It is full of detailed "How to" information with examples, samples and in-depth explanations suitable for beginners and professionals alike. The recovery of one lost file is worth the price alone. BK1181 $22.50.*

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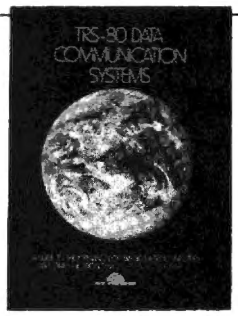
THE CP/M HANDBOOK (with MP/M)—by Rodnay Zaks. A complete guide and reference handbook for CP/M—the industry standard in operating systems. Step-by-step instruction for everything from turning on the system and inserting the diskette to correct user discipline and remedial action for problem situations. This also includes a complete discussion of all versions of CP/M up to and including 2.2, MP/M and CDOS. BK1187 $14.95.*

MASTERING CP/M—by Alan R. Miller For advanced CP/M users or systems programmers who want maximum use of the CP/M operating system, this book takes up where the *CP/M Handbook* leaves off. It will give you an in-depth understanding of the CP/M modules such as CCP (Console Command Processor), BIOS (Basic Input/Output System), and BDOS (Basic Disk Operating System). It explains the incorporation of additional peripherals to the system, console I/O, the use of the file control block and much more. It also includes a library of useful macros and a comprehensive set of appendices. BK1263 $15.95



TRS-80 DATA COMMUNICATIONS SYSTEMS—by Frank J. Derfler. If you are interested in using the TRS-80 as a terminal or message system, this is the book to buy. It covers communications, technical material, software and hardware for the entire TRS-80 family of machines. BK1245 $12.95

MODEL III TRSDOS COMMENTED—Published by Soft Sector Marketing. This book is intended to show moderately experienced programmers the organization and inner workings of a typical Z-80 disk operating system. Every function of the operating system has been decoded and explained, not to bit-by-bit detail, which would be a monstrous task, but rather at an instruction-by-instruction level. Many not-documented features of the system have been found, as well as a few errors. The techniques shown in the system coding will be useful as a guide to programmers interested in systems programming at an assembler level. BK1257 $29.95

INSIDE SUPER UTILITY PLUS—by Paul Weiner. This book really explains *all* the mysteries and functions of that remarkable program—Super Utility Plus. This is an excellent tutorial on TRS-80 disks, it contains detailed instructions for recovering bad disks using Super Utility Plus, and also documents previously undocumented features of SUP. This is an excellent companion book to the Super Utility Plus manual. BK1269 $19.95

TRSDOS 2.3 DECODED AND OTHER MYSTERIES—by James Less Farvour. This book is intended to guide the beginning or experienced system programmer through the internal operations of the TRSDOS operating system used on the Radio Shack Model I computer. A knowledge of basic computer architecture and assembly language programming is assumed, however the significant features of both are presented in the text. An absolute must-have for Model I owners! BK1276 $29.95

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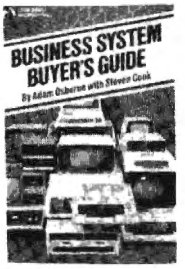

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USING MICROCOMPUTERS IN BUSINESS—By Stan Veit. Written by the owner/manager of one of the country's largest computer stores selling systems to small businesses, this book is an essential background briefing for any purchaser of microcomputer systems or software. In a fast-moving style, without the usual buzz words and technical jargon, Veit answers the most often asked questions. CONTENTS: How a computer can help your business; Data base management to advance your business; Effective use of word processing; How to use a computer without disrupting your business; Buying your system; Computer languages; What are the limitations of the microcomputer; Software: where to find it, how to judge it; What to do when the computer goes down. BK1225 $9.95*

BUSINESS SYSTEM BUYER'S GUIDE—By Adam Osborne with Steven Cook. When you enter the market place of small business computers, you face a bewildering array of products, prices, features and fables. This guide cuts through the jargon and unravels the task of buying the right computer system. This book provides solid information on how to determine your needs, how to choose software and hardware for all business applications, what to expect from vendors, what to avoid, and what questions you must ask. It also provides a wealth of detailed information on products, manufacturers, retailers and the whole microcomputer market. BK1229 $9.95

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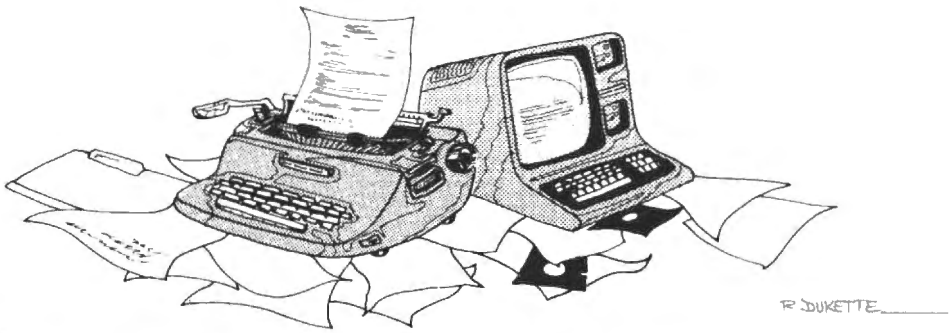

Model 4 Opens in Boston

But Model 100 steals the show at BCS gathering.

One day after it hit the stores, the Model III's successor came out in society: Tandy's new Model 4 made its debut on April 27 in downtown Boston's New England Life Hall. The star of the evening, however, was the TRS-80 Model 100 portable.

The unveiling was sponsored by the Boston Computer Society, which earlier this year played host to Apple Computer's Lisa and Morrow's Micro Decision. For the launch of the Models 4 and 100, Tandy attracted onlookers with four of each of the new machines, from a Model 100 displaying a graphics demo to a 4 flaunting TRSDOS 6.0's impressive directory of utilities.

Several audience members already owned Model 100s, and one Model III user told *80 Micro* he was interested in the Model 4 upgrade. Most others interviewed were not Radio Shack zealots, but intrigued by the new portable: A publisher of fire-protection software envisioned commissioners' using Telcom at fire sites, and an IBM PC owner said, "It (the 100) doesn't replace a larger machine, but for its purpose I think it's quite good." Asked whether she thought the 100 had an advantage over bulkier portables like the Osborne, she answered, "Oh, good Lord, yes."

The evening started with an introduction to Radio Shack. President John Roach described the Fort Worth firm as "a distribution system for the products of technology."

"Tandy and Radio Shack," Roach said, "are a little bit different from everybody else who competes in this business. We're not really a manufacturer, yet we are a manufacturer. We're not exclusively a product developer, yet we do have product development capabilities. We're really different because we're a controlled distribution system that sells our own products under our own brand."

Shirley (l) and Roach (r): Proud to bring the 4 and 100 to Boston. (Hub Graphics photo)

Stressing customer support, Roach described Radio Shack's 400 Computer Centers as "a resource that will help us do the same thing in the microcomputer field that we do in all the other fields we're in, which is have a nice, signifi-

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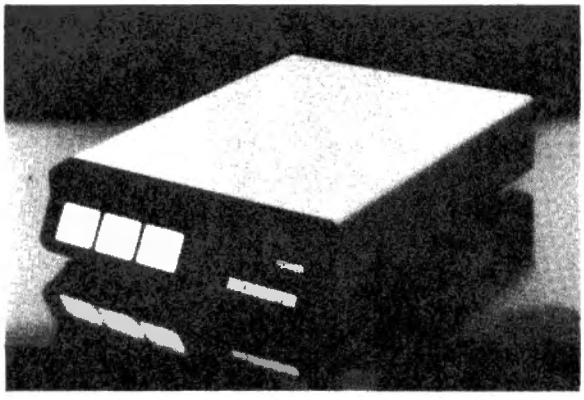

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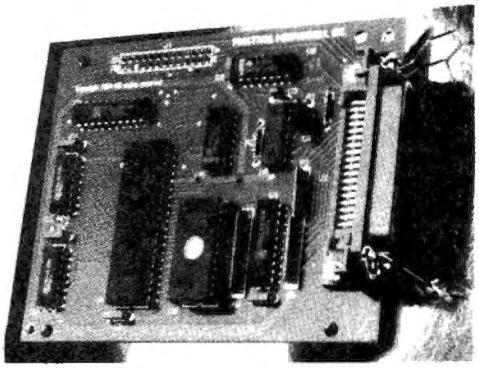
Most computers are able to send data to the printer at very high speeds, usually much faster than the printer can print it. The MBIP, placed between the computer and the printer, accepts this data as fast as the computer can send it, stores it in it's own memory and then sends it on to the printer at the printer's own speed. Since the computer has now transmitted all of its data to the memory of the MBIP, the computer is now free to continue useful work while the MBIP dumps its's memory to the slower printer. Under normal circumstances without a MBIP the computer could be tied up for hours on a large file being dumped into the printer costing you valuable time and money.

Using the MBIP's touch sensitive front panel controls, multiple copies of your document can be made without tying up the computer any further. The MBIP simply keeps dumping copies of your document from its memory until it has printed the amount of copies you have specified. Printing may be halted at any point and continued where it left off later. You can even turn your computer off and MBIP will continue until the print job is complete. Additional files may be transmitted to the MBIP for processing even while the MBIP is handling copies from a previous job.

The MBIP requires no user modifications of software and installs in seconds with virtually any computer (including TRS-80, ATARI, IBM-PC, APPLE, OSBORNE, NEC etc.) and any printer (including EPSON, CENTRONICS, NEC, C.ITOH, IDS, ANADEX, OKIDATA, IBM PERSONAL etc.).



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cant market share, but really have one for different reasons. Radio Shack is the full-service dealer. We're trying to sell you more than just hardware; we're trying to be a support system."

As for hardware, after alluding to Tandy's most recent field of interest, telecommunications, Roach concentrated on computers:

"The pervasiveness of computers is by now almost a foregone conclusion. Computers are going to be, in whatever form, on every desk at school, every desk in the office, on the factory floor.... The capability to expand the mind with computers should and will and has already brought some great enhancements to our quality of life."

Toward that end, he said, "We're proud to have made two interesting, one possibly revolutionary, computer introductions in the past month."

Roach kept to general remarks about "the electronic desk," or workstation, of the future, but his comments on price and productivity concerned today's Model 100: "You simply cannot afford to pay a lot more than a typewriter costs to get the functionality that's needed on the average desk. What the world really needs is a low-cost executive workstation that combines the functions (telephone, dialer, appointment book, calendar) currently found on your desk. When you combine this with networking, you have the finest productivity aid the world has ever had.

"Clearly the Model 100 can do many of the things I've described in addition to being portable," Roach concluded. "I believe it's the first of a generation of not only portable computers, but easier-to-use computers."

While Roach saw the 100 as pioneering "much less memory- and software-intensive" designs for tomorrow's still friendlier and more ubiquitous micros, Jon Shirley, Radio Shack's vice president for computer merchandising, described the portable as "a product of revolutionary change" for today.

"While (the 100) does not have disk drives," Shirley said, "it does have an operating system, and an example of, I think, the operating system of the future." Pointing to its start-up menu of both ROM- and RAM-based programs, he declared, "I've always believed that the best operating system is totally invisible, and in this one we've achieved that.

"This menu approach to operating systems is going to appear on other systems very shortly. Microsoft has already announced an invisible shell for the Xenix system that works exactly like this, and what appears on Xenix will probably appear on MS-DOS sooner or later."

Shirley even compared the Model 100 to the Lisa, albeit with tongue in cheek: "There was a famous machine introduced here some time ago, at over 10 times the price, that almost interacts with its programs—though, granted, they're much larger—but not quite in this way. There are a lot of little glotches in (the Lisa system); there are no little glotches in this machine at this time. We'll put those in later."

Compared to the revolutionary 100, Shirley admitted, the Model 4 is "an evolutionary product, although we're very happy about it. We told our engineering staff that there were a lot of things we wanted to see in a computer at the price of our Model III that it didn't offer, and after all these features we added two more; it had to cost less and it had to be totally compatible with the III and the III's software. They accomplished their task and I think they did it very well."

While a cassette Model 4 "is really absolutely nothing but a Model III" except for the white case and revised keyboard, he said, the disk version is both entirely Mod III compatible and "an all-new computer" under Model 4 software, with an 80-column, 24-line display, 64K RAM expandable to 128K, sound, and doubled operating speed (4 MHz) from the Z80A CPU.

"We put all this stuff in the same case, on the same size circuit board, because there wasn't any more room in there," Shirley recalled. "The primary product is a VLSI chip that is a programmable screen controller letting us have two different screens and two modes in one IC. Our thanks really go out to the semiconductor folks that keep making all these wonderful advances possible. Eight-bit processors are not dead yet."

In addition to the hardware advances, Shirley praised the TRSDOS 6.0 operating system. "It is not invisible to the user, yet it does have some neat features," ranging from Memdisk (the capability to use part of RAM as a fast "disk access" memory) to a communications program. "We also added a utility to load Model 100 cassette tapes," he noted, "although in retrospect I'm not sure why because all it takes is a cable between the machines and they can talk to each other very easily."

In addition to TRSDOS, Shirley said, "We will supply CP/M Plus, the 3.0 version that supports the whole 128K capacity and will be available in a few months." Asked whether the 4 would use some other manufacturer's CP/M format or "add to the confusion," he confessed, "I don't know. The implementation is being done by Digital Research themselves; it is not your normal thing done by some guy who says, 'Hey, this is the way I'll write the BIOS.' I would expect it would be compatible with someone else's."

As for 80-column software, Shirley answered, "SuperScripsit will probably be the first package that is available. Two of the packages being demonstrated in pre-release form are VisiCalc, which takes advantage of the full 128K, and the older version of Scripsit, which is probably going to be included in a pack that you can take advantage of at a fairly low price. There are going to be a lot of things for the 4 that you couldn't get before because of memory or screen limitations."

(Audience member Tracy Licklider, vice president of Software Arts, later confirmed Shirley's announcement of 128K VisiCalc and told *80 Micro* that his firm's TK!Solver would be available for TRSDOS 6.0. "I think it'll be a good program for the 4," Licklider said.)

Asked about Radio Shack's view of the new machines' market position, Shirley answered, "The 4 audience is really the Apple market. The Apple's got color, but look at their own statistics on how many people use it with monochrome monitors. Color is really the game aspect, and we've never really thought of this as a good game machine.

"The 100 is certainly appealing to business people wanting to communicate with the home office. It's also, I guess, one of the hardest to classify, in terms of what its audience is. A magazine for IBM PC owners is reviewing the 100. We asked them, 'Why are you doing this? It's not IBM-compatible,' and they said, 'Hey, it's a great peripheral for my computer.' So we're going to see people who think it's a peripheral for their systems."

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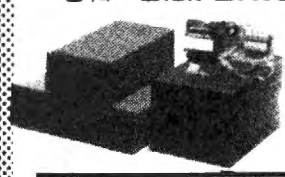

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Except for one man who asked about disks and a CRT for the portable ("We're not expecting momentarily to add additional hardware on the 100") and another who wondered why the 4 didn't have double-sided disk drives (" 'Cause we wanted to sell it for $2,000 with two drives in it. The price trend for disk drives has not quite been the same as it has in RAM"), the Tandy presentation seemed to impress the BCS audience.

After a question-and-answer session, people crowded around the display tables to ask more questions and examine the machines. One neophyte peered intently at a Model 4, pressed the orange reset button, and walked shamefacedly away as the screen went blank. The computer had been running a cassette demo. ■

BUSINESS

Danger from the Asian Rim

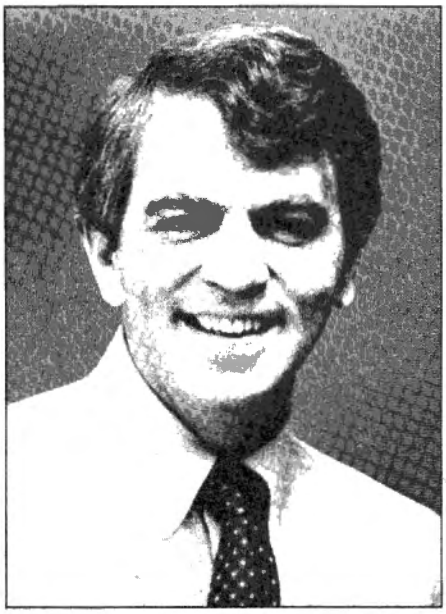
U.S. must prepare for "two wars," says Senator.

The challenge from Japan is as serious to our long-term security as the challenge from the Soviet Union. It's different, it's more benign, but in terms of the challenge to our industrial infrastructure it's just as important."

With those words, U.S. Senator Paul Tsongas warned computer retailers and industry representatives at a seminar titled "The Small Systems Economy" not to be complacent about America's electronics success. The keynote speaker at a Framingham, MA meeting on May 2, the Massachusetts Democrat began his remarks on "High-Tech Challenge from the Asian Rim" by addressing two reporters who were taking notes on TRS-80 Model 100s: "Where were those two products that you're working on made? Japan. That's my speech, ladies and gentlemen."

In the seminar, sponsored by Comdex producers The Interface Group, Tsongas mentioned the prosperity of high-tech firms along Massachusetts' Route 128, sometimes known as "Silicon Valley East," and Wang Industries' role as a major employer in his home town of Lowell. However, he said, today's profits are no guarantee of 1990's: "The basic approach from many people in Washington is that everything is fine and that we can just keep going on the same way. What we should be concerned about, though, is not where we are today but where we're going to be tomorrow. And I would suggest to you that the trends are not favorable."

As a member of the Senate committees on Foreign Relations and East Asian and Pacific Affairs, Tsongas has strong opinions on Japanese versus



Tsongas: It takes the three R's and R&D to compete with Japan.

American investment policy: "The Japanese are very Darwinian in determining where their money's going to go and where the future is. The U.S. has a very different approach. We tend to focus on those industries that are in decline and try to save those industries.

"The Japanese have a sunrise mentality; we have a sunset mentality. Or, as one businessman put it lately, we have a mortician's view of an industrial base."

Another grave handicap, Tsongas noted, involves our education system. In a report titled *A Nation at Risk*, the National Commission on Excellence in Education described the U.S. school system as so mediocre that, had a foreign power somehow promoted its decline, we would consider the process an act of war.

"The Japanese have math and science courses in school every year," Tsongas said, "as opposed to the U.S. where if you're interested in dance and basketweaving you can get your education in that and then try to take on the Third World nations in high technology." Combined with the spiraling cost of capital, our investment and educational priorities put America at a disadvantage:

"World War II was won by the U.S., given the sacrifice and bravery on both sides, because we produced more planes and ships and tanks and eventually overwhelmed them with our capacity," Tsongas declared. "In this next war, if they produce more engineers than we do, commit three percent of their GNP to research and development and we don't, have a better educational system, a better cost of capital, there is an inevitability to their ascendancy and an inevitability to our decline."

What to do? "We are not monocultural, so we're not going to emulate Japan; there's no reason why we have to," the Senator said. "The Japanese are more structured, are good at taking an idea and implementing it. We're a much more dynamic society."

Nevertheless, he argued, it would be beneficial to follow Japan and other countries in their commitment to a percentage of the gross national product for R & D. While skeptical of France's state-controlled push in telecommunications, citing the Concorde as an example of government financing gone wrong, Tsongas believes that laissez-faire is no longer practical: "One executive said to me recently, 'I don't mind competing with my Japanese counterpart, but I can't compete with him and Japan.' "

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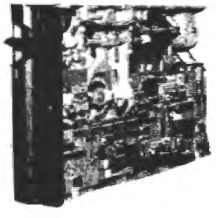

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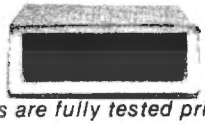

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cept of "a high-tech Morrill Act," giving the nation's educational system a boost similar to that which launched the "land-grant colleges" of the 19th century. Such a scheme would benefit both children—Tsongas praised a computer literacy program now operating in the Cambridge, MA schools ("We want that program to be in place in every Massachusetts city and town by September 1984")—and adults, such as middle-level managers sent from Digital Research back to M.I.T. for a semester.

"It would be an education in basic skills, coming from industry, working with a state agency, and matched dollar-for-dollar by the Feds, with use of Federal money but no Federal direction of ideas," Tsongas proposed.

In his summary, the Senator returned to the analogy of military preparedness: "What we need in this country is a realization that we're in trouble. What is lacking in this country is a sense of urgency, a sense of the continuing capacity not only of Japan—when Atari left California they didn't go to Japan, they went to Taiwan—but of the so-called mini-Japans along the Asian rim."

The U.S., he concluded, must be prepared to wage "the two wars," one against the USSR and one of economic competition with the East. Putting all of our resources into the former and ignoring the latter, he threatened, would bring disastrous results.

A week later, *The Wall Street Journal* embraced Tsongas' metaphor: In a May 11 story headlined "Japan, U.S. Gird for Microchip War," Urban C. Lehner reported that "the conviction is growing that Japan will deal the U.S. a devastating defeat" in the struggle to produce and sell 256K RAMs, which could "mark the beginning of the end of the U.S. lead" in other semiconductor work.

After "its loss in the 64K RAM war," Lehner wrote, the U.S. has few firms left with the resources or inclination to enter the fray against the Japanese again. The article quoted executives of two American companies, who said that "chances of the U.S. doing very well in the 256K RAM...market are highly unlikely" and "It's quite reasonable to assume a Japanese victory." An unidentified Silicon Valley spokesman summarized things with the words, "We are in deep sushi." ■

BUSINESS

Here Comes Warmware

Retailers discuss micro sales strategies.

Besides competition from the East (see above), computer dealers have their American customers to worry about. Other speakers at the Framingham symposium told the assembled retailers and ISO (independent sales organization) vendors of two increasing demands: after-sales help for novice owners, and integrated product lines for those wishing to upgrade their systems.

Peter Lowber, a market analyst for The Yankee Group, described the fallout that occurs when "users acquire a personal computer and find that they have no idea what to do with it. And they go back to the computer store and find that the people there don't have any idea either." Price and other things being equal, Lowber said, people prefer to buy equipment from vendors instead of retail outlets, citing reliability, vendor reputation, and service and maintenance.

Offering those attractions at the retail level is the goal of H.E. James Finke, whose Internetworx Inc. chain takes existing computer stores and adds "warmware—cosseting, nurturing, tender loving care of the owner who may otherwise have been mystified by his purchase."

The home computer boom, Finke said, became strong in 1982 and was accelerated substantially by Texas Instruments' 99/4 rebate: "TI...created an impetus that is still with us today. That impetus is measured in the millions of units." The introduction of easy-to-use micros at affordable prices, he said, rivals the advent of TV in the 1950s as "a revolution in how people use their time and resources. Each year, more machines are being made than are in the installed base."

A consumer product, according to Finke, by definition used to need no more than an 8½-by-11-inch sheet by way of documentation. "The right of Americans to buy a complex piece of technology, plug it in, and use it without reading an instruction manual is an inalienable right of being an American citizen." The home computer has changed that. While rebates and low prices are moving computers off the shelves at discount chains, buyers are disappointed when they return with questions. Expecting computing advice from a salesclerk can be like asking a McDonald's cashier about the right wine.

By contrast, when "an entry-level buyer wants more than a box handed to him by a clerk at one of these stores," ISOs and other retail outlets can carve out a market share with instruction and service—to use Finke's term, warmware.

It seems that Finke's idea of added value, help beyond high-volume merchandising, endorses Tandy's perception of its Radio Shack stores. A former Tandy competitor as previous president and CEO of Commodore, Finke agreed up to a point but had reservations about the Shack's exclusivity:

"Tandy has capillary market presence through its six or seven thousand individual Radio Shack stores and its 400 Computer Centers. I think they are beginning to feel the limitations of not selling through independent sales organizations and mass merchandisers. However, their avowed aim is not market or sales success but return on shareholders' equity, and if that's their aim they can do that without market share."

Computer users, particularly businesses, don't stay rookies for long. When owners want to upgrade from micro to mini, Lowber said, "Some of these start-ups, Apple included, can't do that." DEC and IBM, he declared, profit by having integrated product lines, selling personal computers as well as larger machines.

"There are a lot of small businesses in this country, and they really haven't got their operations on line yet," Lowber

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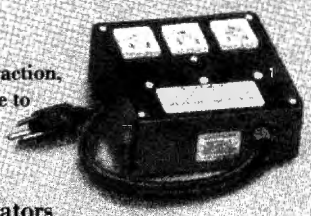

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said. "Maybe they've got general accounting." As more businesses computerize more thoroughly, he predicted, the decade will see an increasing demand for hardware, software, and support.

Edson DeCastro, president of Data General Corp., dismissed Finke's K-Mart shoppers while agreeing with Lowber's business buyers. "Some personal computers could very well become a passing fad, like the hula hoop," DeCastro said. "We could see some computers enjoy initial acceptance, and make it through a couple of Christmas buying seasons, before being relegated to the basement with other toys. It is quite likely that the personal computer business for home entertainment will become a commodity business like that for calculators and radios, with most production done in such countries as Thailand and Korea."

Data General's strategy, he said, centers on the business and professional market, where margins are higher and there's less competition from high-volume Japanese vendors. DG's new micro, expected this summer, is for this audience: "What we're going to bring that isn't in the market today is coherence. We're going to bring a product line that fits together, one that allows a customer to come in at the low end and move on up."

Data General hasn't been in the limelight since Tracy Kidder published *The Soul of a New Machine*, but DeCastro was optimistic about his firm's prospects: "We're in a first-time buyer market now. In two or three years, we may be in a replacement market, which will be more difficult for single micro vendors. . . . The talk today is of the hot new micro vendors, but don't sell the traditional vendors short in competing in new markets. We may be old dogs, but we might be able to learn new tricks."

Still, the audience seemed inclined to view DG's move to micros, especially since the company plans to bypass retail stores in favor of its existing minicomputer distribution channels, as too little and too late. Speaking before DeCastro, Finke described home and mass-market sales as "the computer revolution of our time. . . . I doubt that any of the minicomputer manufacturers have the momentum to catch up in any way, shape, or form to this, and not the Japanese either."

In fact, the name most mentioned at the symposium was not Data General but Bell; events since the breakup of AT&T indicate that the telephone titan is about to add computing power to its PBX and communications equipment. One tidbit that kept attendees buzzing was a quote from Archie McGill, president of American Bell's Advanced Information Systems division, in the April 18 *Computerworld*:

"When we talk about terminals, we are really talking about workstations. It's very obvious that once you develop an intelligent workstation, as we have, it provides the basic capability to support multiple functions such as word processing and personal computing.

"We expect to have an effective family of intelligent workstations. There will be additional announcements in 1983." ■

HARDWARE

Portable Pursuit

Mod 100 competitors debut at Comdex.

BY KEN SHELDON

SPECIAL TO 80 MICRO

The TRS-80 Model 100 has been called the harbinger of a new wave of briefcase-sized portable computers. If this spring's Comdex in Atlanta is any indication, the 100's success might be largely responsible for the wave's size.

As always at the computer trade show, well-established manufacturers boasted massive, elaborately designed displays while small start-up companies tried to attract dealers, venture capital, and press attention. This year, the most attention went to portables.

Teleram Communications and Grid Systems, which entered the notebook micro market before Tandy, exhibited their business-oriented, bubble-memory machines, the Teleram T3000 ($2,495) and Grid Compass ($8,150), the latter scheduled to offer the popular MS-DOS as well as its proprietary operating system. At the Epson booth, company representatives said that word processing software would soon be available for the HX-20.

A new company, joining Teleram and Grid in the higher-priced, business-oriented segment of the portable field, was Gavilan Computer Corp., which treated members of the press to a champagne breakfast in order to show off the Gavilan "mobile office" for executives on the move.

The Gavilan features an eight-line, 66-character LCD screen display, the Intel 8088 16-bit microprocessor, low-power CMOS circuitry, 80K of internal memory (of which 32K is available to the user), a built-in 3-inch microfloppy disk drive for another 320K of storage, and a 300-baud modem. In addition, a touch panel or "solid-state mouse" allows users to control the cursor and choose menu items with a touch of the finger.

The portable's proprietary software allows users to pass data back and forth between application packages, which are available on disk or plug-in modules known as "capsuleware." According to a company spokesman, these capsules are so precisely designed that if their labels were any thicker, the cover plate wouldn't close over them—an indication of how hard it is to fit a lot of computer in a small package.

Other modules let users add 32K of RAM or EPROM to the system; these expansion capsules have their own batteries to store data for up to a year.

Besides the built-in and applications software, the Gavilan includes the MS-DOS operating system with Basic and Pascal. The whole package weighs nine pounds (15 with an optional dot-matrix printer) and measures 2.9 by 11.4 by 11.4 inches.

What's the catch? To begin with, the price: at $3,995, the Gavilan will have a hard time stealing customers away from Radio Shack, whose 32K Model 100 sells for under $1,000. Still, Tandy's price doesn't seem to bother the Gavilan folks, who feel that executives can afford to pay for their portable's innovative, easy-to-use features.

Another edge for Radio Shack is that the Model 100 is on the shelves and selling today, while Gavilan doesn't expect volume shipments until later this year.

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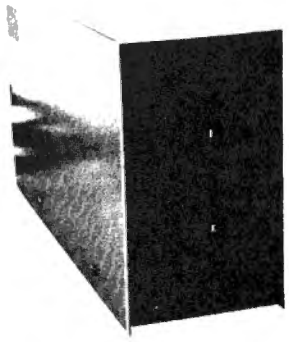

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Asked what the portable's two function keys were for, a Gavilan software designer said, "We haven't really decided yet."

In one demonstration, the designer attempted to use the touch panel to scroll down a text file, only to have the lines merge together into an illegible mass. His comment was, "Gee, it shouldn't have done that." As with other Comdex vendors, it seemed Gavilan had obtained an excellent booth location before being quite ready to show the product.

A few aisles away, NEC Home Electronics launched a more direct challenge to Radio Shack, introducing the Model 100's closest competitor. In fact, the NEC PC-8200 is a near twin of the TRS-80 portable—the same firm, Kyocera Electronics of Japan, makes both machines, the U.S. version sold by Tandy as the Model 100.

The PC-8200 features the same eight-line, 40-character display and text editing and Telcom software as the 100; it does not have the 100's modem or address and schedule programs, but boasts a floppy disk expansion port and adapter for a full-size CRT display.

A 32K RAM pack can be plugged into the NEC portable, but users cannot span or address both it and internal RAM simultaneously. Finally, the NEC has 10 function keys; the 100 has eight, plus four dedicated keys (Paste, Label, Print, and Pause/Break).

When the original PC-8200 was released in Japan, some weeks before its TRS-80 brother debuted on this side of the Pacific, NEC general manager Tom Priestley said that a U.S. introduction date is "not until next year, at the earliest." At Comdex, however, NEC exhibitors said the 8200 would be on sale by the end of the summer—although the model on display still had Japanese characters on the keys. Whether the success of Tandy's portable hastened NEC's move is open to question.

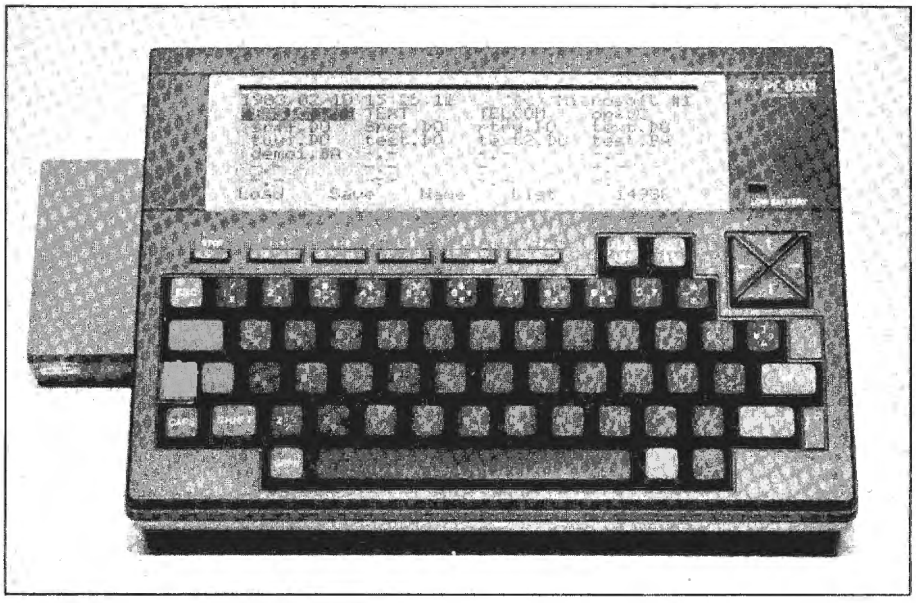
Ed Juge, Radio Shack's director of computer merchandising, gave Fort Worth's side of the story in an appearance on CompuServe's software authors' special interest group. The Model 100, he said, "had been defined before NEC negotiations began," but the addition of features such as automatic dialing and log-on delayed its appearance until after the 8200's debut in Japan.

"We have an exclusive deal with the manufacturer, for the U.S.A.," Juge claimed. "He won't provide NEC with a U.S. model. If NEC chooses to import their Japanese model (maybe they'll change the Kana keycaps themselves), so be it...

"I don't know their U.S. setup well, but I don't think they have significant distribution or service capability, so while I'd like to see us stay exclusive, I doubt the competition would prove too traumatic," Juge concluded. He added a final quip: "But I gotta admit, they've got us cold in at least one feature: We don't come in your choice of four designer colors!"

Traumatic or not, one of the lessons from Comdex is that Radio Shack has competition. Other manufacturers have seen the Model 100's success, and are beginning to follow suit. ■

Gavilan: 16 bits in a briefcase.



The NEC portable: Why does this machine look familiar?

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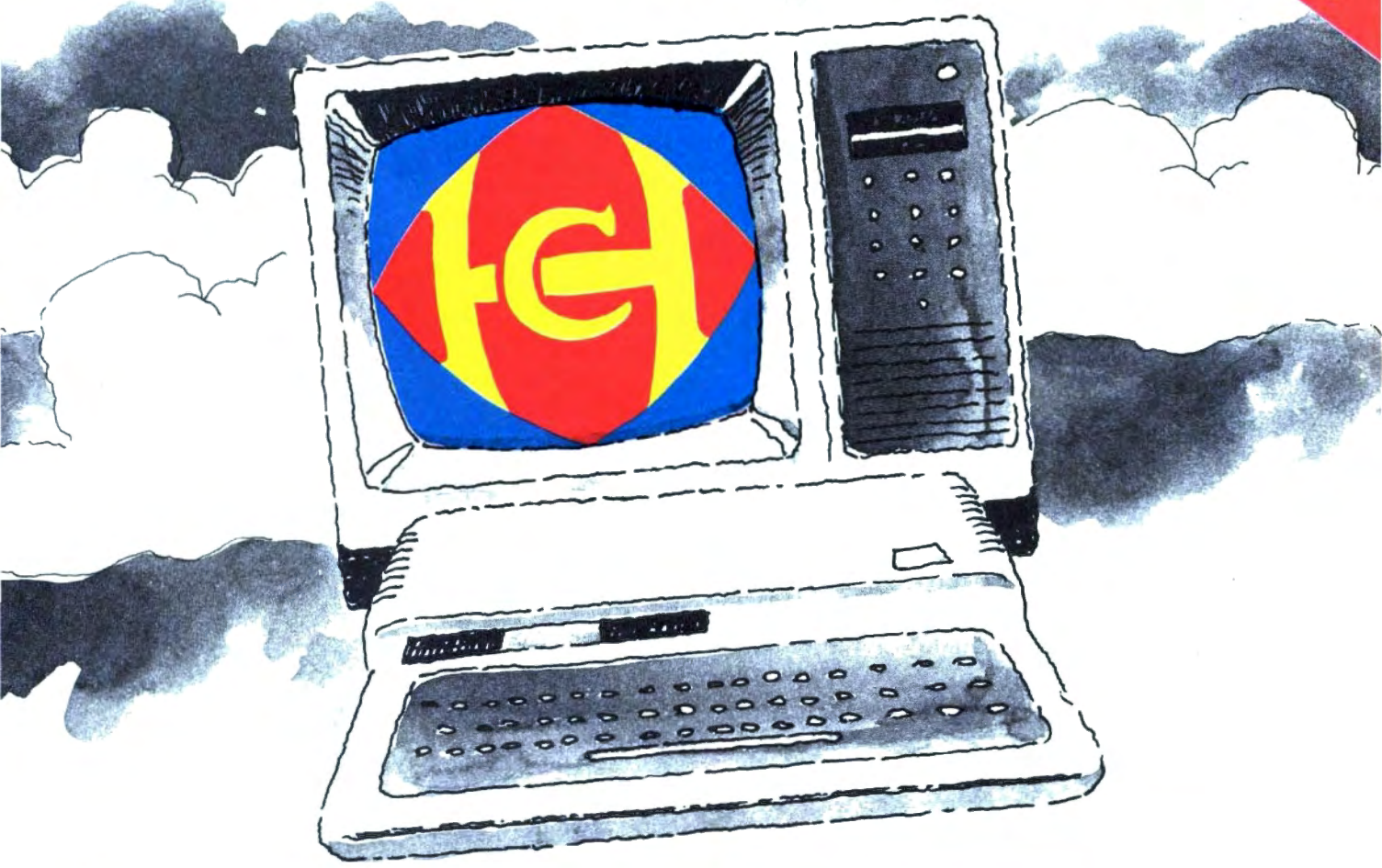

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PULSE TRAIN

High tech, low skills

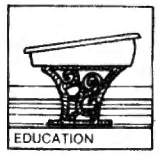
While high-tech advocates believe that the electronics and computer age mean more jobs for more highly skilled workers, two Stanford University researchers say it's just the opposite: The technological age will bring about fewer jobs and an overall reduction of skills.

In a new study, "The Educational Implications of High Technology," Prof. Henry Levin and research associate Russell Rumberger point out that high-tech occupations will total only 7 percent of new jobs created between 1978 and 1990. The U.S. will need 150,000 new computer programmers and 200,000 more systems analysts during this period, but 600,000 more custodians and 800,000 more fast-food and kitchen workers.

Besides creating comparatively few jobs in the future, the study says, computers and robots will send many of today's workers to the showers. Computer-aided design may make 300,000 draftspersons obsolete; office micros perform many tasks that formerly required a secretary. In addition, computers are becoming easier to operate even as they serve more complex functions.

Paradoxically, the microprocessor era may prove to be a boon for the liberal arts: "The educational implications of high technology are that a solid basic education rather than narrow vocational preparation will become most important in the future," Levin and Rumberger conclude.

Schools: The micro majority



By January of this year, 53 percent of all schools in the United States had at least one microcomputer used in education. High schools led the way, with 85 percent reporting ownership, while the figure for elementary schools is 42 percent and rising.

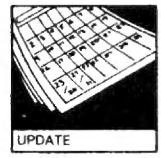
The percentages come from a study of 2,209 public, private, and parochial elementary and secondary institutions surveyed by Johns Hopkins' Center for Social Organization of Schools. Besides analyzing hardware (40 percent of U.S. secondary schools have five or more micros, and one in 10 has machines linked in a network), the study found some interesting details of computer use.

Rather than administering drill and practice in other subjects, most computers are being used to teach computing. General computer literacy is mentioned as a regular or extensive subject by 85 percent of secondary and 64 percent of elementary teachers, while 76 and 47 percent respectively say the computers are being used for Basic programming instruction. Only 31 percent of secondary and 59 percent of elementary teachers use the micro for drill and practice.

While the computer boom isn't benefiting all schools equally—small parochial schools and public schools in poorer districts are less likely to have micros—the benefits have been substantial.

Three of 10 teachers report that micros have produced "much more" general enthusiasm for school; 24 percent report more learning, at least by above-average students; and 18 percent say more students are working independently, without direct supervision.

Homes: Pleasure before business



While most schools now use micros for serious instruction, the machines haven't made as much progress on the home front. Only 3 to 5 percent of U.S. households have a computer, and—though an impressive one-third of home units are $1,000-and-up desktop models rather than TV-monitor machines—game-playing is still the first use.

According to *New York Times* reporter Andrew Pollack, "A compelling use has not emerged that would make the computer an essential purchase." A Gallup survey last January revealed that 46 percent of owners reported using their computers for business homework or children's education, with 42 percent mentioning adult education. But the most popular use—admitted by 51 percent of owners—was video games.

Some applications, frequently mentioned in computer showrooms, are surprisingly unpopular at home. Only 37 percent of owners use the computer to balance their checkbooks or budgets; only 27 percent operate a business from home with it. Word processing is a pastime of 18 percent, telecommunications of 14 percent, and storing recipes and counting calories attract a mere 9 and 4 percent respectively.

Different surveys, however, make different claims. Entertainment placed behind "personal management" in a poll by the consulting firm of Arthur D. Little Inc., which combined budgeting, investment analysis, word processing, and data base management in the latter category. Analyst Everett T. Meserve said, "What we're seeing in fact is that the computer in the home has a utility that is of lasting value.... It says we don't have a flash in the pan."

Bert Cowlan, who directed a home software study for market researchers Frost & Sullivan, takes Gallup's rather than Little's side: "Overwhelmingly we found that very little serious use seems to be made at the home level." Other surveys also rate game-playing over business, and mention under-$200 computer owners' frustration with the difficulty and expenses of adapting their machines to other tasks.

With those possible exceptions, though, at least micro owners are happy. Sixty-eight percent told Gallup they were "very satisfied" with their purchase and 24 percent "somewhat satisfied," and about half of those who did not own a computer expressed at least some interest in buying one.

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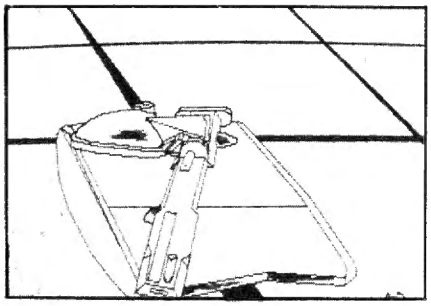

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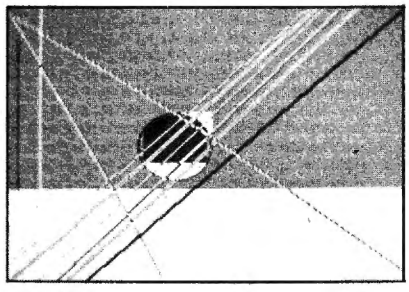

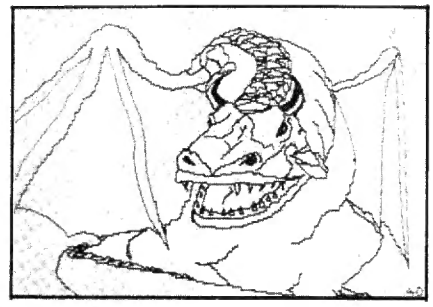

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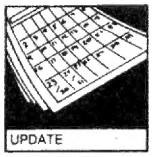
PULSE TRAIN

China: a 10-year computer gap



Since Chairman Mao's death in 1976, China has been hurrying to catch up with the West. According to the Joint Congressional Economic Committee, one of the People's Republic's top priorities is computer technology, where China is 10 years behind and will need help in the form of imports.

A series of papers on China under the Four Modernizations reports that vice premier Fang Yi, speaking at China's National Science Conference in 1978, said that China "should have acquired a group of comparatively advanced specialists in computer science research and... built a fair-sized modern computer industry" by 1985. Two goals were mentioned: giant ultra-high-speed computers, and the popularization of micros for wider use.

The Fourth Ministry of Machine Building, which has jurisdiction over planning and producing electronic components and computer systems, oversees at least 200 large and 500 small plants, as well as 1,500 "neighborhood" factories. However, *Electronic News* reports, China as of January 1980 had only about 1,000 computers in operation, nearly all of them foreign models and perhaps a fifth of those almost obsolete.

Both Control Data Corp., which instituted a corporate China office in 1973, and the U.S. Institute of Electrical and Electronic Engineers told the Joint Committee that "a market of great potential in fourth-generation computers for U.S. firms could exist" in the People's Republic.

Still, the study concluded, "It is much too soon to predict the outcomes in terms of benefits obtained or the particular obstacles encountered in... negotiations. In any venture with U.S. firms, the Chinese have stated that mutual benefit, mutual cooperation, and long-term relationship must apply to any pending association." With U.S.-China relations cooled by the defection of Chinese tennis star Hu Na, it seems a major computer-export agreement is some way off. ■

Costs, kids, and correspondence

END BYTES

● 1982 brought the $99.95 Timex-Sinclair 1000 and Texas Instruments' rebate; 1983 has brought a new wave of **COMPUTER PRICE REDUCTIONS**. Recently, IBM cut 15 percent from PC price tags. Xerox has knocked 21 to 26 percent off its systems, with the 820-II going from $2,445 to $1,795. The slow-selling Apple III now lists for $2,695 instead of $3,495, and stores have discounted the Commodore 64 to $299 (Tandy's price for a 16K Extended Basic Color Computer). As for the Timex, the paperweight of computers is now $49.95.

● Talmis, a market survey and consulting firm, reports that VIC-20 users have the most **CHILDREN** (an average of two per household), but TI 99/4 owners have more kids under six years old.

Over a third of all computer-using households have no children, Talmis notes; while 71 percent of Atari 800 buffs have children at home, the number falls to 62 percent for Radio Shack and 57 percent for IBM.

● RCA Corp., whose Consumer Electronics division supplies Tandy with displays for TRS-80s, will market its own computer **VIDEO DISPLAYS** for OEMs. Executive vice president Roy Pollack estimates that the U.S. display market will reach $1.6 billion by 1990. RCA's first entry will be a 13-inch, high-resolution color unit, due in the fourth quarter of this year.

● Brains before beauty: The British magazine *Micro-Scope*, printing some photos of **MISS WORLD** holding an Epson HX-20, reports that the connection goes beyond mere publicity—Epson "will, in future years, be closely involved in the judging of the contest."

Said a company spokesman, "As a result of the Epson/Miss World tie-up, more emphasis will be placed on mental abilities (in the judging of Miss World contests), and some of the questions asked of the entrants will be of a more technological nature than heretofore."

● There are new **MAGAZINES** for every taste, from *Micro Discovery*, "The Non-Technical Magazine of Personal Computing," to the bimonthly *PC: The Technical Journal*, an advanced-level spinoff of Ziff-Davis' *PC* for IBM fans.

Modem owners can read *Plumb*, a newsletter about personal telecommunications. And there are two more magazines for video gamers: *Joystick* and *Vidiot, The Magazine of Video Lunacy*.

● Computer **BOOKS**, too, are booming. Doubleday & Co. has advanced $1.3 million—reportedly the highest price ever paid for a trade paperback—to Stewart Brand, the man who brought you *The Whole Earth Catalog*. Brand's new opus? *The Whole Earth Software Catalog*.

● Least Significant Byte: The chairman of TeleCheck, a check verification service affiliated with Tymshare Inc., plans to revolutionize **BUSINESS CORRESPONDENCE**. "We will address our customers and colleagues with a capital 'Y' in 'You,'" says Robert J. Baer. "We are saying 'I respect You—that I'm in business to serve You.'"

"To continue to grow and help our subscribers serve their customers, we must be together on the same plane. That is not the implication of correspondence that uses a capital 'I' for the writer and a lowercase 'y' for the person addressed." Presumably, should Baer mention a customer in an interoffice memo, he'll refer to him as Him.

● Finally, "Fun House" columnist Richard Ramella reports that a 10-year-old girl walked up to a piece of **EQUIPMENT** in a Chino, CA Radio Shack store, grasped its sides, and yelled, "How do you play this thing?" "You don't," replied a clerk. "That's a battery tester." ■

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EPSON MX100	½ x 30	12.00	11.50	11.00	32.00	60.00
IDS Paper Tiger 460/560	½ x 36	7.75	7.50	7.00		
NEC 5500/7700 Nylon	½ x 15	6.25	6.00	5.50	30.00	56.00
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CALENDAR

August

2–4 **Microprocessor Background for Management Personnel** University of California Extension, Berkeley, CA.

8–10 American Management Associations, New York, NY. **User Documentation Course** New York, NY.

22–26 American Association for Artificial Intelligence, Menlo Park, CA. **National Conference on Artificial Intelligence** Hilton Hotel, Washington, DC.

26–28 University of Minnesota, St. Paul, MN. **Computers for Farm and Family** Minnesota State Fair, St. Paul, MN.

September

12–14 IEEE Computer Society, Silver Spring, MD. **International Conference on Computer-Aided Design** Santa Clara, CA.

19–21 American Management Associations, New York, NY. **User Documentation Course** Washington, DC.

26–29 IEEE Computer Society, Silver Spring, MD. **Compcon Fall '83** Marriott Crystal Gateway, Arlington, VA.

29–Oct. 1 Northeast Expositions Inc., Chestnut Hill, MA. **CP/M '83 East** Hynes Auditorium, Boston, MA.

October

3–6 IEEE Computer Society, Silver Spring, MD. **8th Data Communications Symposium** Cape Cod, MA.

5–6 DeNardi Enterprises, Los Altos, CA. **Compusource '83** Red Lion Inn, San Jose, CA.

7 Creative Learning Association, Charleston, IL. **Compucon '83** Martin Luther King University Union, Charleston, IL.

18–19 Architecture Technology Corp., Minneapolis, MN. **Conference on Local Computer Networks** Hilton Inn, Minneapolis, MN.

18–20 IEEE Computer Society, Silver Spring, MD. **EdCompCon'83: Applying Technology to Education** Red Lion Inn, San Jose, CA.

22 Plymouth State College, Plymouth, NH. **Conference on Computers and Education** PSC campus.

24–26 American Institute of Aeronautics and Astronautics, Orlando, FL. **Computers in Aerospace Conference** Hartford, CT.

Coming Next Month

With the games issue over, *80 Micro* returns to work in September. The month's topic is business, and applications range from a Model III program that illustrates VisiCalc's data interchange format (DIF) files to inventory control on the Model I.

There's a time distribution summary that tracks employee work by project and task categories, and a menu-driven program to record financial transactions on the II/12/16. SuperScripsit owners who've been struggling with non-Radio Shack printers will find a generic printer driver that fits anything with a parallel interface. Finally, September's Buyer's Guide looks at business software.

Programmers can pump up Basic with 14 new commands, including the ability to recover programs lost after New or Reset. There's a fast Z80 disassembler that fits into 3K, a three- to five-line screen dump, and an INKEY$ routine that won't lose characters no matter how fast you type.

C•Notes will have more Model 100 programs, and *80*'s other departments will meet September in style. Richard Ramella's Fun House even has programs for kids who are too young to join their brothers and sisters in going back to school. ■

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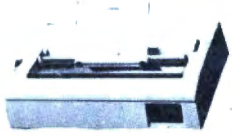

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Edit without Retyping with insert & delete	YES	YES	NO	NO
Restrict field Length automatically	YES	YES	YES	NO
Unlimited Restriction choice for each field	YES	YES	NO	NO
User defined Custom Prompts for each Field	YES	YES	NO	NO
Full Speed Typing in ALL Fields	YES	YES	NO	YES
Immediate Exit from Any Field to Menu	YES	YES	NO	YES
Enter Fields from last Record automatically	YES	YES	NO	NO
Fast BTREE File Structure (No Sort Needed)	YES	YES	NO	NO
Find Record with Part of a Key	YES	YES	NO	NO
Hi-Speed Global Search for ANY Field in a Record	YES	YES	NO	NO
Duplicate Keys and Multiple Keys Supported	YES	YES	limited	NO
Global Field Replacement Function	YES	YES	NO	NO
Run Predefined Reports from Finished Program	YES	YES	NO	NO
Select Reports from Menu in Finished Program	YES	NO	NO	NO
Sort (machine language) ANY Field-Free	YES	NO	NO	NO
Custom Mailing Labels Option (any Size)	YES	NO	NO	NO
Do Calculations on fields in Program	YES	YES	YES	NO
Sell Finished Program with No Royalty	YES	YES	NO	NO
PRODUCER CAPABILITIES & FEATURES				
Toll Free Question Line	YES	YES	NO	NO
Create PROFESSIONAL Finished Program	YES	YES	NO	NO
Modify Program without Starting Over	YES	YES	NO	NO
Ease of Use, including Complete TUTORIAL	YES	NO	NO	NO
Number of Calculations allowed per field	8	8	1	0
Use Field Names for Calculations	YES	NO	NO	NO
Use ALL Math Functions in Calculations	YES	NO	NO	NO
Generates a BASIC Program	YES	YES	YES	YES
Custom Design exact Screen YOU desire	YES	YES	NO	NO
Full Feature Screen Generator (graphics)	YES	NO	NO	NO
Easy Report Generation with Any Restrictions	YES	NO	NO	NO
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See descriptions in March and April Issues of 80 Micro

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FUN HOUSE

by Richard Ramella

Computer Characters

It's usually a bit lonely here in the Fun House, except once a month when all you kids (and kids in spirit) drop by. But this month, three people got here before you did: a Mystery Guest, Minerva the Fortune-teller, and a mind-reading magician called LaMarle the Amazing.

They've been practicing their routines and waiting for you to arrive. All three work in Level II and on any Color Computer with at least 4K.

So this month's theme, *Computer Characters*, does not refer to the graphics capabilities of the TRS-80, but to the imaginary people who dwell in the three programs below.

The computer is famous for crunching numbers, but it's just as good at juggling words to create interesting two-way communication between you and a program's imaginary character.

The Key Box

Model I and III
Color Computer
4K RAM
Level II Basic
Color Basic

Mystery Guest

```
100 REM * MYSTERY GUEST * TRS-80 LEVEL II AND COLOR BASIC
110 REM * FUN HOUSE / AUGUST '83 / R.RAMELLA
120 CLS
130 DATA 78,75,84,73,83,69,77,82,73,83,76,84,76,80,85
140 DATA 83,77,65,76,76,70,65,73,82,89,32,84,65,76,69
150 DATA 83,84,82,65,87,32,84,79,32,71,79,76,68
160 CLEAR 200
170 DIM A(43)
180 L$="* * * * * * * * * *"
190 FOR A=1 TO 43
200 READ A(A)
210 NEXT A
220 FOR A=1 TO 15
230 A$=A$+CHR$(A(A))
240 NEXT A
250 FOR A=16 TO 20
260 C$=C$+CHR$(A(A))
270 NEXT A
280 FOR A=21 TO 30
290 D$=D$+CHR$(A(A))
300 NEXT A
310 FOR A=31 TO 43
320 E$=E$+CHR$(A(A))
330 NEXT A
340 FOR B=15 TO 9 STEP -1
350 B$=B$+MID$(A$,B,1)+MID$(A$,B-8,1)
360 NEXT B
370 B$=MID$(A$,8,1)+B$
380 PRINT L$
390 PRINT "GUESS MY NAME."
400 PRINT "GIVE IT A SPIN."
410 PRINT "RECALL MY FAME"
420 PRINT "AND YOU WILL WIN."
430 PRINT L$
440 PRINT "20 GUESSES..."
450 PRINT L$
460 FOR A=1 TO 20
470 PRINT "GUESS"A;
480 INPUT X$
490 PRINT L$
500 IF X$=B$ GOTO 680
510 IF LEFT$(X$,4)=LEFT$(B$,4) GOTO 730
520 F=RND(5)
530 IF F=1 THEN PRINT "NOPE!"
540 IF F=2 THEN PRINT "WRONG... WRONG... WRONG..."
550 IF F=3 THEN PRINT "YOU'LL NEVER GUESS IN A MILLION YEARS."
560 IF F=4 THEN PRINT "NO, BUT THE LETTER ";MID$(B$,RND(15),1);"
 IS IN IT."
570 IF F=5 THEN PRINT "REALLY! HOW COULD ANYONE BE NAMED "X$"?"
580 IF A/5=INT(A/5) GOSUB 790
590 NEXT A
600 PRINT "HO! HO! HO!"
610 PRINT "I DANCE IN GLEE!"
620 PRINT "YOU DO NOT KNOW"
630 PRINT "THE NAME FOR ME!"
640 PRINT L$
650 PRINT
```

Listing continued

RACET COMPUTES LTD. Integrity in Software
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RACET COMPUTES = SYSTEM SOFTWARE

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***** Speed-Up Kit Version 2.X *****
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NOW WITH OPTIONAL 2-SIDED DRIVE SUPPORT FOR MOD XVI UNDER 2.0!!!
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Diskette Catalog System 'DISCAT' Mod I and III NEWDOS 80 Version 2 $50

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Keyed File System 'KFS-80' Mod I and III $100 Mod II $175 Machine language BASIC ISAM utility. Binary tree index system.

Model II Utility Package $150 Includes Superzap, bulk copies and other utilities for repair of blown diskettes. Complete documentation on diskette structure and guidance for repair.

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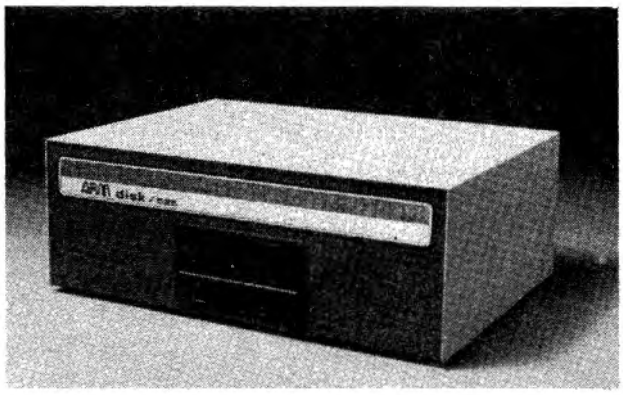

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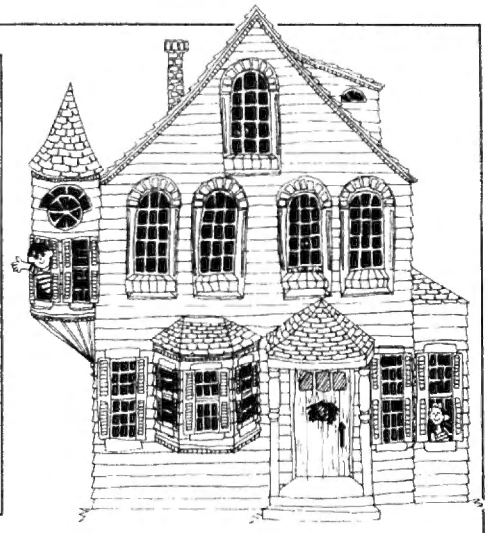
✓See List of Advertisers on Page 323

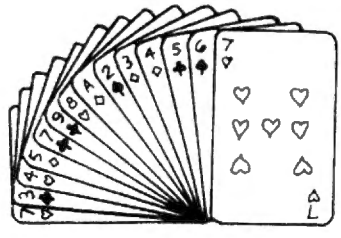
Listing continued

```
660 PRINT "AND I'LL NEVER TELL... GOODBYE!"
670 END
680 PRINT "I HATE IT WHEN PEOPLE GUESS";
690 IF A<6 THEN PRINT " SO SOON!" ELSE PRINT "!"
700 PRINT "YOU'RE RIGHT."
710 PRINT "I'M LEAVING. GOODBYE!"
720 END
730 PRINT "YOU DIDN'T SPELL IT RIGHT,"
740 PRINT "BUT YOU KNOW!"
750 PRINT "IT'S "B$", O CLEVER ONE!"
760 PRINT "YOU WEREN'T SUPPOSED TO BE ABLE TO GUESS!"
770 PRINT "I'M GOING NOW. AND DON'T FOLLOW ME!"
780 END
790 N=N+1
800 IF N=1 THEN PRINT "CLUE 1: I AM "C$"."
810 IF N=2 THEN PRINT "CLUE 2: I AM IN A "D$"."
820 IF N=3 THEN PRINT "YOUR LAST CLUE (HEH-HEH): "E$"..."
830 RETURN
840 END
```



LaMarle the Amazing

```
100 REM * LAMARLE THE AMAZING * TRS-80 LEVEL II AND COLOR BASIC
110 REM * FUN HOUSE / AUGUST '83 / R. RAMELLA
120 CLEAR 50
130 L$="****************"
140 A$="A23456789TJQK"
150 B$="<Y>ES OR <N>O"
160 CLS
170 PRINT "I GET AN IMPRESSION...  IT'S A 7 "B$
180 GOSUB 790
190 IF C$="Y" GOSUB 820 ELSE GOSUB 900
200 IF C$="Y" THEN M$="7": GOTO 270
210 Z=RND(12)
220 GOSUB 1060
230 PRINT "SAY, IS YOUR CARD... "Z$" - "B$
240 GOSUB 790
250 IF C$="N" THEN PRINT "I WAS SURE IT WASN'T.": Z$="": Z=0
260 IF C$="Y" THEN M$=Z$
270 IF C$="Y" THEN PRINT "I AM TRULY GREAT, AM I NOT": C$="": PR
INT L$: Z=0: GOTO 330
280 C$=""
290 PRINT L$
300 GOSUB 1020
310 GOSUB 790
320 GOSUB 980
330 D=RND(2)
340 PRINT "THIS CARD IS ";
350 IF D=1 THEN PRINT "BLACK." ELSE PRINT "RED."
360 GOSUB 790
370 IF C$="Y" GOSUB 820 ELSE GOSUB 900
380 IF C$="N" AND D=1 OR C$="Y" AND D=2 THEN C$="": GOTO 480
390 F=RND(2)
400 PRINT "THE CARD IS A ";
410 IF F=1 THEN PRINT "CLUB." ELSE PRINT "SPADE."
420 GOSUB 790
430 IF F=1 AND C$="Y" OR F=2 AND C$="N" THEN D$="CLUBS"
440 IF F=2 AND C$="Y" OR F=1 AND C$="N" THEN D$="SPADES"
450 IF C$="Y" GOSUB 820 ELSE GOSUB 900
460 C$=""
470 GOTO 560
480 F=RND(2)
490 PRINT "FURTHERMORE, THE CARD IS A ";
500 IF F=1 THEN PRINT "DIAMOND." ELSE PRINT "HEART."
510 GOSUB 790
520 IF F=1 AND C$="Y" OR F=2 AND C$="N" THEN D$="DIAMONDS"
530 IF F=2 AND C$="Y" OR F=1 AND C$="N" THEN D$="HEARTS"
540 IF C$="Y" GOSUB 820 ELSE GOSUB 900
550 C$=""
560 IF M$<>"" GOTO 730
570 H=1
580 GOSUB 1020
590 GOSUB 790
600 GOSUB 980
610 IF V<>2 GOTO 580
620 FOR B=1 TO 3
630 Z$=MID$(A$,B,1)
640 GOSUB 1060
650 PRINT "IT'S THE "Z$
660 GOSUB 790
670 IF C$="Y" GOTO 740
680 NEXT B
```



Listing continues

Always remember that computers are not creative in themselves. They need commands or programs from you or me before they can do anything.

In creating characters, you must let the characters fib about their supposed powers. Accept the fantasy when you try these programs, but don't forget reality.

Mystery Guest

First, let's find out who the mystery guest is. You get 20 guesses. Even if it seems hopeless at first, keep trying because there are some hidden clues. You won't find them even if you key in the program.

The mystery character presents 20 numbered prompts, starting with GUESS 1. Type in a name as your guess. Keep guessing to find those clues, and don't be disturbed if the character taunts you a bit.

I'd be happy to identify this person for you, but I don't know the answer. She—or he—has worn a bag over his—or her—head since arriving.

LaMarle the Amazing

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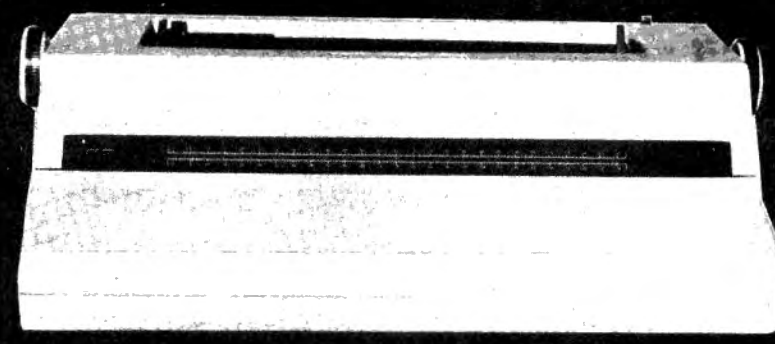

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536

See List of Advertisers on Page 323

Listing continued

```
690 PRINT L$
700 PRINT "YOU DIDN'T GIVE AMAZING LAMARLE"
710 PRINT "STRAIGHT ANSWERS. TRY AGAIN?"
720 END
730 IF M$<>"" THEN Z$=M$
740 PRINT "THEN YOUR CARD IS THE "Z$" OF "D$
750 FOR T=1 TO 300
760 NEXT T
770 GOSUB 820
780 GOTO 750
790 INPUT C$
800 IF C$<>"N" AND C$<>"Y" THEN PRINT "I NEED A Y FOR YES OR N F
OR NO.": GOTO 790
810 RETURN
820 C=RND(5)
830 IF C=1 THEN PRINT "I KNEW IT."
840 IF C=2 THEN PRINT "I AM SELDOM WRONG."
850 IF C=3 THEN PRINT "HOW ABOUT THAT?"
860 IF C=4 THEN PRINT "RIGHT AGAIN!"
870 IF C=5 THEN PRINT "I AM TRULY AMAZING."
880 PRINT L$
890 RETURN
900 C=RND(5)
910 IF C=1 THEN PRINT "HMMM... I WAS SO SURE..."
920 IF C=2 THEN PRINT "YOU MUST THINK HARD."
930 IF C=3 THEN PRINT "CONCENTRATE... PUH-LEEZE!"
940 IF C=4 THEN PRINT "RATS!"
950 IF C=5 THEN PRINT "A TEMPORARY SETBACK."
960 PRINT L$
970 RETURN
980 IF C$="Y" THEN A$=RIGHT$(A$,INT(LEN(A$))/2)
990 IF C$="N" THEN A$=LEFT$(A$,INT(LEN(A$))/2)
1000 V=V+1
1010 RETURN
1020 Z$=MID$(A$,INT(LEN(A$))/2,1)
1030 IF H=1 GOSUB 1060
1040 PRINT "YOUR CARD IS HIGHER THAN "Z$" - "B$
1050 RETURN
```

Listing continues

FUN HOUSE

masquerading as a magician tell which one of a deck's 52 cards you have secretly chosen? Of course not. But somehow LaMarle the Amazing blunders his way to an answer every time, if you respond correctly.

One of the secrets of creating a computer character is giving it a few faults—like you and I have—and letting it blab and blunder all it wants. LaMarle is an effective character because he is imperfect in a humorous way.

He makes wild claims, gets wrong answers, and generally puts on a foolish performance.

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262

Printers

Tandy did the right thing locking TRS-80s into parallel printers—problem is, you're supposed to use *their* parallel printers. Getting help from your dealer may be more trouble than it's worth, so ask for help from local user groups. SuperScriptsit software compatability may be your biggest hurdle.

C. ITOH

Prowriter

Reviewers laud the **Prowriter**'s speed (120 cps), the buffer (1.5K), character sets (5 fonts) and graphics (160x144 dpi). The **Prowriter 2** has the same specs, but in a 132 column format. Because delivery is slow nationwide, the **Prowriter** has become "The Printer Worth Waiting For..."

Prowriter **$399.88**
Prowriter 2 ..... **$734.88**

STAR MICRONICS

Gemini 10X/15

Gemini 10X is an improved version, with 120 cps, 120 x 144 dpi, 5 fonts (w/italics) and a 2.2K buffer. It's Epson code compatible, too. The **Gemini** comes with tractors & uses plain spool ribbons. The **Gemini 15** is the 132 column version.

Gemini 10 ..... **$339.88**
Gemini 15 ..... **$499.88**

OKIDATA

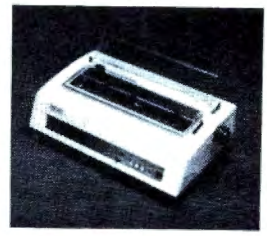
Microline Series

Microline 82As & **83A**s are data crunchers with 120 cps and optional dot-addressable graphics ROM. They come with both parallel & RS-232C interface (up to 1200 baud).

The **Microline 92** & **93** are text processors with 160 cps draft mode, a 40cps correspondence mode & the graphics included.

Microline 82A **$419.88**
82A/92 Tractor **$59.88**
Microline 83A **$679.88**
Microline 92 ..... **$524.88**
w/RS-232C **$634.88**
Microline 93 ..... **$884.88**
w/RS-232C **$994.88**

DTC **380Z** Letter-Quality Printer
$1119.88 UPS DELIVERED



The **DTC-380Z** is a 30 cps letter-quality printer with true Diablo emulation. 10/12/15 cpi, sub/super scripts, underlining, graphics, 48K data buffer & 3 on-board interfaces for maximum compatability (RS-232C or IEEE488 cost $1139.88). Looks like the Brother HR-1, Comrex & Daisywriter, & it uses the same printwheels & ribbons. The **380Z**'s documentation & packaging is superior to the Daisywriter's, as is the support. We think Daisy's cute, but she's not as efficient as the **380Z**.

We sell other dot matrix printers, including the **Anadex** Series, **Centronics** Series, the **Epson** Series, the **IDS** Prism Series & the **Mannesmann Tally 160-L**.

Letter-Quality

C. ITOH

Starwriter

The **Starwriter** uses Diablo code, wheels & ribbons, has 132 columns, a 40 cps print speed, 1/48" line space & 1/120" horizontal spacing—ideal for proportional modes. Parallel or RS-232C interfacing. (For real speed freaks, there's the **Printmaster**, at 55 cps. Same specs as above.)

Starwriter **$1379.88**
Printmaster **$1679.88**

SILVER REED

EXP-550

Why buy a Transtar when you can buy from the guys who make them? The Silver Reed **EXP-550** is a 16 cps, 132 column letter-quality printer with *true* Diablo emulation, making it compatible with most word processing software. It's ideal for medium duty office work. The **EXP-500** is a 12 cps version.

EXP-550 (Parallel) **$719.88**
EXP-500 (Parallel) ..... **$CALL**

We sell a variety of other letter-quality printers, including the **Diablo 620 & 630**, the **NEC 3530 & 7730** Spinwriters, the **Qume Sprint 11+** & many others. Call (603) 881-9855 for technical details. To order, call (800) 343-0726.

Modems

EMTROL

Lynx

The **Lynx** is a bus-converting modem, meaning you don't need a RS-232C interface to run it. It's a 0-300 baud modem, originate/answer, that has auto dial/answer, full/half duplex & comes complete with all hardware & software. The communication's program, Emterm, is on cassette. We suggest you buy one on disk that supports all the Lynx's features (see **Microterm** below).

Lynx **$229.88**

DC Hayes Modems

Smartmodem (300 baud) **$219.88**
Smartmodem (1200 baud) ... **$539.88**

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```
1060 IF Z=1 OR Z$="A" THEN Z$="ACE" ELSE IF Z=10 OR Z$="T" THEN
Z$="TEN"
1070 IF Z=11 OR Z$="J" THEN Z$="JACK" ELSE IF Z=12 OR Z$="Q" THE
N Z$="QUEEN"
1080 IF Z=13 OR Z$="K" THEN Z$="KING"
1090 IF H=1 THEN RETURN
1100 IF Z>1 AND Z<10 THEN Z$=MID$(A$,Z,1)
1110 RETURN
1120 END
```

Minerva the Fortune-teller

```
100 REM * MINERVA THE FORTUNETELLER * TRS-80 LEVEL II AND COLOR
BASIC
110 REM * FUN HOUSE / AUGUST '83 / R.RAMELLA
120 CLS
130 CLEAR 200
140 PRINT " HELLO, I AM MINERVA THE FORTUNETELLER..."
150 PRINT "MY FEE IS 50 BYTES."
160 FOR T=1 TO 1000
170 NEXT T
180 CLS
190 PRINT "WELL... ON TO BUSINESS."
200 INPUT "DO YOU BELIEVE I HAVE THE POWER TO FORETELL THE FUTUR
E";C$
210 N=N+1
220 IF N=3 GOTO700
230 IF C$<>"YES" AND C$<>"NO" THEN PRINT " COULD YOU BE SPECIFIC
, SUCH AS YES OR NO?": PRINT: GOTO 200
240 IF C$="YES" THEN PRINT "AND I'LL BET YOU BELIEVE IN THE TOOT
H FAIRY." ELSE GOTO 700
250 PRINT
260 PRINT "FOR 50 BYTES I WILL ANSWER THREE YES-NO QUESTIONS."
270 PRINT
280 FOR T=1 TO 3
```

Listing continues

And when you least expect it, he might correctly guess the card you've chosen.

To see what LaMarle can do, answer his guesses with a Y for yes or an N for no. Always tap enter after answering Y or N.

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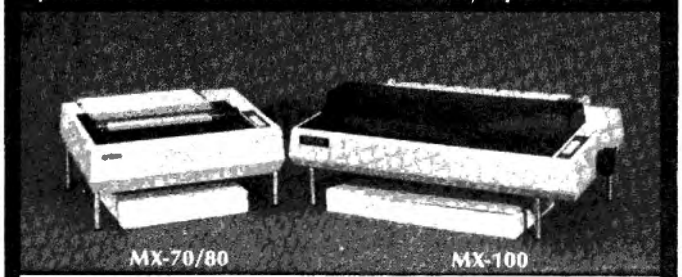

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Listing continued

```
290 PRINT "QUESTION"T
300 INPUT Z$
310 PRINT
320 PRINT "H";
330 FOR G=1 TO RND(30)
340 PRINT "M";
350 FOR H=1 TO 50
360 NEXT H
370 NEXT G
380 PRINT
390 A=RND(10)
400 IF A=1 THEN PRINT "NO." ELSE IF A=2 THEN PRINT "YES."
410 IF A=3 THEN PRINT "PERHAPS, BUT THE CRYSTAL BALL IS CLOUDED.
"
420 IF A=4 THEN PRINT "YES, BUT YOU'LL SOON BE SORRY."
430 IF A=5 THEN PRINT "SIGNS SAY NO."
440 IF A=6 THEN PRINT " YES, AND YOU WILL BE SURPRISED WHEN IT C
OMES TO PASS."
450 IF A=7 THEN PRINT " THE OUTCOME IS DIMLY SEEN. ASK LATER."
460 IF A=8 THEN PRINT "IF YOU WISH IT... YES. OTHERWISE... NO."
470 IF A=9 THEN PRINT "THIS IS VERY POSSIBLE."
480 IF A=10 THEN PRINT "IF THIS IS A WISH, TAKE IT BACK AND AVOI
D DISASTER."
490 PRINT
500 NEXT T
510 PRINT "NOW FOR YOUR SPECIAL FORTUNE."
520 FOR T=1 TO 1000
530 NEXT T
540 A=RND(10)
550 IF A=1 THEN PRINT "YOU WILL SOON TAKE A TRIP OVER WATER... S
O WATCH OUT FOR MUD PUDDLES."
560 IF A=2 THEN PRINT "YOU SHALL BE HAPPY AS LONG AS YOU ARE KIN
D TO CHILDREN AND GYPSY FORTUNETELLERS."
570 IF A=3 THEN PRINT "SOMETHING IMPORTANT WILL HAPPEN ON YOUR B
IRTHDAY."
580 IF A=4 THEN PRINT "YOU RECEIVE JUST PAY FOR A DEED YOU WILL
PERFORM."
590 IF A=5 THEN PRINT "SOMEONE VERY NEAR LIKES YOU QUITE A BIT.
IT IS... I CAN'T QUITE MAKE OUT THE NAME."
600 IF A=6 THEN PRINT "YOU WILL HAVE MANY FRIENDS, FOR YOU ARE A
 FRIEND TO MANY."
610 IF A=7 THEN PRINT "IF TODAY IS APRIL 1, BEWARE! MANY PEOPLE
WOULD TRICK YOU."
620 IF A=8 THEN PRINT "SOMEONE WISHES GOOD THINGS FOR YOU..."
630 IF A=9 THEN PRINT "HAPPINESS IS YOURS FOR THE PRICE OF THE S
MILES YOU SPEND."
640 IF A=10 THEN PRINT "REMEMBER THE PAST? IT MAY HAPPEN AGAIN."
650 FOR T=1 TO 1000
660 NEXT
670 PRINT
680 PRINT "CROSS MY SOLENOIDS WITH 50 BYTES AND DEPART. THANK YO
U."
690 END
700 PRINT "I ALSO CAN BE CONTRARY. I FOLD MY TENT AND DEPART."
710 END
```

believe she can tell the future or she becomes angry and the program ends.

When Minerva gives the prompt QUESTION 1 ?, type in your question and tap enter for the answer. After the third answer, Minerva provides a special fortune. It's special because it's one of ten she can choose. The program ends with Minerva demanding her fee and saying thank you.

The program Minerva can crash if your questions are too long. If you have a 16K or higher system, change line 130 to read 130 CLEAR 1000. If you have a 4K system, ask shorter questions. ■

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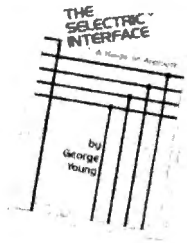

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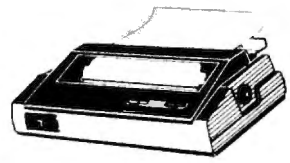

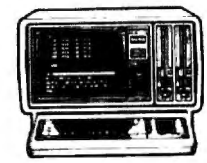

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by Terry Kepner

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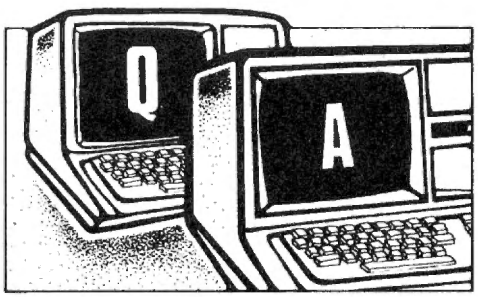

Questions and answers

A number of companies are offering CP/M support systems for the Model III. How do you go about obtaining CP/M public domain software, and what are the compatibility problems?

R.K.
Albany, NY

Finding public domain software of any kind is difficult. There's lots of it out there, but you don't see it advertised. Your best sources of public domain programs are user's groups, clubs, and bookstores. Another source is *Dr. Dobb's Journal* (P.O. Box E, Menlo Park, CA 94025, $2.50). It frequently has articles on CP/M, as well as programs you can use without worrying about copyrights. If you have a CompuServe number, you can either put a request for help in their bulletin board section or join their CP/M Special Interest Group (SIG–PCS47).

CP/M compatibility problems are similar to the compatibility problems involving Basic. Different dialects require alterations to the programs. Unlike Basic, however, CP/M has been rigidly controlled by Digital Research, the company that owns CP/M. This control has considerably reduced the incompatibilities you might encounter. The only real problems lay with machine-language subroutines.

I think the question of expanding RAM in the TRS-80 deserves more attention. Many of us have kept our Model I's simply because they've been good to use and we like them, but we do get frustrated by their 48K limitation.

A firm called MicroHatch has a modification called Bigmem that replaces the 16K keyboard RAMs with 64K RAMs. They claim this allows Model I users to use 96K while using RAMs that require 20 percent less power than the old RAMs. Bigmem will also support CP/M 2.2-compatible programs.

If all this is true, every Model I owner should know about it. What do you think of it? There has to be a way to upgrade beyond 48K without bypassing ROMs or making other sacrifices.

J.M.
San Clemente, CA

The theory of all CP/M and other memory expansion units for the Model I and III computers is to replace the ROM with RAM. The Z80 can address only 64K of contiguous RAM. That's a physical limitation of the 16-bit address bus (2 to the 16th power equals 65,536 possible addresses). When you have the full 48K of RAM installed in your computer (from addresses 4000H to FFFFH), the remaining addresses (0000H to 3FFFH) are used for the ROMs and miscellaneous system RAM overhead. This means that you've used all the addresses available on the Z80 bus.

To get more RAM you have to resort to programming and hardware tricks. Simply replacing the ROM with RAM would leave you a 64K Z80 computer with no way of communicating with the outside world (remember, part of the ROM is used to tell the Z80 how to interface with the cassette tape, disk drives, video monitor, and keyboard).

The CP/M modification always includes a simple program that boots your disk drive and loads the CP/M system driver software, letting you communicate with the Z80 via the keyboard and video monitor. In effect, you've replaced the Tandy Basic ROMs with a new system in RAM that puts you in a DOS environment instead of Basic.

If you need Basic, it's loaded from the disk. Because the CP/M system doesn't include Basic in ROM, you have more RAM available for programs and data until you load in Basic. One company, however, puts the entire CP/M system into ROM so you can switch from Basic to CP/M without having to load from a disk.

To get more than 64K of RAM in your system, you have to use a system called memory banking: You address 64K contiguous bytes of memory, but the Z80 doesn't care which bank of contiguous memory it addresses. Memory banking requires both hardware and software to switch banks of RAM into and out of the address bus. This is how Bigmem works. You normally address the 64K in your keyboard. When you want to address the 32K in your expansion interface, you turn off the upper 32K bank of memory in the keyboard and turn on the RAMs in the expansion interface. Thus, you can store data in one bank, process it, and then switch to the other bank and process its data. You can't have a program that spans both banks. If you try to do that, when the program switches banks, part of the program will no longer exist as far as the CPU is concerned.

To accomplish that type of memory banking requires a supervisor program to constantly check the program and make sure that the proper part of the program is always turned on when the Z80 goes to address it. One mistake and your program becomes hopelessly confused and you have to start over.

Memory banking can be done on a Model I or III without sacrificing ROM. In fact, you can even use memory banking for word processing and spelling programs. Just put your program in the upper 32K bank, the data in the lower 16K, and then switch the upper banks between spelling and word processing.

I'm interested in increasing the available RAM in my Model III. In reading advertisements, it appears you can get an additional 16K and also increase the display to 80 columns by 24 rows. It isn't clear, however, if these kits require CP/M to use these features. I'd like to have 64K and the larger display to use with both my DOSPLUS 3.4 VisiCalc and Scripsit programs, but I don't want

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Includes updates for Model III. INSIDE LEVEL II $15.95

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to have to convert these programs to CP/M.

W.L.
Sun City, AZ

Yes, you do have to use CP/M to get the increased RAM, but not necessarily for the larger display (see the following letter for details on increased video display). To get the extra RAM, you'll have to disable the built-in ROM Basic, which also disables the I/O routines of the ROM and makes DOSPLUS virtually useless. Since both Scripsit and VisiCalc are designed to operate in a TRSDOS environment, and since CP/M is definitely not a TRSDOS environment, you'll have to scrap these two programs and buy a new word processor and VisiCalc program for the CP/M system.

I'd like to have an 80 by 24 video display on my Model I in order to communicate and execute programs. The 64 by 16 display is fine when used as a computer, but I need the larger display if I want to use it as a terminal.

Could you give me some information on the various modifications? Also, would it be worthwhile to modify my Model I, or would I be better off purchasing an inexpensive 809 by 24 terminal instead? I plan on communicating to a dual system 83 using RM/COBOL.

R.K.
Pittsburgh, PA

Holmes Engineering (3555 South 3200 West, Salt Lake City, UT 84119) has introduced an 80 by 24 display unit for the Model I, the VX-1. It works by replacing the device control block addresses for the standard video with addresses pointing to their driver. The board is enclosed in a separate box about the size of a disk drive. The board retails for $279.95, and the enclosure, actually an expansion interface system for the Model I, sells for $99.95.

The MF-2, as it's called, plugs into the expansion port of your expansion interface and uses its own internal 16K RAM for video mapping and control. The VX-1 includes its own bootstrap ROM routine that automatically puts itself into operation when you turn on the computer. When needed, it can be disabled, leaving you in the standard 64 by 16 display.

Since this unit requires no modification to the Model I boards, it should be easy to install and maintain. The total cost ($379.90 plus shipping) is cheaper than buying a dedicated terminal. However, if you can get a terminal with modem for less, I'd suggest buying the terminal instead.

I recently installed Omikron's CP/M Mapper I in my Model I disk system. I'm satisfied with the system, but now I'm interested in using CP/M software formatted for other systems without having to send it to Omikron for reformatting. Can you advise me of other alternatives?

K.J.S.
Sudbury, Ontario

This is a software problem. What you need is a machine-language program that reads formats other than your standard. As long as the other software is on 5¼-inch soft-sectored disks, you should be able to transfer the programs to your system disks. I know such programs exist, but I can't find anything specific in my references. Have you tried writing Omikron and asking if the software they use is for sale? If that fails, I suggest you try the CP/M user's group on CompuServe.

As a last resort, Hurricane Laboratories (5149 Moorpark Ave., Suite 105, San Jose, CA 95129, 408-257-8676) has a Model III program that reads Osborne, Xerox 820, Cromenco, IBM PC (single-sided), NEC PC-8000, Omikron Mapper I, and Zenith formatted disks. If you talk with them they may be able to sell you a patched program for your Model I.

I have a Model I, two-disk drive system with Radio Shack's double-density board. I bought Radio Shack's Profile (26-1562) for the Model I, and had a friend customize the hard copy to a format I wanted. Things work fine as long as I stay in single-density, but this restricts me to only 150 records per disk.

I tried using the program in double-density, but all I get is "I/O Attempt to Unopen File". I'm not a programmer, and I don't want a complicated data handling program. Help!

J.S.S.
West Chatham, MA

The problem is that Radio Shack's 2.7DD uses different disk I/O addresses than TRSDOS 2.3, and Radio Shack won't support any of their programs on the double-density board.

The only solution I know of is to switch to another DOS that does support both double-density and the Profile program. This is expensive, but it'll eliminate future problems with programs being incompatible with 2.7DD. Does anyone have a patch for Profile to make it work with 2.7DD?

I've written a program that formats track zero, sector zero in single-density, and track zero, sector one in double-density. The utility achieves this without resorting to hardware modifications, is entirely software controlled, and works with the Model III (16K RAM and one drive required minimum).

Because of the diversity of program writers, Dual Density Formatter formats only track zero. Any programmer has the means at hand to format the rest of the disk in the desired density.

DDF is easy to use. Just load DDF from its self-loading disk, format the target disk in dual density, and then copy your single-density boot loader to sector zero and your double-density boot loader to sector one.

This utility is sold by Applied 80 Software (18 Ivy Lane, Cherry Hill, NJ 08002, 609-482-6864) for $29.95 in single units. There is a discount for quantity orders.

L.G.
Cherry Hill, NJ

Sounds good. If anyone is interested, give Applied 80 Software a call.

Regarding the object code output from EDTASM that B.B. of San Jose and A.L. of Studio City had (April 1983, p. 394), the probable cause is with the unclear instructions in the manual. Command W writes the current text buffer to tape. This isn't object code, but rather source code. It is loaded back into EDTASM with the L command.

Command A is the one that gives the object code output after assembly listing and error count. The manual states this on p. 3, but it's difficult to see and can confuse someone. I think both B.B. and A.L. confused W with A.

B.S.
Anaheim, CA

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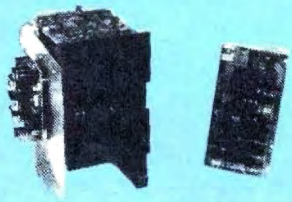

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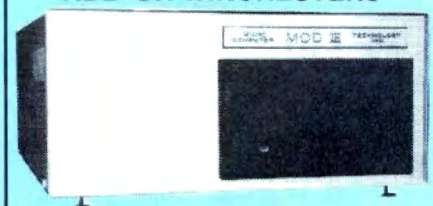

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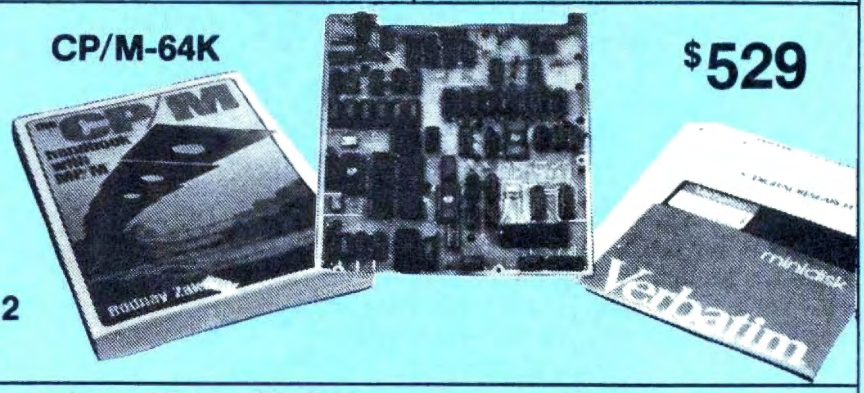

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After looking over their letters, I believe that you may have solved their problem.

My Model I system works reliably and I've never had any problems with my RS-232. Why? The secret is in my treatment of the connectors.

I scrupulously clean the edge connectors with a pink pencil eraser, and then with isopropyl alcohol. This is repeated until no more black oxide can be removed. I then cover the cleaned surfaces with Dow Corning High Vacuum Silicone Grease. Silicone grease has a very high dielectric constant and is quite viscous, so gaseous diffusion is very slow.

This treatment is good for about a year and a half. Before I came to this solution I had to clean the surface every two days.

D.M.
Calgary, Alberta

That's one solution about which I'd never heard.

I'm having an annoying problem with my Model I. When I use DOS I'm presented with waves of lines, roughly three to four inches apart, moving at a 45-degree angle from the lower left of my video monitor to the upper left. These appear only if the CPU is waiting for me to do something.

The problem seems to be in the expansion box, since the problem disappears if I disconnect the LNW expansion box. I didn't always have this problem; it began after I blew a fuse in the LNW box. I checked the voltages and they appear to be good. I can mask the lines by adjusting the brightness control on the monitor, but then the screen becomes too dark for me to use.

R.R.
Stacy, MN

My first thought was RFI, until you mentioned you could make the lines vanish by adjusting the brightness control. I suspect that the problem is actually a part in the LNW box that was pushed to its limit by whatever caused the fuse to blow. This part is now marginal. It works well enough to be almost impossible to find on the circuit board since all the voltages and currents will be close to their correct marks, but just bad enough to foul up other parts in the system. That kind of problem takes a lot of work to find, and in most cases it's better to leave it alone.

If you're an accomplished technician, you could probably track the errant part down, but to pay someone to do it for you would be both ridiculous and expensive. Try sending a letter to LNW describing the problem (a photograph would be very helpful, use 1/30th speed setting). Perhaps they've run into the problem before and can tell you where to start.

My wife is a Spanish/French teacher, and she does a lot of business correspondence in Spanish. Even though they are on my Daisy Wheel II, I have been unable to find any patches for writing the Spanish/French characters from SuperScripsit. What can I do?

G.S.
Santa Rosa, CA

What you need to do is to set the User Printer Codes to the values needed for your Spanish/French letters, and embed them in your documents. By combining the User Printer Codes with the backspace command you should be able to get all the accent marks and special characters you need from your Daisy Wheel II printer.

I have a Model III, dual-disk system. My previous computer was a Model I cassette system. I want to convert my tape data so they can read, write, and store data on disk (e.g., Tape Mailing List by Radio Shack). Is there a simple way to do this?

J.G.
Santa Clara, CA

Converting a tape program to disk is not a task easily done by a novice. You have to change all the tape I/O commands to disk I/O commands. Even transferring the data from tape to disk is a chore. Considering the difficulties, it may be cheaper to get disk programs and retype the information.

As a last hope for J.G., does anyone have a Radio Shack Tape Mailing List program that's been converted to disk?

In response to M.H. (April 1983, p. 392), I'd like to say that I have a similar problem with EDTASM on my 16K Model III. When inserting lines between other lines I sometimes get incorrect line numbers:

```
00100  ;THIS IS LINE 100
00110  ;THIS IS LINE 110
00120  (BREAK)
*I105
00105  ;THIS IS LINE 105
00115  (BREAK)
P#:*
00100  ;THIS IS LINE 100
00110  ;THIS IS LINE 105
00120  ;THIS IS LINE 110
```

*The EDTASM manual says this shouldn't happen, although a program similar to this one is shown on p. 10. When adding line 105 between lines 100 and 110, the lines are renumbered. The only solution I've found is to insert using *I105,1 and specify a line increment of one.*

By the way, about the letters mentioning incorrect object code output from EDTASM (I use Series I Editor/Assembler Version 1.1), I have no problem with output of assembled code.

J.G.
Dearborn Hts., MI

Regarding the letter from M.H. (April 1983, p. 392), I have the same problem with EDTASM on my Model III, as does a friend of mine. It's not that line 110 was replaced, the new line was inserted and the program renumbered.

I checked renumbering and memory, and both checked out fine. I'm going to try a new copy of EDTASM from Radio Shack in a few days. I'll let you know what happens.

J.M.L.
Eden Prairie, MN

I think we've discovered a bug in the Insert/Renumber portion of EDTASM. It's supposed to tell you if there isn't enough room for a new line between line numbers (using the default increment, of course). The only solution seems to be to specify a line increment less than the increment to the next highest line number.

I would like to point out to W.B. (April 1983, p. 383) that his C. Itoh 8510 printer is identical to the NEC

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1. Final entries must be in by November 1, 1983.
2. All entries must be submitted in a 10 × 13" envelope and must include: typewritten, double-spaced documentation; a printed copy of the program listing; a magnetic disk or cassette containing the program listing, the documentation, and any figures or tables; and a completed entry blank.
3. Documentation should consist of an explanation of the program, its purpose, how to use it, and the necessary software and hardware needed to use it (including memory requirements). Good documentation also points out the interesting algorithms and program techniques used without giving a line-by-line account.
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PC-8023A printer. The C. Itoh 8510, the NEC PC-8023A, the ADS 8001, and the PMC DMP-85 are all manufactured by TEC of Japan. The major difference between all these machines is just the logo on the manual cover. Therefore the NEC driver found on p. 376 of the April issue works perfectly, and without any changes.

Where can I get the 20-pin connector used to attach the Model III logic board to the keyboard? I want a longer cable so that I can use the keyboard a short distance from the video monitor. Can I get the cable from National Parts?

M.O.
Houston, TX

Do you want to increase the distance between the logic board and the keyboard? Or do you want a second cable? If you want to buy a second cable, it's available from National Parts (900 E. Northside Drive, Fort Worth, TX 76102, 817-870-5662). Its serial number is #AW2539, and it costs $11.50 plus shipping ($1.50). Be forewarned that the cable has female connectors at each end, so you can't put two cables together to make one long cable. Also, increasing the distance between the logic board and the keyboard makes the unit susceptible to RFI and other electrical noise.

If you do want to use an extended cable, Priority One Electronics (9161 Deering Ave., Chatsworth, CA 91311-5887, 800-423-5922) has both connectors and cables, as does Jameco Electronics (1355 Shoreway Road, Belmont, CA 94002, 415-592-8097).

I'm looking for a Pascal compiler that meets either the ISO or UCSD standard agreement. This compiler must operate on a Model III.

J.P.
Tracy, Quebec

Any Pascal that would meet the UCSD or ISO standards wouldn't fit in the available memory of the Model III.

New Classics Software (239 Fox Hill Road, Denville, NJ 07834, 201-625-8838) sells a version of Pascal that comes close to the UCSD standard, except that Mark and Release are used instead of Dispose; it doesn't have variant records, the Width statement or Page; it uses enhanced Read and Write instead of Get and Put; and File and Text are allowed only in variable declarations and not Type declarations. It sells for $99.

PCD Systems (P.O. Box 143, Penn Yan, NY 14527, 315-536-7428) sells a version that meets UCSD standards, but they suggest you don't use it to develop programs since there isn't much room left for the actual program. Instead, they suggest using the run-time package on the Model III and use their Pascal on a Model II to develop programs for the Model III.

Other companies marketing Pascal programs for the TRS-80 Model III are:
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Digital Research/Languages Division—P.O. Box 579, 160 Central Ave., Pacific Grove, CA 93950, 408-649-3896
Hexagon Systems—Regent St., P.O. Box 397, Station A, Vancouver, BC., Canada V6C 2N2, 604-682-7646
Microsoft—10700 Northup Way, Suite 200, Bellevue, WA 98004, 206-828-8080
Pickles & Trout—P.O. Box 1206, Goleta, CA 93117, 805-685-4641
Radio Shack—1300 One Tandy Center, Fort Worth, TX 76102, 817-390-3011
Ticom Systems Inc.—13470 Washington Blvd., Marina Del Rey, CA 90291, 415-829-7550

I have an MT-32 Microtek expansion interface with 32K RAM. Lately it's been locking up when I load or try to create a large program. I tried new RAM chips without success. When I tried setting memory size below the expansion interface memory locations, everything is fine. What's wrong?

T.W.
Waukesha, WI

It's not the memory that's at fault, it's the cable connecting the expansion interface to the keyboard. Remove the cable, rub the contacts on both the keyboard and expansion interface with a pink eraser, and then wash the contacts with isopropyl alcohol (use cotton swabs). This should give you a more reliable system. If the problem returns or persists, you may have to use Gold-Plugs, or Silver-It to cure the problem (see previous columns for more on this subject).

I have several friends with different computers. Their computers are able to generate new characters. Is it possible to do the same on the Model I? If not, can I put in a new character generator? Where can I get a better memory map for my computer?

D.J.
Cleveland, TN

No, you can't generate Model III special characters on the Model I. Yes, you can replace the character generator of the Model I, but I don't know of any company presently selling such chips for the Model I, except to provide an upper/lowercase display on home modified Model I's.

If you're looking for a very detailed memory map, get *MicroSoft Basic Decoded & Other Mysteries* by IJG (1953 West 11th St., Upland, CA 91786). It sells for $29.95, but is well worth the price.

After installing the Gold-Plug 80 connectors on my Model I keyboard, expansion interface, and disk-drive port, I experienced the same problems as those described by V.C., R.Z., and L.W. in your March and February 1983 columns.

The problems disappeared when I shortened the buffered expansion interface cable by removing one inch on the expansion interface side. Apparently, the additional length of the Gold-Plug 80 connectors was enough to cause memory problems. I suspect that V.C., R.Z., and L.W. are having problems with their expansion interface cable.

R.M.
Honolulu, HI

That's interesting. I didn't think the Gold-Plugs added enough to make a difference.

How do you connect a Signalman Mark I modem to a Radio Shack Model I with the RS expansion interface and RS-232 board? The modem and the RS cable both terminate in male DB25 plugs. I tried making a short double female cable, but nothing happened. I tried the COMM and TERM positions

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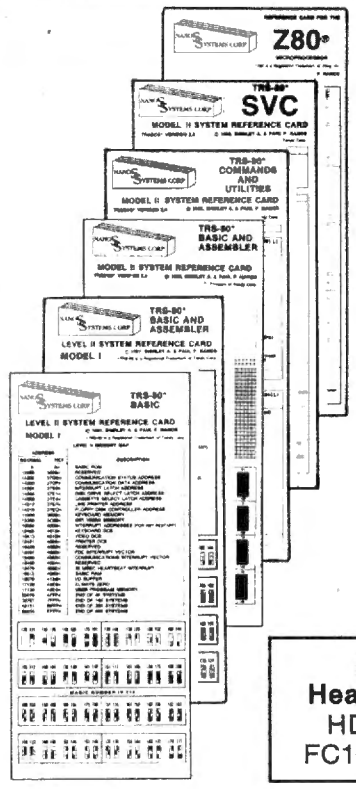

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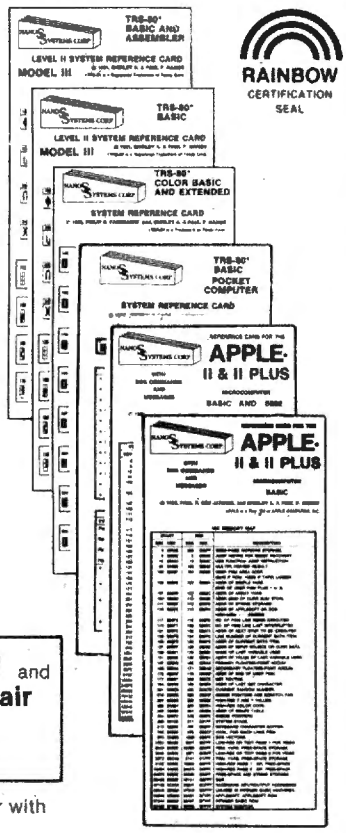

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on the RS-232 board switch without success.

D.M.
Red Bank, TN

First check and make sure the RS-232, board is operational. Short pins 2 and 3 together. Whatever you type in, your terminal program should be echoed to the screen. If it doesn't, the board is making poor contact with the expansion interface. Loosen the screws and fiddle with the board until you get a response.

Second, check the cable you made with a volt/ohmmeter to make sure that all the connections are good and that you don't have any pins accidentally connected together.

Third, check the manuals for the RS-232 board and the Signalman modem to make sure they are using the same pins for the same purpose.

After all that, you should get a response and be ready to go.

I recently upgraded the expansion interface on my Model I from 16K to 32K, but when I Print Mem my total was 38340, which is wrong for a 48K machine. I tried two different sources for the 16K chips, with the same results.

E.C.
Norfolk, VA

You might not have a hardware problem, but rather a misunderstanding. Do you get the 38340 from Level II Basic or from Disk Basic? If you're in Disk Basic, the missing RAM is the DOS and Disk Basic (the DOS and Disk Basic take up almost 10K). The 38340 sounds awfully familiar to me. I vaguely remember that as being the memory size from TRSDOS Basic with a 48K machine.

If you get that response from Level II Basic, take the unit to the repair center. There's nothing you can do unless you have access to an electronics shop and a troubleshooting manual for the Model I.

I typed in the printer driver for the NEC PC-8023A-C printer with Super-Scripsit (April 1983, p. 376). It works fine on my C. Itoh Prowriter 8510, but I can't get a document to double-space just by specifying double-spacing in the open document options. Neither do the super/subscript features work correctly. Not knowing much about Assembly language, I decided to use a few user-defined print codes to do the job.

To double-space, use 27 84 52 56. These codes set the line pitch to 48/144 of an inch. Note that simply using 27 84 48 won't work, as the printer is expecting 2 bytes in ASCII code to describe the pitch.

To superscript, use:

```
27 91
27 84 49 50 27 114 10
27 84 49 52 27 102 10 27 65
27 93
```

I recommend using each line as a separate print code. The first sets the printer to incremental print. The second sets line pitch to 12/144 of an inch, sets reverse line feed on, and sends one line feed. The third sets line pitch at 14/144 of an inch, sets forward line feed on,

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sends a line feed, and resets pitch to normal 1/6 of an inch. Finally, the last line sets the logic seek mode back on. Line 2 has 2/144 of an inch more line feed because the printer doesn't return to the same place it started from if it's given 12/144 of an inch both times. I recommend using four print codes for the same reason. If you're going to be doing several jumps, it's best to set the printer to incremental mode, do the superscripts and subscripts, and then return to logic seek mode.

Subscripting is done in a similar fashion:

```
27 91
27 84 49 50 10
27 84 49 52 27 114 10 27 65 27 102
27 93
```

Note that it's important to be in incremental mode; if you aren't, the printer ignores the entire command. If you're doing this from Basic you'll notice you get a carriage return along with the CHR$(10) if you aren't in incremental mode. Very irritating.

G.J.
Indianapolis, IN

Thanks for the information.

Can you tell me where I can buy the CP/M conversion for a Model II?

Also, can you provide the name or address of any company that copies large numbers of disks for small-time people who want to sell their programs? I'm also looking for Pascal on the Model II.

E.V.
Baltimore, MD

Got your pencil ready? These are companies with CP/M for the Model II:
Aton International—260 Brooklyn Ave., San Jose, CA 95128, 408-554-9922
Cybernetics—8041 Newman Ave., Suite 208, Huntington Beach, CA 92647, 714-848-1922
FMG Corporation—5280 Trail Lake Drive, P.O. Box 16020, Fort Worth, TX 76133, 817-294-2510
Omikron—1127 Heart St., Berkeley, CA 94702, 415-845-8013
Parasitic Engineering—1101 Ninth Ave., Oakland, CA 94606, 415-839-2636
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Now for the Model II Pascal companies:
Alcor—(see previous letter this column)
Digital Research/Language Division—(ibid)
FMG Corporation—(see CP/M listing above)
Hexagon Systems—(see previous listing this column)
Microsoft—(ibid)
Radio Shack—(ibid)
Ticom Systems Inc.—(ibid)

For your second request, I don't have the name of any company that manufactures second-party disk programs, although I do know of one that reproduces tape programs in lots of 100. Are there any companies interested in assisting E.V.?

I have a Model III, two-disk-drive system with LP VIII. The computer, cassette recorder, and printer are all connected to a power strip. When I turn it on the printer's print head moves first to the right margin, and then to the left margin. As the computer comes on, the printer prints an E. Is there any way to prevent this?

After a few minutes there is a soft, but annoying, hum from inside the computer. It sounds like a power transformer. Is it the sign of an impending disaster? I live in Europe and we have a 220V, 50Hz power supply. I'd like also to know what will be involved, when I return to the U.S., in changing my computer from 220V to 110V operation.

P.B.
Zurich, Switzerland

The E is the result of a control code sent by the Model III to the printer port on power up. The easiest solution is to leave your printer off until you need it.

The hum develops because the power supply transformer windings are loose (probably due to age) and vibrating with the 50Hz line supply. Nothing is wrong, and no damage will result. If you can put up with the hum, it doesn't need to be replaced.

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Terry Kepner is a free-lance writer and programmer, and the vice president of Interpro. He's been writing about microcomputers since 1979.

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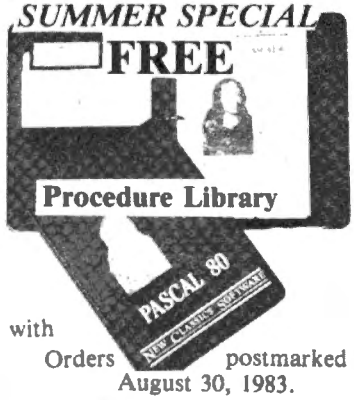

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TAKE II

This column features Model II, 12, and 16 conversions of earlier programs. Readers who have converted programs for their own use are encouraged to submit them.

CRAM, a program by Hardin Brothers, appeared in the August 1982 issue of *80 Micro*. It was short and nicely annotated—a clear candidate for rewriting.

The game is diabolically clever; push any key to make the moving line turn right. The game is over when the line runs into itself or a border. Your score is the number of right turns you are able to make.

While your tendency is to tap out a steady pattern on the keyboard, that strategy leads to a quick finish with few points. A steadily accelerating pace appears to be required, but be careful, the horizontal and vertical rates of motion are not quite the same.

Since the command IF POINT(I,J) is not available in Model II Basic, a few counters remember the increasingly smaller physical bounds of the playing space. A small delay compensates for the vertical movement that otherwise would be too fast with the 4.0 MHz clock. Without the delay, the program differs only in the screen size.

A young child who practiced for hours and an older person who spent a long lunch hour hold the highest scores—both obtained scores of 24. I'll bet you can't play just one game. ■

Rick Johnson is an analyst for Advanced Technology Inc. and can be reached at P.O. Box 41238, Indianapolis, IN 46241.

The Key Box
Model II
32K RAM
Basic

```
10 'CRAM MODEL II- Rick Johnson's rewrite of Hardin Brother's
20 'program in 80 Micro of August 1982.
30 DEFINT A-Z:GOSUB 270
40 L=0:R=79:T=1:B=22:N=0:GOSUB 230
50 ' *** move right
60 J=J+1:IF J=R THEN 200ELSE PRINT@(I,J),"*";
70 IF INKEY$="" THEN 60ELSE N=N+1:R=J
80 ' *** move down
90 GOSUB 180:I=I+1:IF I=B THEN 200ELSE PRINT@(I,J),"*";
100 IF INKEY$="" THEN 90ELSE N=N+1:B=I
110 ' *** move left
120 J=J-1:IF J=L THEN 200ELSE PRINT@(I,J),"*";
130 IF INKEY$="" THEN 120ELSE N=N+1:L=J
140 ' *** move up
150 GOSUB 180:I=I-1:IF I=T THEN 200ELSE PRINT@(I,J),"*";
160 IF INKEY$="" THEN 150ELSE N=N+1:T=I:GOTO 60
170 ' *** delay vertical
180 FOR Z=1 TO 20:NEXT Z:RETURN
190 ' *** game over
200 CLS:PRINT@ 820,"Turns=";N, "Previous high=";M:IF N>M THEN M=N
210 FOR I=1 TO 2000:NEXT I:GOTO 40
220 ' *** initialize border
230 CLS:FOR J=0 TO 79:PRINT@(0,J),"-";:PRINT@(22,J),"-";:NEXT J
240 FOR I=0 TO 22:PRINT@(I,0),"|";:PRINT@(I,79),"|";:NEXT I
250 I=1:J=0:A$=INKEY$:RETURN
260 ' *** directions
270 FOR I=1 TO 20:CLS:PRINT CHR$(26):CLS:PRINT CHR$(25):CLS:NEXT I
280 CLS:PRINT TAB(8),"Welcome to the game of CRAM":M=0
290 PRINT:PRINT"Do you want instructions?"
300 A$=INKEY$:IF A$="" THEN 300
310 IF A$="N" OR A$="n" THEN CLS:RETURN
320 IF A$="Y" OR A$="y" THEN 330ELSE 280
330 PRINT:PRINT TAB(8) "The object of the game is to cram as many"
340 PRINT"stars as you can onto the screen. Each time you wish to"
350 PRINT"change the direction of the moving line, press any key"
360 PRINT"except <BREAK>. The game is over when the moving line runs"
370 PRINT"into any previously drawn position. At the end of the game"
380 PRINT"your score will be reported.":PRINT
390 PRINT"Press any key to start the game."
400 A$=INKEY$:IF A$="" THEN 400ELSE CLS:RETURN
410 ' *** L is current Leftmost position, R is Right
420 ' *** T is Top, B is Bottom, N is Number counter for turns
```

Program Listing

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B. How do you acquire most of your software?
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- ☐3. From friends and other programmers
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- ☐5. Copy it

C. Where do you buy most of your computer hardware?
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- ☐6. Model 16
- ☐7. Model 12
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E. How much have you invested in computer hardware (including peripherals) during the last 12 months?
- ☐1. Nothing
- ☐2. Under $1,000
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- ☐5. $3,000–$4,000
- ☐6. $4,000–$5,000
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F. How much do you plan to spend on computer hardware (including peripherals) during the next 12 months?
- ☐1. Nothing
- ☐2. Under $1,000
- ☐3. $1,000–$2,000
- ☐4. $2,000–$3,000
- ☐5. $3,000–$4,000
- ☐6. $4,000–$5,000
- ☐7. Over $5,000

G. Which of the following peripherals do you plan to buy during the next 12 months?
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H. Do you ever write Assembly-language programs?
- ☐1. Yes
- ☐2. No

I. Do you invest in the stock market?
- ☐1. Yes
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J. The articles in 80 Micro are
- ☐1. Too simple
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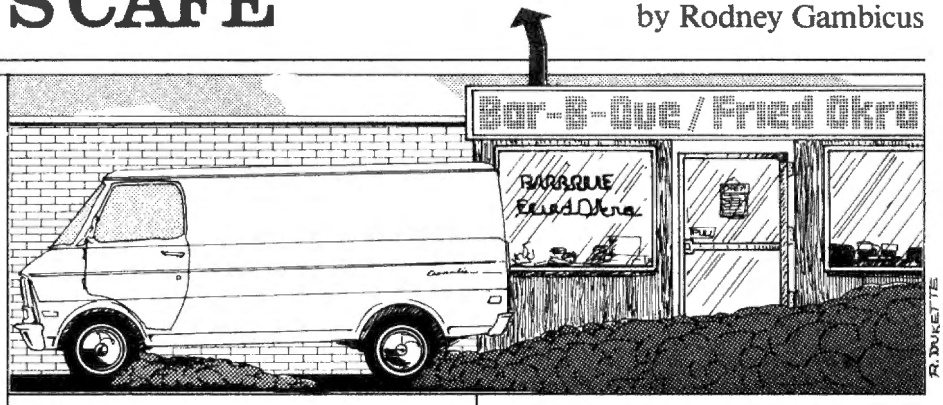
The GAMER'S CAFE

by Rodney Gambicus



Take that, Scott McClure

We'd never have gotten into this jam if Max hadn't stopped for fried okra in Marietta. We were heading south on Route 80, planning to bypass Atlanta and stop in Macon. That is, until Max spotted the neon sign.

"Bar-B-Que! Fried okra!"

Next thing you know, we'd crossed the median, dodged a line of Georgia traffic, and headed back the other way. Econolines are not meant to jump medians. I thought we'd had it. I could tell Mercedes did too; she made a syntax error in the program she was writing.

While Max traded our extra copy of Dig Out for three orders of okra and four barbecue sandwiches to go, Mercedes and I decided to set up the Cafe in Atlanta after all: spread some gamers' good will, soak up that Southern hospitality, and keep Max off the highways for a while.

The plan was good, but my sense of direction was bad. I proceeded to circle the city on I-95 until sundown, muttering, "How do you get off this beltway?" while the others lost themselves in lunch ("This isn't bad," Mercedes said. "It's sort of like zucchini") and the mail.

*****

Modesty is the true sign of a serious gamer, and Scott McClure, the "Expert High Score Demolisher" of Winter Park, FL (he bellowed, "I HAVE SPOKEN" in May), has been rebuked by several readers. Some thought his letter a joke or deplored his boasting; Jim Dossey of Ocala, FL was more businesslike—"I think he brags too much, so I beat his Bounceoids score (3,059,800 to 2,028,450)."

But even Jim's score must bow to Chas Weiss (Cleveland, OH), who had the game reset on him at 8,879,950 points with 135 men left. There's a remarkable silence from Winter Park.

Speaking of high scores ("Do we ever speak of anything else?" Mercedes muttered), we're considering dropping some entries from the board. Steven C. Ohliger II of Cincinnati may be innocent—he says, "I guess I found out the secret of the game Armored Patrol"—but his score of 1,000,000 makes us think he's stumbled into the "garage," as A.P. experts call it.

80 Micro revealed this invulnerable shelter in August 1982 (p. 21), and it seems the trick could make score claims meaningless. Steve Kolokowsky of Spring Valley, NY, even topped 500,000 just by leaving the game on all night.

Patrick Kellogg (White Bear Lake, MN) writes with other suspect games: "If you load in Super Nova in double-spaced (CHR$(23)) letters, you can play the game while your ship disappears. You can play forever doing this.

"Liberator will contort itself at 400,000 points, where the player can walk through walls, barrels, anything. And if you get blown up while bombing the base in Penetrator, you can fly underground. . . . Hasn't anyone else found these programming errors?"

We may drop these games from the Much-Too-Big Board (as the editors in Peterborough call it). Meanwhile, Patrick adds, "How about the secret message in Asylum, the 'dividing line' in Eliminator, or the way to get 10,000 free points in Demon Attack? But that's for you to find out."

Finally, there's someone with no name, no address, and no spelling: "My name is Doctor Damage. That's all you'll ever now." We'll print scores without photos, but only from real people.

*****

Max had been looking at the prism-and-glass cityscape and mumbling "Rhett Butler. . . here?" and Mercedes had fallen asleep by the time I veered off the beltway somewhere on the outskirts of town. The first thing we saw was a sign for a place called the Limelight.

"A bar?" Max asked, looking at me.

"Drinks? Beer? Pretzels?" I murmured, looking at him.

"Months on the road sharing milk shakes with an 11-year-old," he growled. "I've had it." So we locked Mercedes in the van and rushed for the entrance.

Once inside, Max and I just stood on the balcony taking it all in: the lights flashing in the cavernous black interior; the frenetic dancers amidst the Lucite; New Wave music, decibels beyond our Radio Shack Minisette.

It was there, beers in hand, that we came to the awful realization: We couldn't think of anything to think or talk about but the Cafe. The dancers reminded Max of Apple Panic, and the lights made me think of readers' answers to our call for screen photo tips.

Michael Peters, district technical representative for Business Imaging Systems, sent advice from Eastman Kodak: "Adding light from a flash or other source only serves to overpower the light produced from the monitor. Try photographing the screen with little or no room light and no flash.

"For best results, use a shutter speed slower than 1/60 of a second to permit a complete scan. Faster speeds will cause a diagonal band to appear on the screen, obliterating information."

Kurt Plowman (Harrisonburg, VA) recommends an even slower speed—1/30, sometimes 1/15 or 1/8—since the monitor is displaying 30 frames per second. Carl Mann (Newburyport, NH) adds that 400 ASA color film works nicely; set the f-stop or aperture after you set the shutter speed.

Inexpensive models with fixed focus and aperture, Carl says, just can't use the screen's light, though an SX-70 or other instant camera with an automatic shutter might do the job.

*****

Conversation was dragging again when Max suddenly spilled his beer. "Mercedes!"

"What?" I followed his shaking finger and saw someone cutting across the dance floor. "Here?"

"No," Max said hopefully. "Could be anyone."

"With dyed hair, leather flight jacket, tap shoes, and a Model 100 slung on her hip from a guitar strap?" I moaned. "It's her all right."

Max was so unnerved at seeing her that he jumped off the balcony and landed below on all fours. He won the dance contest. I took the stairs.

We caught up with her just as she was describing audio spectrum analyzers and sound frequencies to a member of the stage crew. "Oh, hi, guys. This is a neat place. Did you know the Tubes use a Color Computer to synchronize their light display?"

At that moment a security guard arrived, shouting something about jumping off the balcony and being underage. He made us wait backstage while he called Mercedes' dad in Baltimore.

"Twenty years to life," I muttered. "This is going to put us behind schedule on the one-line games contest."

"I think I'll write an adventure and enter the contest myself," Max said. "Win a subscription to *80 Micro* for the Harlan County Jail."

He grabbed a napkin and started scribbling:

```
10 CLS:PRINT"WELCOME TO...";
:FORX=1TO800:NEXT:PRINT"ESCAPE
FROM DOOM!":FORY=1TO2STEP0:"FORX
=1TO800:NEXTX:CLS:INPUT"You are in a
room with 3 doors marked 1, 2, & 3. Which do you
want";A:IFA=1CLS:PRINT"Wow! You've
escaped!"ELSECLS:PRINT"Sorry, try
again!":NEXTY
```

Mercedes was not impressed: "Geez, that's even duller than the guess-the-random-number games."

"There's a line here that's too long for the screen," I added. "Could you put in a carriage return?"

"No way," Max said. "I had to go into Edit mode to get the last few characters in."

"And that was after I showed him how to use question marks for PRINT," Mercedes muttered.

"Miss Silver?" the guard yelled. "Your father wants to talk to you." Mercedes winced and scurried off to the phone. She returned, walking very fast—"Dad told them we were harmless; let's get out of here"—and we made, as the saying goes, a bolt for the door.

*****

So we're back on the road—Mercedes' dad apparently wants us to take her straight to Baltimore, but she says the Epcot Center and Disney World are very educational—and the contest's on schedule after all.

If you think you can do better than Max (either adventure or arcade, as long as it fits in 255 bytes of Model I/III/4 Basic), send those games, postmarked by August 1. We're going to publish a bunch of runners-up as well as the lucky subscription winner.

And Max says he's working on a tip sheet for Escape from Doom.■

The Big Board

Alien Defense	1,124,950	Tommy Seniuk, Vegreville, Alta.
Armored Patrol	1,000,000*	Steven Ohliger, Cincinnati, OH
Astro Blast (CC)	15,225	Andrew Puglise, Aliquippa, PA
Attack Force	1,306,810	Johanna Bennett, Ft. Greeley, AK
Bable Terror	7,858	Mad Max
Barricade	17,520	Troy Scrapchansky, Uncasville, CT
Bounceoids	8,879,450	Chas Weiss, Cleveland, OH
Caterpillar	249,656	David Smith, Kingwood, TX
Chicken	8,922	Halfdan Hansen, Nelson, N.Z.
Cosmic Fighter	581,280	L. Ken Jackway, Phoenix, AZ
Cyborg	99,960	George Heineman, Framingham, MA
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Voyager I	833	Farhad Abrishami, Silver Spring, MD
Weerd	17,120	Chris Athanas, Topsham, ME

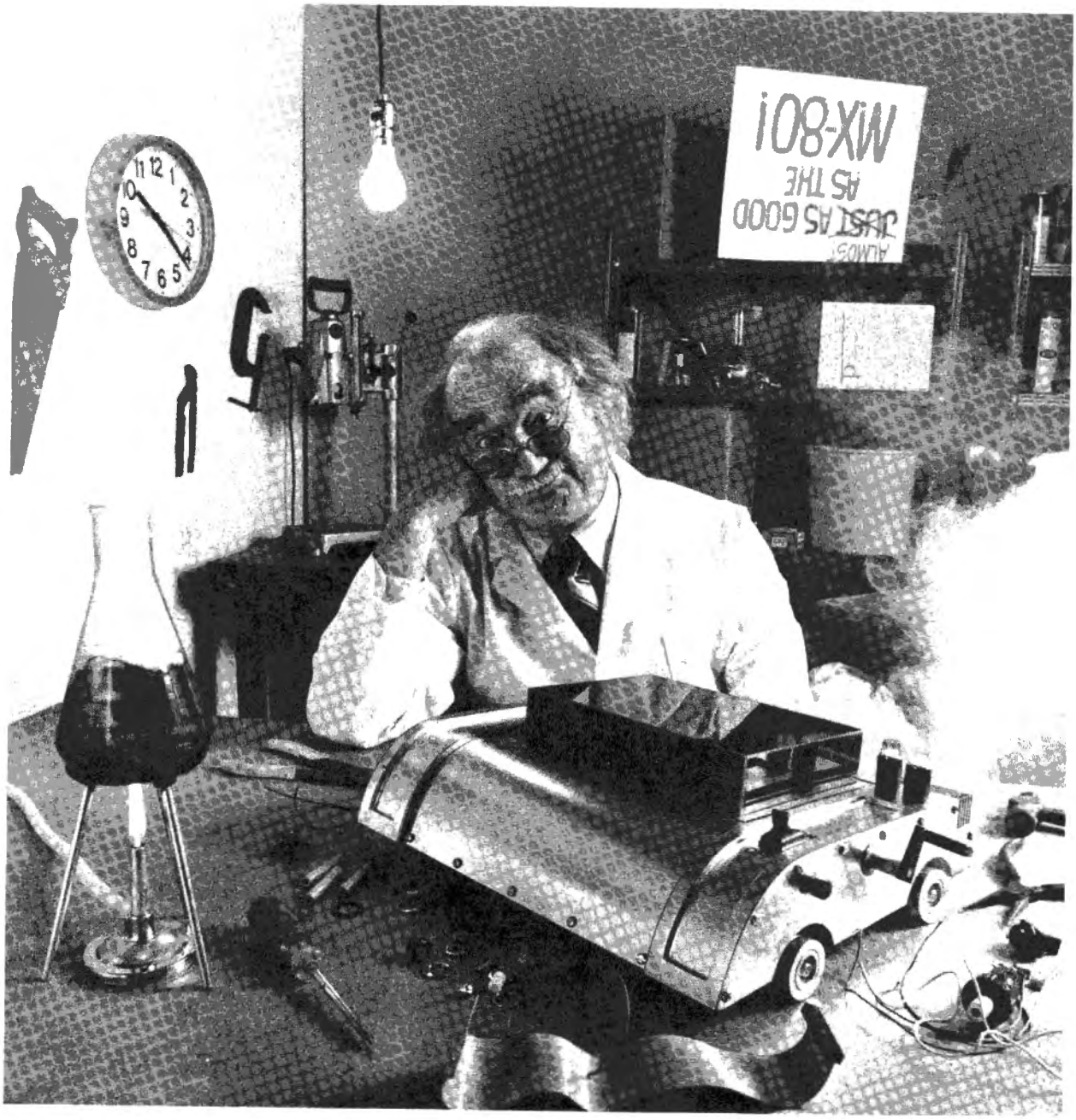
* Armored Patrol and several other games are on Cafe probation. See next month's Big Board for the verdict.

** Solo record: 2,423,850 (Michael Titus, Horseheads, NY).

\+ Level 6.

\+\+ Expert mode: 339,080 (David Smith, Kingwood, TX).

Gamer's Cafe readers are invited to submit their high scores, for these and other TRS-80 games. We'll print unvalidated scores, but validated ones (a photo of the screen) will, of course, rank higher in prestige.



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The Epson MX-80 is the best-selling dot matrix impact printer in the world. It has been since its introduction. And despite the host of imitators it spawned, no one has been able to top it. Until now.

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The new Epson FX-80 is far more than just doo-dads added on to last year's model. It's the most astonishing collection of features ever assembled in a personal printer.

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But that hardly scratches the surface.

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With the new FX-80, you aren't limited to ASCII characters. You can create your own. Any character or symbol that can be defined in a 9x11 matrix can be added to the FX-80's already impressive library of type styles and stored in its integral 2K RAM.

So you can create "Sally's Gothic" or "Tom's Roman" just by downloading and modifying standard characters. Or you can create a custom set from scratch. Either way, you can store up to 256 new characters. And if you don't need a new alphabet, the RAM functions as a 2K data input buffer.

Who knows graphics better than Epson?
Nobody, that's who. And if you don't believe it, witness the FX-80.

With a 12K ROM capacity, the FX-80 gives you a few things the others don't. For example, not one, not two, but *seven* different dot addressable graphic modes are program selectable. And can be mixed in the same print line. Everything from 72 DPI (dots-per-inch) Plotter Graphics to the 640 dots per line resolution designed to match the remarkable monitor clarity of the Epson QX-10 personal computer.

And *that* is in addition to an astonishing array of 136 different user-selectable type styles including Proportional, Elite and Italic as well as the more conventional faces you get on other printers.

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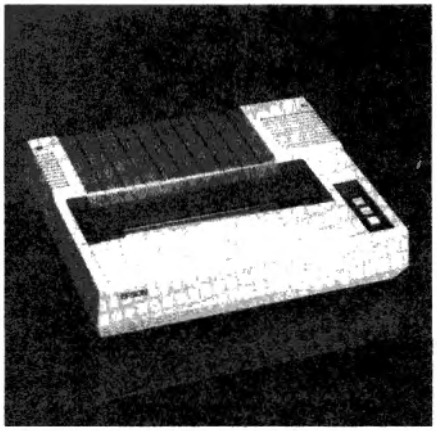
We'd be willing to bet that the FX-80 — like the MX-80 — will have its share of imitators. Don't be fooled. To make sure you get the genuine article, rush down to your local computer store right now and let them show you everything the FX-80 can do.

And while you're there ... ask them to show you how it works with our computers.



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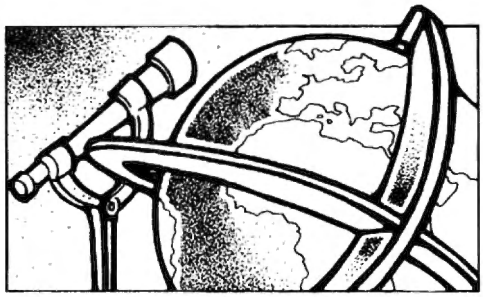
COPERNICA MATHEMATICA

by Bruce Douglass



Eigenvalues and eigenvectors

A variety of problems in science, engineering, mathematics, and statistics lead to eigenvalues. The determination of frequencies in freely oscillating mechanical or electrical systems, or critical frequencies for rotating shafts, lead to eigenvalue problems. The solutions of many partial differential equations also lead to eigenvalue problems. Determining the principal components of regression matrices (a type of statistical analysis called factor analysis) and determining the relationship between two groups of correlations (called cannonical correlation) lead to eigenvalue problems.

An eigenvalue is also known as a characteristic value. In equation 1, A is a square n by n matrix, λ is a scalar (real number), and X is an n by 1 vector:

$$AX = \lambda X \qquad \text{Equation 1}$$

The values of λ that make equation 1 true for matrix A are called the *eigenvalues*. The vectors X that make the equation true for some λ are called *eigenvectors*. Together, an eigenvalue and its corresponding eigenvector are called an *eigenpair*.

In principle, the λ's are easy to find. If you evaluate the determinant in equation 2, you obtain the nth-order polynomial. The I in equation 2 is the nth-order identity matrix. The roots of this polynomial are the eigenvalues. The polynomial arrived at is the *characteristic equation*.

$$\det(\lambda I - A) = 0 \qquad \text{Equation 2}$$

Determination and solution of the characteristic equation is one of the least practical methods for solving eigenvalue problems, however. First, expanding the determinant of a 20 by 20 matrix requires 10^{18} arithmetic operations. Since errors add up, the coefficients for the characteristic equation may be totally meaningless by the time the expansion is complete. Add to this the round-off error due to numerical solutions of the polynomials, and you have a pretty bad mess.

The most popular method for determining the largest eigenvalue is the *power method*. Assume that the square matrix A has n eigenvalues, one of which is larger than the others, and that A has n linearly independent eigenvectors $U_1 \ldots U_n$ (linearly independent means that no eigenvector is produced by the combination of the other eigenvectors).

Any vector in the n-dimensional space can be represented by a weighted sum of the various eigenvectors. For an arbitrary vector X0,

$$X_0 = a_1 U_1 + a_2 U_2 + \ldots + a_n U_n \qquad \text{Equation 3}$$

If you let:

$$X_1 = A X_0$$
$$= A (a_1 U_1 + a_2 U_2 + \ldots + a_n U_n) \qquad \text{Equation 4}$$
$$= a_1 A U_1 + a_2 A U_2 + \ldots + a_n A U_n \qquad \text{Equation 5}$$

Since all the U_i's are eigenvectors of A, then

$$A U_i = \lambda_i U_i$$

This is true for all i = 1 to n, so the substitution in equation 5 produces:

```
10 REM  EIGENVALUES VIA POWER METHOD
20 DEFINT I-N:DEF FN MAX(A,B)=-(A>B)*A-(B=>A)*B
25 DEF FN DNE(A,B)=(ABS(A-B)<=0.00001)
30 CLS:PRINT"EIGENVALUES BY POWER METHOD"
40 INPUT"ENTER THE ORDER OF THE MATRIX";N
50 DIM A(N,N),B(N),C(N)
60 PRINT"ENTER THE ROWS OF A"
70 FOR I=1 TO N:PRINT"ROW #";I
80   FOR J=1 TO N:INPUT A(I,J):NEXT J,I
90 PRINT"ENTER INITIAL VECTOR"
100 FOR I=1 TO N:INPUT B(I):NEXT I
110 FOR K=1 TO 10:REM MAX ITERATIONS
120   GOSUB 1000:REM  A(,)*X(K)==>M*X(K+1)
130   GOSUB 3000:REM  COMPUTE B = EIGENVALUE
140   GOSUB 2000:REM  UPDATE VECTOR
150   GOSUB 4000:REM  PRINT APPROXIMATION
160   IF FN DNE(B,B1) THEN PRINT,"CONVERGED!":GOTO 190
170   B1=B:REM  UPDATE LAST EIGENVALUE
180 NEXT K:PRINT,"DID NOT CONVERGE"
190 END
1000 REM  MULTIPLIES A(N X N) BY VECTOR B (N)==> VECTOR C (N)
1010 C=0:FOR I=1 TO N:C(I)=0
1020   FOR J=1 TO N
1030     C(I)=C(I)+A(I,J)*B(J)
1040 NEXT J:C=FN MAX(C,C(I)):NEXT I
1050 FOR I=1 TO N:C(I)=C(I)/C:NEXT I
1060 RETURN
2000 REM STUFF VECTOR C ==> B AND SCALE IT
2010 FOR I=1 TO N:B(I)=C(I):NEXT I
2020 RETURN
3000 REM  GET EIGENVALUE
3010 XK=0:XJ=0:FOR I=1 TO N
3020   XK=B(I)*B(I)+XK
3030   XJ=B(I)*C(I)+XJ
3040 NEXT I
3050 B=C*XK/XJ:REM EIGENVALUE APPROXIMATION
3060 RETURN
4000 REM PRINT RESULTS
4010 PRINT,"CURRENT APPROXIMATION"
4020 PRINT"EIGENVALUE=";B
4030 PRINT"EIGENVECTOR=";:FOR I=1 TO N:PRINT B(I);:NEXT:PRINT
4040 RETURN
```

Program Listing 1

If You Do A Lot Of Editing Of Your BASIC Programs, Then This Is The Editor For You!!!

The Full Screen Text Editor for BASIC, we were the first to give the TRS-80 this indispensable ability. What ability? The ability to edit your BASIC program with the ease of word processing. It is a type of word processor specifically designed to handle BASIC programs instead of letters and documents.

■ **The capability to change, insert and delete a character or characters:**

Simply position the cursor over the character that you wish to change and type in the new one. Another handy feature is Insert Mode, this is used to add text in the middle of a program line.

■ **Extend a line or insert new lines:**

Extending a line is as simple as two keystrokes, instantly the cursor jumps to the end of the program line and the editor is placed in the insert mode.

■ **Delete, copy or move statements:**

All you have to do is mark the line or block of lines and then tell the editor where to move or copy them.

■ **Global Search and/or change any specified string:**

Have you ever needed to change a lot of PRINT statements to LPRINTs?

■ **Macro key facility:**

Macro keys can cut your programming time in half. You can define each of the 26 letter keys (A-Z) to represent BASIC keywords, or any letter or number combination up to 6 characters per key.

■ **Renumber commands:**

Whats so special about this renumber facility? Not only can it renumber selected portions of your program, it also checks all GOTO, GOSUB, THEN and ELSE statements and updates them as needed!

You may have seen other Editor programs advertized that give you one, maybe two of these features. You may have also seen some of these features sold as separate utility programs.
Only CAU offers a complete editing system, not just a word processor patched up to handle line numbers.

You can order the BASIC Editor directly from Computer Applications Unlimited or ask your local computer store.

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Program Listing 2

```
PROGRAM POWER;
  CONST
    MAX_SIZE = 10;  (* maximum size of the matrix *)
  TYPE
    MATRIX = ARRAY(.1..MAX_SIZE,1..MAX_SIZE.) OF REAL;
    VECTOR = ARRAY(.1..MAX_SIZE.) OF REAL;
  VAR
    A     : MATRIX;
    B,C   : VECTOR;
    SIZE,MAX_IT,LOOPS : INTEGER;
    EIGENVALUE,LAST,SCALE    : REAL;
  FUNCTION DONE(A,B: REAL): BOOLEAN;
    BEGIN
      DONE := (ABS(A-B)<=0.00001)
    END;
  PROCEDURE INPUT_MATRIX(VAR A: MATRIX; VAR S: INTEGER);
    VAR
      I,J : INTEGER;
    BEGIN
      WRITE('ENTER THE SIZE OF THE MATRIX: ');
      READLN(S);
      FOR I:= 1 TO S DO
        BEGIN
          WRITELN('ENTER ROW NUMBER',I:4,' ');
          FOR J:= 1 TO S DO
            READLN(A(.I,J.));
        END;
    END;
  PROCEDURE INPUT_VECTOR(VAR V:VECTOR; S:INTEGER);
    VAR
      I : INTEGER;
    BEGIN
      WRITELN('Enter initial guess of eigenvector');
      FOR I:= 1 TO S DO
        BEGIN
          WRITE('ENTER ELEMENT',I:4,' ');
          READLN(V(.I.));
        END;
    END;
   PROCEDURE MULT_A_X_B(VAR A: MATRIX; VAR B,C:VECTOR;
        VAR SCALE: REAL; SIZE: INTEGER);
     VAR
       I,J : INTEGER;
     FUNCTION MAX(A,B: REAL): REAL;
       BEGIN
         IF ABS(A)>ABS(B) THEN
           MAX := A
         ELSE
           MAX := B
       END;    (* end MAX *)
     BEGIN
       SCALE := 0;
       FOR I:= 1 TO SIZE DO
         BEGIN
           C(.I.) := 0;
           FOR J:= 1 TO SIZE DO
             C(.I.) := C(.I.) + A(.I,J.)*B(.J.);
           SCALE := MAX(SCALE,C(.I.));
         END;  (* END FOR I *)
       FOR I:= 1 TO SIZE DO
         C(.I.) := C(.I.)/SCALE
     END;    (* END MULT_A_X_B *)
   PROCEDURE GET_EIGEN(VAR B,C:VECTOR; SIZE: INTEGER;
       VAR EIGENVALUE,SCALE: REAL);
     VAR
       X,Y : REAL;
       I : INTEGER;
     BEGIN
       X := 0;  Y := 0;
       FOR I:= 1 TO SIZE DO
         BEGIN
           X := B(.I.)*B(.I.) + X;
           Y := C(.I.)*B(.I.) + Y;
         END;
       EIGENVALUE := SCALE*X/Y;
   END;  (* END GET_EIGEN *)
  PROCEDURE PRINT(EIGENVALUE: REAL; VAR EIGENVECTOR: VECTOR);
    VAR
      I : INTEGER;
    BEGIN
      WRITELN('Current approximation');
```

Listing 2 continues

$$X_1 = a_1 \lambda_1 U_1 + a_2 \lambda_2 U_2 + \ldots + a_n \lambda_n U_n$$ Equation 6

We can define X_2.

$$X_2 = A X_1 = a_1 \lambda_1 U_1 + \ldots + a_n \lambda_n U_n$$

or

$$X_2 = A X_1 = A^2 X_0$$ Equation 7

We can define a sequence of these X_i's as $X_i = A X_{i-1}$. Therefore,

$$X_k = a_1 \lambda^k U_1 + \ldots + a_n \lambda_n^k U_n$$ Equation 8

We can factor out $\lambda 1^k$, leaving

$$X_k = \lambda 1^k (a_1 U_1 + a_2(\lambda_2^k/\lambda_1^k)U_2 + \ldots + a_n(\lambda_n^k/\lambda_1^k)U_n)$$ Equation 9

Since λ_1 is larger than the rest of the eigenvalues (we assumed we had a largest eigenvalue at the start), then as k approaches infinity all the ratios of $(\lambda i_k / \lambda 1_k)$ will approach zero.

Therefore, for a sufficiently large k:

$$X_k \approx \lambda_1^k a_1 U_1$$ Equation 10

or

$$X_{k+1} = \lambda_1 X_k$$ Equation 11

This is a convergent sequence of numbers. As k gets larger, the accuracy of equation 10 increases, since the other terms get closer to zero.

This approach, formalized into an algorithm, is called the power method. Since you want to find λ_1 (and because division by a vector doesn't make any sense), you need to produce the dot product of both sides of equation 11 and solve for λ_1:

$$\lambda_1 = (V \cdot X_{k+1})/(V \cdot X_k)$$ Equation 12

There are several options for our choice for the vector V, as long as we don't let V be all zeros. A common choice is $V = X_k$. This makes equation 12:

$$\lambda_1 = (X_k \cdot X_{k+1})/(X_k \cdot X_k)$$ Equation 13

By the definition of the eigenvalue problem, the X_k's converge to the eigenvector corresponding to the eigenvalue computed. There is a problem, however.

Listing 2 continued

```
        WRITELN('Eigenvalue =',EIGENVALUE:8:5);
        WRITELN('Eigenvector: ');
        FOR I:= 1 TO SIZE DO
          WRITE(EIGENVECTOR(.I.):16:5);
        WRITELN;
      END; (* END PRINT *)
    BEGIN   (* MAIN PROGRAM STARTS HERE *)
      WRITELN('Eigenvectors by Power Method');
      WRITELN('by Bruce Powel Douglass');
      WRITELN('A-Priori Software, 1983');
      INPUT_MATRIX(A,SIZE);
      INPUT_VECTOR(B,SIZE);
      WRITE('Enter maximum number of iterations: ');
      READLN(MAX_IT);
      LOOPS := 0;
      LAST  := 0;
      WHILE (LOOPS<=MAX_IT) AND NOT(DONE(LAST,EIGENVALUE)) DO
        BEGIN
          LAST := EIGENVALUE;
          MULT_A_X_B(A,B,C,SCALE,SIZE);
          GET_EIGEN(B,C,SIZE,EIGENVALUE,SCALE);
          B := C;  (* UPDATE EIGENVECTOR *)
          PRINT(EIGENVALUE,B);
          LOOPS := LOOPS + 1;
        END;
      IF LOOPS>MAX_IT THEN
       WRITELN('DID NOT CONVERGE!')
      ELSE
        WRITELN('CONVERGED!');
  END.
```

Since these equations compute powers of λ and the eigenvector X, they run the risk of under- or overflow. An overflow occurs when the range of single-precision numbers is exceeded (about 1 E 38). An underflow occurs when the number represented falls between the smallest number greater than zero that the computer can represent in single-precision format and zero, and it is represented as zero. To avoid this problem, we will scale the eigenvector during each iteration by dividing all elements of the eigenvector by the largest element. Numbers are thus not allowed to grow significantly larger than zero during each iteration.

If we let m_i be the scaling factor for the ith iteration, we see the algorithm producing:

$$A X_0 = m_1 X_1 \quad \lambda_1 = m_1 (X_1 \cdot X_0)/(X_1 \cdot X_1)$$
$$A X_1 \quad m_2 X_2 \quad \lambda_2 = m_2 (X_2 \cdot X_1)/(X_2 \cdot X_2)$$

Program Listing 1 (Power) performs this algorithm to find the largest eigenvalue of a square matrix. It assumes the eigenvalue is real and not complex. If the matrix is symmetric, the power method converges twice as fast as for a nonsymmetric matrix. A well-known theorem of linear algebra also assures us

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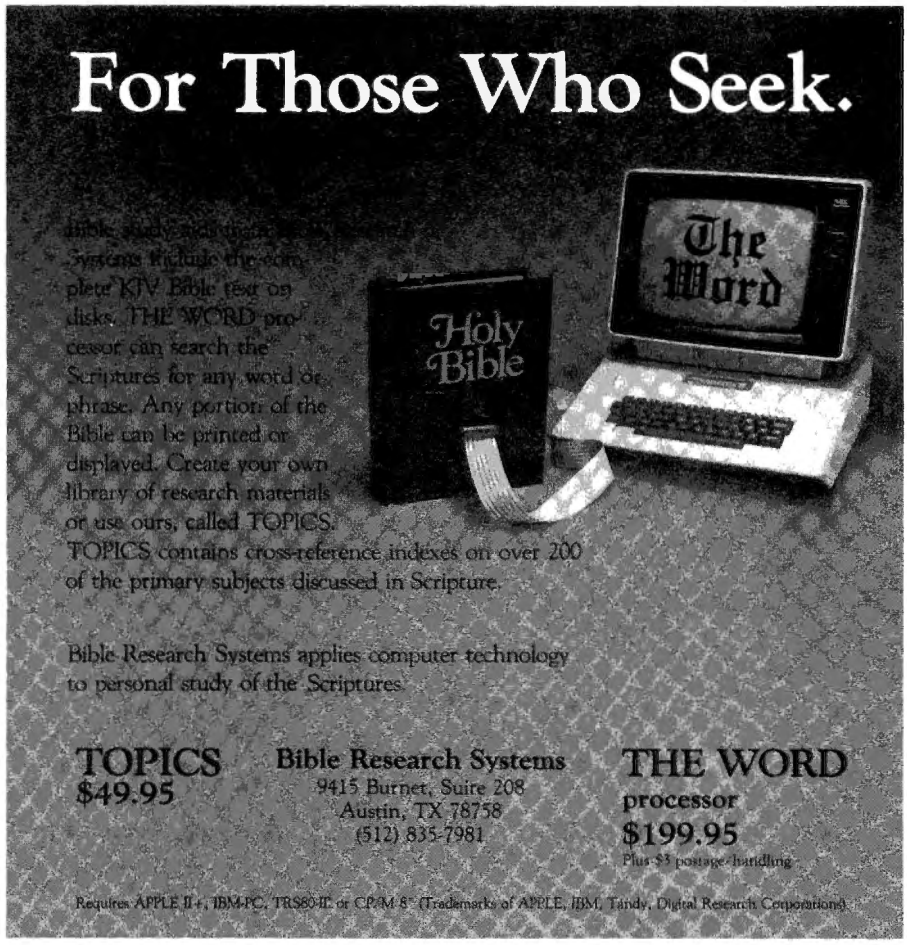

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Program Listing 3

```
10 REM       EIGENVALUES/VECTORS BY DEFLATION-POWER METHOD
20 REM  BY BRUCE POWEL DOUGLASS, A-PRIORI SOFTWARE 1983
30 DEFINT I-L,N:DEF FN MAX(A,B)=-(ABS(A)>ABS(B))*A-(ABS(B)=>ABS(
A))*B
40 DEF FN DNE(A,B)=(ABS(A-B)<=0.0001)
50 CLS:PRINT"EIGENVALUES BY POWER METHOD"
60 INPUT"ENTER THE ORDER OF THE MATRIX";N:N1=N:NS=1
70 DIM A(N,N),B(N),C(N),E(N),DF(N,N),UR(N,N),U(N,N),Z(N,N)
80 PRINT"ENTER THE ROWS OF A"
90 FOR I=1 TO N:PRINT"ROW #";I
100   FOR J=1 TO N:INPUT A(I,J):NEXT J,I
110 FOR I=1 TO N:UR(1,I)=A(1,I):NEXT I
120 PRINT"ENTER INITIAL VECTOR"
130 FOR I=1 TO N:INPUT B(I):NEXT I
140 INPUT"MAXIMUM NUMBER OF ITERATIONS";IT
150 FOR L=1 TO N:REM GET ALL EIGENVALUES
160 FOR K=1 TO IT:REM MAX ITERATIONS
170   GOSUB 290:REM  A(,)*X(K)==>M*X(K+1)
180   GOSUB 390:REM  COMPUTE B = EIGENVALUE
190   GOSUB 360:REM  UPDATE VECTOR
200   GOSUB 460:REM  PRINT APPROXIMATION
210   IF FN DNE(B,B1) THEN PRINT,"CONVERGED!":GOTO 240
220   B1=B:REM  UPDATE LAST EIGENVALUE
230 NEXT K:PRINT,"DID NOT CONVERGE":STOP
240 GOSUB 740:REM  STORE EIGENVALUE AND CALCULATE EIGENVECTOR
250 IF L<N THEN GOSUB 500:REM DEFLATE MATRIX
260 NEXT L
270 GOSUB 680:REM  DISPLAY FINAL RESULTS
280 END
290 REM  MULTIPLIES A(N X N) BY VECTOR B (N)==> VECTOR C (N)
300 C=0:FOR I=NS TO N:C(I)=0
310   FOR J=NS TO N
320     C(I)=C(I)+A(I,J)*B(J)
330 NEXT J:C=FN MAX(C,C(I)):NEXT I
340 FOR I=NS TO N:C(I)=C(I)/C:NEXT I:REM  SCALE VECTOR
350 RETURN
360 REM STUFF VECTOR C ==> B AND Z
370 FOR I=NS TO N:B(I)=C(I)/C(NS):Z(L,I)=B(I):NEXT I
380 RETURN
390 REM  GET EIGENVALUE
400 XK=0:XJ=0:FOR I=NS TO N
410   XK=B(I)*B(I)+XK
420   XJ=B(I)*C(I)+XJ
430 NEXT I
440 B=C*XJ/XK:REM EIGENVALUE APPROXIMATION
450 RETURN
460 REM PRINT RESULTS
470 PRINT"CURRENT APPROXIMATION",
480 PRINT"EIGENVALUE=";B
490 RETURN
500 REM  DEFLATE MATRIX A(,)
510 GOSUB 550:REM BUILD DEFLATION MATRIX DF=A1()*U(I,)
520 GOSUB 610:REM A<== A-DEFLATION MATRIX, N<=N-1
530 FOR I=1 TO NS:B(I)=0:NEXT I:B(NS)=1
540 RETURN
550 REM  BUILD DEFLATION MATRIX <== A1()*U(I,)
560 FOR I=NS TO N
570   FOR J=NS TO N
580   DF(I,J)=C(I)*A(NS,J)
590 NEXT J,I
600 RETURN
610 REM  DEFLATE MATRIX A(N,N) TO A(N-1,N-1) AND
620 REM  DECREASE N<==N-1
630 FOR I=NS TO N:FOR J=NS TO N
640 A(I,J)=A(I,J)-DF(I,J):NEXT J:NEXT I
650 NS=NS+1
660 FOR I=NS TO N:UR(NS,I)=A(NS,I):NEXT I
670 RETURN
680 REM  DISPLAY FINAL RESULTS
690 PRINT"RESULTS:"
700 PRINT"EIGENVALUES: ";:FOR I=1 TO N:PRINT E(I);:NEXT I:PRINT
710 PRINT"EIGENVECTORS ARE THE COLUMNS"
720 FOR I=1 TO N:FOR J=1 TO N:PRINT USING "###.####  ";U(I,J);:N
EXT J:PRINT:NEXT I
730 PRINT:RETURN
740 REM  STORE EIGENVALUES/VECTORS
750 E(L)=B:FOR I=NS TO N:C(I)=B(I)/B(NS):NEXT I
760 GOSUB 800:REM  COMPUTE EIGENVECTOR
770 REM  STORE EIGENVECTOR IN COLUMNS OF U
780 FOR I=1 TO N:U(I,L)=B(I):NEXT I
790 RETURN
```

Listing 3 continues

that if the matrix is symmetric, all the eigenvalues are real.

The program asks for the size of the matrix. This is equal to the number of the rows or columns of the matrix. A starting estimate for the eigenvector is also requested. You might type 1 (enter) 0 (enter)...0 (enter), for example. The program then computes the dominant eigenvalue and its corresponding eigenvector.

Consider the matrix A:

$$\begin{vmatrix} 5 & -2 \\ -2 & 2 \end{vmatrix}$$

Enter this 2 by 2 symmetric matrix by rows. Row 1 is 5 and −2. Row 2 is −2 and 2. The true result is $\lambda = 6$ and $X = [1 \; -.5]$.

Power uses the DEF FN capability of Disk Basic. FN MAX(A,B) returns the value of the greater (in absolute terms) of its two arguments. FN MAX(−10,9) returns −10; FN MAX(3,4) returns 4.00. FN DNE(A,B) returns a logical True (−1) if the absolute value of the difference between them is less than 0.00001, the convergence criterion. You can set your own convergence criterion in the program or request it from the user, as you see fit. These functions are simply inserted within the program lines or called as subroutines for Level II users without Disk Basic.

Try Power with the sample problem and see how quickly it converges! Program Listing 2 is the same program written in Pascal. I tested it with Alcor Pascal, but it should run on any standard Pascal implementation, since no special features are used. Note that in Pascal the size of the arrays must be declared since Pascal does not support dynamic array dimensioning.

Well, that's an easy way to find the largest eigenvalue and eigenvector. As it turns out, the initial assumptions are a bit too strict. The largest eigenvalue can be repeated (there can be two largest eigenvalues) and the eigenvectors do not necessarily have to span the vector space for the power method to converge. For some problems, all you need is the largest eigenvalue and its eigenvector.

For other problems, however, you must know most or all of the eigenvalues, eigenvectors, or both. Other methods have been developed to solve this problem. I will discuss two: deflation technique and the inverse power method.

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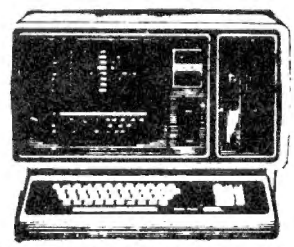

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Listing 3 continued

```
800 REM  COMPUTE EIGENVECTOR
810 REM  B(I) IS PASSED AS THE COMPUTED EIGENVECTOR
820 REM  OF THE DEFLATED MATRIX, AND B(I) IS PASSED
830 REM  OUT AS AN EIGENVECTOR OF THE ORIGINAL MATRIX
840 REM  UR(I,J) HOLDS THE FIRST ROW OF THE VARIOUS
850 REM  DEFLATED MATRICIES
860 REM  Z(I,J) HOLDS THE COMPUTED EIGENVECTORS OF THE
870 REM  DEFLATED MATRICIES. THIS EMULATES A RECURSIVE
880 REM  DEFINITION FOR DETERMINING THE FINAL EIGENVECTOR
890 REM  OF THE ORIGINAL MATRIX
900 FOR I=L-1 TO 1 STEP -1
910   SUM=0:FOR J=1 TO N
920     SUM=SUM+UR(I,J)*B(J)
930   NEXT J:REM  SUM HOLDS THE DOT PRODUCT OF THE ROW AND THE C
OMPUTED EIGENVECTOR
940   IF SUM=0 THEN 990
950   T=(B-E(I))/SUM
960   FOR J=1 TO N
970     B(J)=Z(I,J)+T*B(J)
980   NEXT J
990 NEXT I
1000 RETURN
```

22.406875	7.513724	4.848950	1.327046	1.096595
		Eigenvectors (columns)		
0.245878	0.550962	0.547173	−.341013	−.469358
0.302396	0.709440	−.312570	0.116435	0.542212
0.453215	−.340179	0.618112	0.019591	0.544452
0.577177	−.083411	−.115607	0.682043	−.425866
0.556380	−.265436	−.455494	−.636071	−.088989

Figure 1

The scheme behind the deflation method is to use the power method to determine the largest eigenvalue and eigenvector. Then you factor out this solution from the matrix (deflate the matrix) and reapply the power method.

Let λ_1 be the dominant eigenvalue and U_1 be its eigenvector of matrix A. Both values were determined by the power method. U_1 is normalized by dividing all its elements by the first, leaving a vector $U_1 = [1, u_2/u_1, u_3/u_1, \ldots, u_n/u_1]$, or $U_1 = [1, e_1, e_2, \ldots, e_n]$. Let a_1 be the first row of A, a_2 be the second row, and so on. We can easily demonstrate the following equation:

$$A\,U_1 = \begin{vmatrix} a_{11} & a_{12} & a_{13} & \ldots & a_{1n} \\ . & . & . & \ldots & . \\ . & . & . & \ldots & . \\ . & . & . & \ldots & . \\ a_{n1} & a_{n2} & a_{n3} & \ldots & a_{nn} \end{vmatrix} \begin{vmatrix} 1 \\ . \\ . \\ . \\ e_n \end{vmatrix}$$

$$= \begin{vmatrix} a_{11} + e_2 & a_{12} + e_1 a_{11} + e_n a_{1n} \\ a_{21} + e_2 & a_{22} + e_1 a_{23} + e_n a_{2n} \\ & \ldots\ldots\ldots \\ & \ldots\ldots\ldots \\ a_{n1} + e_2 & a_{n2} + e_3 a_{n3} + e_n a_{nn} \end{vmatrix}$$

$$= \lambda_1 U_1$$

which implies

$a_1 U_1 = \lambda_1$

$a_1 U_2 = \lambda_2$

so we form the matrix

$$A - U_1 \cdot a_1$$

which zeros out the top row of the result:

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} & \ldots & a_{1n} \\ . & . & . & \ldots & . \\ a_{n1} & a_{n2} & a_{n3} & \ldots & a_{nn} \end{vmatrix} - \begin{vmatrix} 1 \\ . \\ e_n \end{vmatrix} \begin{vmatrix} a_{11} & a_{12} & \ldots & a_{1n} \end{vmatrix}$$

$$= \begin{vmatrix} 0 & 0 & 0 & \ldots & 0 \\ z & & & & \\ z & & B & & \\ z & & & & \\ z & & & & \end{vmatrix}$$

The result of the process A − U1·a1 leaves an n by n matrix with the top row

Continues on p. 338

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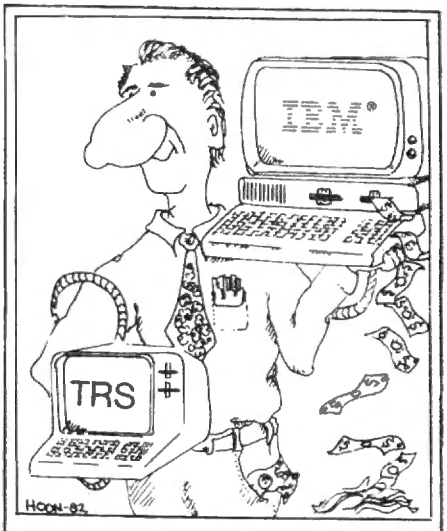
Program Listing 4

```
PROGRAM DEFLATE;
  CONST
    MAX_SIZE = 10;  (* maximum size of the matrix *)
  TYPE
    VECTOR = ARRAY(.1..MAX_SIZE.) OF REAL;
    MATRIX = ARRAY(.1..MAX_SIZE.) OF VECTOR;
  VAR
    A,U,UR,Z : MATRIX;
    B,C,E    : VECTOR;
    SIZE,MAX_IT,LOOPS,L,J,NS,I : INTEGER;
    EIGENVALUE,LAST,SCALE   : REAL;
  PROCEDURE INITIALIZE(VAR A,U,UR,Z: MATRIX);
    VAR
      I,J : INTEGER;
    BEGIN
      FOR I:= 1 TO MAX_SIZE DO
        FOR J:= 1 TO MAX_SIZE DO
          BEGIN
            A(.I,J.):=0;
            U(.I,J.):=0;
            UR(.I,J.):=0;
            Z(.I,J.):=0;
          END;
    END;
  FUNCTION DONE(A,B: REAL): BOOLEAN;
    BEGIN
      DONE := (ABS(A-B)<=0.00001)
    END;
  PROCEDURE INPUT_MATRIX(VAR A,UR: MATRIX; VAR S: INTEGER);
    VAR
      I,J : INTEGER;
    BEGIN
      WRITE('ENTER THE SIZE OF THE MATRIX: ');
      READLN(S);
      FOR I:= 1 TO S DO
        BEGIN
          WRITELN('ENTER ROW NUMBER',I:4,' ');
          FOR J:= 1 TO S DO
            READLN(A(.I,J.));
        END;
      UR(.1.):= A(.1.);
    END;
  PROCEDURE INPUT_VECTOR(VAR V:VECTOR; S:INTEGER);
    VAR
      I : INTEGER;
    BEGIN
      WRITELN('Enter initial guess of eigenvector');
      FOR I:= 1 TO S DO
        BEGIN
          WRITE('ENTER ELEMENT',I:4,' ');
          READLN(V(.I.));
        END;
    END;
   PROCEDURE MULT_A_X_B(VAR A: MATRIX; VAR B,C:VECTOR;
        VAR SCALE: REAL; SIZE,NS: INTEGER);
     VAR
       I,J : INTEGER;
     FUNCTION MAX(A,B: REAL): REAL;
       BEGIN
         IF ABS(A)>ABS(B) THEN
           MAX := A
      FOR I:= 1 TO NS-1 DO
        B(.I.):= 0;
      B(.NS.):= 1;
    END;   (* END REDUCE *)
  PROCEDURE PRINT(EIGENVALUE: REAL; VAR EIGENVECTOR: VECTOR);
    VAR
      I : INTEGER;
    BEGIN
      WRITELN('Current approximation');
      WRITELN('Eigenvalue =',EIGENVALUE:8:5);
      WRITELN('Eigenvector: ');
      FOR I:= 1 TO SIZE DO
        WRITE(EIGENVECTOR(.I.):16:5);
      WRITELN;
    END; (* END PRINT *)
  PROCEDURE PRINT_RESULTS(EIGENVALUES: VECTOR;
       VAR EIGENMATRIX: MATRIX; SIZE:INTEGER);
    VAR
      I,J : INTEGER;
    BEGIN
```

Listing 4 continues



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Listing 4 continued

```
          WRITELN('Final results');
          WRITELN('Eigenvalues');
          FOR I:= 1 TO SIZE DO
          WRITE(EIGENVALUES(.I.):8:5);
          WRITELN;
          WRITELN('Eigenvectors are the columns: ');
          FOR I:= 1 TO SIZE DO
            BEGIN
              FOR J:= 1 TO SIZE DO
                WRITE(EIGENMATRIX(.I,J.):16:5);
              WRITELN;
            END;
        END;     (* END PRINT_RESULTS *)
      BEGIN   (* MAIN PROGRAM STARTS HERE *)
        WRITELN('Eigenvalues/vectors by Deflation-Power Method');
        WRITELN('by Bruce Powel Douglass');
        WRITELN('A-Priori Software, 1983');
        WRITELN('Initializing ...');
        INITIALIZE(A,U,UR,Z);
        INPUT_MATRIX(A,UR,SIZE);
        INPUT_VECTOR(B,SIZE);
        WRITE('Enter maximum number of iterations: ');
        READLN(MAX_IT);
        NS:= 1;
        FOR L:= 1 TO SIZE DO
          BEGIN
          LOOPS := 0;
          LAST  := 0;
          EIGENVALUE := 1;
          WHILE (LOOPS<=MAX_IT) AND NOT(DONE(LAST,EIGENVALUE)) DO
            BEGIN
            LAST := EIGENVALUE;
            MULT_A_X_B(A,B,C,SCALE,SIZE,NS);
            GET_EIGEN(B,C,SIZE,NS,EIGENVALUE,SCALE);
            (* UPDATE EIGENVECTOR *)
            FOR I:=NS TO SIZE DO
              B(.I.):= C(.I.)/C(.NS.);
            PRINT(EIGENVALUE,B);
            LOOPS := LOOPS + 1;
          END;
          IF LOOPS>MAX_IT THEN
            WRITELN('DID NOT CONVERGE!')
          ELSE
            WRITELN('CONVERGED!');
          Z(.L.) := B; (* STORE EIGENVECTOR OF SUBMATRIX *)
          UPDATE_VECTOR(L,NS,EIGENVALUE,C,E,UR,Z);
          IF L<SIZE THEN
             REDUCE(A,NS,SIZE,C);
          END;    (* END FOR L *)
        PRINT_RESULTS(E,U,SIZE);
    END.
            ELSE
              MAX := B
          END;    (* end MAX *)
        BEGIN
          SCALE := 0;
          FOR I:= NS TO SIZE DO
            BEGIN
              C(.I.) := 0;
              FOR J:= NS TO SIZE DO
                C(.I.) := C(.I.) + A(.I,J.)*B(.J.);
              SCALE := MAX(SCALE,C(.I.));
            END;   (* END FOR I *)
          FOR I:= NS TO SIZE DO
            C(.I.) := C(.I.)/SCALE
        END;    (* END MULT_A_X_B *)
      PROCEDURE GET_EIGEN(VAR B,C:VECTOR; SIZE,NS: INTEGER;
          VAR EIGENVALUE,SCALE: REAL);
        VAR
          X,Y : REAL;
          I : INTEGER;
        BEGIN
          X := 0;  Y := 0;
          FOR I:= NS TO SIZE DO
            BEGIN
              X := B(.I.)*B(.I.) + X;
              Y := C(.I.)*B(.I.) + Y;
            END;
          EIGENVALUE := SCALE*Y/X;
      END;   (* END GET_EIGEN *)
      PROCEDURE UPDATE_VECTOR(L,NS: INTEGER; VAR EIGEN:REAL;
        VAR C,E: VECTOR;  VAR UR,Z: MATRIX);
        VAR
```

Listing 4 continues

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Listing 4 continued

```
        I,J  : INTEGER;
        SUM,T: REAL;
      BEGIN
        E(.L.) := EIGEN;
        FOR I:= NS TO SIZE DO
          C(.I.) := B(.I.)/B(.NS.);
        FOR I:= L-1 DOWNTO 1 DO
          BEGIN
            SUM := 0;
            FOR J:= 1 TO SIZE DO
               SUM := SUM + UR(.I,J.)*B(.J.);
            IF SUM<>0 THEN
              BEGIN
                T := (EIGEN-E(.I.))/SUM;
                FOR J:= 1 TO SIZE DO
                  B(.J.):= Z(.I,J.)+T*B(.J.);
              END    (* END IF *)
          END;  (* END FOR I *)
        FOR I:= 1 TO SIZE DO
          U(.I,L.):= B(.I.);
      END;    (* END  UPDATE_VECTOR *)
    PROCEDURE REDUCE(VAR A:MATRIX; VAR NS:INTEGER;
       SIZE:INTEGER; VAR C:VECTOR);
      VAR
        I,J : INTEGER;
        DF  : MATRIX;
      BEGIN
        FOR I:= NS TO SIZE DO
          FOR J:= NS TO SIZE DO
             DF(.I,J.):= C(.I.)*A(.NS,J.);
        FOR I:= NS TO SIZE DO
          FOR J:= NS TO SIZE DO
            A(.I,J.):= A(.I,J.)-DF(.I,J.);
        NS := NS + 1;
        FOR I:= NS TO SIZE DO
            UR(.NS,I.) := A(.NS,I.);
```

Eigenvalues

22.4069	7.51783	4.84594	1.32684	−1.09688

Eigenvectors (columns)

1.0000	1.0000	1.0000	1.0000	1.0000
1.2299	1.2875	−.5792	−.3443	−1.1582
1.8425	−.6173	1.1378	−.0552	−1.1585
2.3467	−.1514	−.2108	−2.0012	0.9081
2.2620	−.4818	−.8335	1.8675	0.1911

Eigenvectors (columns)

0.245878	0.550962	0.547173	−.341013	−.469358
0.302397	0.709353	−.316931	0.117402	0.543634
0.45301	−.3401	0.622593	0.018811	0.543765
0.576998	−.083417	−.115339	0.682444	−.426239
0.556187	−.265456	−.465066	−.636844	−.089681

Eigenvalue errors

−.00002	−.00411	0.00301	0.00021	0.00029

Eigenvector errors

0.00000	0.00000	0.00000	0.00000	0.00000
−.00000	0.00009	0.00436	−.00097	−.00142
0.00020	−.00008	−.00448	0.00078	0.00069
0.00018	0.00001	−.00027	.00040	0.00037
0.00019	0.00002	0.00057	0.00077	0.00069

Fig. 2. Computed Eigenpairs from 5×5 matrix

Continued from p. 334

all zeros. After a little algebra, if λ is an eigenvalue of the smaller $(n-1)$ by $(n-1)$ submatrix B, then it is also an eigenvalue of A, the original matrix. B is a deflated matrix to which you can now apply the power method to find the next most dominant eigenvalue.

Producing the eigenvectors is a little more difficult. The power method applied to matrix B produces an eigenvalue λ_2 and corresponding eigenvector V. Because V has only n − 1 elements, put a zero in the first position, so that it has a total of n elements. However, V is not, in general, an eigenvector of A; it is a linear combination of the most dominant eigenvector and the next most dominant eigenvector. In fact, we can show that

$$U_2 = U_1 - tV$$

where

$$t = (\lambda_1 - \lambda_2)/(a_1 \cdot V)$$

(U_1 and U_2 are the most dominant and next most dominant eigenvectors).

If you compute a third submatrix, C, then the power method produces λ_3 (an eigenvalue of A) and V (a linear combination of U_1, U_2, and U_3). You can iteratively proceed until you've determined all eigenvalues and vectors. The Basic code in Program Listing 3 does this, as does the Pascal in Program Listing 4.

The eigenvectors are computed along with the eigenvalues, as in the straight power method. However, to come up with an eigenvector to the original matrix, you must recursively compute the eigenvectors by determining the vector corresponding to the current eigenvector of the next smallest submatrix that is an eigenvector of the next largest submatrix, until you are back to your original matrix. Easier to compute than to say!

Using the deflation programs, you can compute the eigenvalues and their corresponding eigenvectors from real matrices. If the eigenvalues are complex, the programs have a lot of trouble. But if they are all real, as is the case with a symmetric matrix, the program finds reasonable answers.

For example, run the deflation program for the following matrix:

5	4	3	2	1
4	6	0	4	3
3	0	7	6	5
2	4	6	8	7
1	3	5	7	9

The actual answers are in Fig. 1. The first row holds the eigenvalues in the order they are computed, from largest

to smallest. The column vectors below each eigenvalue are the corresponding eigenvectors.

Figure 2 shows the results returned from the deflation program. The eigenvectors produced by the deflation programs are scaled with respect to the first element. Let's "unscale" them, and compare the computed results with the actual results (see Fig. 3).

Figure 4 shows the error associated with the computed eigenvalues and eigenvectors. The eigenvectors tend to be more accurate the earlier they are computed. The same is also true for the eigenvectors, but the eigenvalues are normally more accurate than the eigenvectors. (I determined the error by subtracting the computed values from the actual values.)

For larger matrices, the deflation method is limited by accumulated round-off error. Since numerical error occurs during deflation, each deflation matrix is in error. This means the coefficients of the deflated matrix are slightly inaccurate.

The next deflated matrix includes local error produced by deflation, and the error associated with the previous deflation step. This is called accumulated round-off error. It means there is an upper limit on the number of deflations you can do and still come up with a reasonable answer. Certainly, the 10th eigenvalue is suspect. The error accumulates at different rates depending on the nature of the matrix. If the matrix is ill-conditioned, error accumulates more rapidly.

One way out of this mess is to use the deflation method to obtain initial estimates of the eigenvalues and eigenvectors, and then apply the *inverse power method* to get better estimates of the true answers.

The inverse power method works just like the power method. You might recall that the power method finds the largest eigenvalue and its corresponding eigenvector. It is easy to prove that the smallest eigenvalue of a given matrix is the reciprocal of the matrix's largest inverse. After inverting the matrix, you can find the smallest eigenvalue of the original matrix by applying the power method to it.

With a little trickery, you can use the inverse power method to find any eigenvalue of the original matrix, provided that you have a decent estimate of it (here's where the deflation method comes in).

Let α be the estimate for the ith eigenvalue (it needn't be either the largest or the smallest). Then, if λ is the true value of the eigenvalue in question, $\alpha - \lambda$ should be small. Since the inverse power method finds the smallest eigenvalue of the original matrix (or the largest of its inverse), then $1/(\alpha - \lambda)$ is the largest eigenvalue of the inverse. Thus, applying the power method to the inverse of the matrix shifted by α zeros in on the eigenvalue desired. Rather than invert the matrix A, you would invert the matrix $(A - \alpha I)$, where I is the identity matrix. The matrix $A - \alpha I$ is the matrix A in which the diagonal elements (A(1,1), A(2,2), etc.) all have α subtracted. Then you can invert this matrix, and apply the power method to get a better approximation of the eigenvalue. ■

CONVERT YOUR TRS-80 MODEL-I OR III INTO A

DEVELOPMENT SYSTEM

Now you can develop Z-80 based, stand-alone devices such as games, robots, instruments and peripheral controllers, by using your TRS-80 as a development system. The DEVELOPMATE plugs into the expansion connector of your TRS-80 and adds **PROM PROGRAMMING** and **IN-CIRCUIT-EMULATION** capabilities to your system (with or without expansion interface).

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When the In-Circuit-Emulation cable is plugged into the Z-80 socket of your stand-alone system, the system becomes a part of your TRS-80: You can use the full power of your editor/assembler's debug and trace program to check out both the hardware and the software. Simple test loops can be used to check out the hardware, then the system program can be run to debug the logic of your stand-alone device.

Since the program is kept in TRS-80 RAM, changes can be made quickly and easily. When your stand-alone device works as desired, you use the Developmate's PROM PROGRAMMER to copy the program into a PROM. With this PROM, and a Z-80 in place of the emulation cable, your stand-alone device will work by itself.

The DEVELOPMATE is extremely compact: Both the PROM programmer and the In-Circuit-Emulator are in one small plastic box only 3.2" x 5.4" A line-plug mounted power supply is included. The PROM programmer has a "personality module" which defines the voltages and connections of the PROM so that future devices can be accommodated. However, the system comes with a "universal" personality module which handles 2758, 2508 (8K), 2716, 2516 (16K), 2532 (32K), as well as the new electrically alterable 2816 and 48016 (16K EEPROMs)

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by Amee Eisenberg

Meet the bugbears

The bugbears of Load 80 are Assembly-language programs. You shouldn't be intimidated by them, though—it's easy to run a program labelled /SRC.

To run an Assembly-language program, you must own an editor/assembler. Editor/assemblers are supplied on disk or on tape; buy one that runs on your model TRS-80. If you never use disks, a tape editor/assembler is what you want. If you always use disks, get a disk editor/assembler. If you usually use disks but buy Load 80 on a cassette, you need a disk editor/assembler that supports tape I/O.

Load 80 Cassette: Cassette Editor/Assembler

Following the directions in your editor/assembler manual, load the editor/assembler.

Use your ears to find the beginning of the program you wish to load.

Enter the Load command—it should be some variation of L *file* <enter>. Your editor/assembler manual has the correct syntax.

Play the Load 80 cassette. A good load displays flashing stars in the upper right corner of the screen.

Check the listing. Most editor/assemblers use the command P#:* to PEEK at the buffer from beginning (#) to end (*). Check your editor/assembler's manual for proper syntax. The listing should scroll across the screen.

Assemble the listing using the A command. At the Ready Cassette prompt, place a blank cassette in your tape recorder, set it to record, and press the enter key. The computer then writes the assembled code to your tape.

Use the tape of the assembled code as a system tape. (See your computer manual if you have questions about how to do this.) Read the *80 Micro* article accompanying the Load 80 program to find out more about the program.

Load 80 Cassette: Radio Shack Disk Editor/Assembler

Boot the Editor/Assembler disk. The Editor/Assembler manual's appendix has a section on the TPSRC utility. Read it.

Use your ears to find the beginning of the program you wish to enter.

At the DOS prompt, type TPSRC and press enter. The tape source-code utility is engaged. It offers two options; you wish to engage option 1—read a source tape.

Play the Load 80 cassette. The file name appears at the lower left corner of the screen. When the tape is finished, the TPSRC utility automatically saves the program to disk and creates a new file on your disk named *file*/SRC.

Use the A command to assemble the listing. This creates a file on your disk named *file*/CMD. This file runs from the DOS prompt just like any other command file.

Read the *80 Micro* article to find out more about the program.

Please note: The Radio Shack Disk Editor/Assembler runs Load 80 Cassette source code.

Load 80 Cassette: Disk Editor/Assembler (Not Radio Shack)

Read your editor/assembler manual

Index	Page	Article	File Spec	Comments
Side 1				
A			COPYRGHT/BAS	Tape Only
B	120	Muddy Pig Simulator	PIGS/BAS	None
C	226	Attack of the TRS-80	TRS1/BAS	None
D	226	Attack of the TRS-80	TRS2/BAS	None
E	182	Micro-Melodies	MELODY/BAS	None
F	86	Armageddon	ARMAGEDN/BAS	None
G	92	Lost On the Great Barrier Reef	BARRIER/BAS	None
Side 2				
H	268	Light Cycle	LGHTCYCL/BAS	None
I	212	Collegiate Capers	PCHASE/BAS	None
J	256	Strip Blackjack	STRIPBJ/BAS	None

August 1983 Load 80 Directory

Disk

The Alternate Source
ALE Editor
Models I and III
No Tape I/O

Apparat Inc.
EDTASM
NEWDOS80
No Tape I/O

Computer Applications Unlimited
M-ZAL
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32K RAM, Two-Disk System
Allows Tape I/O

Instant Software
Assem/ZSIM
Model I
Allows Tape I/O

Misosys
EDAS-IV
Models I and III with Disk Drives
Allows Tape I/O

Mumford Micro Systems
Instant Assembler (disk version)
Models I and III

Radio Shack
Series 1, Editor/Assembler—Disk
Models I and III
Allows Tape I/O
Needs patch to run Load 80 disks
(see Reload 80, April 1983, p. 404)

Tape

Computer Applications Unlimited
T-ZAL
Model III only

Mumford Micro Systems
Instant Assembler (tape version)
Models I and III

Radio Shack
Series 1, Editor/Assembler—Cassette
Models I and III

A Sampling of Editor/Assemblers (in alphabetical order)

to find out how its tape source code utility works. Follow the directions.

Then follow the instructions above for the Radio Shack Disk Editor/Assembler.

Load 80 Disk: Disk Editor/Assembler (Not Radio Shack)

Place your editor/assembler disk in one drive and your Load 80 disk in another. Load your editor/assembler. (See your editor/assembler's manual if you're uncertain about this procedure.)

Use the L (Load) command to load the selected source code program into the editor/assembler.

Use the P command to check the listing you've just loaded. Most editor/assemblers use P#:* to PEEK at the buffer from beginning (#) to end (*).

"Read the 80 Micro *article to find out more about the program."*

Assemble the listing by using the A command. This will create a new file on your disk named *file*/CMD.

The assembled program runs from the disk operating system (DOS) prompt according to the author's instructions in *80 Micro*.

Load 80 Disk: Radio Shack Disk Editor/Assembler

To run Load 80 disk source code programs with a Radio Shack Editor/Assembler, use a conversion program. (We published one in Reload 80, April 1983, p. 404. It is available on the Load 80 tape or disk, or you can type it in from the listing.)

The Load 80-to-Radio Shack (L80TORS/BAS) program is in Basic and allows single-drive conversions. Run it as you run any Basic program and convert your selected source-code program.

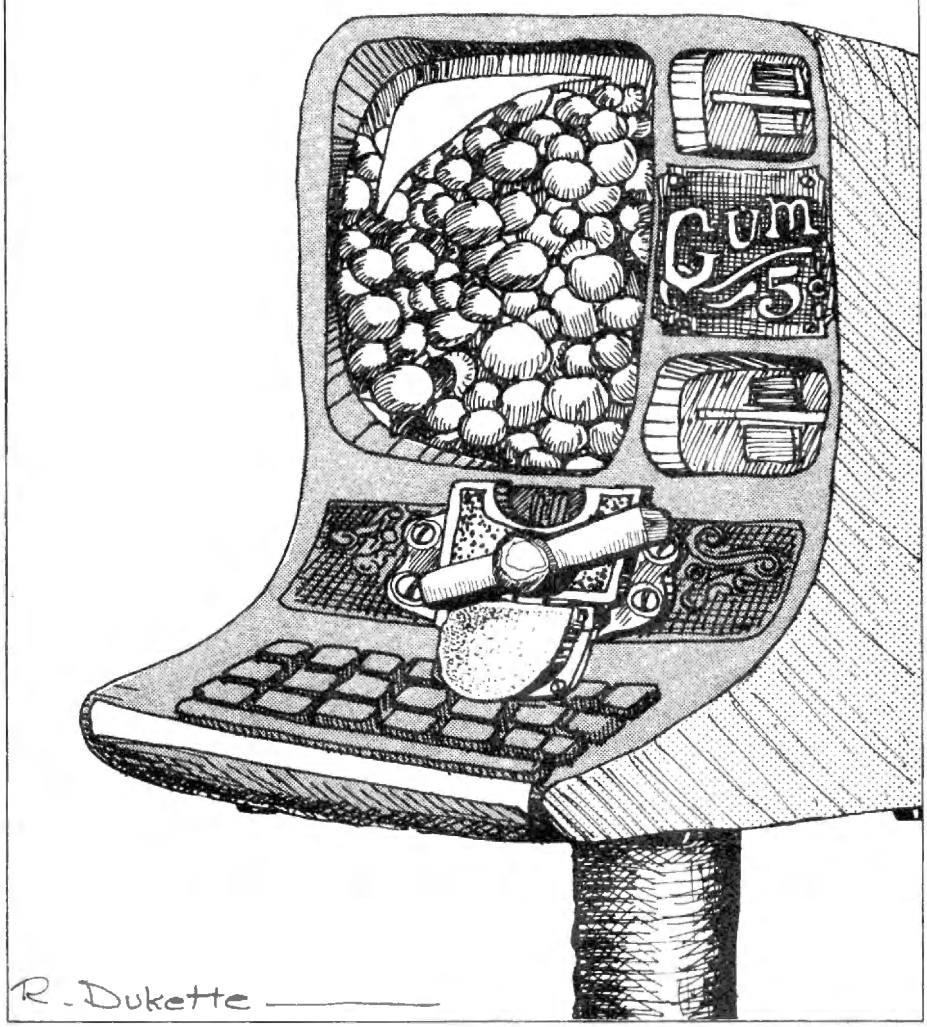
Place your Editor/Assembler disk in one drive and the disk with the selected source-code program in the other.

Follow the directions given above to run a Load 80 disk source-code program with a disk Editor/Assembler.

Please note: You must convert Load 80 disk source-code programs to Radio Shack format to assemble with a Radio Shack disk Editor/Assembler. ■

101 USES FOR A DEAD MICROCOMPUTER

no. 6



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NEW PRODUCTS

edited by S.F. Tomajczyk

200-Megabyte Bank

The Bank, Corvus Systems' new microcomputer mass memory device, stores up to 200 megabytes of data on a removable tape cartridge. The unit costs $2,195, and is available for delivery in September.

Computers perceive The Bank as a Winchester disk drive, which it resembles in size and price. However, it stores data on a continuous loop of 100-track magnetic tape enclosed in a 5½-inch-square cartridge.

Three cartridge sizes are planned—60 Mb, 100 Mb, and 200 Mb, the last with a capacity equivalent to 400 single-sided, double-density floppy disks. The Bank is random-access; individual files are addressed and loaded either onto a disk or into the computer itself.

According to Corvus, the unit will be most popular in network applications, particularly those which require very large amounts of on-line data without exceptional speed. The 200 Mb cartridge takes an average of 10 seconds to find data, then transfers it at up to 60K per second.

The Bank locates files in the order they appear on the tape, not in the order of requests; with a number of users (up to 64 on Corvus' Omninet system) simultaneously accessing files, the continuously looping tape produces access times nearly as fast as a busy Winchester.

Information is available from Corvus Systems Inc., 2029 O'Toole Ave., San Jose, CA 95131, 408-946-7700.

Reader Service ✓566

A Safe Outlet

Four 15-amp, 125 V ac multiple outlet strips are available from SGL Waber Electric. The strips feature an on/off switch and circuit breaker protection, and are designed to detect dangerous ground fault currents caused by moisture, improper or faulty connections, or worn insulation.

Each strip sells for $63.40 (four outlets and a 6-foot cord), $66.70 (four outlets and a 15-foot cord), $70.45 (eight outlets and a 6-foot cord), and $73.80 (eight outlets and a 15-foot cord). They are available from SGL Waber Electric, 300 Harvard Ave., Westville, NJ 08093, 609-456-5400.

Reader Service ✓550

New Dot-Matrix Printers

Japan Digital Laboratory (JDL) exports two dot-matrix printers to the U.S. market. Both feature 180- by 180-dot graphics resolution, condensed and expanded characters, and a bidirectional print head. Both printers have an Intel 8085 chip for Centronics parallel and RS-232C serial ports.

The JDL P200 ($2,149) uses automatic cassette sheet feed; its 16- by 24-dot (single-pass) matrix prints at 70 cps in elite format, 58 cps in pica format. The friction-feed JDL P700 ($2,099) also offers a 145 cps data processing mode.

For more information, contact Pacific Technology Services, 332 Pine St., San Francisco, CA 94104, 415-956-3926.

Reader Service ✓567

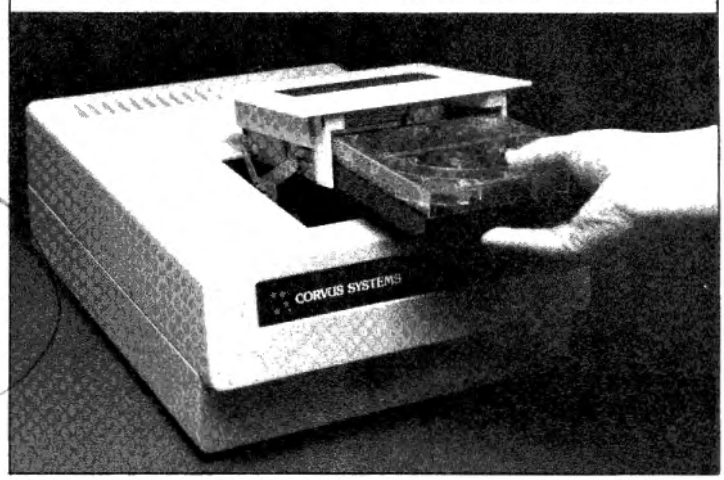
Five More Tracks

Model I owners who use TRSDOS 2.3 with 40-track drives are wasting 12K of space per disk—the storage difference between 35 and 40 tracks. CVT3540 is software that formats the additional tracks and patches TRSDOS 2.3 to recognize and use the extra capacity.

The operating system continues to work with 35-track disks, and no files are disturbed in formatting tracks 35 through 39. The utility checks the system code to prevent incorrectly patching a nonstandard DOS.

CVT3540 is supplied on cassette for unprotected transfer to disk. It costs $17.50 from Mysoft Computer Software, P.O. Box 417, Arroyo Grande, CA 93420, 805-481-3992.

Reader Service ✓559



Corvus Bank

II/12/16 Disassembler

Disassem is a Z80A program that disassembles Model II program files, converting the binary code to Assembly source code. Output takes place through the screen, printer, and/or a source file.

The hold key starts and stops the display scroll. The F1 key orders a printout. Descriptive error messages help trace mistakes.

The program requires 15K of memory. It includes patches for TRSDOS 2.0a that let you disassemble any Radio Shack program file and view the entire memory while using the Debug monitor. With Tandy's Thinline utility, it can be converted to TRSDOS 2.0b for the Models 12 and 16.

Disassem costs $49.99 from K & S Associates, 202 Park Ave., Bloomfield, CT 06002, 203-243-3321.

Reader Service ✓576

Logic Analyzer

The OmniLogic LA-1680 works with a 48K Model I or III to provide features normally found in logic analyzers costing $10,000 or more. Its interactive menus and help routines make complex digital analysis easy.

The LA-1680 can collect 1,000 data samples on each of 16 channels. In addition to triggering modes, such as And/Or/Not on data or glitch (with trigger point located anywhere in its 1,000-word sample memory) the unit features triggering modes like absence of repetitive event and delay by event or time (from 1 microsecond to 30 seconds). The system uses internal or external clocks as fast as 20 MHz; both clock and trigger out-

DOES STRING COMPRESSION HAVE YOU TIED UP IN KNOTS?

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250	11.8	0.7	94
500	45.8	1.6	96.5
1000	179.6	3.5	98
2000	713.2	7.8	98.9

(All timings done on TRS Model I. Model III 15% faster, but pct improvements identical. Listing of timing program available on request.)

WHAT'S STRING COMPRESSION?

When a BASIC program changes a string (words, names, descriptions), it moves it to a new place in memory, and leaves a hole in the old place. Eventually, all available memory gets used up and BASIC has to push the strings together to free up some space. This takes time. Lots of time. The computer stops running for seconds or minutes, and you may even think it's "crashed".

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As soon as you start using TRASHMAN, those delays will almost disappear. The program is **very easy to use**, so you don't have to be a computer programmer to take advantage of it. It's written in "machine language" and uses only 578 bytes of memory for itself, plus two bytes for each "string" in your program. It works with other machine language programs and all the major operating systems.

HOW WELL DOES IT WORK?

If you use it with a BASIC program that has only a few strings, very little time is wasted in string compression, and TRASHMAN will be only slightly helpful. But in programs that use hundreds or thousands of strings, including large string arrays, TRASHMAN is just what you need. If you have any remaining doubts, just look at the chart, and then get yourself a copy as fast as possible.

TRASHMAN is available on disk for just $39.95.

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Trashman may be licensed for use with your packages. Call for details.

SAVE TIME WITH FASTER

"FASTER" speeds up most TRS-80 BASIC programs by 20-50%. It's helped hundreds of satisfied people and it can help you. Detailed instructions make it easy to use. FASTER analyses your BASIC programs *while they run*, then displays a simple change, usually one line, that sequences program variables so the ROM will find them faster.

You can use FASTER to speed up programs you've bought, as well as programs of your own. Since it isn't a compiler, your BASIC programs can be read and changed afterwards. FASTER works on business programs, models, and games. The more complex your program, the better the results.

Does FASTER really work? Yes! Just check the reviews in *Personal Computing*, May, 1981, p. 116: **"FASTER is effective and easy to use"**; *80 U.S. Journal*, April, 1982, p. 106: **"I recommend FASTER to everyone"**; and *80 MICRO* (April, 1982, p. 40): **"If you...would like a significant increase in the run-time speed, then buy FASTER."**

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RPM is supplied on diskette for the TRS-80 Models I and III. We suggest you order a copy *before* you need it.

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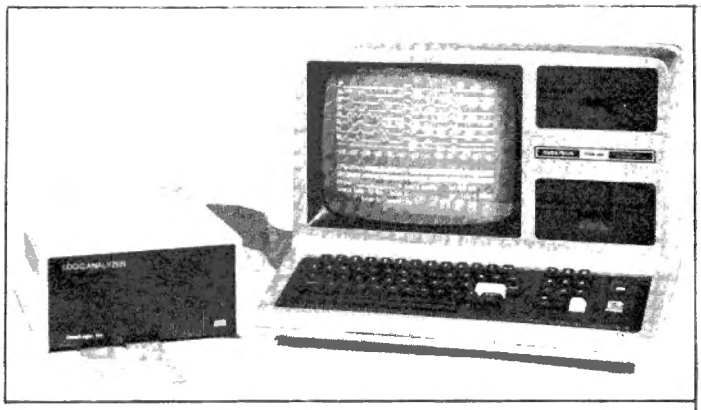


LA-1680 Logic Analyzer

puts can be qualified.

After collection, data is analyzed via several innovative displays ranging from standard timing diagrams to eight-channel maps and histograms. Signature analysis is a newly popular method of digital testing; the LA-1680 derives the hexadecimal signature of 14 test points simultaneously.

All test parameters, data, and time and date can be stored on TRSDOS disk, and all channels can be relabeled for convenience. All displays can be printed.

The unit costs $1,250 from OmniLogic Inc., P.O. Box 87, Renton, WA 98057, 206-271-2000. A Model I/III demo disk of LA-1680 displays is $5.

Reader Service ✓568

Custom Screen Utility

Scrnwrtr is a Model I/III utility that lets you design specially formatted screens for use in Basic programs. Once a screen is designed, pressing the enter key saves it to disk; subroutines are included for later recall.

The design process uses a floating, nondestructive cursor controlled by arrow keys. A corner display constantly shows the cursor's numerical location, and the shift and arrow keys move lines of text.

The program costs $19.95 from K & L Software, P.O. Box 39093, Northbridge Station, Charleston, SC 29407, 803-552-9990.

Reader Service ✓554

Graphics for LNW

The Chart-Ex program lets LNW80 computers plot high-resolution bar, line, and pie charts on the screen and print them on an Epson MX-70, -80, or -100 printer with Graftrax.

Data is entered from the keyboard or users' VisiCalc or other files. Chart-Ex plots up to three variables, and offers eight printer output selections.

Chart-Ex costs $89.95 plus $2.25 postage (California residents add 6.5 percent sales tax). It is available from Erb Computer Systems, 10840 Hunter Ave., Whittier, CA 90601, 213-699-6684.

Reader Service ✓561

Software Library

TRS-80 users, as well as Apple, IBM, Atari, and CP/M buffs, can borrow programs from the Electric Bookshelf, a member-owned collection of microcomputer software. There are no membership fees required to join.

For a membership application and list of available programs, write The Electric Bookshelf, P.O. Box 1409, Norcross, GA 30071.

Reader Service ✓555

Office Dot-Matrix

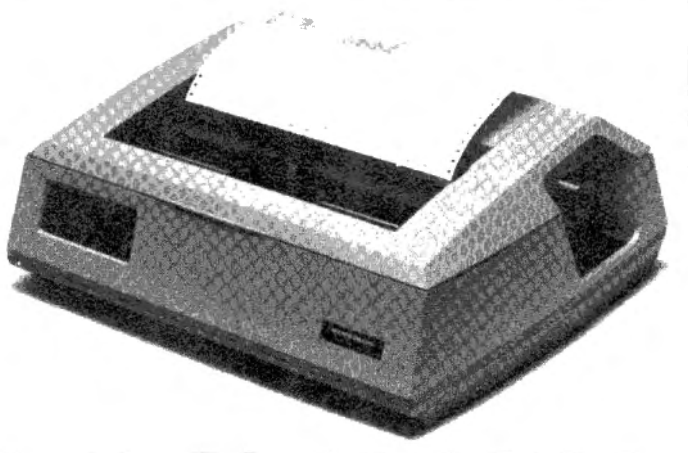
The Mannesmann Tally MT 1800 is a multifunction printer designed for small business systems with large print runs. Besides offering letter-quality printing at 50 cps and draft work at 200 cps, it operates at a low 52 decibels.

Two letter-quality fonts are included, with additional fonts available in kit form. A graphics option provides three different dot densities and tone gradations from gray to solid black.

A quick-tear assembly allows individual fanfold forms to be removed without wasting the next form. Automatic front feed controls the printing and formatting of pre-cut forms, and a bottom feed accommodates adhesive labels or heavy paper stocks.

The MT 1800 sells for $1,995 from Mannesmann Tally, 8301 South 180th, Kent, WA 98032, 206-251-5524.

Reader Service ✓560



Mannesmann Tally Printer

Touch Me in the Morning

WattsOut is a 2- by 3-inch anti-static device that attaches to your micro's keyboard and a ground. The words "Touch Me" are prominently displayed on its surface; follow its suggestion before using the keyboard, and charges that could cause data errors and circuit damage are harmlessly drawn away.

According to the manufacturer, WattsOut's $9.95 price makes it a bargain compared to anti-static mats and sprays. It is available from WattsOut Inc., 2020 S. Oneida #201, Denver, CO 80224, 303-759-3880.

Reader Service ✓562

Hard-Disk Xenix

Aton International has announced support of the multi-user Xenix operating system on Model II, 12, and 16 micros equipped with Tandy's 8- or 12-megabyte hard disks.

Aton CP/M 2.2 allows users to share different operating systems on the same Winchester. CP/M and either Xenis or TRSDOS can be booted up, allowing access to both Xenix's multi-user capability and CP/M's vast software library on one hard disk. Flawed sectors, bad tracks, and other problems are automatically detected and fixed.

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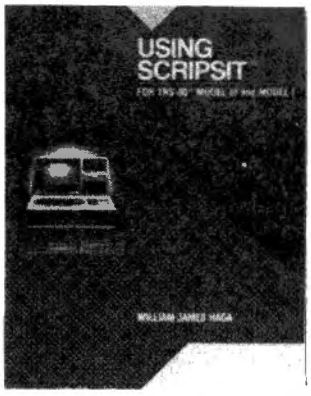

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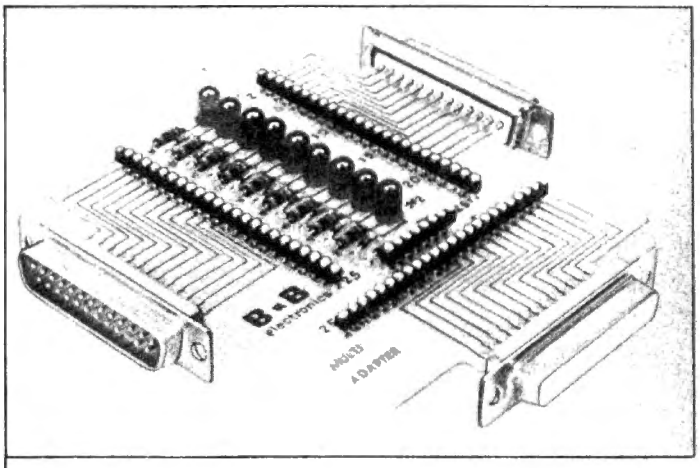


RS-232 Multi-Adapter

Aton CP/M 2.2, the hard disk adaptation, and documentation. Xenix must be purchased separately from Radio Shack. A hard disk upgrade for current Aton CP/M owners is $100.

For more information, contact Aton International Inc., 260 Brooklyn Ave., San Jose, CA 95128, 408-554-9922.

Reader Service ✓569

RS-232 Multi-Adapter

B & B Electronics' Multi-Adapter has one male and two female RS-232 connectors, with pins 2–25 connected to socket strips. The male connector's LEDs monitor the status of pins 2–6, 8, and 20. Two spare LEDs are connected to their own socket strip; they can connect to any pin.

With 20 jumper wires included, the unit costs $79.95 plus $1.75 shipping and handling from B & B Electronics, P.O. Box 475, Mendota, IL 61342, 815-539-5827.

Reader Service ✓551

June's New Products section gave the bulk wholesale price for Head Computer Products' disk drive cleaning kit (p. 364). The suggested retail price is $34.95.

Disks Tabs and Boxes

Lewis Computer Supply Co. (38211 Logan Drive, Fremont, CA 94536, 415-792-1531) offers Super Tabs, adhesive disk labels that extend from the drive opening, letting you see which disk is in which drive at all times. The tabs come in six colors, and cost $2.50 per sheet of 12.

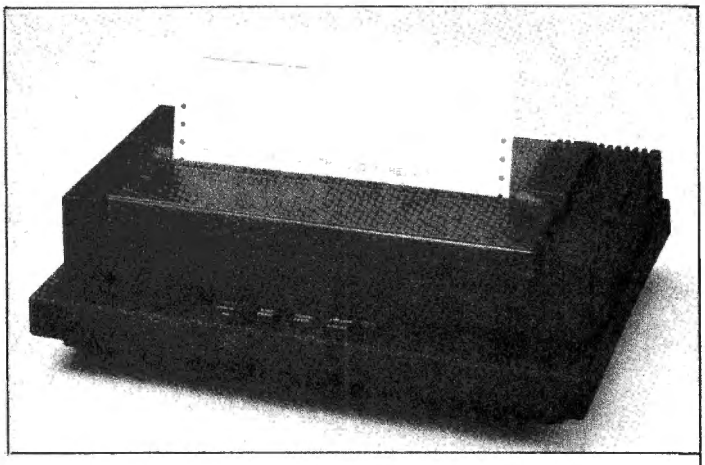
The firm also supplies acrylic disk cabinets with file dividers. A 12-inch file ($49.95) will hold 90 disks; a 6-inch one ($34.95) holds 45. Bronze, green, red, or blue cabinets are available for an extra $3 each.

Reader Service ✓573

Faster CoCo Cassettes

Fastape is a machine-language utility for the Color Computer that doubles the speed of cassette operations. It allows full use of the CoCo's high-speed mode, can read tapes accidentally saved at high speed, and allows speed mode to be changed with a control key for automatically adjusting cassette and printer parameters.

The program is transparent to Basic, features control-key entry of common Basic commands, and takes only ½K of available memory. It sells for $21.95 from Spectro-Systems, 11111 N. Kendall



Olivetti PR2300

Drive, Suite A108, Miami, FL 33176, 305-274-3899.
Reader Service ✓570

$560 Ink-jet Printer

Ink-jet technology, usually reserved for large and expensive printers, is now available in a 12-pound, 15- by 10½- by 4½-inch package costing $560.

The Docutel/Olivetti PR2300 uses a single-jet printing head to direct carbon particles onto standard paper in a 7- by 7-dot matrix. The paper is sensitized with electric impulses in the form of the desired character or graphics pattern; it attracts and permanently affixes carbon particles to the paper. The process is similar to that used in dry-paper copying machines.

The unit prints all 96 ASCII characters, with seven other symbol or foreign-language sets software selectable. It operates at up to 110 cps at 10, 12, or 15 pitch, with six or eight lines per inch. Normal, compressed, double height, double width, and bold printing are available, as is single or double underlining. Graphics are supported at 110 horizontal and 216 vertical points per inch.

The printer uses a standard Centronics or RS-232C interface. It is sold by Docutel/Olivetti Corp., 155 White Plains Road, Tarrytown, NY 10591, 914-631-8100.
Reader Service ✓571

Model III Artistry

Draw ($29.95) is a graphics and text program on disk for the 48K Model III. It lets you draw designs on the screen using cursor control keys, special commands, and automatic drawing routines, and include text and special characters in the drawing. Displays can be saved to disk and included in other programs.

Printing options include three print sizes, single or double strike, border size, and automatic line, circle, fill in, and overlay. Error messages and "bail-out" routines prevent displays from being spoiled or lost accidentally. The disk includes 10 sample displays.

Kwikdraw ($74.95) is a fast machine-code version of Draw with expanded features. Routines are included to move, duplicate, and erase figures or text and to move the entire screen with or without wraparound. Material is saved to or retrieved from 10 RAM buffers, and eight menu/help screens are instantly available.

The programs run under TRSDOS 1.3 and support Epson MX printers. They are

Continues on p. 352

YORK 10™ ✓156
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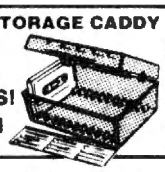

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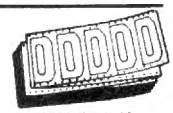

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Continued from p. 349

sold by Lichen Software, 6603 N. Lee St., Spokane, WA 99207, 208-664-6516.

Reader Service ✓563

Model III Business Kit

Business Multi-Pack is a collection of programs for the 48K Model III. It includes sales forecasting (arithmetic average, regression analysis, and futures analysis), economic order quantity determination, inventory analysis, and several business utilities. Also included are price determination for a desired profit margin, present and future value of a preset sum, an amortization schedule, and a perpetual calendar.

The disk sells for $99.95 from Single Source Solution, 2699 Clayton Road, Concord, CA 94519, 415-680-0202.

Reader Service ✓577

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Two compact display monitors for personal computers are available from Comrex International.

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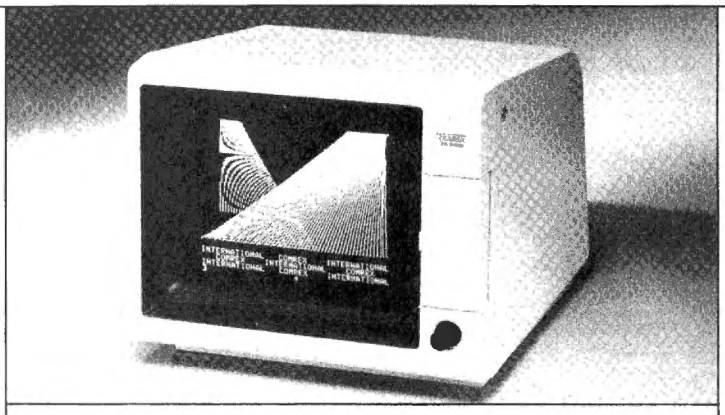
The tutorial runs on a 16K Color Computer. It costs $17.95 (cassette) or $22.95 disk, plus $2 shipping, from Computerware, Box 668, 4403 Manchester Ave., Encinitas, CA 92024, 619-436-3512.

Reader Service ✓564



Comrex CR-5400 Monitor

Soundplus

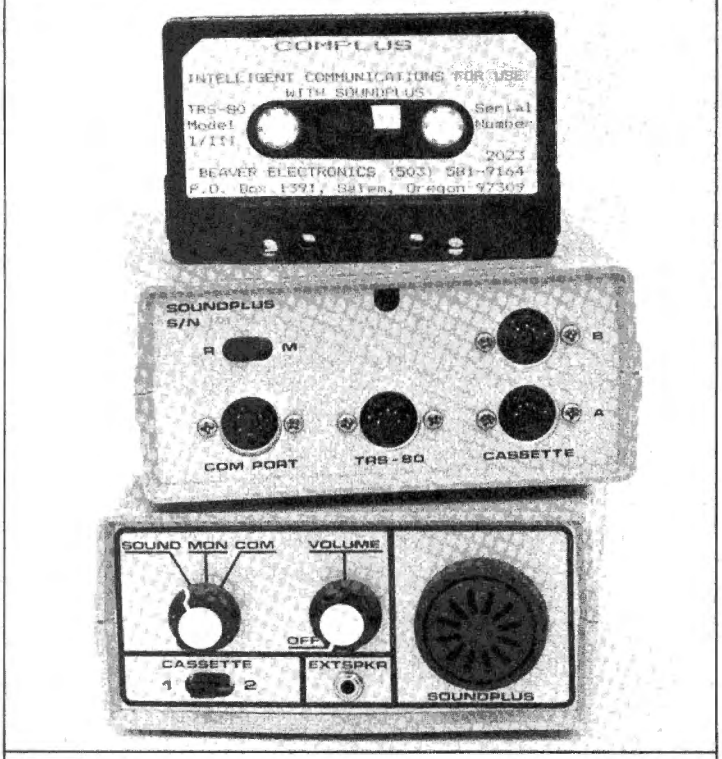
Soundplus ($79.95) is a sound and communications device for the Models I and III. It connects between the cassette port and up to two cassette recorders, and provides 300 baud serial communications for terminals, printers, modems, and other RS-232C devices.

Its amplifier and speaker reproduce sound from games and other programs, and monitor cassette signals to determine the start of programs and detect data dropouts. All features are switch-selectable to eliminate cable swaps.

Soundplus measures 5 by 5 by 2½ inches; it is compatible with Radio Shack's cassette communication software or its own communications program, Complus ($10 to registered Soundplus owners, $39.95 to others).

It is available from Beaver Electronics, P.O. Box 13291, Salem, OR 97309. Include $4 shipping and handling for mail orders.

Reader Service ✓558



Soundplus

Add-a-Voice

16K Color Computer owners can add voice output to Basic programs with Add-a-Voice, a machine-language utility with a vocabulary of 25 digitally recorded words. Extended Color Basic is not required.

Two simple commands select a word and vocalize it through the television speaker. Two sets of words are available: The game set includes words such as "I," "got," and "stop." The quiz set features "yes," "no," "right," and so on. A program with one word set and driver takes only 4K of memory.

Add-a-Voice costs $14.95 plus $1 shipping and handling (cassette) from H.I.B., 3505 Hutch Place, Chevy Chase, MD 20815, 301-656-1825 (phone after 6 p.m.).

Reader Service ✓572

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Programmable RS-232 Translator

The PCT-100 is a user-configurable RS-232 interface that uses two bidirectional RS-232 ports and a built-in communications language to perform virtually any translation algorithm.

The unit provides terminal or printer emulation, compatibility and macro-function keys for word processing or other software packages, DEC or IBM family compatibility, type-ahead and data buffering, and baud rate and handshake protocol conversion. A single unit without power supply sells for $369.

For more information, contact Method Systems Inc., 19751 S. Lakeshore Blvd., Euclid, OH 44119, 216-531-0404.

Reader Service ✓574

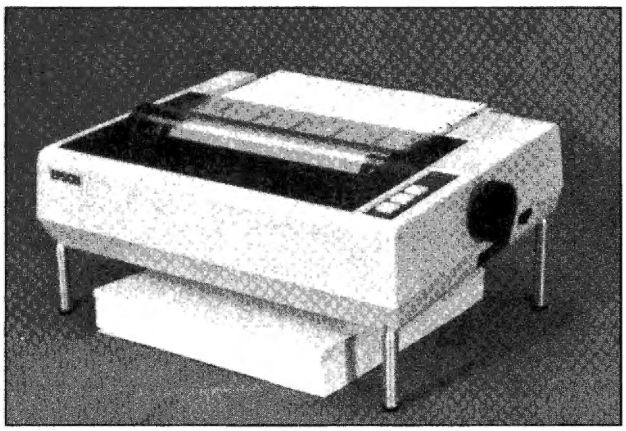
$19.95 DBMS

Memory Jogger is a database management system for home, personal, or small-business use. Up to six retrieval keywords or identifiers can be specified for each note or record; one or more (using And/Or) keywords access information.

The menu-driven program requires a 48K Model I or III with one disk drive. It sells for $19.95 from Micro Software, 205 Dumaine Court, Suite 105, Fort Walton Beach, FL 32548, 904-862-5588.

Reader Service ✓579

DIFFERENT TRACK



Printer-Stilts

Want your printer to stand above the crowd? Put it on Printer-Stilts, a set of four rubber-tipped aluminum legs that elevate an Epson MX-70/80 or MX-100 by several inches. The stilts leave space for several hundred sheets of fanfold paper, and tilt the printer for easy viewing of controls and text.

Installation is a simple matter of inserting the legs into the printer housing recesses. No tools are required. You can have a quadruped Epson for $9.95 plus $2 postage and handling from Datatek Inc., Dept. 100, P.O. Box 5956, Shreveport, LA 71135, 318-868-2241. Specify MX-70/80 or MX-100.

Reader Service ✓565

New Products listings are based on information supplied in manufacturers' press releases. 80 Micro *has not tested or reviewed these products and cannot guarantee any claims.*

Making Transparent Sorts Visible

Pulse Software's Transparent Sort program is a graphics demonstration of the Shell-Metzner sort, an efficient Basic sorting subroutine.

Although the subroutine is only 16 lines long, how and why it works can be a mystery to beginning Basic programmers. The Pulse program shows the compare/swap process as it happens, with a display of 26 letters being sorted into alphabetical order. Arrows indicate the letters being compared, and a top-of-screen display shows a continuously updated table of statistics and variables. A comment at the bottom of the screen explains the line being executed.

The Level II program is available on 16K cassette ($14.95) or 32K disk ($19.95) for the Models I/III. For more information, contact Pulse Software, P.O. Box 1086, Freehold, NJ 07728.

Reader Service ✓557

Build Your Own Disks

Dual Density Formatter is a Model I/III disk utility that formats track zero, sector zero in single density and track zero, sector one in double density. The machine-language program requires no hardware modifications.

It sells for $29.95 from Applied 80 Softwares, 18 Ivy Lane, Cherry Hill, NJ 08002, 609-482-6864.

Reader Service ✓575

Look Out Below

Subterranean Encounter is an adventure for the Models I and III that combines the standard text format and two-word commands with graphics illustrations of each location.

The objective is to gain access to the wizard's forbidden castle and collect the treasures within. Lots of nasty surprises await on the subterranean levels, and you'll need logic, luck, and a taste for bad puns to survive.

The adventure requires 32K of memory. It sells for $24.95 (disk) or $22.95 (cassette) from Toucan Software, 4024 Canonero Court, Fair Oaks, CA 95628, 916-966-4241.

Reader Service ✓552

Model 16 Spreadsheet

EasyCalc is an electronic spreadsheet program for Model 16s using the TRS-DOS-16 operating system. Written in Cobol, it is designed for fast format planning, so that "what if" questions are answered in minutes rather than hours.

The system features a window mode for data entry and rule modification, and defines rules by columns and rows as well as by individual cells. Multiple spreadsheets can be designed and saved into a menu with password protection.

Since EasyCalc is both command-driven and menu-driven, spreadsheet set-up, data entry, and format and data editing are quick and simple. Its object code takes roughly 50K of memory; finished files require the same amount.

The program sells for $395 from Datamate Co., 4135 South 100th East Ave., Suite 101, Tulsa, OK 74145, 918-664-7276.

Reader Service ✓553

If you guessed that a Practical Peripherals Microbuffer™ printer buffer saves time, you're right. For the way it works, this inexpensive product is the most practical addition to your microcomputer system ever.

With Microbuffer, you don't have to wait for your printer to finish before you resume using your computer. Data is received and stored at fast speeds, then released from Microbuffer's memory to your printer. This is called buffering. The more you print, the more productive it makes your workflow.

Depending on the version of Microbuffer, these buffering capacities range from a useful 8K of random access memory — big enough for 8,000 characters of storage — up to a very large 256K — enough for 256,000 characters of storage.

Practical Peripherals makes stand-alone Microbuffers for any computer and printer combination, including add-on units especially for Apple II computer and/or Epson printers. Each has different features like graphics dumps and text formatting besides its buffering capabilities. You can choose one that's just right for your system.

Best of all, they're built to last and work exactly like they're supposed to.

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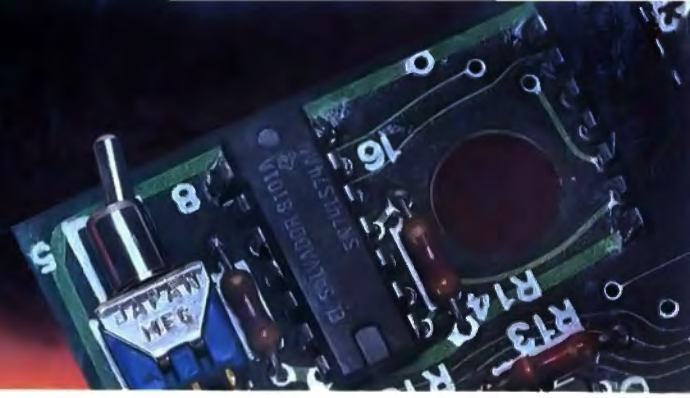

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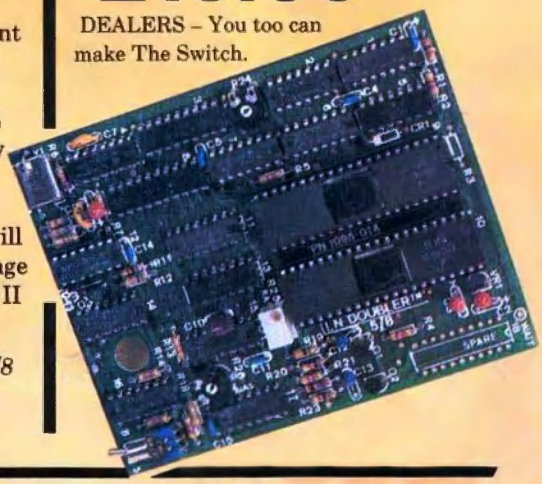

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*8" drive operation requires special cable, 8" double-density requires 3.55MHz CPU speed-up modification or LNW-80 4MHz computer. TRS-80 is a trademark of Tandy Corporation.