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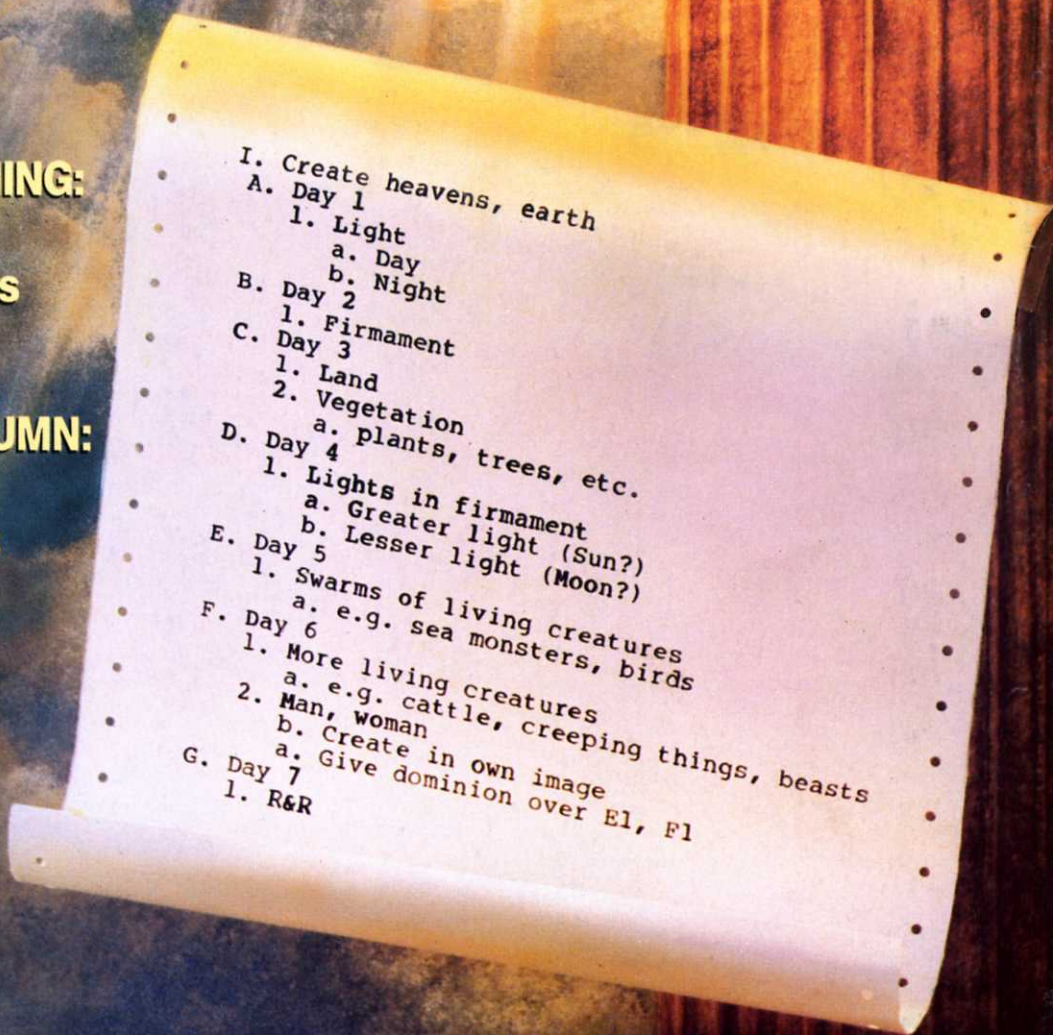

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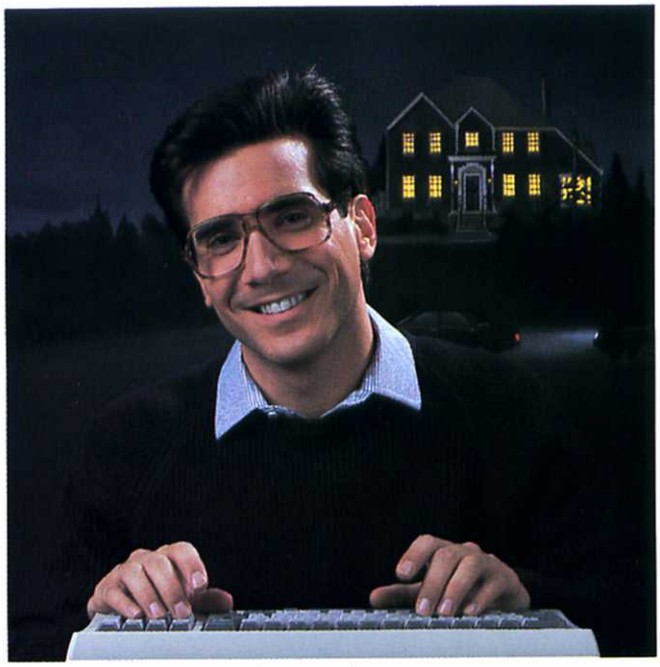

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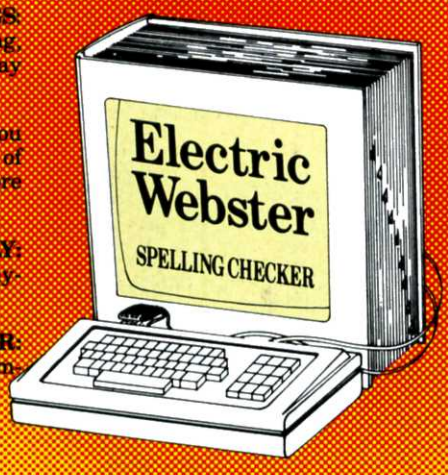

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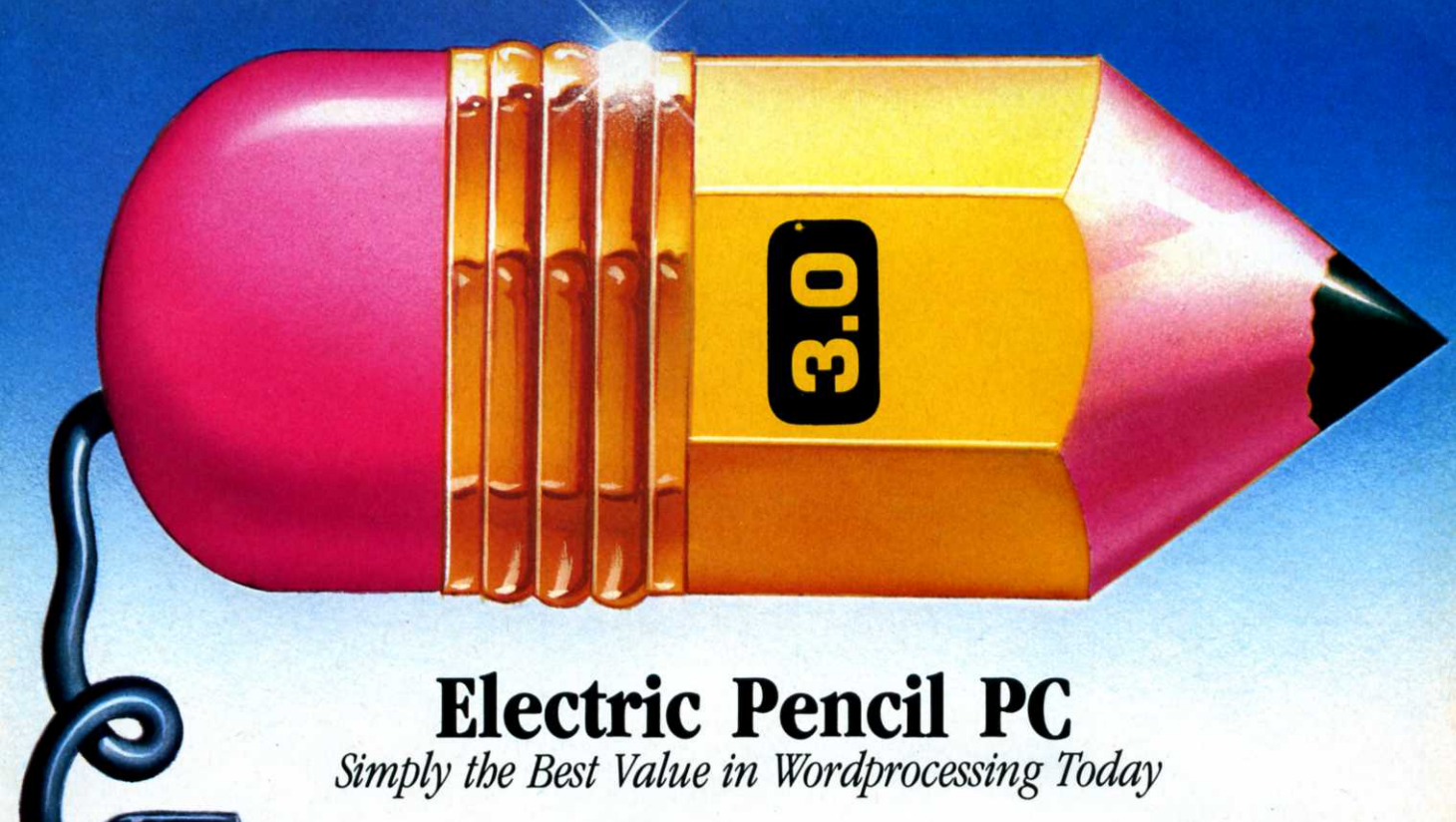

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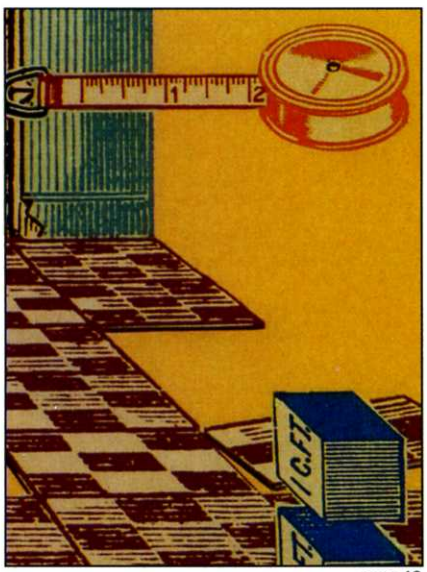

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LOAD 80

Load 80 gathers together selected programs from this issue of *80 Micro* and puts them on a magnetic medium for your convenience. It is available on disk and runs on the Models I, III, and 4.

Load 80 programs are ready to run, and can save you hours of time typing in and debugging listings. Load 80 also gives you access to assembly-language programs if you don't have an editor/assembler. And, it helps you build a substantial software library.

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Not all programs will run on your system. Some Model III programs, for instance, will run on the Model 4 in the Model III mode, but not in the Model 4 mode. You should check the system requirements box that accompanies the article to find out what system configuration individual programs require.

If you have any questions about the programs, call Keith Johnson at 603-924-9471. Yearly disk subscriptions to Load 80 are $199.97. Individual loaders are available on disk for $21.47, including postage. To place a subscription order, or to ask questions about your subscription, please call us toll free at 1-800-343-0728 between 9 a.m. and 5 p.m. Or, you can write to Load 80, 80 Elm St., Peterborough, NH 03458.

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Article: That Thinking Feeling (p. 42).
System: Model 4, 64K RAM.
Outline your thoughts, just like your English teacher advised.
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Calculating Material Needs
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Cut through tricky arithmetic and easily calculate the material requirements for your do-it-yourself home improvements.
Language: Basic.
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Gain Memory
Article: Switching Station (p. 62).
System: Model 4, 128K RAM (Series 1 Editor/Assembler is optional).
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System: Models I, III, and 4; 32K RAM.
Use our checksum program to check the accuracy of the Basic listing you type in.
Language: Basic.
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Loc-Editor
Article: How to Read *80 Micro* (p. 96).
System: Models I and III; 32K RAM.
A program that finds errors for you.
Language: Basic.
Filespec: LOCEDITR/BAS.

BAS = Basic ASM,SRC = source code CMD = object code

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LeScript Named No.1 Choice in Word Processors!

80 MICRO Review, November 1985

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System requirements - IBM-PC Compatible: One disk drive, 128K memory, color or monochrome monitor, and DOS 2.0 or higher.
TRS-80 Model 1/3/4/4D/4P: One disk drive and 48K memory.

Not-So-Public Domain

Last summer we sponsored the Great *80 Micro* Disk Swap in which we offered to mail readers a selection of public-domain (PD) software in exchange for three programs from their own PD collections. The results were both good and bad. On the one hand, a lot of people sent us disks that contained excellent programs. But on the other, far more offered material that wasn't public domain. Apparently, even with all of the hoopla during the last five years over software piracy, many computerists still don't know what "public domain" means. Here, then, is a rundown of the myths and realities of software and copyrights.

Myth #1: Free programs are in the public domain.

The truth is that the cost of a program has nothing to do with its copyright status. The purpose of a copyright is to give the owner the right to do whatever he wants with his work. If he wishes to give it away, that's his privilege. If he wants to set conditions for its use—say, that the user can't resell the program—that also is his right. But he doesn't surrender his ownership rights unless he expressly says he does.

Thus, a program you find on a bulletin-board system or get from a users group is not necessarily PD.

Myth #2: Commercial software that is no longer being manufactured is fair game for free distribution.

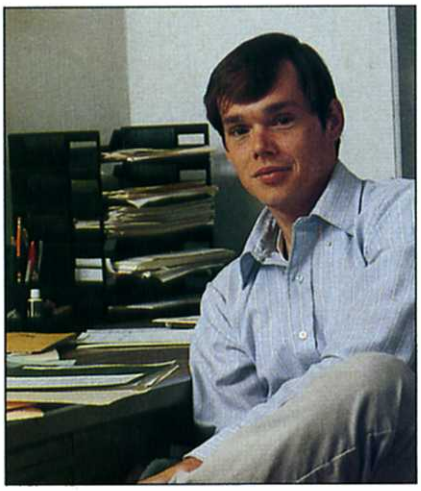
Wrong. Again, a program's owner has complete control over the fate of his work. If he wants to, he can take it off the market and prevent it from ever seeing the light of day again.

For instance, Lotus bought Software Arts and the rights to Visicalc and soon thereafter discontinued sales of the spreadsheet program. The company still owns the rights to Visicalc and can prosecute anyone it finds distributing copies.

Such absolute ownership bothers a lot of people, who for some reason feel they have the right to freely share other peoples' software. Well, that's the price we pay for believing in private property.

Myth #3: Programs in magazines are public domain.

No. Most programs published in magazines (and books) are owned by the publication or the author and are for the private use of the magazine's readers. They can't be distributed on bulletin boards or through users groups without permission.



80 Micro has fought this problem for years. It didn't surprise us to receive a number of our own programs during the Disk Swap.

Software piracy has become so pervasive that it is now an assumed part of the average computerist's life. Is this any way to treat your fellow programmers?

Takes on Tandy

A sign of the times: International Data Corp.'s *Personal Computer Markets 1985-1990* for 1986 refers several times to Tandy, even including an analysis of Tandy in the section "Company Profiles: Major PC Vendors." Get that—Tandy has been endorsed by a research group as a "major PC vendor." Furthermore, IDC sees Tandy as one of seven companies (can you guess the others?) that will "continue to influence the industry for the foreseeable future." That Tandy should be so considered by IDC is indeed an unfamiliar experience for the folks in Fort Worth.

IDC is particularly positive about Tandy's role in the education market, noting that PCs and compatibles have taken a significant portion of that market from Apple.

"Tandy, in particular, went from obscurity to the number 2 position in unit shipments with 23.6 percent of the market," IDC continued. "Improved performance by both Tandy and IBM is due to lower prices of full-fledged IBM PCs...and the IBM-compatible Tandy 1000s."

The report goes on to say, "Apple is sure to continue its efforts to increase its portion of the educational market, but it will also be met with increased competition from low-cost PCs and compatibles. We believe that Tandy is especially well poised to continue capturing market share here with its low-cost Model 1000 and follow-on products."

IDC lists as Tandy's strengths its retail network; renovations to Radio Shack stores; and the educational, small-business, and home/hobby markets. Tandy seeks to attract small businesses, says IDC, with "an atmosphere for one-stop shopping, planning, service, and support," and has maintained a presence in the home/hobby market "by continuing to offer lower-priced products through a retail network that, unlike many PC dealers, caters to the individual buyer."

On the other hand, IDC feels that Tandy is fighting a poor image ("To attract the corporate buyer's attention, it will be forced to assume a more professional image") and Asian competitors. The latter in particular could affect Tandy by attracting price-conscious businesses that are Tandy's meat.

The report concludes that we can't expect to see any "bold or adventurous product developments" soon, but that Tandy will "keep a watchful eye on PC industry innovators like IBM and Compaq, and...appropriate the most promising developments of these leaders."

IDC's profile of Tandy is about as accurate as any I've seen recently. It appropriately focuses on what is Tandy's strength and weakness: A massive retail chain with a down-home image that attracts some customers (small businesses, schools, and home users) and repels others (the Fortune 1000 user).

There is another side, however, to the issue of Asian competition. As Tandy director of market planning Ed Juge points out in his November *Tandy User Group Newsletter*, "The Asian no-names...have made buyers aware that viable personal computers don't absolutely require either an IBM price tag or label." Once the market accepts the idea that compatibles do not carry typhoid, Tandy is left with the much easier job of selling the customer on the company's service and stability.

By the way, the other companies profiled in the IDC report are IBM, Compaq, Zenith, AT&T, Leading Edge, and Apple.■

Photograph by Frank Cordelle

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JUNE, 1985
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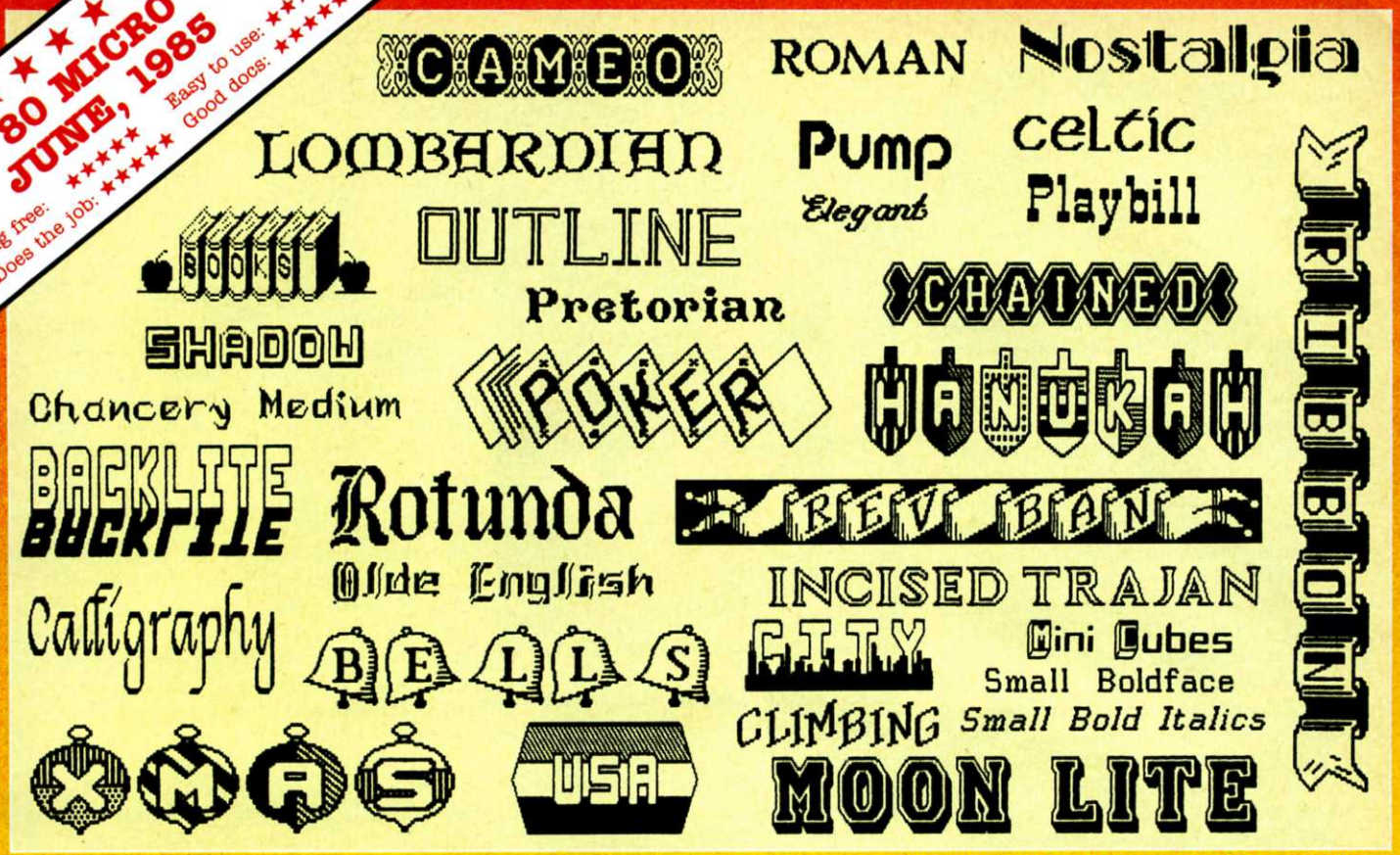

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The Path to Enlightenment

Where does a neophyte thirsting for knowledge begin? Like most others, I took the obvious route of investing in a library of how-to and made-simple books, all promising instant enlightenment for the otherwise uneducated masses. But after investing hours and getting nowhere, I realized two other things were essential on the road to enlightenment: a computer and the human touch.

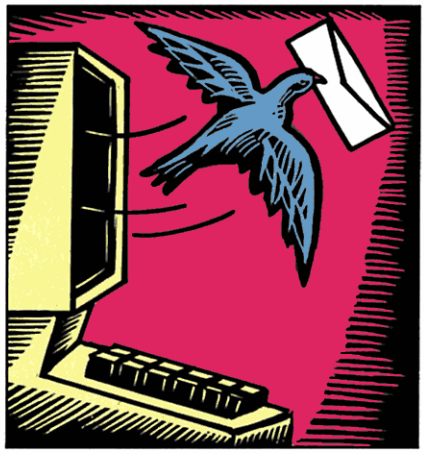
I enrolled in the local evening school, which boasted a classroom full of somewhat antiquated Apple IIs. During the next nine weeks, the instructor managed at least to reduce my fear of computers from abject terror to deep and mistrustful apprehension.

A considerable help was the availability of a Lisa computer where I work. The Lisa and I became so well acquainted that I seriously considered buying one, but disaster struck: Apple discontinued the machine. Undaunted, I sought other computer sources, and for nearly a year I was a fixture at Radio Shack, Computerland, and similar hallowed locales. In the majority of cases, the sales personnel were just what their name implies. I knew at least as much as most of them did.

Later, I found one salesman who appeared to know what his computers do. Nearly on my knees I approached him, and after a period of silence he acknowledged my existence. He inquired what I wanted his computer for, and my lack of knowledge became painfully obvious as I tried to stammer out a reply. His growing awareness of my inadequacies was matched only by his disdain of so low a life form, indeed a subhuman, who not only didn't speak Fortran, Fortran IV, Cobol, Algol, or Pascal (not to mention failure to observe the dress code of tie-dyed T-shirt, jeans, and sneakers), but was barely conversant in Basic. He appeared to listen to my humble replies to his barked commands while shuffling a few hundred disks with the deftness of a blackjack dealer and appraising me with the tenderness of a rattlesnake.

He also hastened to point out that, but for him, the store wouldn't exist (it still does), that he was there to keep it all together (he isn't there anymore), that the others were a bunch of simpletons (they were), and that he was the only person to buy a system from (I didn't).

Arpad L. Lengyel
Marietta, PA



Microhelp Takes Exception

We'd like to clarify misconceptions and glaring errors in reviews of two of our products, Peeks 'n Pokes and The Inside Track (October 1986, p. 27).

For the record, we do market a library of subroutines called Mach 2, which was advertised on p. 161 of the same issue.

The review gives the wrong prices. The Inside Track has a list price of $65; while Peeks 'n Pokes sells for $45.

Your reviewer ignores what our customers consider to be the most useful features of The Inside Track, namely:
1. The ability to go beyond Basic's 64K data limit and use all available DOS memory for storing strings.
2. Windowing in Basic using a machine-language subroutine.
3. Fast screen displays (instant when compiled).
4. Reading and writing files as fast as DOS can.

In addition, no mention is made of the fact that assembly-language source code is included on disk.

Your reviewer writes that The Inside Track "has no instructions for using the OBJ files for interpretive Basic." Object modules are *never* used in interpretive Basic. On pp. 1–4 of our manual, we discuss how to use the machine-language subroutines by storing them as strings; we do not suggest, as your reviewer says, that the user poke machine-language subroutines into memory.

Regarding the Peeks 'n Pokes program, your reviewer states, "The structure of these programs does not allow for their use as subroutines. They have no stated rules for variable names and don't use Basic line numbers." Balderdash! The single assembly subroutine included in the package has clearly identified variable types and the sample programs include Basic line numbers.

The comment, "To use these examples, you will need to do a lot of debugging and analysis" is off the wall. Each feature is demonstrated in small sample programs. The routine for calling DOS/BIOS functions and interrupts even has a large demonstration program covering many sample calls. The manuals encourage the user to incorporate our program code into his own programs so he does *not* have to do a lot of debugging.

Mark E. Novisoff
President, Microhelp Inc.
Marietta, GA

80 Micro's BBS is open 24 hours a day. It offers programs you can download, special-interest groups, and a classified section. You can reach the board at 603-924-6985; UART settings are 300/1,200 baud, 8-bit words, 1 stop bit, no parity.

Reviewing GW-Convert

Permit me to add information and correction to David Engelhardt's GW-Convert review (October 1986, p. 161).

Separate versions are available for the Radio Shack and Micro-Labs high-resolution graphics boards. There isn't enough room to include both on the same disk, and the documentation is different, so we offer both versions for 20 percent above the purchase price.

Microsoft's Basic compiler supports the hi-res graphics commands included with the Radio Shack board. You can thus compile converted MS-DOS Basic graphics programs for maximum speed in the Model 4 mode. You don't need a hi-res board to use MS-DOS Basic's non-graphics commands.

Finally, Engelhardt mentions that the Set, Reset, and Point commands aren't normally supported by Model 4 Basic. The latest version of GW-Convert includes a routine called Graphic/CMD that supports these commands.

Charley Butler
The Alternate Source
Lansing, MI

Send your correspondence to Input, 80 Micro, 80 Pine St., Peterborough, NH 03458. We reserve the right to edit letters.

Illustration by Anthony Russo

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Jumping Hurdles

Q: I've experienced two Model 4 graphics programming problems that I can't seem to solve.

1. How can I change the following Model III program fragment so it will run on the Model 4?

```
FOR A=3 TO 127
B=40
SET(A,B)
NEXT A
```

2. I created a diagram-block format by experimenting with characters and strings. When I finished, the cursor was on the outside. How can I get it back inside so I can type information in the blocks? I know I can enter information while building the frame, but I want to do so after the frame is completed. *(Frank Gillespie, Stoughton, MA)*

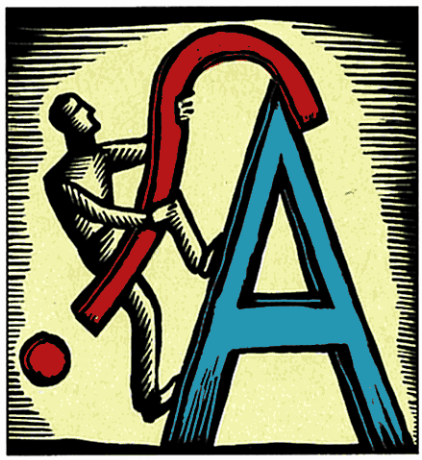
A: 1. You can add the graphics Set, Point, and Reset commands to Model 4 Basic. Alan D. Smith's "Upgraded Graphics" in the August 1985 *80 Micro* (p. 76) tells you how.

2. A Print@ command ending with a semicolon (;) will let you print inside the diagram block from within the program, but if you try to use an Input command, some of the graphics will be erased. Adding a high-resolution board will allow you to insert text inside graphics with a program such as Jim Abbassian and Glen E. Sparks's "Drawing in Detail" (September 1985, p. 56).

Dance, Mercedes

Q: I want to remove unnecessary files from my Model I system disk to make room for word-processing and spelling-dictionary programs. I've tried unsuccessfully to use the Kill command with a password-utility program to remove Format and Backup. I would appreciate your telling me how to remove these files. If you can't, please cancel my subscription and refund my money. *(Joe Simanonok, Bradenton, FL)*

A: Use the F3GUM password. (For example, the correct code for killing the Format file is KILL FORMAT/CMD.F3GUM.) I have extended your subscription for two years. You will be billed shortly.



Comparative Mnemonics

Q: I need information about the assembly- and machine-language mnemonics of the Models III and 4 to compare them with those of my version of CP/M 2.2. I could then use programs in *80 Micro* that are now beyond my abilities. *(David Layman, Cedartown, GA)*

A: I can recommend two books. *How to Program the Z80*, by Rodney Zaks (Radio Shack catalog no. 62-2066), is no longer available in the warehouse, but some Radio Shack stores might still have it. *Inside CP/M*, by David E. Cortesi, is available for $25 from Montezuma Micro (Redbird Airport, Hangar #8, P.O. Box 32027, Dallas, TX 75232, 800-527-0347).

Separated By a Common Language

Q: I am about to go to England for a year and plan to use the built-in word processor of a Model 100 running on four AA batteries. Because of power incompatibility, it is impractical to take any of my printers (standard 220–240 volts [V] ac, 50 characters per second). However, a computer person in England tells me that most printers there use the RS-232 interface; the Model 100 word processor expects the Centronics standard. Where can I buy an interface that doesn't require the ±5/±12V power supply required by Roger Alford's parallel-to-serial converter (Ever the Twain Shall Meet, April 1986, p. 78)?

I am told a transformer that runs off 110–120V isn't practical. I looked into Radio Shack adapters, but the label says they might cause transformers to overheat. I could adapt batteries if the interface required only 5V or 9V dc.

Also, I recently tried to build a speech synthesizer using the new text-to-speech algorithm chip and the old sound chip from Radio Shack. I used the schematic that allowed use of the RS-232, but I couldn't get it to work. I then purchased Echo GP, which came with a 9V dc power supply and allowed direct text-to-speech synthesis. (I also wrote a program to send ASCII text to the RS-232 and have the synthesizer "speak" it.) I hooked up seven NiCad C cells and the setup worked fine, but it required so much power that it drained the batteries in three hours. Do you know of a low-power unit that allows text-to-speech conversion without a special program and accepts input from the computer via the RS-232? I'd also like it to be portable. *(David T. Elder, Birmingham, AL)*

A: Roger Alford informs me that the parallel/RS-232 conversion interface in his April 1986 Project 80 column can use a standard ±5/±12V power supply, including one that is available in England. The ±12V supply can be anywhere from ±5V to ±25V—the actual voltage is not critical. You could, for example, use two 9V batteries to generate these voltages.

You can buy a parallel-to-serial converter from Tigertronics Inc. (2734-C Johnson Drive, Ventura, CA 93006, 805-658-7466) for $89.95 plus $3 shipping and handling. Order Model 775. A connector option costs $10 extra.

As for the speech system, Roger recently worked with an overseas company to develop a portable, battery-operated computer with advanced text-to-speech capability. The system, called Buddy MX, has a built-in text editor, terminal emulator, and printer buffer, and includes an RS-232C and Centronics parallel-printer port, as well as other features. It will sell for a reasonable price and should soon be on the market in the United States.

Strung Out on Pascal

Q: I am writing a file-management system using TRSDOS 6 Basic for input/output and Alcor Pascal for sorts and manipulation. I get garbage when I use the Pascal Decodei[string] function to convert a string generated by the Basic MKI$[integer] function back to an integer. Is there an inverse to MKI$ in Alcor Pascal or a way to produce one? Also,

Illustration by Anthony Russo

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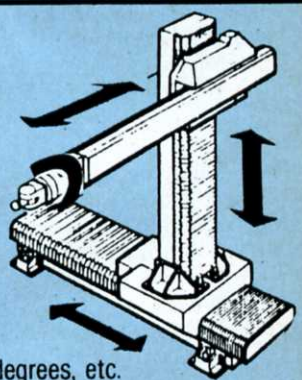

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how does one call TRSDOS JCL (job-control language) files from Pascal? *(F. P. Lynah III, Broadway, NJ)*

A: You seem to misunderstand the MKI$ function, which allows Basic to store an integer value in an area set aside for string fields in a file-record structure. Program Listing 1 establishes a file containing 37-byte records consisting of an integer record number, a 25-character string, and five integer numbers. After writing 20 data records, the program closes the file and exits.

Program Listing 2 is a Pascal program that defines a record structure identical to that of the Basic program. The Pascal program opens the test data file, reads each record, and lists it to the video screen. Note that using the MKI$ function in Basic writes a pure binary integer to the file, which any other language can access. With the exception of the program-header statement and the use of the Assign statement, this program works directly in Alcor Pascal.

In general, you can access any information written from Basic (using the Field statement) by arranging your record structures correctly. Strings written by Basic in this manner contain no length information. In the sample program, the string is written left-justified, with blank fill taking up a 25-byte area. When the string is read in Pascal, you must use a 25-character array and expect the string to fill all of it.

Integers are stored as full 16-bit words in the "byte-reversed" Intel format common to Z80 and 8088 machines. You can read this Basic data by making sure record alignment is correct. Floating-point and double-precision numbers aren't so simple: They require in-depth study of the interpreter and compiler technical references to verify that the internal format of real numbers is the same. In most cases, it *will* be for Model I and III compilers, which use the ROM routines. Other implementations may use their own internal real-number format, invalidating information transferred with the techniques outlined here.

There is no way to call a JCL procedure from within Pascal without writing the routine to link to the operating system.

Program Listing 1. Program that sets up files used in Pascal Decodei-Basic MKI$ conversion.

```
10 DEFINT A-Z
20 OPEN "R",1,"TEST/DAT",37
30 FIELD 1, 2 AS R$, 25 AS S$, 2 AS A$, 2 AS B$,
   2 AS C$, 2 AS D$, 2 AS E$
40 STRNG$="abcdefghijklmnopqrstuvwxyz"
50 FOR REC=1 TO 20
60   LSET R$=MKI$(REC)
70   LSET S$=STRNG$
80   LSET A$=MKI$(-2)
90   LSET B$=MKI$(-1)
100   LSET C$=MKI$( 0)
110   LSET D$=MKI$( 1)
120   LSET E$=MKI$( 2)
130   PUT 1,REC
140   STRNG$=RIGHT$(STRNG$,1)+LEFT$(STRNG$,LEN
    (STRNG$)-1)
150 NEXT REC
160 CLOSE 1
170 END
```

End

Program Listing 2. Alcor Pascal program with Basic record structure.

```
PROGRAM Test;

TYPE
  testdat = RECORD
              recno : Integer;
              strinfo : ARRAY*..25* OF Char;
              num1 : Integer;
              num2 : Integer;
              num3 : Integer;
              num4 : Integer;
              num5 : Integer;
            END;

VAR
  testfile : FILE OF testdat;
  testitem : testdat;
  i : Integer;

BEGIN
  Assign(testfile, 'TEST.DAT');
  Reset(testfile);

  FOR i := 1 TO 20 DO
    BEGIN
      Read(testfile, testitem);
      WITH testitem DO
        BEGIN
          Write(recno:2, ' ');
          Write(strinfo:25, ' ');
          Write(num1:2, ' ');
          Write(num2:2, ' ');
          Write(num3:2, ' ');
          Write(num4:2, ' ');
          WriteLn(num5:2, ' ');
        END;
          END;

END.
```

End

Taking the Bypass

Q: I use Newdos/80 on a Model III with an LP VIII printer. Whenever I use the Route,PR,Do,PR or Route,Do,Do,PR command, the printer underlines everything. When my friends with Epson printers try it, their printouts are compressed. Can you help? *(Fay Price, Muncie, IN)*

A: Newdos/80 sends a 15 code (0F hex) to the video driver to turn off the cursor when entering Basic or executing direct commands. Coincidentally, the same code activates the underline mode in LP VIII dot-matrix and daisy-wheel printers.

You might also notice that after the screen is cleared, the first character on the printout repeats 31 times, which is another video-control code problem. Newdos/80 issues home (28) and clear-to-end-of-screen codes (31) that, on the LP VIII, activate the repeat mode and the number of times a command is to be repeated. The first character after the clear-screen command, 31, also serves as the third character of the repeat sequence.

If you don't need your printer's special features while routing data, try the Routefix/CMD program that was incorrectly labeled "Patch/BAS" in the November Feedback Loop (p. 16). If the printer is underlining, turn it off and back on, install Routefix, and then route your command.

Accounts Unreceivable

Q: I have been using Radio Shack's Accounts Receivable and other business programs for five years and have upgraded them from Model I to Model III versions. They now run on my Model 4's with LDOS.

The programs don't provide enough space for long name or address lines, and when printing invoices for billing they chop the end off these address lines even further. The problem existed long before I upgraded to the Model 4's and LDOS. Although I know a little about Basic, I am unable to find where name and address lengths are established in the program. *(Walter A. McCall, Campbell, CA)*

A: The problem is in the Field statement, which establishes the size of the data in each record and usually follows an Open file statement. Since your files have been established as fielded, they'll become garbage when you change the Field statement. If you lengthen the

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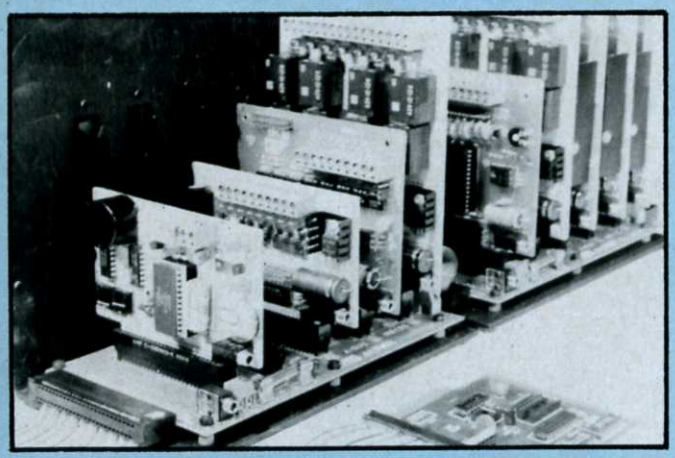

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Digital Input Card — IN-141: $59

The eight inputs are optically isolated, so it's safe and easy to connect any "on/off" devices, such as switches, thermostats, alarm loops, etc. to your computer. To read the eight inputs, simply use BASIC INP (or PEEK).

24 Line TTL I/O — DG-148: $65

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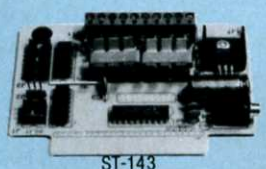
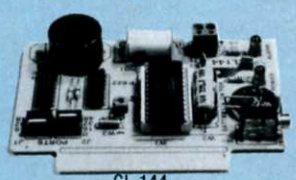


ST-143



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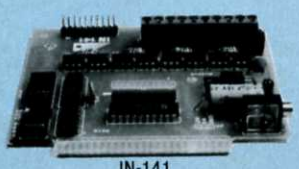
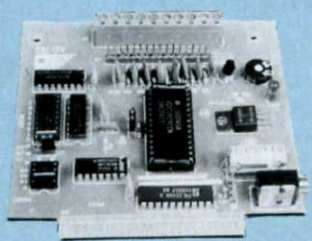


IN-141



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name field, your printout might end up with the name including part of the address. You must establish new files when you lengthen fields.

It might be easier to find where the program accepts input and control the data lengths from there. (See "Restricted Entry," by Jose E. Anaya, May 1985, p. 70, for a helpful Basic input routine.)

Patches, More Patches

Q: Years ago, I came across a patch to Model I Disk Scripsit that allowed me to use any delimiter after an F, R, or D command. The only rule was that the character typed after the command became the delimiter.

I got used to that convention, but now I use Model III and 4 Scripsit and have lost the patch. Can you give me any help? *(Frank Blunda, Unity, MD)*

A: Here are three patches. For the Model I, use the Patch/BAS program in the January 1987 Debug column (p. 87) and insert the following lines:

```
600 DATA SCRIPSIT/LC
610 DATA 06,67,0A,3A,D3,7D,CD,FF,53,C8,
    32,41,68
620 DATA 06,71,09,32,4D,68,32,A4,68,32,
    A8,68
630 DATA 06,7A,04,3A,40,7C,C9
640 DATA 16,E9,03,CD,4B,58
```

You can substitute Scripsit/UC for Scripsit/LC (the upper- and lowercase control files) if you need to.

Here are the Model III patches:

```
PATCH SCRIPSIT/CMD (ADD = 5203,FIND =
2843292028,CHG = 3A297CCDC4)
PATCH SCRIPSIT/CMD (ADD = 5208,FIND =
5029203139,CHG = 54C8328168)
PATCH SCRIPSIT/CMD (ADD = 520D,FIND =
3830205441,CHG = 328D6832E4)
PATCH SCRIPSIT/CMD (ADD = 5212,FIND =
4E44592043,CHG = 6832E8683A)
PATCH SCRIPSIT/CMD (ADD = 5217,FIND =
4F5250,CHG = 757AC9)
PATCH SCRIPSIT/CMD (ADD = 68D3,FIND =
3A757A,CHG = CD0352)
```

With the Model 4 version, use the Build command to create a file called Scripsit/FIX and type in the following data:

```
D00,07 = 3A 5C 60 CD DD 3A C8 32
F00,07 = 43 4F 50 59 52 49 47 48
D00,0F = C7 4C 32 D3 4C 32 2A 4D
F00,0F = 54 20 31 39 38 33 20 54
D00,17 = 32 2E 4D 3A C9 5E C9
F00,17 = 41 4E 44 59 20 43 4F
D14,8C = CD 03 38
F14,8C = 3A C9 5E
```

Exit the Build mode by typing the control-shift-@ combination; then type PATCH SCRIPSIT USING SCRIPSIT. Now you can use any delimiter regardless of which version of Scripsit you are running.

Specific Density

Q: I bought a used Model I with 16K, Level II Basic, and a Micro Design MDX-2 expansion board with 48K. The MDX-2 uses a 1771 floppy-disk controller. I plan to use two Pentec FD-200 5¼-inch drives.

The 1771's spec sheet says it is designed for single-density IBM 3740 format or "user-selected sector format." Does this mean that DOS can format it? The FD-200 can run single or double density, but is the IBM 3740 compatible with 5¼-inch drives?

I need to know if the MDX-2 and FD-200 will work properly together and which DOS I should use. *(Vance Petersen, Cornelius, OR)*

A: The 1771 floppy-disk controller chip can format disks a number of ways under DOS control. The problem is that it's designed for single-density operation only and doesn't support the double-density operation of the FD-200. You should still be able to run the FD-200 with single-density operation, however.

You *can* operate the FD-200 in double-density mode with a double-density board available from third-party vendors. These boards once were hot-selling items but are difficult to find now, since the Model I has been out of production for some time. One board still available is the Aerocomp DDC ($99 plus $3 shipping and handling) from Total Access (P.O. Box 790276, Dallas, TX 75379, 214-337-4346). You can also purchase the board with LDOS for $159 or with Newdos/80 2.0 for $179.

It is difficult to pick an operating system, and *80 Micro* has reviewed the ones that are available (including Dosplus 3.4 in October 1982, p. 244; LDOS in June 1981, p. 130; LDOS 5.1 in September 1982, p. 250; and Newdos/80 2.0 in February 1982, p. 152). Newdos/80 and LDOS are both good operating systems, Newdos/80 being more for the programmer. Study the features of the various DOSes before choosing one.

100 Problems

Q: Recently, my 24K Model 100 developed a strange problem. I was unable to download a file in Telecom mode, save a new file name in Basic, or open a new file name in Text (I could reopen existing files in all three modes, however). At that point I had about 10K of free space left. When I deleted some files and had about 11K free, I could open new files. When the free space was again about 10K, the problem returned.

Having previously uploaded all my files via Telecom and RS-232, I killed the Model 100 (and erased the files) by simultaneously pressing both the control and pause keys while turning the power on instead of turning the memory power switch off. I turned the power off then back on shortly afterward. The problem was gone until I again reached about 10K of free memory, and then it vanished again when I deleted some files. Now, however, the problem has been gone for several weeks and I can open new files with the computer showing as little as 645 bytes free. *(Stephen L. Johnston, Huntsville, AL)*

A: Carl Oppedahl, author of *Inside the Model 100* (published by Weber Systems of Chesterland, OH, and available in B. Dalton bookstores), gives three possible explanations.

1. The directory is full. Model 100 (and 102) directories have two limitations: The total space filled by the files may not exceed the installed RAM, and the number of distinct file names may not exceed the number of spaces available on the main menu. Although your letter doesn't mention the exact error message you got in Basic, it was probably "?FL," which means you bumped up against the latter limitation. The fact that you can use existing files but can't create new ones makes this the most likely explanation. Since files can be made invisible (as in some commercial programs), you might see blanks on the main menu and yet not have enough room for a new file name.

To see if you have any invisible files, run this two-line program:

```
1 FOR I = 63842 TO 64106 STEP 11: IF (PEEK
  (I) AND 136) = 136 THEN FOR J = I + 3 TO
  I + 10:PRINT CHR$(PEEK(J)); :NEXT:
  PRINT
2 NEXT
```

The program always reveals at least two usually invisible files, the paste buffer and Basic*. In the 100, they are called Hayashi and Suzuki, while in the 102 they have unpronounceable names starting with "2" and "/2." Maybe your problem came from having more than those two invisible files.

2. Defective RAM chip. Your 24K computer contains three 8K chips. Depending on your HIMEM setting, when the menu shows 10K free you might be approaching the start of the second 8K chip, marked M8 on the PC board. It is remotely possible that a faulty chip caused the trouble, but in the 100, a bad memory chip almost always destroys every file. If your computer is a 26-3801, M8 is socketed, and you can troubleshoot by swapping it with a good chip. (If it is a 26-3802, M8 might be socketed or soldered in.) Be sure to save important files before swapping memory chips or performing a RAM test.

3. A program you are running is poking in RAM above 62960. The control-break-reset you described is a good way to get a clean, empty Model 100, and sets right anything amiss above 62960. Be sure to save important files first.■

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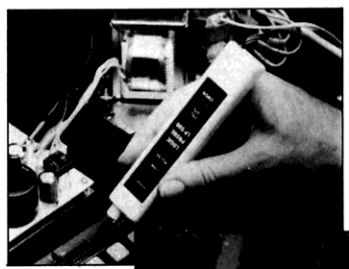

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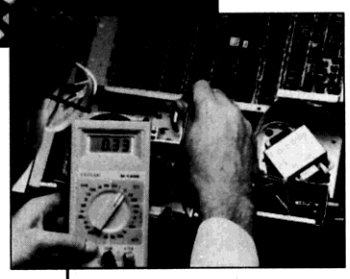

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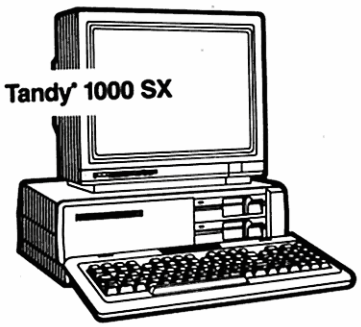
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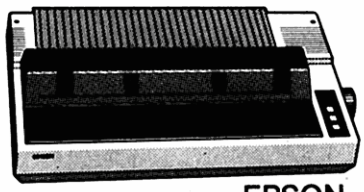
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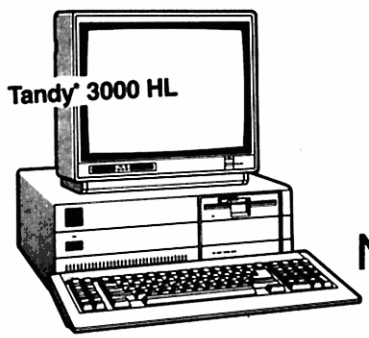
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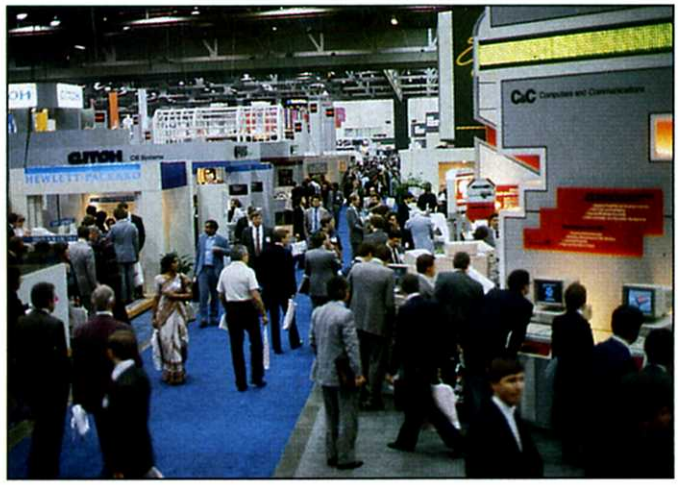

Comdex/Fall highlighted a host of interesting products.

The success story at Comdex/Fall was Intel Corp., the manufacturer of the central-processing chips (8086, 8088, 80286, and 80386) at the heart of today's PCs. Computers and other devices incorporating either the Intel 80386 or 82786 graphics chip were more prevalent at Comdex than sand from the Nevada desert.

For the embattled Intel, this was a resounding vindication. Like other American chip makers, Intel has been waging a costly war against overseas competition. For the moment, however, the California semiconductor maker has the industry tiger by the tail.

Though the show spotlighted a host of interesting products (enhanced video boards, desktop-publishing systems for PCs, networks, and clones under every bush), conversation focused on the 80386 and what it portends for the industry. The 32-bit chip is the successor to the 16-bit 80286 chip found in AT-type machines like the Tandy 3000. The 16-megahertz (MHz) 80386 runs DOS programs two to three times faster than the 8MHz 80286; in multitasking mode, it can run several programs—even several different operating systems—simultaneously. Clearly, the 80386 is for the next generation of computers.

What software is available for this hotshot chip? At present, none. Rumor had it that Microsoft would announce a 386 version of Windows at Comdex, but the software developer's hands were empty. The company is apparently scrambling to finish its 80286 operating system so it can get on with the 80386 version. When *will* the new 286 operating system appear? Look under your Christmas tree next December.

Other companies, meanwhile, are trying to capitalize on the lack of an 80386 operating system by offering all manner of pseudo-operating system software. Control systems, DOS/Unix hybrids, multitasking/multiuser configurations—even assemblers, linkers, and C compilers—were exhibited at Comdex. While Microsoft is preoccupied, developers of these products hope to carve a market niche. They just might be successful.

IBM cast a long shadow at the show. Its presence extended beyond its booth and into conversations about the future of 80386 computers. Though everyone expects IBM to produce an 80386 machine, nobody knows what it will look like, how it will be configured, or whether it will be compatible with existing PCs and other manufacturers' 386 computers.

William Lowe, president of IBM's Entry Systems Division and the convention's keynote speaker, gave some clues in his address. While emphasizing new PC requirements (more memory, better graphics, higher performance, advanced communications, and user support), he also expressed commitment to the current PC line: "We'll do this by supporting current products in a compatible way to coexist in the environment where new ones are used." Translation: Expect some PC upgrades.

Lowe also hinted at future multimedia systems with interfaces combining text, graphics, voice, and images. IBM is currently spending more than half its research-and-development budget on software emphasizing "connectivity, ease of use, multitasking, enhanced graphics, and the support of complete IBM systems," he said. "This will integrate the PC effectively into our large-account offerings."

Lowe's speech did not entirely ignore the home market. "What I also find exciting," he said, "is the opportunity to apply these advances to education and home-use applications, as well as to business. ... Better price performance and more function at a specific price point will provide more power to the many users of personal computers, whether they are in business, in an educational environment, or using a PC at home for their personal needs."

Lowe's most important news was that IBM will "continue to support open-architectured interfaces for applications providers to write to." This might not make PC-compatible makers sleep better, but it's the clearest delineation yet of IBM's future plans. Overall, Lowe predicted that 1987 will be an exciting year for the microcomputer industry, which means an exciting year for IBM. Sounds like Big Blue has some surprises in store.

About 15 companies demonstrated 80386 computers, the most notable being Compaq Computer Corp., Zenith Data Systems, PC's Limited Inc., Corvus Systems Inc., SCI Technology Inc., Kaypro Corp., Computer Dynamics Inc., and Multitech Electronics Inc. Other companies showing 80386 machines were Advanced Logic Research, Wyse Technology, American Research Corp., Laser Digital Inc., Citron Electronic Corp., Mitsui & Co. Inc., Rexon Inc., and American Computer & Peripheral Inc. Most of the computers are scheduled for shipment in the first or second quarter of 1987.

If you don't want to spend $6,000 for an 80386 computer, you might consider spending $2,000 or so for an 80386 speed-up board. Quadram Corp., Applied Reasoning Corp., Intel, Seattle Telecom & Data Inc., Orchid Technology, and American Computer & Peripheral displayed boards that offer most of the

Photograph by Don Ploke

advantages of an 80386 computer while costing only a third of the money.

The best 80386 deal: Cheetah International Inc.'s 4-inch circuit board ($400), which you can plug into the 80286 socket of an AT computer. The board gives you more speed and the ability to run 80386-based programs.

High-speed 80286-based AT computers were almost as popular at Comdex as regular clones. Many run at speeds up to 12.5MHz with no wait states. The champion's ring goes to PC's Limited, which exhibited a 16MHz AT—the speed equivalent of many 80386 machines.

Though Tandy had nothing remarkable—other than a Model 4D—among the 30-odd computers at its booth, it did demonstrate a full-length Enhanced Graphics Plus board ($359) with the new EM-1 monitor ($699). The board has 256K of video RAM and can display 16-color graphics with 640- by 350-pixel resolution (the standard set by IBM's Enhanced Graphics Adapter [EGA]). What's most interesting about the board is that you can use it to display EGA-standard graphics on Tandy's high-resolution CM-1 color monitor ($529.95).

Just when you think EGA-standard graphics are the ultimate, something new comes along that's even better. Several companies at Comdex displayed enhanced-video boards that work with multimode monitors, such as NEC Home Electronics (USA) Inc.'s Multisync. NEC's monitor, which works with almost any graphics board, has been the industry's hottest seller. In high-resolution mode, it provides 640- by 480-pixel resolution—the same as IBM's Professional Graphics Controller (PGC). The high-resolution mode produces a sharper image and makes quite a difference when you're using EGA-specific programs.

Other manufacturers offering variable-sync monitors include Taxan USA Corp., Magnavox/NAP Consumer Electronics Corp., Princeton Graphics Systems, and Teknika Electronics Corp.

Number Nine Corp. and Quadram displayed video boards (both priced at about $1,000) using Intel's 82786 graphics coprocessor chip. Quadram's QuadHPG and Number Nine's Pepper Plus are designed for EGA users needing better graphics performance. Both boards are EGA and PGC compatible and can display 256-color graphics with 650- by 480-pixel resolution.

The 82786 chip provides a hardware solution to the problems associated with running graphics-intensive programs. By putting many of the graphics functions at the hardware level, you can greatly increase speed, since the main processor doesn't have to spend all its time wrestling with graphics calculations.

Expect to see a slew of video boards using graphics chips this year. Texas Instruments Inc. is already offering a graphics chip that competes with Intel's. Within two years, the price of these boards should be down to about $400. By then, however, most computers will have built-in EGA-standard video. For now, the problem with these boards is finding software to run with them—most require software drivers.

I saw an interesting demonstration of Digital Research's Gem 786, which is configured for the Quadram board. The demonstration dispelled my misgivings about Gem, and even Windows for that matter. The graphics interface was extremely fast and fluid; in fact, it ran about as fast as the Atari 1040ST. Based on this performance, Gem could make a resurgence.

Though most of the attention at Comdex was given to new, high-powered AT machines, regular PCs are undergoing a quiet revolution of their own. Now that PCs have become commodity items, computer companies are eschewing the plain-vanilla MS-DOS boxes and bundling new features with their machines. Today's PCs are smaller, faster, cheaper, and more capable than their predecessors.

How fast can a PC perform? American Research Corp. and Wyse Technology have 8088-based computers operating in the 10MHz range. One way to make PCs perform faster is to run them without wait states (cycles during which the CPU stops). Zero wait-state capability has been a feature of more advanced 80286 machines, but it is migrating to the low end.

The original PC is an ungainly beast compared to current models. Even the Tandy 1000 looks portly compared to new machines like Wyse Technology's pc+. Tandon Corp., the manufacturer of the Tandy 1200, displayed its AT-class computer, the Targa, which Tandon says is "compatible by design." The unit is a little box (measuring 6 inches wide, 15.7 inches deep, and 6.3 inches high), but it comes with a color-graphics card, five open slots, 640K on the motherboard, a 1.2MB floppy drive, and a 30MB drive—all for about $3,000. If only all computers looked this good.

In other news, Borland International unveiled several new products, including Turbo Basic (an inexpensive Microsoft Basic compiler), Eureka: The Solver (problem-solving and numerical-analysis software), and the Turbo Pascal Numerical Methods Toolbox. Each package sells for $99.95.

Borland International's new Turbo Basic compiler is a shot across the bow at Microsoft's Quick Basic. Borland touts 8087/80287 support, true recursion, faster compilation, and smaller compiled programs as some of the advantages Turbo Basic has over Quick Basic. Turbo Basic can use all available memory for array data, with any single array using up to 64K. String data can occupy up to 64K. You don't have to link a library to generate a stand-alone executable file, as you do in Quick Basic. Borland, as usual, will hype this program to high heaven. With True Basic beginning to gain market share, this has the markings of a real cat fight.

Eastman Kodak finally introduced its 6.6-megabyte (MB) floppy disk ($799) and its 12MB hard-shell removable disk ($1,499). Verbatim Corp., a Kodak subsidiary, will push the products into the marketplace.

Kodak might have missed the boat, however. Konica Technology Inc. announced a 10MB floppy, scheduled for shipment in mid-1987. It costs the same as the Kodak disk and gives you 40 percent more storage.

The most-notable-clone award goes to Bondwell's $499 X'Press 16. Of all the clones displayed, it gives the most bang for the buck. It's the Commodore 64 of the MS-DOS world.

Portable makers causing the biggest stir were Datavue Technical Systems and NEC. Datavue introduced its Spark portable ($995), featuring a dual-speed (4.77 or 9.54MHz) 8088 processor, a 3.5-inch disk drive (a second 3.5-inch drive is optional), 384K RAM (expandable to 640K), a super-twist or super-twist electroluminescent screen, an external RGB port, serial and parallel ports, a rechargeable nickel-cadmium (NiCad) battery, and an internal 300-/1,200-baud modem port.

NEC unveiled the Multi-Speed portable ($1,995), featuring a dual-speed (4.77 or 9.54MHz) NEC V30 chip; two 3.5-inch disk drives; a detachable, super-twist, 80-character by 25-line, liquid-crystal display (LCD) screen; 640K RAM; a numeric keypad; MS-DOS 3.2; a rechargeable NiCad battery; parallel and serial ports; and an external RGB port. The Multi-Speed also has five firmware programs in ROM: an outliner and notepad, plus filer, dialer, and telecommunications programs. All the programs can operate as background tasks and be called from other programs. ■

Circle 108 on Reader Service card.

More Software from the Creators of Super Utility™

T R S C R O S S

The SECOND Generation of Disk/File Transfer Utilities

is here from PowerSoft!

TRSCROSS™

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1 - Copy from TRS-80™ diskette
2 - Copy to TRS-80™ diskette
3 - Format TRS-80™ diskette
4 - Purge TRS-80™ diskette
5 - Display directory (PC or TRS-80™)
6 - Exit

Shown above is the Main Menu displayed when running TRSCROSS on your PC or compatible.

TRSCROSS will READ FROM and COPY TO the following TRS-80 double-density formats: TRSDOS 1.2/1.3, TRSDOS 6.2*, LDOS 5.1.4*, DOSPLUS 3.5, NEWDOS/80*, & MultiDOS.

TRSCROSS runs on your PC, yet reads your TRS-80 diskettes! Copy files in either direction! • Written completely in-house by our programmers and 100% supported by PowerSoft •

TRSCROSS is as easy to use as it looks to be! The program is very straightforward, well thought out, and simple to operate. TRSCROSS has several "help" features built into the program to keep operation as easy as possible. Just pop in your TRS-80 disk to your PC and copy the files right to your PC data disk or hard disk. *It couldn't be any faster or easier!* Packed in the PowerSoft binder is a typeset instruction manual with Index. All steps are detailed. Advanced features, for those that desire to use them, include executing menu options right from DOS or from a .BAT file or macro. This can really speed up transfers when similar operations are performed frequently.

TRSCROSS allows you to "TAG" all files to be moved in ONE pass!

INCLUDES BUILT-IN BASIC CONVERSION!

Other features include converting BASIC programs or Superscripsit™ "files on-the-fly"! Forget about having to save your programs or files in ASCII first, or running a separate conversion program before transferring! TRSCROSS reads your tokenized BASIC program or Superscripsit file directly off your TRS-80 disk and performs the conversion all in *ONE pass* while being transferred directly to your PC or compatible

TRSCROSS will even FORMAT a TRS-80 disk right on your PC!

computer!. (Does not cover PEEKs, POKEs, graphics, or machine language calls or subroutines.)

(Handy for those who use both machines!) Former TRS-80 users who no longer have their TRS-80, but still have diskettes with valuable data. . .this is exactly what you've been waiting for! Similar in concept to our SuperCROSS, but runs on the PC rather than the TRS-80.

DOS formats listed above flagged with * signify that earlier versions of these DOS's are readable as well, but one or more sectors may be skipped due to a format problem in that version of the DOS. One or more sectors may also be skipped on NewDOS/80 formats. (Disks that were formatted with SUPER UTILITY + or SU4/4P do not, and have never had this problem.) TRSDOS 6.02.01, or higher should not have this problem. Disks formatted in any 80 track format, any single density or mixed density (Model I "boot" disks) are not supported.

TRSCROSS requires: PC or compatible computer, 128K and a normal 360KB (40 track drive) PC drive. Double-sided operation is fully supported. If you have more than one disk drive, fixed drive, or RAM disk, operation will be much smoother. TANDY 1000 requires extra memory card because of the required DMA chip that resides there. TANDY 3000 is supported as long as you have a 360KB drive to use for transferring, rather than the hi-density drive. TANDY 2000 is not supported at this time due to a difference in disk controller and floppy drives. TANDY 1200 is OK. "Special" data files like PROFILE +™ would need to be converted to ASCII on a TRS-80 first before they would be of any use on a PC or compatible.

If you plan to retire your TRS-80, or use both machines, TRSCROSS is for you! TRSCROSS will allow access to your TRS-80 diskettes for years after your TRS-80 is gone!

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Signature: _____

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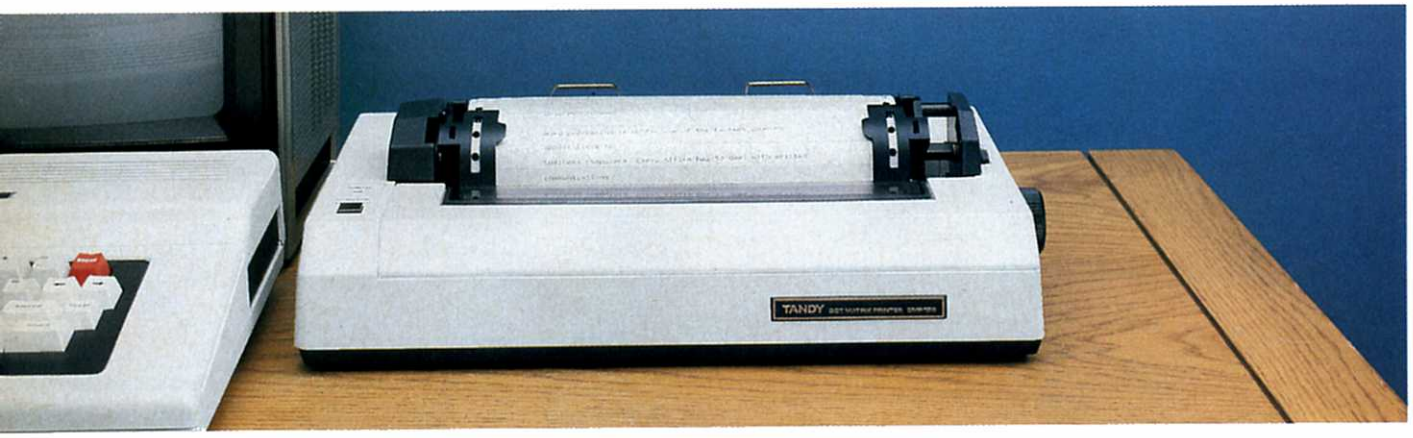

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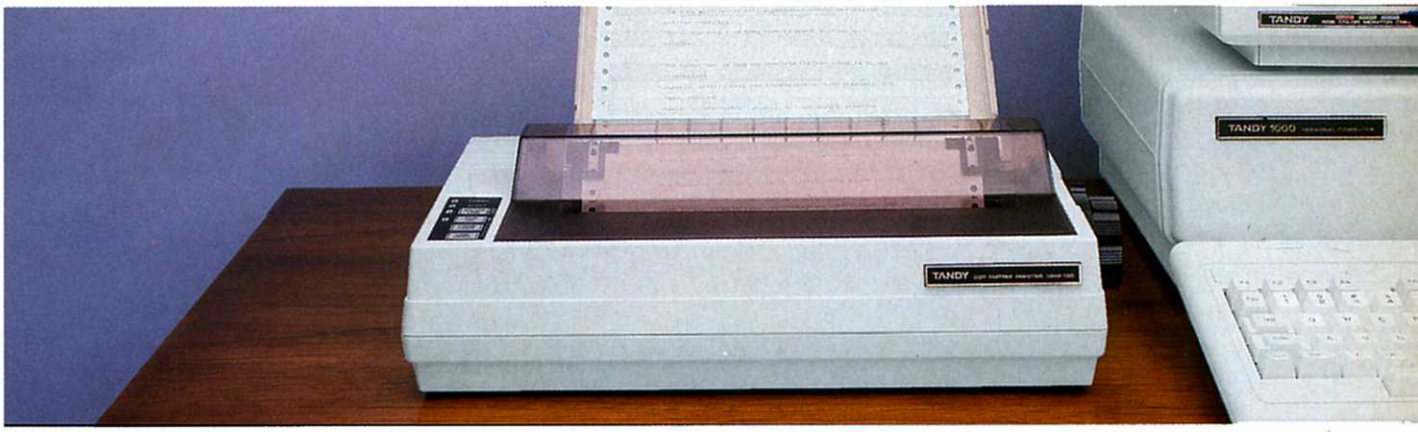
Budget-priced high performer

The DMP 105 (26-1276, $199.95) is the low-cost solution for data-processing and general-purpose use. The DMP 105 features a bidirectional head that prints 80 characters per line at 43 lines per minute (10 cpi). Elongated and condensed modes are also available. Prints up to 80 characters per second. Parallel and Color Computer-compatible serial interfaces.

Triple-mode "personal printer"

The low-cost, versatile DMP 130 (26-1280, $349.95) features word-processing and data-processing, as well as dot-addressable graphics modes. You can choose from four character styles: standard or italic cursive, in draft or correspondence modes. The DMP 130 supports super/subscripts, double-width, bold, double-strike and microfonts. The bidirectional, logic-seeking print head prints original, plus two copies on 4" to 10" fanfold paper or single sheets. Prints up to 100 characters per second. Built-in tractor. Parallel and Color Computer-compatible serial interfaces. IBM® PC compatible.

PC-compatible computer,



Tandy printer.

Low-cost business printer

The DMP 430 (26-1277, $699.00) is a dot-matrix printer with an 18-wire print head that delivers superior correspondence fonts in a single pass. Prints 10, 12, or 16.7 cpi, plus elongated, standard, elite and condensed. You can also get micro, italic and double-high fonts. Prints original, plus two copies at 180 characters per second. IBM PC compatible.

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Get high speed and high performance with our finest printer, the DMP 2200 (26-1279, $1695.00). Efficient, fast printing means no long and costly delays for reports. Supports elongated, double-high, bold, underline, super/subscripts, italics and double-strike modes, plus bit-image graphics. Prints up to 380 characters per second. Features a true pin-driven tractor—not sprocket. Prints original, plus up to six copies. Parallel interface only. IBM PC compatible.

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Circle 82 on Reader Service card.

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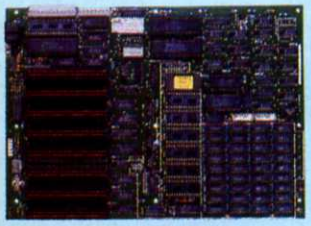

Now for the heart of your IBM clone: the Main Board. No cost has been spared in manufacturing this fully IBM compatible, 640K RAM (already installed on the main board), 8 slot Clone of the IBM XT. The latest technology has been applied such as an 8087 socket and DMA along with our ROM BIOS giving you compatibility that Tandy 1000 and 2000 owners dream about but will never have. The board fits the case perfectly. You merely plug in the power connector, hook up the speaker and install the rest of your peripherals **$249**

Add our 135W (twice IBM's) power supply for all the power you are likely to ever need. It has outputs for the main board plus up to 4 disk drives. The IBM-style side switch mates with our case . . . . . **$ 99**

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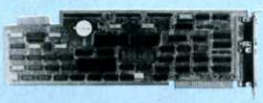
The Multi I/O card provides for 5 major functions—floppy disk drives (up to 4 DS/DD 360K drives); IBM parallel printer port; 2 serial (RS-232) ports, 1 populated, 2nd optional ($10); Game port; Battery backup clock/calendar. Includes clock software and internal disk drive cable . . . . . **$ 149**

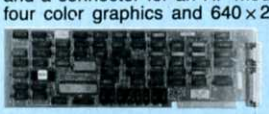


Standard . . . . . $ 89

Deluxe . . . . . $ 129

Keyboards are one area where nobody copied IBM. Many feel the standard IBM keyboard leaves a lot to be desired. We have the most popular aftermarket keyboards. The 5150 and the 5151 are capacitive types with the feel professionals demand. Both models offer lighted NumLock and Caps keys and the deluxe model has lighted Power and Cursor Pad keys along with a Reset key and a separate cursor and numeric keypad.

Two video boards are available. The color graphics video card has 3 outputs; RGB TTL; composite color; composite monochrome, plus a light pen port and a connector for an RF modulator. Standard IBM resolution of 320 × 200 four color graphics and 640 × 200 monochrome graphics . . . . . **$ 99**



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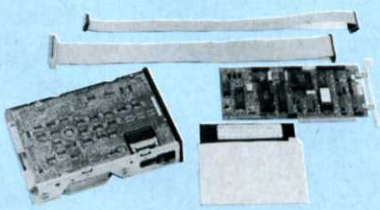
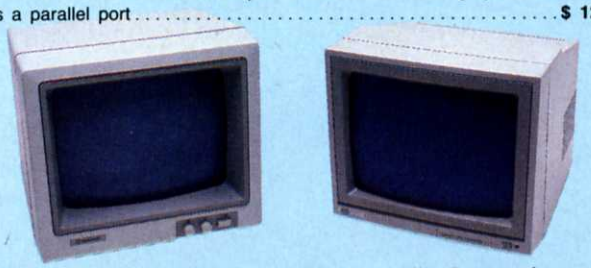
Our monochrome graphics display card is Hercules compatible with a 720 × 348 TTL monochrome output. It runs Lotus 1-2-3 graphics and also has a parallel port . . . . . **$ 129**

Want to go with a hard drive? How about a 20MB half-high, low-power hard disk drive? Our complete kit includes the drive, cables, controller and software. It fits right inside your Clone and you can forget the floppy. Boot directly from the hard disk. Future expansion is assured as the controller accepts a second hard drive whenever you are ready . . . . . **$ 489**





The standard floppy disk controller is also available. It controls 2 internal and 2 external floppys like the Multi I/O card. This card comes with the internal 2-drive cable . . . . . **$ 59**

In order to finally see what you are doing we offer 2 monochrome video displays. The TTL display is able to display the hi-res output (720 × 348) of the Hercules or compatible card. This 12″ video display has a non-glare display. Green or amber . . . . . **$ 110**
The composite model is also able to display hi-res monochrome characters and graphics. Green or Amber with a 12″ display . . . . . **$ 99**

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Electric Webster Meets LeScript

I've encountered several problems while using Electric Webster and its Grammar and Style Checker with the LeScript word processor. I have a Model 4 with TRSDOS 6.x.

My advice to avoid these problems follows:

- Avoid file-name extensions such as L86:1. Although TRSDOS 6.x allows this, Electric Webster looks for a drive other than 1 (6?) upon entering Electric Webster from LeScript.
- Make sure you have free disk space at least equal to the length of the file to be checked before running Electric Webster.
- With the Grammar and Style Checker, use the JB rather than JL justification within the body of the text. The program is more likely to hang up if you use JL.
- Don't ask the Grammar and Style Checker to change underlined words. It frequently writes garbage in place of altered underlined words. Leave underlining until after you pass the text through the Grammar and Style Checker.
- When the Grammar and Style Checker asks if you want to make a backup or replace a document file, make the backup.

H.L. Smith
Tasmania, Australia

Loose-Leaf Listings

I like to file my Basic program listings in a loose-leaf notebook, but I had trouble finding a way to produce printouts with blank spaces at the top and bottom of each page.

To do this, I wrote List (the Program Listing). It reads any ASCII file, including Basic programs saved in ASCII format, and prints exactly 50 lines per page with a header and footer. The header shows the file name and date, and the footer shows the page number. The printing speed is acceptable with only slight hesitations when the computer reads the disk.

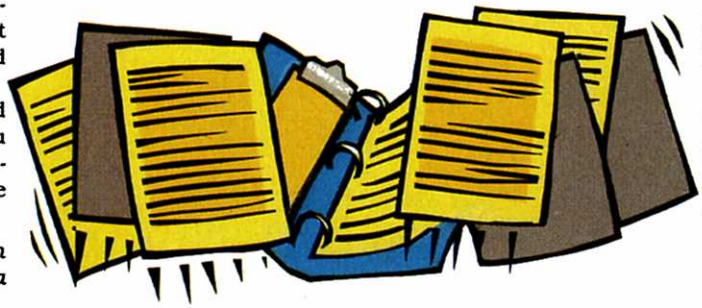
I use a lot of down-arrow keys in my programs to separate blocks of code. Lines 3 and 4 include this character. List looks for the down-arrow character and treats it as a carriage return. The program automatically breaks up lines longer than 80 characters into segments of 80 or fewer characters.

Kenneth M. Frith
Baton Rouge, LA

Program Listing. List.

```
1    '
2    'ASCII file listing program by Kenneth M. Frith
3    '
4    DEFINT I - L
     '
1000 CLS
1005 INPUT "Enter program filename "; FILE$
1010 OPEN "I", 1, FILE$
1015 LPRINT "Program: " FILE$ SPC(63 - LEN(FILE$)) D
ATE$
1020 LPRINT STRING$(80,"=")
1025 LPRINT
1030 IF I$ = "" THEN LINE INPUT #1, I$
1035 IF LEN(I$) < = 80 THEN J = LEN(I$) ELSE J = 80
1040 K = 0
1045 FOR I=1 TO J
1050 IF ASC(MID$(I$,I,1)) = 10 THEN J = I:K = 1:GOTO
 1060
1055 NEXT
1060 J$ = LEFT$(I$,J - K)
1065 I$ =RIGHT$(I$, LEN(I$) -J)
1070 L = L + 1
1075 LPRINT J$
1080 IF EOF(1) THEN FOR I = L+1 TO 50:LPRINT:NEXT:GO
TO 1090
1085 IF L<50 THEN 1030
1090 LPRINT
1095 LPRINT STRING$(80,"=")
1100 PG = PG + 1
1105 LPRINT SPC(36) "PAGE - " USING "##"; PG
1110 LPRINT CHR$(12)
1115 L=0
1120 IF NOT EOF(1) THEN 1015
1125 END
```

End



Vitamin E Poke For 4 in III

I have found a way to increase the Model 4's clock speed in III mode. From Basic, type POKE 16912,200. POKE 16912,16 returns operation to normal speed.

This Poke works with all Basic and many assembly-language programs. Although, it boosts clock speed, it does not make disk operations faster. To be safe, slow down the clock before disk I/O.

Wayne Culbreth
Little Rock, AR

6.2 Tips

Here are three items of interest to TRSDOS 6.2 users.

You can change TRSDOS 6.2 commands by loading SYS1/SYS.LSIDOS into a zap utility and changing the bytes of the old command to the new command. If the command falls short of six letters, fill the rest of the space with 20 hexadecimal or 32 decimal.

If you've used TRSDOS 1.3, you're probably accustomed to the Kill command. While TRSDOS 6.2 uses Remove instead, Logical Systems did include a Kill command. You can activate it by installing the following patch:

```
PATCH SYS1/SYS.LSIDOS
(X'2054' = "K")
```

Once this patch is installed, you can use the Kill command, and it will be listed by the LIB command.

You can remove most of the TRSDOS 6.2 password checking by installing this patch:

```
PATCH SYS2/SYS.LSIDOS (D02,
33 = 18:F02,33 = 28)
```

Jeff Schickel
Malone, NY

Illustration by Julia Talcott

Circle 85 on Reader Service card.

New! "PCXZ" $79.95 READ, WRITE, FORMAT TRS-80 DISKS IN A PC DETAILS BELOW

TRANSFER ANY MOD I/III/4 FILE
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"..Conv3toPC has saved me months of work!"

"..Conv4toPC is the best conversion package I ever used."

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Important note: Every converted BASIC program will require some user editing (the 5% or less) before it will run on a PC. To facilitate such revisions, every keyword that may need manual attention is flagged and our user guides explain why and what needs to be done. For most programs, a casual knowledge of BASIC is sufficient to make the changes. However, if a BASIC program contains machine language, it will be extremely difficult for the average user to handle some of the necessary manual revisions!

Please feel free to call us if you have any questions or doubts about whether these packages are right for you. We will candidly answer all your questions and send you our free demo disk ($2.00 for S/H). Or, order either package; read through the entire user guide for complete details; then, if you decide it doesn't suit your needs, return it for a full refund—less a $10.00 restocking fee. Refunds will NOT be granted if the sealed bag containing the program diskettes has been opened!

OTHER EMSI SOFTWARE

PCXZ 1.0 Cross-Zap Utility for PC/MS-DOS

Now, from The Author that brought you **Hypercross, HyperZap and SuperCross** comes an amazing new program for owners of Tandy 1000, 1200, 3000 and true PC compatibles. **PC Cross-Zap** allows you to read all double density TRS-80 type disks **on your PC**. Not only that, PCXZ offers many of the features that TRS-80 owners have long enjoyed with Hypercross and Hyperzap.

PC Cross-Zap is a utility program that runs on your PC or PC-compatible. With it you can copy files to or from TRS-80 disks at will. You can also format a disk, copy disks, explore, read and write sector data, repair bad directories and much more. Long after your TRS-80 is gone you will still be able to read your old disks. Even when your TRS-80 disks are gone you can continue to use PCXZ to read, fix and modify MS-DOS and other disks so your investment will never be lost.

With PCXZ you can format a TRS-80 disk (not the mixed density Model I types). You can copy files from a TRS-80 disk error free, without losing any data. Just like HyperCross.

Formats Supported Model I mixed density DOS+ 3.4, DoubleDOS, LDOS (SOLE), MultiDOS, NEWDOS 80 V2, TRSDOS 2.7/8. Model I/III Double Density: DOS+ 3.5, LDOS 5.1 Model III: DOS+ 3.4, MultiDOS, NewDOS 80, TRSDOS 1.3 Model 4/4P: MultiDOS, DOS+ 4, TRSDOS 6. Max-80: LDOS 5.1. All formats also supported in double sided, 35, 40 and 80 tracks were appropriate. For 80 track formats you must have an 80 track drive on your PC.

Systems Requirements PC,XT,AT or compatible, Tandy 1000 or 1000Ex (needs DMA), 1000 SX, 1200, 3000 with at least one 40 track drive and 256K minimum memory.

Get PCXZ—not half a program! $79.95

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Cnv3toPC.BAS (No Hypercross) $99.95
Conv4toPC V1.0 (Complete) $139.95
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HYPERCROSS MOD I/III $49.95
HYPERCROSS MOD 4 $49.95
CROSS REFERENCE $24.95
For PC BASIC programs. Referenced variables, line #s, keywords.
FASTSORT $24.95
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INSIDE TRACK $59.95
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MACH2 NEW!! $69.95
A tool chest of routines that do for PC BASIC what Rosenfelder's fantastic BASIC FASTER AND BETTER did for Mod III BASIC.
QuickBASIC V2.0 $79.95
Compile PC BASIC programs for speed and enhanced functions.

NORTON UTILITIES V3.1 $69.95
Industry standard for directory & file recovery. Also, modify file attributes, search/sort directories etc, etc.
FRACTION CALCULATOR $24.95
Solve mixed number arithmetic problems on your PC. Exact common fraction answers without decimals. Instruction mode great for children.
LOGIC and DEDUCTION $24.95
Full color Mastermind game for the PC to challenge any age. Play 1-9 columns, 2-5 colors, direct or indirect hints. Have fun while improving your powers of deductive reasoning. Requires color monitor/adapter.

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Debugging the MS-DOS Way

by Hardin Brothers

★★★★

Advanced Trace86 runs on the Tandy 1000, 1200, or 3000. Morgan Computing Co. Inc., P.O. Box 112730, Carrolltown, TX 75011, 214-245-4763. $175.

★★★★

Periscope runs on the Tandy 1000, 1200, or 3000. Data Base Decisions, 14 Bonnie Lane, Atlanta, GA 30328, 404-256-3860. $295.

★★★★

X-View 86 runs on the Tandy 1000, 1200, or 3000. McGraw-Hill CCIG Software, 2600 10th St., Berkeley, CA 94710, 415-548-2805. $59.95 (plus $3 postage and handling).

Using MS-DOS Debug as a serious programming tool is like trying to understand a forest by studying bark patterns. Debug has limited uses, such as patching programs according to a formula or creating and debugging very short utilities. For debugging medium-size or larger programs, it's inadequate.

Debugging the MS-DOS Way

A number of companies have produced powerful debuggers. These can help you understand how assembly-language programs work, locate and fix bugs quickly, and forget the frustrations of Debug forever. I'll look at three such programs that run on most MS-DOS computers. Two require minor patching to run on the Tandy 1000 and overcome their manufacturers' insistence that they aren't compatible with the 1000 at all (see the sidebar, "Patching Debuggers for the Tandy 1000").

Advanced Trace86

I must admit a bias: I have used Advanced Trace86 (AT86) for more than a year and it is one of my favorite programming tools, an invaluable aid during the development of several major programs. The best way to describe AT86 is to take you through a typical debugging session. Assume that you have written a program in assembly, assembled it with the Microsoft MASM assembler, and linked it using the /MAP option to create a list of public symbols and their program addresses.

To start debugging, type AT86 from the DOS prompt. Register and command information, as well as some reminders about how to run the system, appear at the top of the screen display. If you've installed AT86 with color options, each area of the screen is displayed in a set of user-defined colors.

The top four lines of the AT86 screen are always the same. The first two display the current contents of the 8088 registers (AT86 also works on computers using the 80286 processor and with math coprocessor chips). The program displays the registers in a logical order. For example, it is easy to see that the AX, BX, CX, and DX registers are a logical group and that DS and SI are often related, as are ES and DI; CS and IP; and SS, SP, and BP. The display shows the current status of each of the flag bits, including the direction flag settings (shown by an arrow) and whether maskable interrupts are enabled or disabled. If the current instruction at CS:IP directly accesses memory, a display shows the segment register and offset of the memory address, along with the contents (either a byte or word) of that location.

The third line of the display shows some of the currently available commands. You can always get help with any command by typing its first letter followed by a question mark. AT86 displays a list of all commands starting with that letter, and the syntax and a short description of each appear in a pop-up window. Another keystroke erases the help window and restores everything that was underneath it.

The fourth line of the register display is a bar separating the window from the rest of the screen. AT86 does an amazing job of keeping its screens neat while displaying a great deal of information. At almost any time, tapping the @ key brings up a window with a full ASCII table, including all displayable characters from zero to 255. A second @ changes the display to an EBCDIC (extended binary-coded decimal interchange code) table. Any other keystroke removes the ASCII table and restores the previous screen.

You want to debug a program, so give AT86 the name of its map file and load the map file, name, and program. Key in command-line parameters that you would normally want the program to see. You could have done all this except loading the name and map file when you originally entered AT86 from the DOS prompt. You can also set the size of AT86's internal buffers from the DOS prompt if you like.

The Star Ratings

80 Micro's star ratings reflect our reviewer's impression of a product. The stars mean:

★★★★★ Superior
★★★★ Excellent
★★★ Good
★★ Fair
★ Poor

Illustration by Betsy Scheld

Once the map file and the program are in memory, you can ask AT86 for a complete list of labels or the address of any particular label. Perhaps you know that the program runs fine up to a label called CALC5. Tell AT86 to set a breakpoint there by typing BSCALC5. Typing BL displays a list of breakpoints.

You can now type G, and AT86 runs your program; a message at the top of the screen alerts you when the program reaches the breakpoint. Perhaps your program has a table in memory that you want to examine or change before single-stepping through the CALC5 routine. If you type D DS:1000, for example, AT86 uses the entire screen below the top four lines to display 336 bytes of memory (21 lines of 16 bytes each), along with the ASCII representation of each byte. AT86 can also display memory in word, double-word, or ASCII-only format.

One of AT86's nicest features is that you can change any section of memory easily by moving the cursor to the byte you want to change, pressing control-O, and typing. You can enter changes either in hexadecimal (hex) or ASCII form, and the program constantly updates the screen to show what changes you have made. You can also use any 2-byte word or 4-byte double word on the screen as a pointer to a new memory location and display that location with a single keystroke.

Hitting the escape key takes you out of the display mode and back to command mode. Your program stops at a breakpoint, and you now want to trace through the CALC5 routine. Pressing "T" puts AT86 into trace mode. The top of the screen still shows the current contents of the registers. Below it is a display that looks much like the assembly source code you originally wrote, plus the address and actual bytes of each instruction with labels attached to appropriate instructions.

In other words, AT86 has disassembled the CALC5 routine for you, with the screen's right edge displaying the current stack contents. If your program uses the BP register as a frame pointer, the word to which BP points is highlighted. Press "T" again and the bottom two or more lines of the screen show an area of memory in byte and ASCII form. A cursor in that area blinks under the last changed byte, and you can set AT86 to toggle between displaying a set area of memory or keeping the display linked to the program. You always see the section of memory that the program is changing.

Most important of all is the disassembly presented in the middle of the screen. The current instruction is highlighted and, if it is a conditional jump, a small arrow shows whether or not the jump will be taken. By pressing the

Patching Debuggers for the Tandy 1000

Periscope and Advanced Trace86 will not run on the Tandy 1000 without modification. Both fail because neither is configured for the 1000's memory-management scheme.

The IBM PC and PC/XT use I/O port A0 hex to enable and disable non-maskable interrupts. This is a write-only port that controls a hardware switch that determines whether non-maskable interrupts, which are normally generated during a memory parity error, will reach the 8088 CPU. If a byte is sent out of this port with bit 7 set, interrupts are turned on. If a byte is sent out of port A0 hex with bit 7 reset, interrupts are turned off. Any value equal to or greater than 80 hex turns on interrupts, and any lower value turns them off.

The Tandy 1000 does not normally use non-maskable interrupts, although it has the same hardware switch. Unlike the IBM PC (but like the PCjr), it uses 3 bits of port A0 hex for memory management. If incorrect values are sent to port A0 hex on the 1000, the computer freezes up completely and you must reboot.

Since both AT86 and Periscope send values to port A0 hex, you must patch them to run on the 1000. The specific patches depend on the amount of memory installed in your 1000. First, use the memory size shown when you boot up your computer; use the following table to find a hex digit you will use in the patch:

Memory size	Hex digit
128K	0
256K	2
384K	4
512K	6
640K	8

In each patch, find the current value the program is sending out and substitute the hex digit from the list above for the second digit of the current value. For example, if you find that the program is currently using a value of 80 hex and you have 256K of memory, change that value to 82 hex.

The actual location of the patches in AT86 and Periscope depends on which release version you have. The following procedures find the correct patch locations regardless of version number. Also, be sure to work with a copy of the original program. Don't change the original on disk.

Advanced Trace86

This program needs a patch to only 1 byte. The instructions in the program, and its disassembly, are:

```
B8 80 30   MOV   AX,3080
E6 A0      OUT   A0,AL
```

You need to change the zero in byte 80 to match your memory size.

Copy AT86.COM to NEW86.COM. Now follow this series of commands. What you type is underlined:

```
A>DEBUG
-NNEW86.COM
-L
-S CS:100 7FFF B8 80 30 E6 A0
nnnn:12F1  (offset might differ)
-E CS:12F2  (add one to offset above)
nnnn:12F2 80.8x (use value from table for 'x')
-W
Writing CD02 bytes  (number might differ)
-Q
```

To test this patch, type:

```
NEW86
BYE
```

If you return to DOS successfully, you have installed the patch correctly.

Periscope (Software-Only Version)

Three locations in Periscope need to be patched. First, run the PSPATCH program. The instructions you are looking for are:

```
B0 0B      MOV   AL,0B
E6 A0      OUT   A0,AL
B0 0A      MOV   AL,0A
E6 A0      OUT   A0,AL
B0 20      MOV   AL,20
E6 A0      OUT   A0,AL
```

These three sets of instructions are near each other and seem to be Periscope's method of checking for or resetting the slave controller on a PC/AT, which is addressed through port A0 hex. To make the patches:

```
A>DEBUG
-NPS.COM
-L
-S CS:100 7FFF E6 A0
nnnn:0C26  (offsets might differ)
nnnn:0C32
nnnn:0C38
-E CS:0C25  (1 byte before first offset)
nnnn:0C25  0B.0x  (use x digit from table)
-E CS:0C31  (1 byte before second offset)
nnnn:0C31  0A.0x
-E CS:0C37  (1 byte before third offset)
nnnn:0C37  20.2x
-W
Writing AA6D bytes  (value might differ)
-Q
```

To test this patch, follow the tutorial in the manual. If you can load and trace Sample.COM without crashing the computer, you have been successful.■

spacebar, you can execute the current instruction while watching the registers change. The highlighted bar then moves to the next instruction.

AT86's disassembly and single-step trace are its best features. When you are in trace mode, individual keystrokes single-step through the program, run subroutines at native speed or trace through them, skip the current instruction, execute a single instruction (such as REP) at native speed, or take jumps that are normally ignored. AT86 constantly updates the stack and memory displays to show what is happening in other parts of memory.

You can also ask AT86 to reverse direction and trace through a section of code again. In the process, AT86 resets registers, the stack, and memory locations to their previous conditions. Finally, you can have AT86 run a continuous trace, executing program instructions and updating the display for you. A single keystroke puts you back in control of the trace routine.

If your program makes INT calls to DOS or the BIOS, you can tell AT86 to make those calls at normal machine speed or single-step through them. If you aren't sure how DOS is affecting your program, single-stepping through DOS can seem like trudging through a jungle.

AT86 has many other capabilities as well. It has a full assembler on board so you can write a program while using AT86, save it to disk, and single-step through it without returning to DOS. The assemble-and-trace feature is most important if you want to test an algorithm or are just learning assembly. Also, if you are debugging a resident program or a device driver, you can write a small test routine with AT86's assembler and use it to single-step through the device driver.

AT86 can disassemble starting at any address and can move forward or backward through memory. Disassemble a specific address and view the instructions that come before and after that address. If labels are attached to the area of memory you are disassembling, they are included in the output. You can send the disassembled code to a disk file and later reassemble it.

With AT86, you can define long lists of commands, read them from a disk file, and execute them with one or two keystrokes. A built-in calculator performs number-base conversions as well as standard arithmetic operations and works with or without a math coprocessor.

AT86 shows you a directory of the current disk or any directory or subdirectory in your system and can list a text or source-code file in a form that is much easier to use than the DOS Type command. It can load, modify, and return to disk any COM or EXE program (you don't need to rename the EXE program as you must when using Debug).

As with other debuggers, you can use AT86 to compare sections of memory, search for specific bytes, fill an area of memory, read and write files and absolute disk sectors, copy a portion of memory to another location, and use the computer's input/output (I/O) ports. AT86's assembler lets you edit a program that you are debugging, delete a set of instructions, or (if you created a program with the assembler) insert instructions.

AT86 has two other special features. Load AT86 as a memory-resident program, set a series of breakpoints, and return to DOS. Whenever a breakpoint occurs or you press control-enter, AT86 appears on the screen and you can examine registers or trace through a section of a program. Also, AT86 has a trace mode that executes your assembly instructions after every instruction in the program you are debugging. In trace mode, you can develop complex sets of conditional breakpoints.

Configure AT86 to use any colors you choose in its windows and various displays. As it debugs a program, it can write the program's video output to a separate page of screen memory without interfering with the trace screen. On some computers, you can put the trace information on one screen and the program's output on a second video monitor. Overall, this is an excellent program and well worth its price.

Periscope

Periscope is a debugging utility that comes in three versions: with a Submarine memory board, with a breakout switch, and as a software-only package. I tested the software-only and memory-board versions. As the memory board has yet to work correctly on the Tandy 1000, most of my description focuses on the software-only version.

The memory-board version of Periscope is by far the most powerful and the only alternative to an expensive trace and debugging system for some software projects. After you load it into memory on the board, the software is automatically write-protected. You can then return to DOS, run whatever programs you want, and forget about the debugger. However, when you press a button attached to the board, the debugging software takes over. Using it, you can escape from system lock-ups and crashes to determine what bugs caused the system to go down.

If you purchase Periscope with just a breakout switch, it operates the same way but doesn't put the debugger into protected memory. Therefore, an error-riddled program could overwrite the Periscope software or DOS, making the debugger useless until you reboot the system. Periscope's software-only version can use the shift-print-screen keys to interrupt a running program and enter the debugger.

Periscope's features parallel those of AT86, although its screen displays are cosmetically similar to those of DOS Debug. Periscope can display up to four windows of information on screen at one time: data, stack, register, and disassembly information. Like AT86, Periscope can use a program's public symbols as part of a disassembly and as addresses for breakpoints or other commands, and it includes an assembler and disassembler as standard equipment.

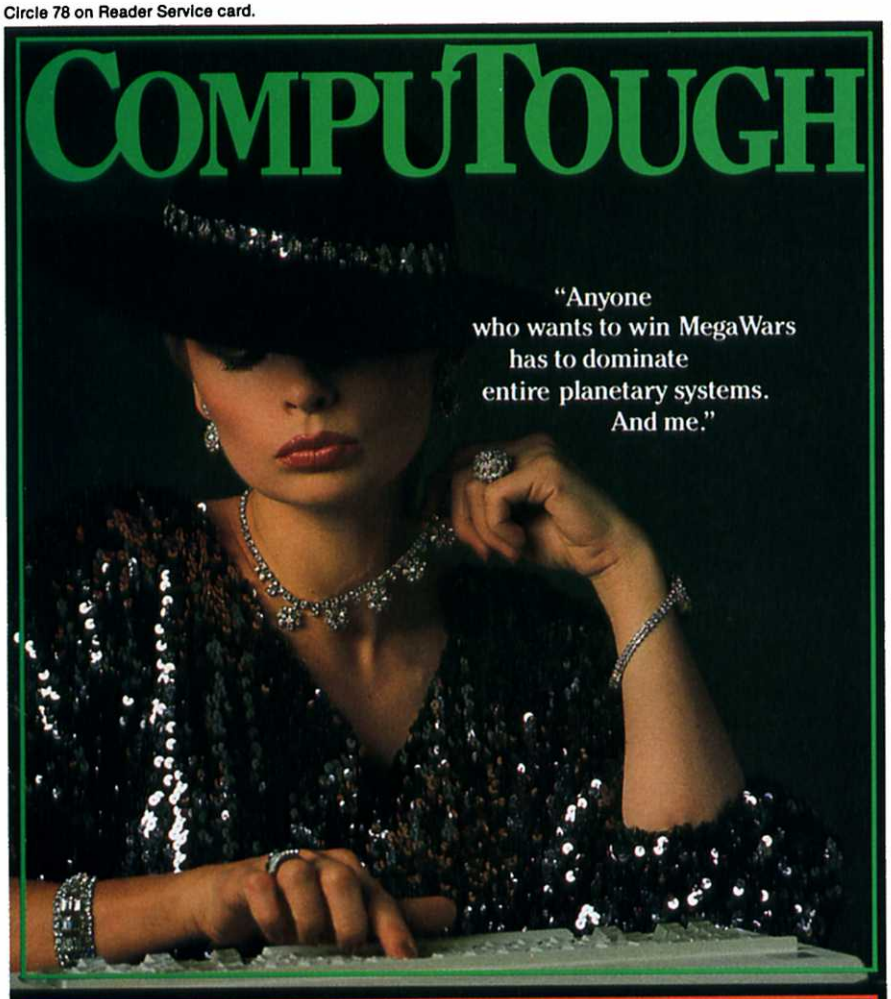
Two superb features of Periscope make it the debugger of choice in some situations. It has more options for setting breakpoints than any other debugger I know of. Besides setting breakpoints on absolute addresses, it can set a breakpoint if a byte or word is changed to or from a given value, if a specific machine instruction is executed, if a software interrupt is used, or if a specific line of source code is executed. This assumes that you are using a high-level language that includes line-number information in its symbol table. Periscope can also set breakpoints if a specific area of memory is read, written, or executed; if one or a range of I/O ports is used; or if an 8- or 16-bit register meets a given test.

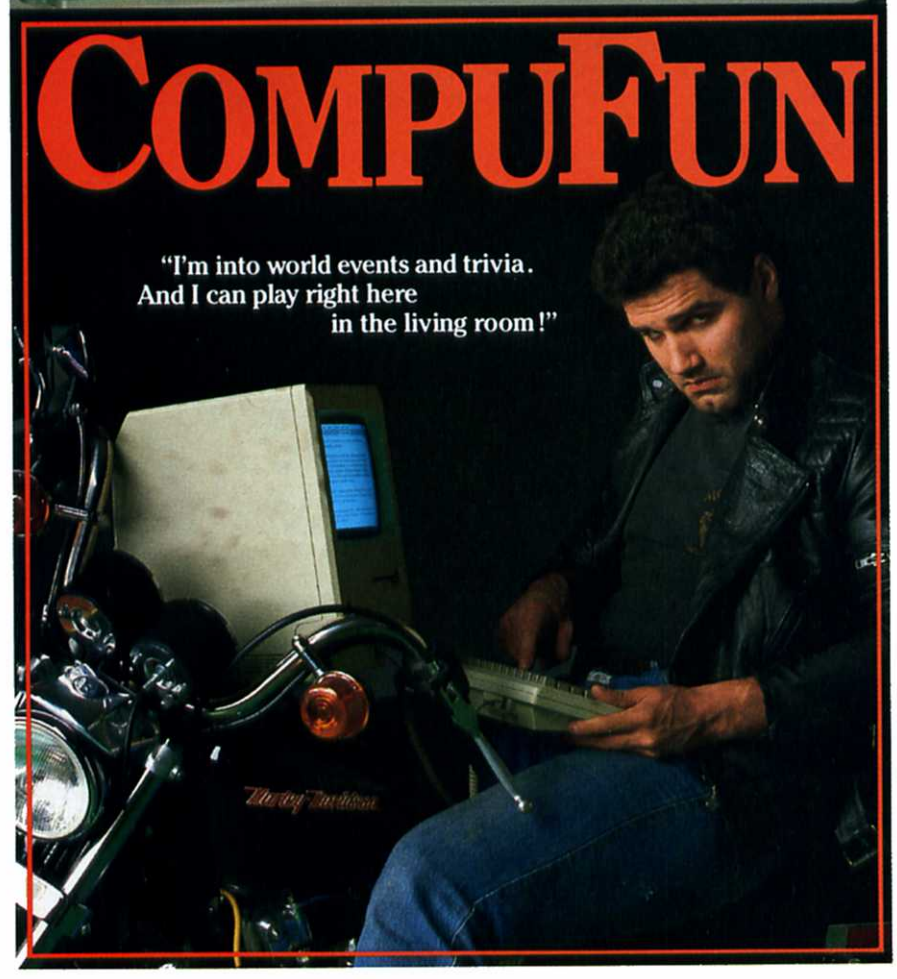
Periscope lets you write your own test in assembly and use it to determine whether a breakpoint should be taken after every instruction is executed. Although you can simulate each of Periscope's breakpoint options in AT86 with user-written code, it is difficult to combine them in as many different ways without a great deal of programming. These many breakpoint options alone make Periscope a valuable programming tool.

Like AT86, Periscope displays memory in byte and ASCII, ASCII-only, and word or double-word formats, and it can link the memory display to the current instructions being traced. It can also display memory in signed or unsigned integer format, and in a special record format.

Using a text editor, you can create a file that tells Periscope how blocks of record information are arranged in memory. For instance, you can define all the parts of the program statement prefix that DOS puts at the beginning of each program as it is loaded. Use that definition as a prototype for displaying a section of memory, and Periscope correctly labels each section of the display. Since many

Circle 78 on Reader Service card.





programs use complex record structures, this feature saves you hours of byte-counting and trying to decipher exactly what information was stored.

I like the Periscope software and use it often. However, if you do a lot of debugging, AT86's screen displays are clearer and easier to use.

X-View 86

AT86 and Periscope are excellent debuggers for everything from device drivers to general-purpose programs. X-View 86 is, in many ways, a completely different kind of programming aid.

X-View 86 runs as an extension of DOS Debug. If you use the version of Debug supplied with PC-DOS 2.0, 2.1, 3.0, or 3.1, you can use X-View 86 as it is supplied on the disk. If you use the version of Debug included with PC-DOS 3.2 or any version of MS-DOS Debug, you must patch X-View before it will work. The patching instructions are included in the X-View manual and a Basic program on the X-View disk helps, but the process is complicated because you must search Debug for addresses and values. Using AT86 to search through Debug hastens the patching process.

X-View supports three kinds of breakpoints: absolute memory address of an instruction, memory reference by a program, or a user-initiated break when both shift keys are pressed simultaneously. But its main job is what it does between breakpoints.

More than anything else, X-View is a program profiler, running other programs in an "interpretive" mode. This means that it reads, disassembles, and then executes each program instruction, also using the instruction to update one or more of its many tables in memory. When the program ends or reaches a breakpoint, a view of the tables details what your program has been doing.

The first X-View 86 table displays the number of executed instructions, the number of RAM accesses and stack operations, how many INT calls you have made, and the number of times you have accessed an I/O port. It also shows the number of segment wraparounds (which should be zero), jump instructions, and conditional jump instructions that were taken or not taken.

The second table analyzes program "hot spots," revealing which 64-byte program blocks were executed most often. X-View displays two tables: One shows the program's 15 most-used blocks, and the other shows the 15 most-recently used blocks.

The third table lists all opcodes used in the program, a disassembly of each, and the frequency of use for each. How many times did your program execute a

POP SI instruction? X-View tells you. X-View's fourth table lists the memory blocks and shows how often the program read from or wrote to each one.

A fifth table shows which I/O ports the program uses, whether it performed word or byte reads and writes to each, and the number of times each port was accessed. Another table indicates which memory segments were used; whether each was a code, data, or stack segment; and whether the program read, wrote, or executed code in each segment.

The last X-View table details the uses of INT calls in a program. When installing X-View 86, you decide which INT calls it should profile and those it should trace through completely. The table shows how many times a specific combination of INT calls and values in AH were used.

X-View collects data as a program runs, not during disassembly. Therefore, it profiles those sections in a program that were actually run. It takes time to collect this information, so programs run slower than normal with X-View 86. In fact, X-View occasionally sends a beep through the speaker just to let you know that it's still working.

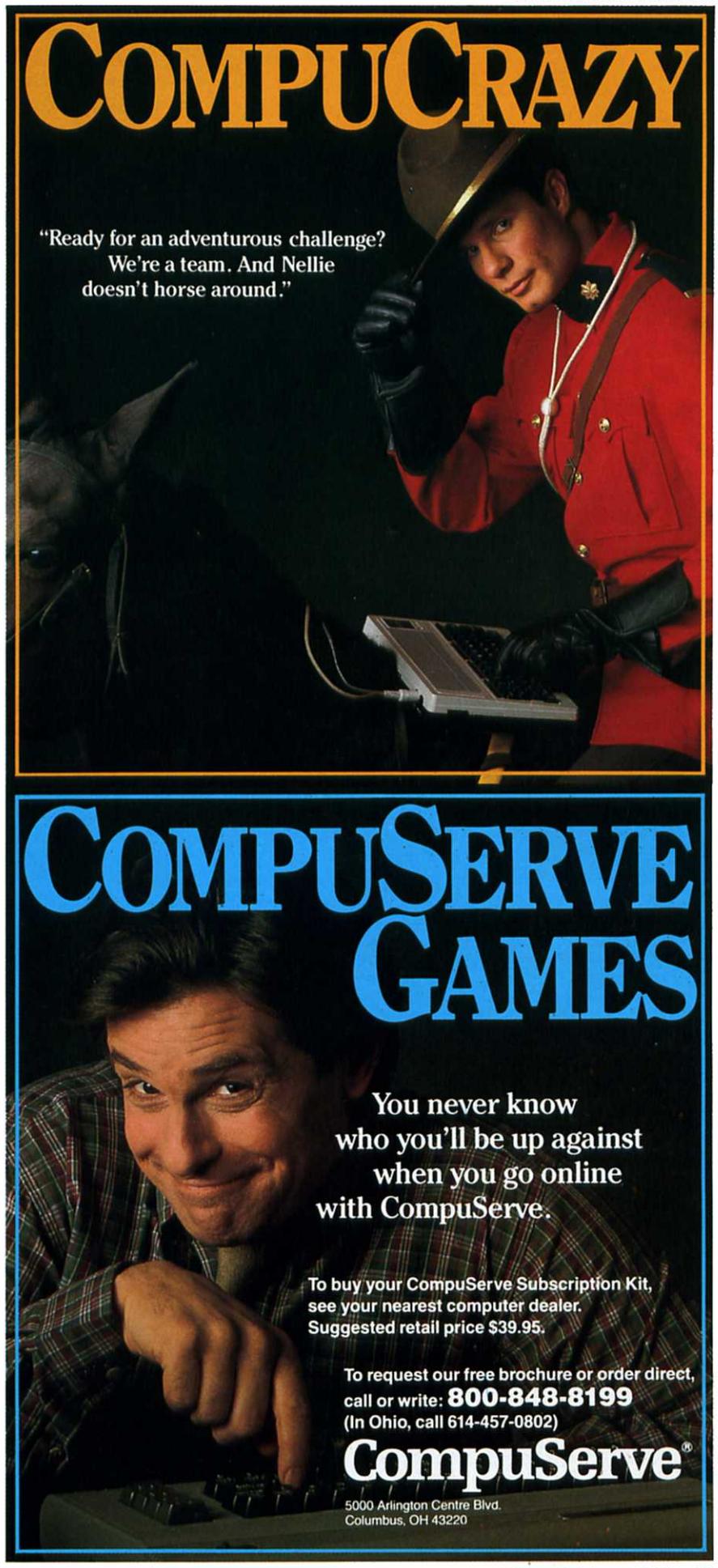
X-View has two main uses besides satisfying your curiosity. If you want to speed up a program, X-View 86 is invaluable for unveiling those program sections deserving the most attention. If your program spends most of its time in two or three hot spots, you should examine the questionable code and smooth it out. Such fine-tuning can speed up its performance significantly. Second, you might want to check out how well a commercial program is performing, especially if you want to see whether it will run on another computer. For example, if you understand how the Tandy 1000 differs from the IBM PC, X-View can profile a program on the PC and note any potential conflicts with the Tandy system.

You can enable or disable each X-View table separately. In most cases, you are unlikely to use all its tables. Under X-View, your program will run faster if you call up as few tables as possible.

Conclusion

All three debuggers are important to have if you write in assembly or a compiled high-level language. The options, use of symbols, and flexibility of AT86 and Periscope make them more powerful than Debug. X-View 86 can give you information that is almost impossible to gather by any other method, sometimes helping you locate bugs that would be difficult to isolate with other programs. The only real problem is deciding which of these tools you can afford and which you can afford to do without.■

Circle 78 on Reader Service card.



Full Speed Ahead

by Mark D. Goodwin

★★★★

8 MHz Super Speed Up runs on the Model 4, 4P, or 4D. Seatronics, P.O. Box 4607, 6202 ZA Maastricht, The Netherlands. Distributed in the U.S. by Sylvester Technologies, 11803 Grant Road, Suite 203, Cypress, TX 77429, 713-251-5700. $129.99.

★★★★

512K or 1MB Memory Board runs on the Model 4, 4P, or 4D. Seatronics, The Netherlands. Also available from Sylvester Technologies for $125 (512K) or $225 (1MB).

Many Model 4 owners bought the machine for faster speed and its ability to harbor an additional 64K RAM bank for printer spooling and a RAM-based disk drive (Memdisk). And although the Model 4's 4MHz clock speed and extra RAM were adequate at the time, these features pale in comparison to those of today's 16-bit computers. Recognizing that Model 4 owners might want faster clock speeds and more memory, Seatronics has developed speed-up and memory-expansion boards that work like gangbusters.

With the speed-up board installed, your Model 4 can clock in at speeds of 2, 4, 5, or 8MHz. The memory-expansion board increases the Model 4's memory to either 512K or 1,024K (1 megabyte [MB]) of RAM. Although the Model 4 can use only 64K of RAM at a time, having a 512K or 1MB RAM disk is very useful.

Installation

Installing the speed-up board in an original version of the Model 4 is simple. Take the Z80 chip out of the CPU board and insert the speed-up board in its place. After plugging in your computer's new brain, you must make a few modifications to the Model 4's timing circuits. You must cut pin 7 of U18. Next, move the wire from pin 6 of U18 to pin 13 of U18. Straighten out pin 6 of U58 by removing U58, bending the pin, and reinserting the circuit. Next, run a wire from pin 6 to pin 8 of U22. A 64K Model 4 requires a 100-ohm resistor between pins 9 and 12 of the U72 socket.

You install the memory-expansion board by removing eight capacitors (C66, C70, C74, C78, C82, C86, C90, C94) and a resistor (R44), cutting the trace to pin 10 of U63, removing jumper E11/12/13, connecting a jumper from the left side of R44's former location to pin E12, and removing jumpers U72 and U71. Reinsert U71 in the expansion board, connect the expansion board's wires to the appropriate locations (brown to pin 11 of U55, red to pin 10 of U63, orange to pin 4 of U60, yellow to pin 7 of U50, green to pin 1 of U76, blue to E12, and white to pin 5 of U51); then insert the expansion board into the sockets vacated by U71 and U72. At this point, check to see whether your computer still functions as a 64K RAM computer. If everything is okay, you complete the upgrade to 512K by removing the 64K RAM chips (U77–U84), connecting a 22-μF tantalum capacitor in parallel to C97, and inserting the 256K RAM chips in positions U77 to U92. The Model 4 should now have 512K of RAM available.

If you invest in Seatronics' 1MB expansion board, you must piggyback an additional 16 RAM chips to those mounted on the new expansion board. To do this, remove one of the installed chips, gently bend pin 15 on one of the new chips, and place this new chip on top of the other. Solder the remaining 15 pins of the new chip to the corresponding pins on the other chip, and insert the piggybacked chips into their socket. Repeat this procedure for all 16 new RAM chips. Next, solder the expansion board's violet lead to pin 15 of each chip in the left RAM row; solder the gray lead to pin 15 of each chip in the right RAM row.

Ramdisk

Both Seatronics boards are software controlled. A program called Ramdisk, which is similar to the TRSDOS 6.x Memdisk utility, controls the memory-expansion board. TRSDOS 6.x can use the first 64K RAM bank of the expansion board as if it were using an upper 64K RAM bank in a 128K machine.

Unfortunately, the accompanying manuals leave a lot to be desired. The speed-up manual details installation and control of the board by setting port 236 and provides programs to set the computer's clock speed. The memory-expansion manual presents installation instructions and a reference section for the Ramdisk program. The biggest shortcoming of either manual is the lack of machine-language programming information. Ramdisk works well, but the expanded memory has more uses than as a RAM-based disk drive. Although the manuals are lacking, the installation instructions are clear and concise.

Without a full understanding of Ramdisk's installation procedure, you might find correct operation difficult to achieve. An easier-to-use version of Ramdisk is in order. Even though the software and manuals deserve only passing marks, the boards receive high honors for easy setup and high quality of workmanship.■

Three Easy Pieces

by Harry Bee

★★★

The Personal Choice Collection runs on the Model 1000 or 1200 (128K) and requires one disk drive. Activision/Personal Choice Software, P.O. Box 7287, Mountain View, CA 94039, 415-940-6044. $119.95 for the set.

Boxed like a C.S. Lewis paperback set, the Personal Choice Collection comprises Writer's Choice, a word processor; Filer's Choice, a filing system; and Planner's Choice, a spreadsheet. As a collection, they share some common features but also act as stand-alone applications that are packaged, documented, and available separately at $49.95 each. The first shared trait is their appearance, which strongly suggests easy, novice-class software. If that makes you pass them up because you're looking for more advanced functions, you'll be missing something.

The manuals are consistently clear, complete, and well organized, in spite of more typos than decent editing should allow. Each package comes with a Quick Reference Command Summary and function-specific help screens; a toll-free help line is available seven days a week. Also, where possible, the programs use function keys and a menu command structure. Not every common feature is a benefit, however. The fact that this software is copy-protected defeats much of the reason for owning the collection. You can't combine programs on a single disk or in a RAM disk, and Activision does not supply procedures to install them on a hard drive. No matter what system you use, you have to do a lot of disk swapping. To add insult to injury, you're allowed to purchase only one back-up copy of each program at an outrageous $15 per disk. Finally, all three programs are shaky at the printer interface. So much for my complaints.

Writer's Choice

What can you say about an editing screen full of dots? It looks like a dime-store text editor. Yet behind that facade hides a surprisingly complete arsenal of word-processing weapons.

To begin with, you get very good cursor control, which is handy for marking blocks of text to copy, move, or delete. The block delete has no protection, but an undo feature lets you restore accidentally removed text. Writer's Choice also gives you global search-and-replace operations. The only fault I found with the editing function was that, for a RAM-based editor, Writer's Choice scrolls text at a snail's pace.

Upgrading to MS-DOS?

LET'S GET SERIOUS.

THE COMPUTER WITH A FUNNY NAME.....

THE CLONE™

Frankly, this is the best computer value in America. Better than IBM. Better than Tandy. Complete MS-DOS™ compatibility. . .lightning fast processing. . .tons of RAM. This machine has everything the Boys in Blue promise. . .and more. All at a price you can afford.

WE DIDN'T NAME IT "CLONE" FOR NOTHING.

What we have here is a computer that is truly IBM PC/XT compatible. The Clone computer is completely MS-DOS compatible and it has all the hardware capability of the IBM PC/XT (except cassette) plus some and comes with MS-DOS 3.2 (the latest version), GW-BASIC and reference manuals (manuals are extra cost on the Tandy 1000!). With the Clone you get eight IBM compatible expansion slots, seven of them a full 13" long. You have six additional slots available; something a Tandy 1000 owner can only dream about.

IBM COMPATIBLE? YOU BET.

Flight Simulator, one of the classic tests of compatibility, runs perfectly. Lotus 1-2-3® can't tell it's not running on an IBM. In fact, we have not discovered an off-the-shelf MS-DOS software package that wouldn't run properly on the Clone. The ability to run standard, off-the-shelf, software is important because it allows you to obtain software from any number of sources.

STANDARD FEATURES:

The Clone computer comes complete, ready to run, with lots of standard features. Like the maximum 640K of system memory installed. Like an IBM standard parallel printer port, a clock/calendar with automatic battery backup, a speaker, two serial ports (one populated), a game adapter/joystick port, a light pen port, a 2-drive floppy disk controller, and the newest AT style keyboard. The video output is IBM standard color graphics with a special port that allows you to view color software on a monochrome monitor as well as 80 x 25 text. A 360K ultra-reliable floppy drive is included with space for three additional half-height floppy or hard disk drives. The 135 Watt power supply runs cool and assures you of adequate power for future expansion.

PC-DeskMates, a powerful multi-function memory resident utility, is included so you can start using the Clone when you receive it. You get an alarm, clock, calculator, calendar, notepad, phone dialer, typewriter, and access to DOS level commands. The Clone also comes with Qmodem, the famous modem program which enables you to access the world of telecommunications. PC-Write, probably the best shareware word processor available, is also furnished. Your Clone comes ready to work for you.

WHAT'S MISSING?

The Big Blue price tag.

. For serious users only.

OPTIONAL FEATURES:

The Turbo Clone is equipped to run at the standard 4.77mHz clock rate or at a blazing 8mHz. That's almost 70% faster processing than a standard IBM. Front panel lights indicate Turbo operation, power status and hard disk activity. A key-lock switch allows the keyboard to be electrically "locked out" for unattended security. Imagine a lengthy Lotus 1-2-3 spreadsheet recalculation with an 8mHz processor! It's awesome.

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A WORD OF EXPLANATION.

We sell Clones exclusively by mail. And there's a good reason why. Supporting the expensive overhead of a chain of retail stores is not our idea of keeping costs down. You're buying the Clone computer at wholesale prices, directly from the manufacturer. Your Clone comes with an ironclad guarantee that exceeds most other manufacturers'. We guarantee your satisfaction or we'll refund your purchase price within thirty days, no questions asked. Our guarantee is backed by a reputation earned in years of experience in the mail order business. Think about it. Repeat orders come from satisfied customers. This makes us work very hard to get it right the first time.

Optional TURBO Clone. $799

Circle 302 on Reader Service card.

Circle 302 on Reader Service card.

US VS. THEM

FEATURES	CLONE	IBM PC/XT	TANDY 1000 EX (SX)	LEADING EDGE Model D
Microprocessor: Intel 8088 @ 4.77mHz	YES	YES	YES	YES
	8mHz Optional	NO	7.16mHz STD	NO
Power Supply Rating	150 WATT	63.5 WATT	54 WATT	130 WATT
IBM Standard Bus:	YES	YES	NO	YES
Operating System:	MS-DOS 3.2	EXTRA	MS-DOS 2.11 (3.2)	MS-DOS 3.1
Disk BASIC:	YES	IN ROM	YES	YES
MS-DOS and BASIC Ref. manuals:	YES	EXTRA	EXTRA	YES
Standard System RAM:	640K	256K	256K (384K)	512K
Cost to Expand RAM:	-0-	$$	$259 ($129)	$
Keyboard:	'AT' STYLE	STD	NON-STD	STD
Video Monitor: (composite)	INCLUDED	EXTRA	EXTRA	INCLUDED
Video Outputs:	BW/NTSC/RGB	EXTRA	NTSC, RGB	B/W, RGB
Disk Drive Capacity:	1-360K	1-360K	1-360K (2-360K)	2-360K
Max Number of Internal Drives:	4	4	1 (2)	2
Internal Expansion Slots:	8	5	1 (5)	4
Accepts Standard IBM Cards:	YES	YES	NO (10" Only)	YES
8087 Math Co-Processor Option:	YES	YES	NO (YES)	YES
Sturdy Steel Case:	YES	YES	PLASTIC	PLASTIC
Standard Parallel Ports:	1	0	1	1
Standard Joystick and Light Pen Ports:	YES	NO	J (J/LP)	NO
Standard Serial Ports:	2 (1 Optional)	0	0	1
Warranty	1 YEAR	90 DAYS	90 DAYS	15 MONTHS
Clock/Calendar	YES	NO	NO	YES
Cost Ready-to-Run	$699	$3,063	$1,398 + ($1,683 +)	$1,295
8mHz Option	$799			

Add $35 for ground delivery; $70 for air.

IBM XT cost figures*: Video Display Adapter $250; Video Display $275; IBM XT computer $2,145; Additional Ports, serial port, game port, parallel port, 640K RAM $308; DOS 3.2 and BASIC $85; Total $3,063. Does not include the battery back-up clock calendar. No light pen port.

Tandy 1000 cost figures*: DOS 2.11 and BASIC reference manuals $29 +; Memory Plus Expansion Board (to 384K) $129 +; 256K Additional RAM $129 +; One serial Port $79 +; Battery Back-up Clock Calendar $99 +; Composite Monochrome Monitor $129 +; Model 1000 EX Computer $799; Model 1000 SX Computer $1199; We were not able to equip the Tandy 1000 to directly compare with the Clone because of the 1000's inherent design limitations.

*The above prices are list prices as best we could determine. Both the IBM and Tandy are available at a discount.

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2nd 360K TEAC Half-height Floppy Drive	$99	HiRes RGB Color Monitor 640 x 200	$299
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80286 SpeedKit. Makes XT faster than AT	399	5339 Accounting Keyboard	89
300-1200 Internal Modem & Software	149	300 Watt Uninterruptable Power Supply	299

OUR GUARANTEE

Simply, if anything is wrong with your Clone or any of its peripherals, we'll fix it free for up to one year after you've received your Clone. You have probably read other manufacturers' warranties, and gotten confused, suspicious or even mad. You're probably skeptical about anything as simple and straightforward as our warranty. So here's the fine print.

You can void your warranty by failing to exercise normal care when hooking up or operating your Clone. Or trashing the guts with a hammer. Or running it over with something. Or burning it up.

You have thirty days after receipt of your Clone to see if you and it are going to be compatible. If you are not satisfied with your Clone for any reason within that time you may return it to us for a full refund, less shipping charges. Just don't write in the manuals or lose anything that was in the original container as it all has to be intact.

The other guys only give a 90 day guarantee. Ever wonder why? Ever try to get a refund? Complete warranty details are available on request.

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Model I & III programs are on one side, and Model 4 programs on the other. Documentation is right on the disk. Just boot up NUCLEAR SUBROUTINES, and you're set for unparalleled programming power! Space is too tight to list them all, but here's a sampling of what awaits you on this once-in-a-lifetime disk, divided into six major categories:

MATHEMATICS

Double Precision—Make your Basic programs more accurate with routines that calculate values with up to 16 significant digits.
Calculator—A two line calculator that gives you the four basic math operations in double precision and exponentiation in single precision.
Random Number Generator—Enter fractions as input, which are converted to decimal values for computation, and output as fractions.

AND MORE!...

SCROLL

Horizontal Scroll—Scrolls messages horizontally across the screen.
Window Scroll—Reserves a block portion of the screen (the window) in which information can be viewed, moving new information into the window and shuffling the old out.

SCREEN

Screen Border—Draw a border around your screen.
Screen Locator—Use PEEKs and POKEs to locate screen positions when speed is a necessity.
Screen PRINT—Use the arrow keys to move a nondestructive cursor while each PRINT location is displayed.
Screen Dump—Model I/III graphics screen dump program for an Epson MX-80 with Graftrax Plus or an RX-80.
Screen Fill—Fill the screen in assorted ways to create the effect you desire.
Screen Save and Restore—Save and restore the screen contents whenever you wish.
Screen Invert—Reverse the content of your Model I or III screen.

AND MORE...

SORTS

VisiCalc Sort—Sort alpha or numeric data in ascending order, and numeric data in descending order.
Model 4 Sort—A lightening-fast string sort for Model 4 Basic that has the feature of Model III Basic's CMD "O".

PLUS MANY MORE!...

GRAPHICS

Upgraded Graphics—Add the Point, Set and Reset commands to Model 4 Basic.
Better Graphics—Run Model I/III Basic graphics up to eight times faster than normal using the LSET and RSET commands.

AND MANY OTHERS!...

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Input Routine—A user input routine.
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Due to this text-editor approach, you must embed formatting commands in your document. This makes on-screen reading and editing difficult. The commands give you extensive control over how your document will look on paper, including options for tabs, boldface, underlining, centering, widow-line protection, forced pagination, and automatic page numbering. To overcome the lack of on-screen formatting, a graphic preview feature shows you a page-by-page mock-up of your printed document.

Most of the formatting functions work well, even though Writer's Choice doesn't have printer-specific drivers. Where the generic approach breaks down is in boldface and underlining. If your printer doesn't respond to the method the program uses, the alternative—embedding escape sequences in the text—is difficult, is not covered in the documentation, and won't overcome every problem situation.

Writer's Choice comes with a spelling checker, Spell-Right, that promises some nice features but is slow. And it accepted as correct such oddities as "wher," "myn," and "cou7rse," to cite a few. When run on a Tandy 1000, it occasionally destroyed the file I was working on, as well as every other file on the disk. I was unable to duplicate the havoc on a Tandy 1200 or an IBM PC.

Filer's Choice

By any standard, Filer's Choice is a powerful filing system, able to hold records as long as four pages (about 8K) with fields of up to 513 characters. Setting up a file is easy; you use a screen editor to design an entry form. You don't have to specify field lengths in advance; limit them by the amount of space you leave in the form. You can predefine the type of entry a field will accept and, even after you've started building a data base, you can alter the entry form, change the *de facto* field sizes, alter field types, or add more fields. Several features make data entry just as easy.

You can search a file in general or specify separate search criteria for each field. Search criteria can contain wild cards. While browsing through a file, you can edit, delete, or print records. Use the same search criteria to select records included in reports, and you can sort reports on up to nine fields. As you spread the fields of a single record over several lines, the program lets you include calculated fields and totaled and averaged columns.

Filer's Choice's documentation is the least satisfactory of the three. In addition to the kind of misprints found elsewhere in the collection, it has several omissions and outright errors. Filer's Choice is also tough to view on a monochrome monitor

and hung up a couple of times after I selected a longer-than-normal field to sort. Although it prints reports without any trouble, it consistently printed individual records in double-spaced format while in browse mode.

Planner's Choice

It amazes me to write that I enjoyed Planner's Choice. As one who doesn't use spreadsheets often, I particularly liked its use of menu trees to lead me through most general functions such as copying, moving, formatting, sorting, and printing.

At first glance, Planner's Choice seems short on functions. Gone are common fare like cosine and arctangent, guaranteed to horrify anyone involved in financial planning or statistical analysis. More useful are the two look-up functions, a conditional function with a full set of logical operators, and three loan-calculation functions.

Moving around the 64- by 255-cell matrix is easy with one exception: As with Writer's Choice, the scrolling is deadly slow. You can split the screen horizontally or vertically into independent or synchronized windows. You can lock column or row headers to remain visible as you move around, and sorting by row or column works well unless you want to sort a group of cells calculated by formula. I tried that and wound up with a hopelessly jumbled mess.

Of the three programs, Planner's Choice has the best printer interface, with a set-up screen that lets you customize the program to work with whatever printer you have. You can send all or any part of a spreadsheet to either printer or disk file and extract lists of formulas or notes. When I tried to print these lists, however, Planner's Choice sent line feeds without carriage returns even though other print functions worked correctly. The result was a diagonal arrangement, pretty but impossible to read.

Conclusion

For all but professional use, I recommend any of these programs, with the emphatic exception of the spelling checker. Each one contains enough features to be a bargain at $50. If you have a color monitor and one of the printers certified and tested with the programs (listed in each manual), many of the problems I noted disappear.

All the programs I tested were version 1.0, and the manufacturer is aware of their shortcomings. If the few nagging bugs are corrected in subsequent releases and if the programs are made more compatible with a wider range of hardware configurations, this trio will be hard to beat in its class.■

Beyond The Basic Limit

by David Engelhardt

★★★

Mach 2 runs on the Tandy 1000, 1200, or 3000 (128K) and requires one disk drive and an 80-column monitor. Microhelp Inc., 2220 Carlyle Drive, Marietta, GA 30062, 404-973-9272. $75.

One way to improve your Basic programming is to first improve Basic. Mach 2 is one means to do just that. It is a collection of utilities and subroutines that works with either Microsoft's GW-Basic or IBM's Basic/Basica. Mach 2 can speed up and add features to Basic, and it allows Basic to go beyond the 64K limit when using string and numeric data.

Mach 2 enhances Basic by linking certain assembly-language routines to your Basic programs and by performing equivalent Basic functions faster. These routines are normally available only in dedicated assembly programs. Mach 2 supports sorting large amounts of data at assembly speeds (although I could not get this feature to work), along with storing large numeric arrays outside of Basic's data area.

What It Can Do

Mach 2 consists of four disks containing the source code for either compiled or interpreted programs, object modules, and a program disk. The latter contains demo programs that provide insight into what Mach 2 can do. I found the source code for the Basic demo programs helpful as a reference guide.

Mach 2 speeds Basic functions such as data handling, string manipulation, and file input/output. It has an extensive window-manager feature, allowing you to save an unlimited number of windows and restore them anywhere on the screen. You can also draw single- or double-line boxes anywhere on the display.

You load the machine-language routines into memory from the MS-DOS prompt by using MHLOAD. You invoke this memory-resident program once per DOS session; it stays in memory until you restart the computer. Some assembly routines require reserved memory, and MHLOAD has an optional parameter setting for 1 to 1,023K bytes of memory. When running MHLOAD, you must specify a sequential file name as a target file to be linked with your Basic program. This file contains the segment address and offset locations of the machine-language routines located in memory.

An important program included in this package is Shell.BAS, the Basic skeleton containing routines and control codes to link Basic to the machine-language routines in memory. This program also determines whether Shell.BAS is compiled, the type of monitor used, and so on. Shell.BAS resolves and obtains memory locations in its initialization section by reading the MHLOAD-specified file and linking the addresses to their related commands. Typically, the file specified during MHLOAD is Mach2.ADR. You must insert your own main-body program into Shell.BAS, but don't change any of the existing Shell.BAS line numbers, as this can make it incompatible with future versions of Mach 2.

When loaded via MHLOAD, each Mach 2 routine has its own calling subroutine section in the Basic shell program. You must supply and initialize specific variables required to perform a desired function. Once your Shell.BAS program is complete, you can compile it using any suitable compiler. Be careful, as some variable names in the shell program are different from those specified in the manual. This is most likely a typographical error. What's nice about Shell.BAS is that you can alter the variable names as long as you make sure they are in their proper order before you make the machine-language call.

A few of the assembly subroutines require that you reserve memory before using them. You can store data outside the 64K memory boundary that is normally limited by Basic. Some of the routines using this reserved memory let you store and retrieve strings, search memory for a string, and sort fixed-length arrays.

Looking at Options

In testing Mach 2's options, I discovered that the sort demo did not work properly. This is unfortunate; the sort option is highly desirable because it executes at assembly speeds outside of Basic's 64K boundary. On the other hand, I found string and window-box manipulation to be fast and flexible. In testing, I put strings in reserved memory outside of Basic's 64K and read them back again. At this point, I attempted to use the sort function without any luck. Before you purchase this product, verify that the sort function works.

The manual contains an abundance of useful information, including a listing of Shell.BAS, and it describes each assembly routine, along with the variables used to make the routines function. The manual is unclear on how to set up and use different sections of Shell.BAS, and printed examples would be helpful. Mach 2 comes with many fine features, but be prepared to spend time learning how to use them.■

Continued on p. 98

Circle 82 on Reader Service card.

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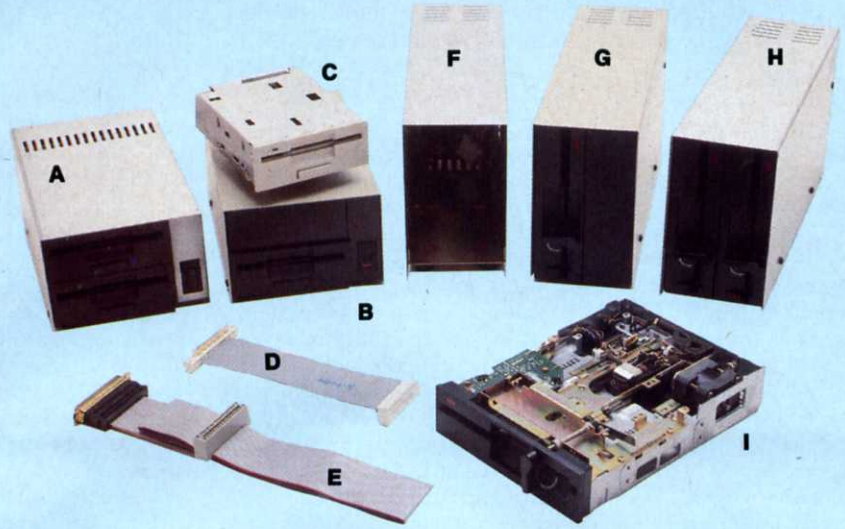

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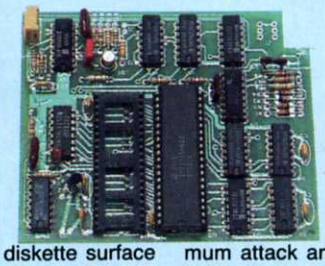

Add double density to your TRS-80 Model I by installing our DDC in your expansion interface. Lets talk about density. The Model I was designed to store data on diskettes in single density. Single density refers to the method used to write data to the disk. Your diskette is organized into tracks and sectors. Early Model I's had 35 track drives while later models, and most aftermarket drives, had 40 tracks. In single density the tracks on the diskette surface are divided into 10 sectors. Each sector contains 256 bytes of data for a total of 2,560 bytes or 2.5k per track times the number of tracks your drive is capable of addressing. Double density, on the other hand, allows each track to be divided into 18 sectors. As in single density each sector contains 256 bytes but now there are 18 sectors instead of 10 giving an new storage capacity of 4,608 bytes or 4.5k per track. The result is 80% more data in the same space. You may wonder why Radio Shack did not choose to use double density in the beginning. The reason is simple. It costs more money. Double density disk storage techniques were more expensive to implement back then.

Reliable double density operation required a better disk drive than Radio Shack was furnishing in addition to better quality components and diskettes. Therefore, no double density for the Model I. We went to work and came up with a design that allowed reliable double density operation on the Model I. In fact, our DDC had a higher probability of data recovery than any other disk controller on the market then or since. Our analog design phase lock loop data separator has a wider capture window than the digital types others use. This allows high resolution data centering. Our "DDC" analog circuit allows infinitely variable tuning with optimum attack and settling times. The oft-stated fears of adjustment problems rumored by digital dilettantes have been proved groundless by thousands of satisfied users the world over. The bottom line is state-of-the-art reliability and performance. TRS-80 Model I disk system owners who are ready for reliable double density operation will get 80% more storage per diskette; single and double density operation with far fewer disk I/O errors; single density compatability; simple plug-in operation. You will need a disk operating system that has the necessary double density software driver. All the popular DOS's (except TRSDOS) have the software driver. We have a special combination offer that saves you $10 and includes the LDOS operating system in the event you do not already have a DOS.

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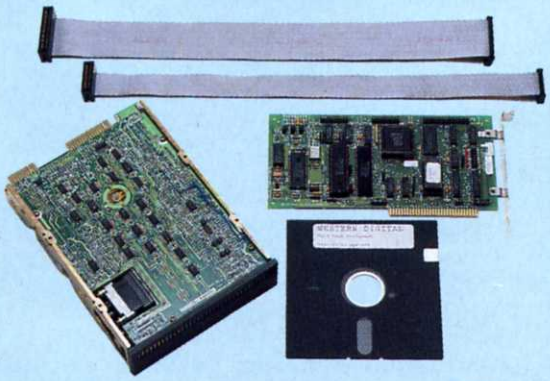

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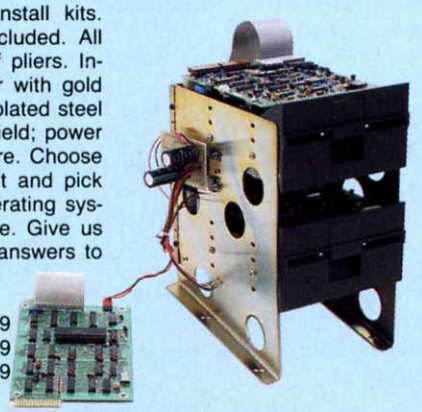

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That Thinking Feeling

by Bruce Tonkin

Organize your ideas with this Basic outline processor.

We who follow our English teachers' advice by outlining essays and speeches on paper are fed up. The truth is that outlines aren't good for organizing thoughts if all the thoughts go into organizing. Often, the result is an uninviting mass of headings and useless information.

The computer's ability to organize data in nearly infinite ways changed outlines for the better. Commercial outliners like Living Videotext's Think Tank go beyond word processing to take over more of the organizational tasks, such as indenting and moving the cursor, allowing you more time to generate and shape your ideas. Outliner programs let you see your thoughts without forcing you to see a forest of detail.

My Thought Outliner program is a scaled-down version of the large commercial packages at a fraction of the cost. You can use it to plan and organize anything, including top-down-style programs in which you outline functions and subroutines, inserting the actual code later.

Thought Outliner lacks the bells and whistles of a Think Tank (space limitations in *80 Micro* and in most versions of Basic were factors, as were Model 4/Tandy 1000 incompatibilities and the fact that I didn't know which features you would want to include) but I will suggest enhancements and start you on the road to implementing them.

The Outliner's Outline

In designing Thought Outliner, I assumed five requirements intended to maximize usefulness and efficiency.

First, it should produce plain ASCII files: It shouldn't use strange characters to mark the ends of paragraphs, to indicate the indentation level, or to show the end of outlines. I distrust an editor that can't produce plain text files.

Second, it should be usable as a simple text editor, allowing such amenities as wordwrap and block reform.

Third, it must provide at least eight levels of indenting; in fact, it has 12.

Fourth, it must be reasonably fast. Few people want a program that runs so slowly as to be useful only for demonstrating coding techniques.

Fifth, it must be easily adapted to the Model 4 (see the sidebar, "Program Notes," for an explanation of the techniques required).

Thought Control

To start using Thought Outliner, type in the Program Listing and save it as Outline. Load MS-DOS or PC-DOS and type in and enter OUTLINE. (For information on a quicker version, see the sidebar, "A Quicker Outliner" on p. 46.) A directory and a work space will appear on the screen. At the prompt, enter the name of a new file or that of a previous one you wish to see. An ever-present display in the top third of the screen tells you the function-key assignments, the amount of memory currently available, the number of lines in a file, the current line, the outline level, and the number of outline levels displayed. (See the Photo.)

Use the MS-DOS function keys (F1–F10) for file- and disk-management commands and for choosing the outline level displayed on screen. I've made some of the same commands available as control keys for both the MS-DOS machines and the Model 4. These Wordstar-like control keys (see the Table) also handle word-processing commands; owners of the Tandy 1000, 1200, and 3000 can substitute their built-in function keys (delete, insert, page up, page down, and so on).

With the cursor in the upper-left corner of the text area, begin typing your outline. The function screen tells you that you're at outline level 1, often the best level for main headings typically labeled with Roman numerals. When you reach the end of the first heading, press the enter key for a carriage return. The program automatically performs wordwrap if you go beyond the end of a line.

Each new line starts under the same outline level as the previous line. To move one level to the right, press the tab key; everything you type here will be indented the proper number of spaces to set it off from other levels. The tab key can take you up to level 13 at the far right. You can use the backspace key (or control-H) to go back to the far left, and from there tab to the level you want.

You can continue adding to the outline, needing only the tab and backspace key to set up headings and entries. To insert something, use the normal word-processing commands; Thought Outliner puts the resulting text in outline form. If the inserted text pushes previous material off screen, however, you can press control-B—the reformat command—to bring everything back in proper format.

F9 and F10 (or control-P and control-L) affect the number of outline levels that are displayed. They let you "collapse" a large, multilevel outline down to its primary headings, or "expand" it out to level 13, including the levels in between. F10 (labeled "move to previous outline level") *reduces* the number of levels on screen; F9 ("move to next outline level") does the opposite.

To print out the final product, simply load the outline file into a word processor and follow the procedure.

Bells and Whistles

As I mentioned earlier, Thought Outliner does not give you all the sophisticated text-handling features available in commercial outline-processing programs. (Then again, you can't purchase a commercial outline processor for much less than $100.) If you have a fundamental grasp of Basic, however, you can add features fairly easily by defining commands at the beginning of the program and inserting the appropriate code internally. Because of Thought Outliner's modular design (see "Program Notes"), you can make enhancements without rewriting large sections of code.

Among the features you might want to add are mark/unmark block, block move/copy/delete/write/read/indent/unindent, undelete, global reformat, print outline to disk or paper (with formatting), automatic topic numbering, and search/replace. I estimate that block operations would add 3K to the program; undelete, 1K; global reformat, 100 bytes; printed output, 5K; automatic topic numbering, 1K; and search/replace, 1K.

You can add speed by implementing all direct screen writes in assembly language. The assembly routine would add about 200 bytes on an MS-DOS machine. To improve flexibility, I'd also add user-definable macros (see "Program Notes") and variable amounts of indentation. The macros might add 250 bytes, while variable indentation might add an additional 1K. In source-code form, the routines might add up to 20K.

LOAD 80

System Requirements

Tandy 1000
(Model 4 version on Load 80)
256K RAM
Basic

Program Notes

Converting Thought Outliner to the Model 4 operating environment was an interesting challenge. Like most programmers, I usually write software with a specific machine in mind. From the start, I know the computer's screen size, its maximum string length, its operation speed, its disk capacity, and its keyboard layout. As I write, I make a mental checklist of this information to ensure that the program will perform properly on the intended user's machine.

Given this *modus operandi*, how do you make a program written for one machine work on another? The keyboards might be different. The screen sizes might be different. In short, the hardware assumptions woven into the original code are probably invalid. Changing them means going back and examining every line of code to make sure it reflects the capabilities of the new machine.

Commercial vendors frequently convert programs this way. The result, in many cases, is inferior software. The assumptions that become part of a program's fabric are not easily changed. For this reason, converted software tends to be slower and less efficient than its forebear. Worse, many such programs are ugly and difficult to use.

Fortunately, there's a better solution.

Have It Your Way

The way around most conversion problems is really quite simple. In Thought Outliner, I defined constants at the beginning of the program. Therefore, if you need to change the screen width from 80 to 64, all you do is change one number in the program. Likewise, to change the number of lines on screen or to redefine keys, you change the appropriate numbers. Virtually nothing in the program is hard-wired. If a computer appears in the market with a screen size of 66 lines by 144 characters, you can run Thought Outliner on it by changing two numbers in the program (last line and margin).

Defining constants in order to make them easier to change later on is not my idea. Languages such as C and assembly use the same technique to make programs transportable. In C, you code a series of #define statements at the start of the program. In assembly, you use an Equate statement.

The C and assembly methods of defining constants are different from Basic's approach of making constants variable, however. The C and assembly methods are actually more efficient. Consider a compiler asked to multiply A and B. If A and B are variables, the program must first retrieve the value of A, then the value of B, and then perform the multiplication. If A and B are defined constants, the compiler already knows their values—they're placed directly into the source code when the program is compiled. The program, therefore, can perform the multiplication immediately.

Using defined constants instead of variables might have saved several hundred bytes in Thought Outliner—a savings too small to be noticeable, however. A program, after all, must only be fast enough to keep up with the user. Fingers are slow, compared with the speed of a microprocessor.

Equivalency Tests

Other features of the MS-DOS program are easily adapted to the Model 4.

The MS-DOS version contains only two user-defined functions, both of which can be written easily on one line. I used block If. . .Then. . .Else statements, which you can simulate with Goto statements in Model 4 Basic. I used the IBM PC/Tandy 1000 function keys in the MS-DOS version, but I also supplied an emulator for them if you use the program on a Model 4.

The only statements in the MS-DOS version that don't have direct Model 4 equivalents are View Print and Color. I used Color only to supply reverse video for some screen messages.

Under MS-DOS Basic, View Print sets up an area of the screen that you can scroll, clear, and manipulate in other ways without affecting other parts of the display. This lets you use the top of the screen for messages and the bottom for text. Scrolling the text does not scroll the messages.

On my IBM PC and Tandy 1000, View Print doesn't work correctly after line 24 on the screen. I had a choice when writing the program: Use machine-language routines to do the scrolling or use View Print. I chose the latter because it let me write a pure Basic program that is reasonably compatible with the Model 4's display capability.

Cursor movement

Operation	Key or key combination
Start a new line	enter
Move up one line	control-E
Move down one line	control-X
Move up one screen	control-R
Move down one screen	control-C
Move right one character	control-D
Move right one word	control-F
Non-destructive backspace	control-H
Move right one tab position	tab
Move left one character	control-J
Move left one word	control-A
Move left one (previous) level	control-L
Move right one level	control-P
Move cursor to line start	control-Q
Move cursor to line end	control-Z

Text editing

Operation	Key or key combination
Delete a character	control-G
Delete a word	control-T
Delete a line	control-Y
Insert a line	control-N
Reformat a section	control-B

File definition

Operation	Key or key combination
Save current outline	control-K
Load outline from disk	control-O

Table. Thought Outliner's command structure (MS-DOS machines only).

Arranging the Display

I assumed that most users would want to see text as they type it in, as well as the most important outline levels at the start of a session. Therefore, I set the Level variable to 5. To see more or fewer levels, you can use the up-level and down-level command keys. Level 5 lets you see five levels, numbered zero to four. The maximum is level 13, which lets you see levels zero to 12.

A small screen array called What( ) holds the numbers of the lines being shown on screen. If a line on the screen—say, line 12—shows line 5 from the text file, then What(12) = 5. If a line on the screen shows nothing (because it is past the end of the file), then What( ) equals one more than the maximum number of lines for the file.

In keeping with the goal of making the program useful as a text editor, I also included the basic cursor-movement commands: up line, down line, to line start/end, left or right by word or character, insert or delete by line, delete by character or word, and up or down by a screen. The commands for these operations are similar to those in My Word! and Wordstar. The commands are defined as variables, so you can change them to whatever you feel most comfortable using. Figuring that some of you might do this, I omitted the help screen on purpose. The subroutine is there, however, and you can put whatever you like into it.

Macro Structures

The code contains several macros, including one for implementing the IBM function keys on machines that don't have them. To implement a macro, append the command string to the string variable Text$(0). When the program runs, it checks Text$(0) for a function-key command. If you've appended one, it will execute; if Text$(0) is empty, the program reads the command from the keyboard.

An extension of this technique gives you a nice keyboard buffer. All you do is call a subroutine from within the program. The subroutine uses Inkey$ to read the keyboard; if a character is waiting, it puts it at the end of Text$(0) and returns to the main program. This creates a keyboard buffer large enough to handle nearly any conceivable series of keystrokes. The only trade-off is the time spent in the subroutine instead of in the main program.■

—Bruce Tonkin

Photo. Sample outline produced using Thought Outliner.

If you add all the improvements and implement a help screen, the resulting program would probably take up 30–42K on an MS-DOS system. On a Model 4, you could squeeze the program by shortening variable names and removing remarks. The existing program, I estimate, takes up 15–20K on a Model 4, so you could probably add a few improvements without putting yourself over the maximum size limit.

The only limit you should encounter on the Model 4 is the amount of memory available in the text array. On MS-DOS machines, the text array can hold about 50K bytes of characters. The Model 4's capacity is 10–15K. You can save space by lowering the number in the text array's dimension (DIM) statement from 1,500 to 500.■

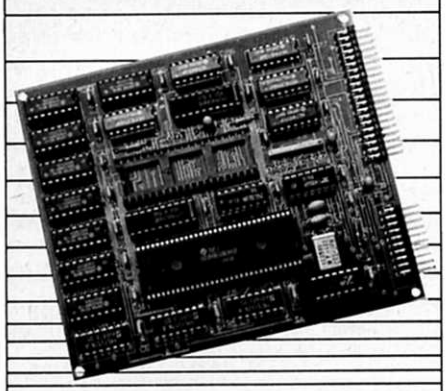
Bruce Tonkin is an independent software developer and industry critic. Write to him at 34069 Hainesville Road, Round Lake, IL 60073. You can also contact Bruce through Syslink (312-622-4442) and BIX (312-642-6365).

Program Listing. Thought Outliner. (See p. 96 for information on using the checksums in this listing.)

```
10 'Outline Processor Program                                                  
20 'written in Quick BASIC 2.0; by Bruce W. Tonkin on 9/13/86.                 
30 'changed to generic GWBASIC by Bruce W. Tonkin on 11/11/86.                 
40 'copyright Bruce Tonkin 1986.  All rights reserved                          
50 'set the various constants to use                                           
60 CLS: PRINT:PRINT:PRINT SPACE$(30);"Initializing"                    '*  3755
70 DEFINT A-Z              'all variables will be integers             '*   809
80 KEY OFF:FOR I=1 TO 10:KEY I,"":NEXT I:I=0                           '*  2678
90 FOREGROUND=7:BACKGROUND=0:BORDER=0   'screen color settings         '*  2532
100 DIM TEXT$(1501)                                                    '*  1068
110 MAXLINES=1500          'number of text lines is 1500               '*  1046
120 FIRSTLINE=9            'first line of text display                 '*   985
130 LASTLINE=24            'last line of text display                  '*   947
140 MARGIN=78              'right margin on screen                     '*   799
150 DIM WHAT(25)           'what lines are on the screen               '*   924
160 KEY OFF:               'program will handle the function keys      '*   725
170 'define cursor movement                                                    
180 CRETURN$=CHR$(13):     'carriage return.  Start new line.          '*  1325
190 UP$=CHR$(5):           'up a line, ctrl-E                          '*   897
200 DOWN$=CHR$(24):        'down a line, ctrl-X                        '*  1085
210 UPSCREEN$=CHR$(18):    'up a screen, ctrl-R                        '*  1390
220 DOWNSCREEN$=CHR$(3):   'down a screen, ctrl-C                      '*  1484
230 RIGHTCHAR$=CHR$(4):    'right one character, ctrl-D                '*  1394
240 RIGHTWORD$=CHR$(6):    'right a word, ctrl-F                       '*  1427
250 BACKSPACE$=CHR$(8):    'non-destructive backspace, ctrl-H          '*  1369
260 RIGHTTAB$=CHR$(9):     'right one tab position                     '*  1331
270 LEFTCHAR$=CHR$(10):    'left one character, ctrl-J                 '*  1360
280 LEFTWORD$=CHR$(1):     'left a word, ctrl-A                        '*  1343
290 LEFTLEVEL$=CHR$(16):   'left one level (previous), ctrl-L          '*  1458
300 RIGHTLEVEL$=CHR$(12):  'right one level, ctrl-P                    '*  1529
310 HOMEKEY$=CHR$(17):     'cursor to line start, ctrl-Q               '*  1307
320 ENDKEY$=CHR$(26):      'cursor to line end, ctrl-Z                 '*  1226
330 'text edit operations                                                      
340 DELCHAR$=CHR$(7):      'delete a character, ctrl-G                 '*  1230
350 DELWORD$=CHR$(20):     'delete a word, ctrl-T                      '*  1304
360 DELLINE$=CHR$(25):     'delete a line, ctrl-Y                      '*  1290
370 INSERTLINE$=CHR$(14): 'insert a line, ctrl-N                       '*  1545
380 REFORM$=CHR$(2):       'reformat a section, ctrl-B                 '*  1189
390 'define file operations                                                    
400 SAVEDOC$=CHR$(11):     'save current outline, ctrl-K               '*  1288
410 QUIT$=CHR$(27):        'quit, don't save, ESC                      '*  1102
420 LOADDOC$=CHR$(15):     'load outline from disk, ctrl-O             '*  1279
430 'define functions                                                          
440 DEF FNMAX(X,Y)=-(X>Y)*X-(Y>=X)*Y                                  '*  2216
450 DEF FNMIN(X,Y)=-(X<Y)*X-(Y<=X)*Y                                  '*  2211
460 'exit from program, saving the document first                              
470 'start:                                                                    
480 VIEW PRINT                                                         '*   932
490 FOR I=0 TO MAXLINES:TEXT$(I)="":NEXT I                             '*  2654
500 COLOR FOREGROUND,BACKGROUND,BORDER                                 '*  2629
510 CLS                                                                '*   408
520 PRINT"Outline processor: version 1.00.  Copyright Bruce W. T
    onkin, 1986"                                                       '*  6203
530 F$=COMMAND$:IF F$<>"" THEN 610                                     '*  1945
540 'getname:                                                                  
550 ON ERROR GOTO 710                                                  '*  1298
560 FILES                                                              '*   558
570 'recover if none:                                                          
580 PRINT"What is the name of the outline file to edit: ";             '*  4820
590 LINE INPUT F$                                                      '*  1056
600 'filecheck:                                                                
610 ON ERROR GOTO 730                                                  '*  1297
620 I=1                                                                '*   367
630 OPEN"i",1,F$                                                       '*   907
640 WHILE I<=MAXLINES                                                  '*  1398
```

Listing continued on p. 106

Circle 209 on Reader Service card.



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A Quicker Outliner

Bruce Tonkin originally wrote Thought Outliner in Quick Basic, a compiled language. Since most people don't own a compiler, we asked for an interpreted version, which unfortunately runs much slower than the compiled version. To improve the speed in the interpreted version, omit remark lines and combine lines whenever possible. Be careful not to combine lines that are objects of Goto or Gosub statements.

Owners of MS-DOS machines can order a disk containing the Quick Basic version of Thought Outliner from Bruce (34069 Hainesville Road, Round Lake, IL 60073). Enclose $11 to cover duplication, shipping, and handling. Orders from outside the United States and Canada require $5 more for overseas airmail, and payment must be in U.S. funds drawn on a U.S. bank or in traveler's checks. The disk version includes source code, compiled code, and a document file. As best we can determine, the Quick Basic (compiled) version works on all Tandy MS-DOS machines but the 2000 and requires 256K RAM. The interpreted version works on all machines (the 3000 requires MS-DOS 3.2).

The Model 4 version is available on this month's Load 80 disk (see p. 6 for ordering information); to obtain a copy of the listing, write to Technical Editors, *80 Micro* 80 Pine St., Peterborough, NH 03458.

In the compiled MS-DOS version, control-S moves the cursor left one space, as it does in My Word! and Wordstar. The Tandy 1000's control-S acts as a hold key, so we have replaced it with control-J in the interpreted version.

Finally, see the Figure for an example of Quick Basic source code that does the same thing as lines 3110–3340 of the interpreted program.■

—Eds.

```
   if mid$(text$(x),1,5*level)=temp$ then goto getcommand:
   for i=lastline to firstline+1 step -1:what(i)=what(i-1):next i
   what(firstline)=x:current=x
   cursorcol=fnmin(cursorcol,len(text$(current))+1)
   gosub redisplay:gosub showstatus:goto getcommand:
   end if

'down arrow
if cmd=80 then
   if cursorline=lastline then
      view print firstline to lastline
      locate lastline,80:print
      view print
      for i=firstline to lastline-1
         what(i)=what(i+1)
      next i
      cursorline=cursorline-1
      current=what(cursorline):x=current+1
      if x<=top then
         temp$=string$(5*level,32)
         while mid$(text$(x),1,5*level)=temp$ and x<=top and temp$<>""
            x=x+1
         wend
         what(lastline)=x:current=x
         else if x>top then top=x:what(lastline)=top:current=x
         end if
      temp=cursorline:cursorline=lastline:gosub showline
      cursorline=temp
      end if
      cursorline=cursorline+1:current=what(cursorline)
      if current>top then what(cursorline)=what(cursorline-1)+1
      cursorcol=fnmin(cursorcol,len(text$(current))+1)
      gosub showstatus:goto getcommand:
   end if

'up page
if cmd=73 then
   current=what(firstline):cursorline=firstline:cursorcol=1
   if current=1 then gosub showstatus:goto getcommand:
   y=lastline-firstline:x=current-1:temp$=string$(5*level,32)
   while y>0
      while mid$(text$(x),1,5*level)=temp$ and x>1:x=x-1:wend
      if mid$(text$(x),1,5*level)<>temp$ then
         for i=lastline to firstline+1 step -1
            what(i)=what(i-1)
         next i
         what(firstline)=x:current=x
         x=x-1
         if x<1 then y=1
```

Figure. Quick Basic equivalent of Thought Outliner lines 3110-3340.

Circle 455 on Reader Service card.

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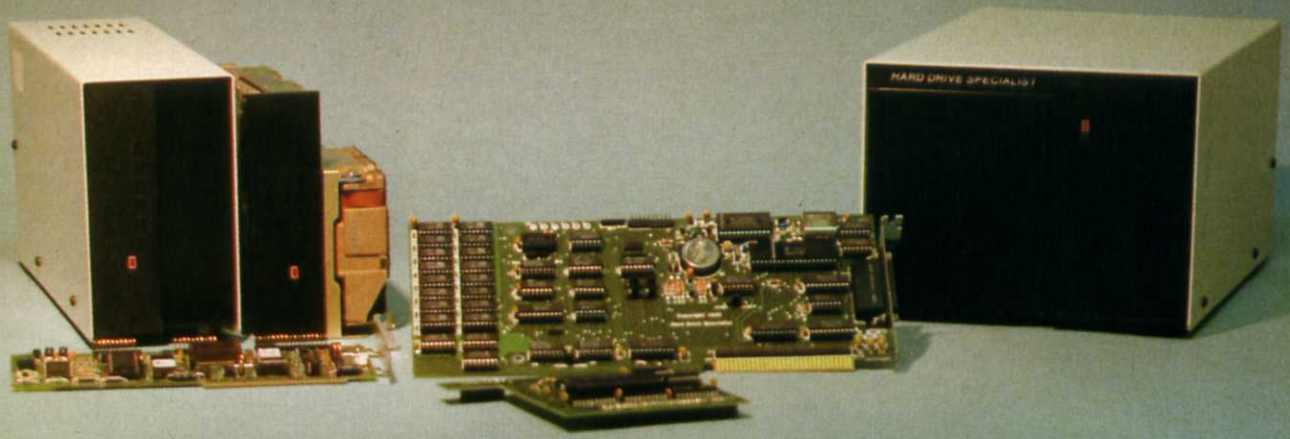

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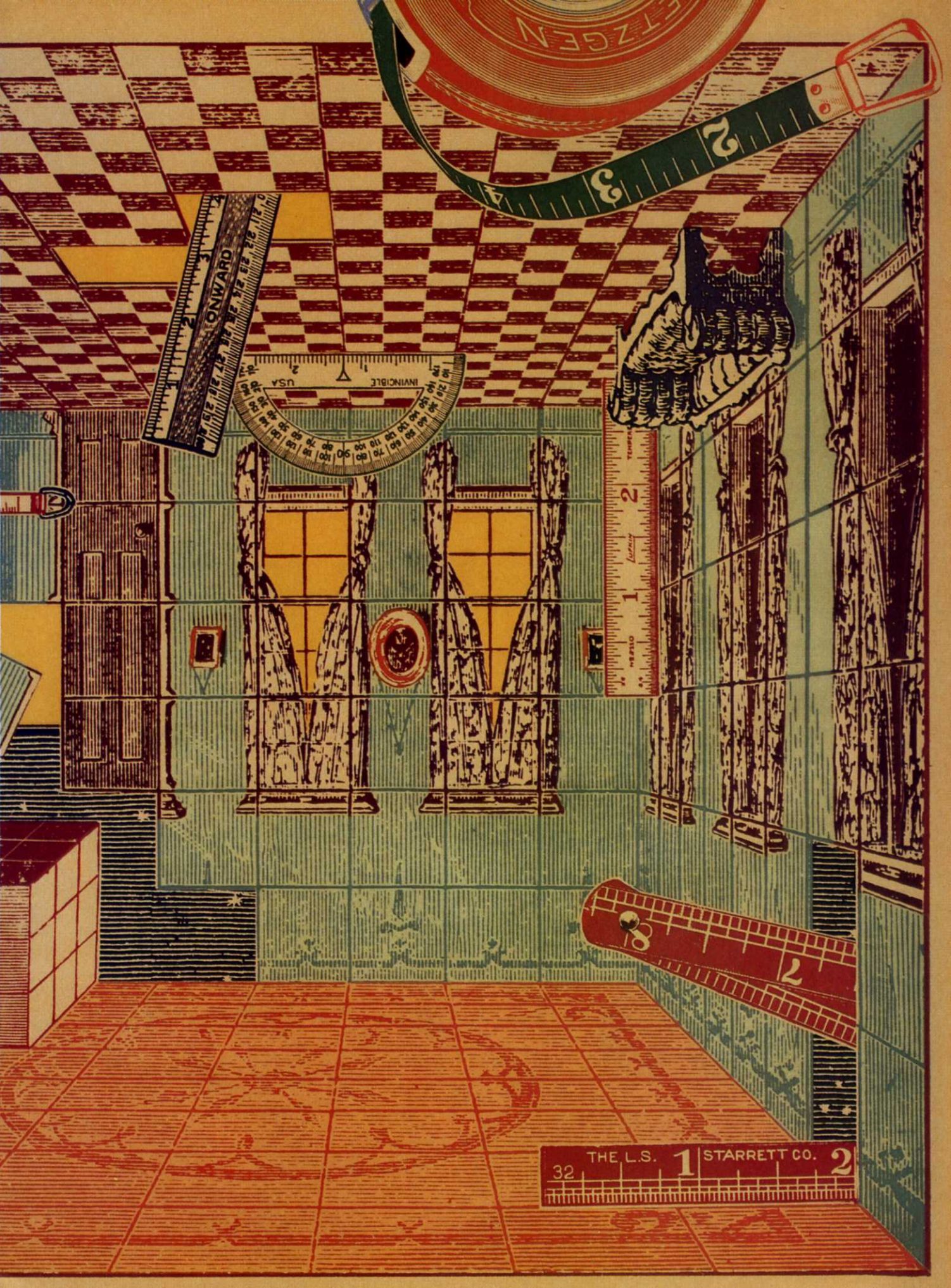
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Taking Measure

by Donald W. Moffat

Puzzled by the material requirements for that room you want to paper? Use this program to make them add up.

Homeowners are often stymied when it comes to calculating material requirements for do-it-yourself improvement projects. Common jobs such as laying a carpet, building a sun deck, or wallpapering a room can involve tricky arithmetic, especially if the work area encompasses a variety of geometric shapes. I experienced this firsthand while attempting to reshingle the roof of my house. The frustration born from that experience led me to write Area.BAS, a program for the Tandy 1000 that calculates areas and material requirements for you.

Though written for the Tandy 1000, Area.BAS can be adapted for use on the Models III and 4. The Program Listing (see p. 55) contains the Basic code for a Model 1000 without special graphics capability; Figs. 1 and 2 are the changes for the Models III and 4 (also without special graphics capability). I'll discuss these and other modifications for the program in more detail later.

Defining Your Space

Area.BAS is easy to learn. You supply the program with the surface measurements for your project, as well as the material specifications you intend to use. It calculates the area and tells you how much material you will need to complete the job.

After you've typed in and run Area.BAS, the program greets you with a menu of nine options. Choose option 1 to figure the area and material requirements for a new project. The option brings up the calculate-area screen, which prompts you to give the area you're working with a name—for example, "exterior wall" or "garage roof."

Once you've entered a name (up to 30 characters in length), the program provides a display of six geometric shapes. Choose the one that corresponds to your work area. The program tells you which measurements to take and asks you to enter them. For instance, if you are working on a rectangular area, it instructs you to measure two adjacent sides. If you're working on a circle, it tells you to measure the radius. The Table defines the six shapes and lists the measurement requirements.

When you've entered all the measurements for the job, the program calculates and displays the area. Press the enter key to return to the main menu. To figure the material requirement, select option 9. You'll be prompted to enter information about the material you're using. (The required information is usually listed on the product's packaging.) When you've finished, the program informs you of how much material you'll need.

Divide and Conquer

If you have complex surfaces that incorporate a variety of geometric shapes, divide them into smaller sections and separately enter the measurements for each shape. The process is similar for surfaces with geometric areas to add or subtract from the total. For instance, suppose you want to paint a wall in which there is a door with a semicircular window above it. First, enter the

Illustration by John Craig

Circle 81 on Reader Service card.

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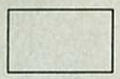
Rectangle		Two adjacent sides.
Parallelogram		Any side and the perpendicular distance to the opposite side.
Trapezoid		The lengths of the sides that are parallel, and the perpendicular distance between them.
Triangle		Each side.
Circle		The radius.
Ellipse		Major and minor axes. The major axis is the longest straight line you can draw in the ellipse. The minor axis, perpendicular at the midpoint of the major axis, is the shortest line you can draw through the center.

Table. Geometric shapes handled by Area.BAS.

Area.BAS tells you how much material you'll need to complete the job.

measurements of the wall with option 1; then return to the main menu and add the wall measurements to memory. Next, enter the measurement of the door. When you return to the main menu, subtract the door measurement from the area calculation. Then do the same for the window.

You can also use the program to find volume; all you do is multiply the calculated surface area by the depth. For example, suppose you enter the dimensions of a proposed concrete patio, and the computer tells you that there will be 240 square feet of surface area. If the concrete will be 4 inches thick (1/3 foot), multiply the surface area by 1/3. The volume will be 80 cubic feet. Since concrete is delivered by the cubic yard (27 cubic feet), you'll need 80/27, or nearly 3 cubic yards.

Between the Lines

As I mentioned earlier, you don't need a computer with special graphics capability to run Area.BAS. Line 1370 to the end of the program draws the graphics. The changes reflected in Figs. 1 and 2 substitute the proper code for the Models III and 4.

In addition, to make the program work on the Model III, change line 130 to:

```
130 CLEAR 250
```

Also, change the commas to semicolons in all Input statements (lines 200, 320, 450, 460, 540, 990, 1040, 1080, 1100, 1160, 1210, 1250, 1290, 1310, and 1360). On the Model 4, you can omit line 130.

The program, from line 140 to line 1320, works as follows: Line 140 dimensions arrays for up to 25 areas. If you expect to enter more than that, change the value of NDAT. Lines 210–240 analyze your selection from the menu. Line 260 ties each item in the GOSUB routine to a menu selection. It saves time during debugging and later modifications. To further help you track down typos, I've included the menu item number on the title line of each subroutine that is called directly from the menu. Subroutines called by other subroutines have a series of angle brackets (<<<<<) in their title lines.

Line 420 toggles A(n) between zero and one. Zero means that area n is to be subtracted; one means it is to be added. This feature allows you to make side calculations of areas that you might not want to include in the list going to memory. You choose either option 1 or 2 from the menu and have the computer calculate an area. If you don't want to include the area in the set going to memory, select option 1 or 2 again and make another calculation. If you want to include the area as either an addition or a subtraction, choose option 3 or 4 before working with another surface.

Lines 990–1050 allow you to work with semicircles and other fractional circles and ellipses. Line 1320 sums the area algebraically, using A(n) to determine whether to add or subtract it. The values for variable FACTR convert each surface's area from the units you measured into the units you select for the result. This means you can measure one area in feet, another in inches, and have the total calculated in meters.■

Write to Donald W. Moffat at 1164 NW Overlook Drive, Corvallis, OR 97330.

LOAD 80

System Requirements

Tandy 1000
(Models III and 4 with changes)
32K RAM
Disk Basic

Fig. 1. Changes to substitute proper graphics code for the Model III. (See p. 96 for information on using the checksums in Figs. 1 and 2.)

```
1370 'Subroutine to draw shapes  <<<<<<<<<                          '*   203
1380 PRINT@1,STRING$(11,131);@321,STRING$(11,176);:FOR C=0 TO 5:
     PRINT@C*64,CHR$(170);@C*64+12,CHR$(149);:NEXTC:PRINT@210,CH
     R$(152);@229,CHR$(155);@230,CHR$(129);@273,CHR$(134);@272,C
     HR$(160);@336,CHR$(177);@335,CHR$(184);@354,CHR$(152);         '* 13461
1390 PRINT@355,CHR$(129);@291,CHR$(160);@292,CHR$(134);@361,CHR$
     (176);@362,CHR$(188);@363,CHR$(179);@300,CHR$(176);@301,CHR
     $(140);@302,CHR$(131);@239,CHR$(176);@240,CHR$(140);@252,CH
     R$(164);@317,CHR$(137);@318,CHR$(144);@382,CHR$(178);          '* 12842
1400 PRINT@383,CHR$(180);@211,STRING$(18,131);@337,STRING$(17,17
     6);@241,STRING$(11,131);@364,STRING$(18,176);                  '*  6277
1410 PRINT@522,CHR$(140);@521,CHR$(176);:FOR C=0 TO 1:PRINT@584+
     C*61,CHR$(131);@583+C*61,CHR$(140);@582+C*61,CHR$(176);:NEX
     T C:PRINT@706,CHR$(179);@705,CHR$(172);@771,CHR$(131);@772,
     CHR$(137);@773,CHR$(140);@774,CHR$(176);                       '* 12535
1420 PRINT@775,CHR$(144);@839,CHR$(130);@840,CHR$(131);@841,CHR$
     (140);@842,CHR$(164);@843,CHR$(186);@523,CHR$(171);:FOR C=0
      TO 3:PRINT@587+C*64,CHR$(170);:NEXT C                         '*  9125
1430 PRINT@660,CHR$(168);@661,CHR$(131);@597,CHR$(160);@598,CHR$
     (158);@599,CHR$(135);@600,CHR$(129);@535,CHR$(160);@536,CHR
     $(176);@537,CHR$(184);@538,CHR$(140);@539,CHR$(140);@540,CH
     R$(135);@541,CHR$(131);@542,CHR$(139);@543,CHR$(140);          '* 12876
1440 PRINT@544,CHR$(140);@545,CHR$(180);@546,CHR$(176);@547,CHR$
     (144);@610,CHR$(130);@611,CHR$(139);@612,CHR$(173);@613,CHR
     $(144);@677,CHR$(131);@678,CHR$(148);@742,CHR$(133);@741,CH
     R$(176);@805,CHR$(129);@804,CHR$(158);                         '* 12054
```

Fig. 1 continued

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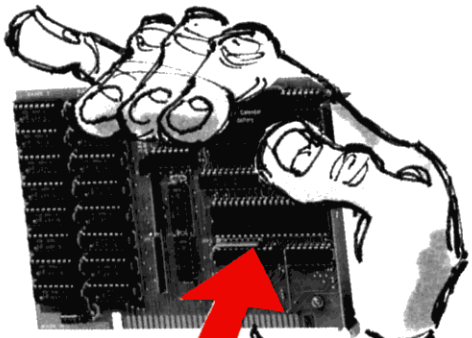

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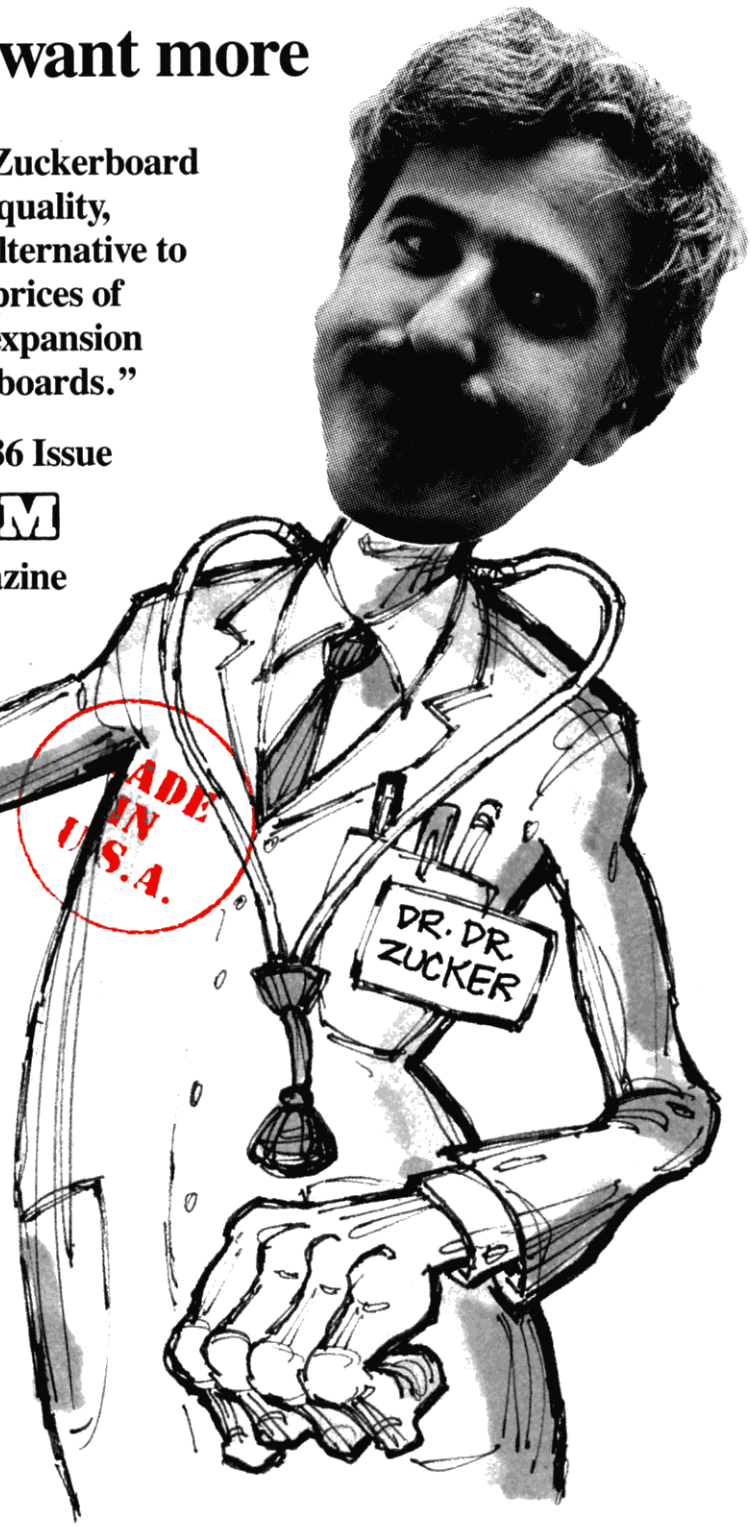

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FOR TANDY 1000EX			
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Fig. 1 continued

```
1450 PRINT@803,CHR$(184);@802,CHR$(160);@867,CHR$(129);@866,CHR$
     (131);@865,CHR$(135);@864,CHR$(140);@863,CHR$(140);@862,CHR
     $(184);@861,CHR$(176);@860,CHR$(180);@859,CHR$(140);@858,CH
     R$(140);@857,CHR$(139);@856,CHR$(131);@855,CHR$(130);          '* 12911
1460 PRINT@792,CHR$(144);@791,CHR$(180);@790,CHR$(173);@789,CHR$
     (130);@725,CHR$(176);@724,CHR$(138);                           '*  5551
1470 PRINT@689,CHR$(154);@626,CHR$(152);@627,CHR$(129);@563,CHR$
     (160);@564,CHR$(184);@565,CHR$(135);@566,CHR$(139);@567,CHR
     $(172);@568,CHR$(144);@632,CHR$(130);@633,CHR$(164);@698,CH
     R$(165);@762,CHR$(150);@825,CHR$(134);                         '* 12094
1480 PRINT@824,CHR$(160);@888,CHR$(129);@887,CHR$(142);@886,CHR$
     (184);@885,CHR$(180);@884,CHR$(141);@883,CHR$(130);@819,CHR
     $(144);@818,CHR$(137);@753,CHR$(169);                          '*  8851
1490 PRINT@262,"1";@386,"RECTANGLE";@283,"2";@402,"PARALLELOGRAM
     ";@310,"3";@432,"TRAPEZOID";@777,"4";@899,"TRIANGLE";@797,"
     5";@923,"CIRCLE";@821,"6";@946,"ELLIPSE"                       '*  9478
1500 INPUT"Select by number";SHAPE:RETURN                           '*  3204
```

Fig. 2. Changes to substitute proper graphics code for the Model 4.

```
1380 PRINT@(1,1),CHR$(151);:PRINT STRING$(22,131);CHR$(171)         '*  5681
1390 FOR RO=2 TO 7:PRINT@(RO,1),CHR$(149):NEXT RO                   '*  3018
1400 FOR RO=2 TO 7:PRINT@(RO,24),CHR$(170);:NEXT RO                 '*  3116
1410 PRINT@(8,1),CHR$(181);:PRINT STRING$(22,176);CHR$(186)         '*  3449
1420 PRINT@(7,12),"1";:PRINT@(9,8),"RECTANGLE"                      '*  2721
1430 PRINT@(8,27),CHR$(186);:FOR C=0 TO 4:PRINT@(7-C*1,28+C*1),C
     HR$(154);:NEXT C                                               '*  4635
1440 PRINT@(3,52),CHR$(155);:PRINT@(8,47),CHR$(186);:FOR C=0 TO
     3:PRINT@(7-C*1,48+C*1),CHR$(154);:NEXT C                       '*  6033
1450 PRINT@(8,55),CHR$(186);:FOR C=0 TO 4:PRINT@(7-C*1,56+C*1),C
     HR$(154);:NEXT C                                               '*  4639
1460 PRINT@(3,33),STRING$(19,131);:PRINT@(8,28),STRING$(19,176);    '*  3769
1470 PRINT@(7,38),"2";:PRINT@(9,31),"PARALLELOGRAM"                 '*  3081
1480 PRINT@(3,61),STRING$(8,131);:PRINT@(8,56),STRING$(20,176);     '*  3715
1490 FOR C=0 TO 1:PRINT@(3+C*2,69+C*3),CHR$(137);:PRINT@(3+C*2,7
     0+C*3),CHR$(144);:PRINT@(4+C*2,70+C*3),CHR$(130);:PRINT@(4+
     C*2,71+C*3),CHR$(164);:NEXT C                                  '*  8627
1500 PRINT@(7,75),CHR$(137);:PRINT@(7,76),CHR$(144);:PRINT@(8,76
     ),CHR$(178);:PRINT@(8,77),CHR$(180);                           '*  5791
1510 PRINT@(7,66),"3";:PRINT@(9,61),"TRAPEZOID"                     '*  2808
1520 PRINT@(18,1),CHR$(140):PRINT@(18,2),CHR$(143)                  '*  2836
1530 FOR C=0 TO 5:PRINT@(17-C*1,3+C*3),CHR$(176);:PRINT@(17-C*1,
     4+C*3),CHR$(140);:PRINT@(17-C*1,5+C*3),CHR$(131);:NEXT C       '*  6825
1540 PRINT@(11,21),CHR$(176);:PRINT@(11,22),CHR$(172);:PRINT@(21
     ,21),CHR$(176);:PRINT@(21,22),CHR$(186);                       '*  5937
1550 FOR RO=12 TO 20:PRINT@(RO,22),CHR$(170);:NEXT RO               '*  3212
1560 FOR C=0 TO 2:PRINT@(18+C*1,3+C*6),CHR$(176);:PRINT@(18+C*1,
     4+C*6),CHR$(176);:PRINT@(19+C*1,5+C*6),CHR$(131);:PRINT@(19
     +C*1,6+C*6),CHR$(131);:PRINT@(19+C*1,7+C*6),CHR$(140);:PRIN
     T@(19+C*1,8+C*6),CHR$(140);:NEXT C                             '* 12247
1570 PRINT@(18,16),"4";:PRINT@(22,6),"TRIANGLE"                     '*  2762
1580 PRINT@(16,26),CHR$(150);:PRINT@(15,26),CHR$(160);:PRINT@(15
     ,27),CHR$(133);:PRINT@(14,27),CHR$(160);:PRINT@(14,28),CHR$
     (134);:PRINT@(13,29),CHR$(176);:PRINT@(13,30),CHR$(140);:PR
     INT@(13,31),CHR$(129);:PRINT@(12,31),CHR$(160);                '* 13152
1590 PRINT@(12,32),CHR$(176);:FOR COL=33 TO 35:PRINT@(12,COL),CH
     R$(140);:NEXT COL                                              '*  4847
1600 FOR COL=36 TO 39:PRINT@(12,COL),CHR$(131);:NEXT COL             '*  3403
1610 FOR COL=40 TO 42:PRINT@(12,COL),CHR$(140);:NEXT COL             '*  3393
1620 PRINT@(12,43),CHR$(176);:PRINT@(12,44),CHR$(144);:PRINT@(13
     ,44),CHR$(130);:PRINT@(13,45),CHR$(140);:PRINT@(13,46),CHR$
     (176);:PRINT@(14,47),CHR$(137);:PRINT@(14,48),CHR$(144);:PR
     INT@(15,48),CHR$(138);:PRINT@(15,49),CHR$(144);:PRINT@(16,4
     9),CHR$(169);                                                  '* 14638
1630 PRINT@(17,49),CHR$(154);:PRINT@(18,49),CHR$(129);:PRINT@(18
     ,48),CHR$(168);:PRINT@(19,48),CHR$(129);:PRINT@(19,47),CHR$
     (152);:PRINT@(20,46),CHR$(131);:PRINT@(20,45),CHR$(140);:PR
     INT@(20,44),CHR$(160);:PRINT@(21,44),CHR$(129);                '* 13202
1640 PRINT@(21,43),CHR$(131);:FOR COL=40 TO 42:PRINT@(21,COL),CH
     R$(140);:NEXT COL                                              '*  4832
1650 FOR COL=36 TO 39:PRINT@(21,COL),CHR$(176);:NEXT COL             '*  3417
1660 FOR COL=33 TO 35:PRINT@(21,COL),CHR$(140);:NEXT COL             '*  3402
1670 PRINT@(21,32),CHR$(131);:PRINT@(21,31),CHR$(130);:PRINT@(20
     ,31),CHR$(144);:PRINT@(20,30),CHR$(140);:PRINT@(20,29),CHR$
     (131);:PRINT@(19,28),CHR$(164);:PRINT@(19,27),CHR$(130);:PR
     INT@(18,27),CHR$(130);:PRINT@(18,27),CHR$(148);:PRINT@(18,2
     6),CHR$(130);                                                  '* 14585
1680 PRINT@(17,26),CHR$(165);:PRINT@(18,37),"5";:PRINT@(22,35),"
     CIRCLE"                                                        '*  4103
1690 PRINT@(17,51),CHR$(154);:PRINT@(16,52),CHR$(176);:PRINT@(16
     ,53),CHR$(134);:PRINT@(15,54),CHR$(176);:PRINT@(15,55),CHR$
     (140);:PRINT@(15,56),CHR$(131);:PRINT@(15,57),CHR$(131);:PR
     INT@(14,58),CHR$(176);:PRINT@(14,59),CHR$(176);:PRINT@(14,6
     0),CHR$(152);                                                  '* 14646
1700 PRINT@(14,61),CHR$(140);:PRINT@(14,62),CHR$(140);:FOR COL=6
     3 TO 66:PRINT@(14,COL),CHR$(131);:NEXT COL                     '*  6283
1710 PRINT@(14,67),CHR$(140);:PRINT@(14,68),CHR$(140);:PRINT@(14
     ,69),CHR$(164);:PRINT@(14,70),CHR$(176);:PRINT@(14,71),CHR$
     (176);:PRINT@(15,72),CHR$(131);:PRINT@(15,73),CHR$(131);:PR
     INT@(15,74),CHR$(140);:PRINT@(15,75),CHR$(176);:PRINT@(16,7
     6),CHR$(137);                                                  '* 14642
1720 PRINT@(16,77),CHR$(176);:PRINT@(17,78),CHR$(165);:PRINT@(18
     ,78),CHR$(150);:PRINT@(19,77),CHR$(131);:PRINT@(19,76),CHR$
     (152);:PRINT@(20,75),CHR$(131);:PRINT@(20,74),CHR$(140);:PR
     INT@(20,73),CHR$(176);:PRINT@(20,72),CHR$(176);:PRINT@(21,7
     1),CHR$(131);                                                  '* 14650
```

Fig. 2 continued

Fig. 2 continued

```
1730 PRINT@(21,70),CHR$(131);:PRINT@(21,69),CHR$(134);:PRINT@(21
     ,68),CHR$(140);:PRINT@(21,67),CHR$(140);:FOR COL=63 TO 66:P
     RINT@(21,COL),CHR$(176);:NEXT COL:PRINT@(21,62),CHR$(140);:
     PRINT@(21,61),CHR$(140);:PRINT@(21,60),CHR$(137);          '* 13498
1740 PRINT@(21,59),CHR$(131);:PRINT@(21,58),CHR$(131);:PRINT@(20
     ,57),CHR$(176);:PRINT@(20,56),CHR$(176);:PRINT@(20,55),CHR$
     (140);:PRINT@(20,54),CHR$(131);:PRINT@(19,53),CHR$(164);:PR
     INT@(19,52),CHR$(131);:PRINT@(18,51),CHR$(169);            '* 13180
1750 PRINT@(18,65),"6";:PRINT@(22,62),"ELLIPSE":PRINT@(23,15),,:
     INPUT"SELECT BY NUMBER ",SHAPE:RETURN                      '*  6329
```

Program Listing. Area.BAS. (See p. 96 for information on using the checksums in this listing.)

```
100 '************************************************************  '*  145
110 '** AREA4.BAS   Calculates areas and coverage requirements  **  '*  146
120 '************************************************************  '*  147
130 '************************************************************  '*  148
140 NDAT=25:DIM NA$(NDAT),A(NDAT),AN$(NDAT),AREA(NDAT),UN$(NDAT)
    ,UM(NDAT),FACTR(7,NDAT)                                       '*  5376
150 DATA 1,144,1296,4.0145E+09,.155,1550,1.55E+09,.006944,1,9,2.
    78784E+07,.001076,10.763922,1.076E+07,.000772,.111111,1,3097
    600,.00012,1.195991,1195992,2.49E-10,3.587E-08,3.228E-07,1,1
    .922E-13,3.861E-07,.387103                                    '* 10645
160 DATA 6.4516,929.0304,8361.276,2.59E+10,1,10000,1E+10,.000645
    ,.092903,.836127,2950000,.0001,1,1000000,6.25E-10,1.211E-07,
    8.361E-07,2.59,1E-10,.000001,1                                '*  7713
170 FOR C=1 TO 7:FOR CC=1 TO 7:READ FACTR(C,CC):NEXT CC:NEXT C    '*  3840
180 CLS                                                           '*   411
190 PRINT" 1 Erase memory and start a new series":PRINT" 2 Calcu
    late another area":PRINT" 3 Include latest area as an additi
    on":PRINT" 4 Include latest area as a subtraction":PRINT" 5
    Delete an area from memory"                                   '* 17820
200 PRINT" 6 Load list of areas from disk":PRINT" 7 Save list of
     areas on disk":PRINT" 8 Display all areas held in memory":P
    RINT" 9 Calculate requirements":PRINT:INPUT"Select by number
     ",SELECT                                                     '* 15985
210 IF SELECT<1 OR SELECT>9 THEN PRINT"There are nine choices: 1
     through 9":PRINT:GOTO 190                                    '*  6648
220 IF SELECT=1 OR SELECT=2 OR SELECT=6 THEN 270'No rqts for new list'*  3005
230 IF SELECT<>3 AND SELECT<>4 THEN 250                           '*  2392
240 IF TAREA<=0 THEN PRINT"No area has been calculated":GOTO 190
     ELSE 270                                                     '*  5288
250 IF N<=0 THEN PRINT"There are no areas in memory":GOTO 190     '*  4595
260 '                    1   2   3   4   5   6   7   8   9       '*   152
270 CLS:ON SELECT GOSUB 290,300,410,410,450,1100,1160,1210,1230:
    GOTO 180                                                      '*  4003
280 'Subroutine to calculate an area  1 2 1 2 1 2                 '*   154
290 N=0          'Enter here to start a new series                '*   374
300 PRINT"CALCULATING AN AREA":PRINT    'Enter here for another area '*  2394
310 PRINT"What do you want to name the area?  Use up to 30 chara
    cters,"                                                       '*  5860
320 LINE INPUT"including spaces.  Type M to return to menu. ",TN
    A$:PRINT                                                      '*  5773
330 IF TNA$="M" THEN 390 ELSE IF LEN(TNA$)<31 THEN 350            '*  3131
340 PRINT"That name is too long":GOTO 310                         '*  3135
350 CLS:GOSUB 1380       'Get shape                               '*  1088
360 I$=" and inches":SQ$="":QM$="":M$="in measurement?"           '*  3996
370 GOSUB 520:IF TUM=2 THEN FCH$="in the form xx'xx"+CHR$(34) EL
    SE FCH$=""                                                    '*  4890
380 CLS:ON SHAPE GOSUB 590,630,670,720,770,820                    '*  2630
390 RETURN                                                        '*   668
400 'Subroutine to place latest area in memory  3 4 3 4 3 4       '*   148
410 N=N+1:AREA(N)=TAREA:UM(N)=TUM:NA$(N)=TNA$:UN$(N)=TUN$         '*  3580
420 IF SELECT=3 THEN A(N)=1:AN$(N)="Add"ELSE AN(N)=0:AN$(N)="Sub
    tract"                                                        '*  4513
430 RETURN                                                        '*   663
440 'Subroutine to delete an area from memory  555555555          '*   152
450 INPUT"Enter number of area to be deleted ",NDEL               '*  4146
460 PRINT NDEL;NA$(NDEL);AN$(NDEL);AREA(NDEL);UN$(NDEL):INPUT"Is
     this the area to be deleted? Y or N, or M for menu ",T$      '*  8682
470 IF T$="n" OR T$="N" THEN 450 ELSE IF T$="y" OR T$="Y" THEN 4
    90 ELSE IF T$="m" OR T$="M" THEN 500                          '*  5747
480 PRINT"Answer Y, N, or M please":GOTO 460                      '*  3185
490 FOR C=NDEL TO N-1:NA$(C)=NA$(C+1):AN$(C)=AN$(C+1):AREA(C)=AR
    EA(C+1):UN$(C)=UN$(C+1):A(C)=A(C+1):UM(C)=UM(C+1):NEXT C:N=N
    -1                                                            '*  7287
500 RETURN                                                        '*   661
510 'Subroutine to choose measurement unit  <<<<<<<<<<            '*   150
520 CLS:PRINT"What units should be used "+QM$+M$                  '*  3739
530 PRINT" 1 "+SQ$+"inches":PRINT" 2 "+SQ$+"feet"+I$:PRINT" 3 "+
    SQ$+"yards":PRINT" 4 "+SQ$+"miles":PRINT" 5 "+SQ$+"centimete
    rs":PRINT" 6 "+SQ$+"meters":PRINT" 7 "+SQ$+"kilometers"       '* 12298
540 PRINT:INPUT"Select 1-7 ",TUM:IF TUM<1 OR TUM>7 THEN 570       '*  3918
550 IF TUM=1 THEN TUN$=" inches"ELSE IF TUM=2 THEN TUN$=" feet"E
    LSE IF TUM=3 THEN TUN$=" yards"ELSE IF TUM=4 THEN TUN$=" mil
    es"ELSE IF TUM=5 THEN TUN$=" centimeters"ELSE IF TUM=6 THEN
    TUN$=" meters"ELSE TUN$=" kilometers"                         '* 15740
560 RETURN                                                        '*   667
570 PRINT:PRINT"Only 1 through 7 is acceptable":GOTO 540          '*  4363
580 'Subroutine to get measurements for rectangle  <<<<<<<<<      '*   157
590 FIGURE$="a rectangle":MEAS$="a side":GOSUB 860                '*  3582
600 S1=L:MEAS$="an adjacent side":GOSUB 870                       '*  3119
610 TAREA=S1*L:GOSUB 1070:RETURN                                  '*  2071
620 'Subroutine to get measurements for parallelogram  <<<<<<<<<  '*   152
630 FIGURE$="a parallelogram":MEAS$="a side":GOSUB 860            '*  4007
```

Listing continued

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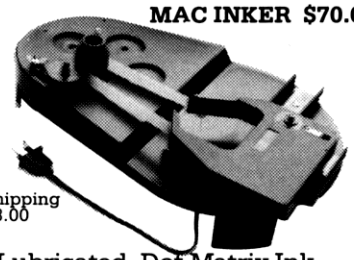

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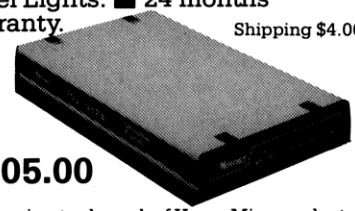

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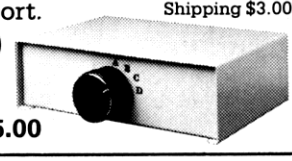

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Listing continued

```
640 S1=L:MEAS$="the perpendicular to that side":GOSUB 870                '*  4525
650 TAREA=S1*L:GOSUB 1070:RETURN                                         '*  2075
660 'Subroutine to get measurements for trapezoid  <<<<<<<<              '*   156
670 FIGURE$="a trapezoid":MEAS$="one of the parallel sides":GOSU
    B 860                                                                '*  5425
680 S1=L:MEAS$="the other parallel side":GOSUB 870                       '*  3838
690 S2=L:MEAS$="the perpendicular between the parallel sides":GO
    SUB 870                                                              '*  5930
700 TAREA=L*(S1+S2)/2:GOSUB 1070:RETURN                                  '*  2425
710 'Subroutine to get measurements for triangle  <<<<<<<<<              '*   152
720 FIGURE$="a triangle":MEAS$="any side":GOSUB 860                      '*  3713
730 S1=L:MEAS$="either of the other two sides":GOSUB 870                 '*  4368
740 S2=L:MEAS$="the third side":GOSUB 870                                '*  2952
750 S3=(S1+S2+L)/2:TAREA=SQR(S3*(S3-S1)*(S3-S2)*(S3-L)):GOSUB 10
    70:RETURN                                                            '*  4392
760 'Subroutine to get measurements for circle  <<<<<<<<<<              '*   157
770 FIGURE$="a circle":MEAS$="the radius":GOSUB 860                      '*  3710
780 FIGURE$="circle":GOSUB 990:TAREA=PART*3.14159*L*L:GOSUB 1070
    :RETURN                                                              '*  4710
790 IF T$="n" OR T$="N" THEN 770 ELSE IF T$="y" OR T$="Y" THEN 8
    10 ELSE IF T$="m"OR T$="M" THEN 820                                  '*  5726
800 PRINT"Answer Y, N, or M please":GOTO 770                             '*  3185
810 'Subroutine to get measurements for ellipse  <<<<<<<<               '*   153
820 FIGURE$="an ellipse":MEAS$="either axis":GOSUB 860                   '*  4049
830 S1=L:MEAS$="the other axis":GOSUB 870                                '*  2974
840 FIGURE$="ellipse":GOSUB 990:TAREA=PART*.785398*S1*L:GOSUB 10
    70:RETURN                                                            '*  4904
850 'Subroutine to get measurements  <<<<<<<<<                          '*   157
860 PRINT"CALCULATING AREA OF ";FIGURE$                                  '*  2533
870 PRINT:PRINT"Enter length of ";MEAS$:PRINT FCH$:INPUT T$              '*  4303
880 IF TUM=2 THEN GOSUB 930 ELSE 900                                     '*  2177
890 IF NG=0 THEN 870 ELSE 910                                            '*  1667
900 L=VAL(T$)                                                            '*   750
910 RETURN                                                               '*   666
920 'Subroutine with special steps for feet and inches  <<<<<<<          '*   155
930 P1=INSTR(T$,"'"):IF P1>0 THEN 940 ELSE NG=0:PRINT"Feet symbo
    l not found":GOTO 970                                                '*  5854
940 FEET=VAL(LEFT$(T$,P1-1))                                             '*  1653
950 P2=INSTR(P1-1,T$,CHR$(34)):IF P2>P1 THEN 960 ELSE PRINT"Meas
    urement must be entered in the form shown":NG=0:GOTO 970             '*  8831
960 I$=MID$(T$,P1+1,P2-1):L=FEET+VAL(I$)/12:NG=1                         '*  2759
970 RETURN                                                               '*   672
980 'Subroutine to ask for fraction of curved area  <<<<<<<<            '*   161
990 PRINT"Do you want to include the entire ";FIGURE$;"?";:INPUT
    " (Y/N) ",T$                                                         '*  5631
1000 IF T$="y" OR T$="Y" THEN PART=1:GOTO 1050                           '*  2722
1010 IF T$<>"n" AND T$<>"N" THEN PRINT"Y or N please":GOTO 990           '*  4003
1020 PRINT"What portion of the ";FIGURE$;" do you want to includ
    e?  Enter a"                                                         '*  6104
1030 PRINT"decimal.  For example, enter .25 if you are using 1/4
     of the"                                                             '*  5720
1040 PRINT FIGURE$;:INPUT" ",PART:IF PART>1 THEN PRINT"Portion c
    annot be greater than one":GOTO 1020                                 '*  7445
1050 RETURN                                                              '*   710
1060 'Subroutine to display result of area calculation  <<<<<<<          '*   199
1070 PRINT:PRINT"Area of ";TNA$;" is";TAREA;"square";TUN$                '*  4057
1080 INPUT"Press <Enter> to return to menu ",T$:RETURN                   '*  4315
1090 'Subroutine to load list of areas  66666666                         '*   202
1100 LINE INPUT"Enter name of file to be loaded - or just <Enter
    > for menu ",T$                                                      '*  6321
1110 IF T$="" THEN 1140 ELSE OPEN"I",1,T$:N=0                            '*  2526
1120 IF EOF(1) THEN CLOSE:GOTO 1140                                      '*  2093
1130 N=N+1:INPUT#1,NA$(N),A(N),AN$(N),AREA(N),UN$(N),UM(N):GOTO
    1120                                                                 '*  3962
1140 RETURN                                                              '*   710
1150 'Subroutine to save list of areas  77777777                         '*   199
1160 LINE INPUT"Enter name of file to be saved - or just <Enter>
     for menu ",T$                                                       '*  6241
1170 IF T$="" THEN 1190 ELSE OPEN"O",2,T$                                '*  2299
1180 FOR C=1 TO N:PRINT#2,CHR$(34);NA$(C);CHR$(34);A(C);CHR$(34)
    ;AN$(C);CHR$(34);AREA(C);CHR$(34);UN$(C);CHR$(34);UM(C):NEX
    T C:CLOSE                                                            '*  7719
1190 RETURN                                                              '*   715
1200 'Subroutine to display areas in memory  8888888                     '*   195
1210 FOR C=1 TO N:PRINT USING"##";C;:PRINT" ";NA$(C);TAB(34)AN$(
    C);:PRINT TAB(43)USING"####.##";AREA(C);:PRINT TAB(51)UN$(C
    ):NEXT C:INPUT"Press <Enter> for menu ",T$:RETURN                    '* 11090
1220 'Subroutine to calculate requirements  999999999                    '*   197
1230 SQ$="Square ":QM$="to display final results":I$="":M$="":SU
    M=0                                                                  '*  4994
1240 GOSUB 520:UN$(0)="Square"+TUN$:CLS                                  '*  2548
1250 INPUT"What material will you use (paint, fertilizer, etc.)?
     ",MAT$:PRINT                                                        '*  6312
1260 PRINT"In what unit of measure (gallon, 100-lb bag, etc.)"           '*  4850
1270 PRINT"will you be using ";MAT$;:INPUT USE$:PRINT                    '*  3963
1280 PRINT"How many ";UN$(0);" per ";USE$;" is specified"                '*  4091
1290 INPUT"by the manufacturer? ",UPM:PRINT                              '*  3437
1300 PRINT"What percent extra do you want?  Press just <Enter> i
    f"                                                                   '*  5601
1310 INPUT"you want to use exactly the specified coverage ",EXTR
    A:PRINT                                                              '*  6058
1320 FOR C=1 TO N:IF A(C)=1 THEN SUM=SUM+AREA(C)*FACTR(TUM,UM(C)
    ) ELSE SUM=SUM-AREA(C)*FACTR(TUM,UM(C))                              '*  6489
1330 NEXT C                                                              '*   649
1340 PRINT"Your total area is";SUM;" square";TUN$                        '*  3863
1350 PRINT"which will require";SUM*(1+.01*EXTRA)/UPM;USE$;"s"            '*  4453
1360 PRINT:INPUT"Press <Enter> to return to menu ",T$:RETURN             '*  4771
1370 'Subroutine to draw shapes  <<<<<<<<<                               '*   203
1380 FOR ROW = 2 TO 7:LOCATE ROW,1:PRINT CHR$(221):LOCATE ROW,24
    :PRINT CHR$(222);:NEXT ROW                                           '*  5664
1390 LOCATE 1,1:PRINT STRING$(24,220);:LOCATE 8,1:PRINT STRING$(
    24,223)                                                              '*  4330
```

Listing continued

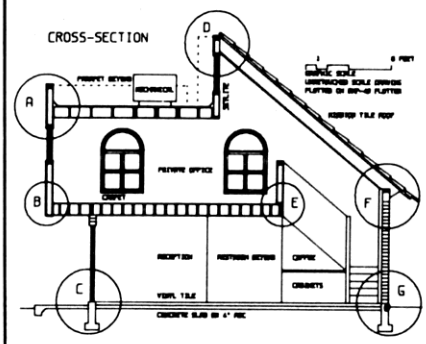
Listing continued

```
1400 FOR C=0 TO 3:LOCATE 7-C,28+C:PRINT CHR$(219);:LOCATE 7-C,48
     +C:PRINT CHR$(219);:LOCATE 7-C,56+C:PRINT CHR$(219);:NEXT          '*  7317
1410 LOCATE 3,32:PRINT STRING$(21,220);:LOCATE 8,27:PRINT STRING
     $(21,223):LOCATE 3,60:PRINT STRING$(9,220);:LOCATE 8,55:PRI
     NT STRING$(23,223);                                                '*  8703
1420 FOR C=0 TO 3:LOCATE 4+C,69+2*C:PRINT CHR$(223);:LOCATE 4+C,
     70+2*C:PRINT CHR$(220);:NEXT                                       '*  5482
1430 FOR C=0 TO 7:LOCATE 18-C,6+2*C:PRINT CHR$(220);:LOCATE 18-C
     ,7+2*C:PRINT CHR$(223);:NEXT          'start triangle              '*  5492
1440 FOR ROW=0 TO 2:FOR COL=0 TO 2:FOR C=0 TO 1:LOCATE 19+ROW,5+
     3*C+6*ROW+COL:PRINT CHR$(223-C*3):NEXT:NEXT:NEXT                   '*  7023
1450 FOR ROW=11 TO 21:LOCATE ROW,22:PRINT CHR$(219);:NEXT               '*  3569
1460 FOR ROW=15 TO 17:LOCATE ROW,26:PRINT CHR$(219);:LOCATE ROW,
     49:PRINT CHR$(219);:NEXT    'Start circle                          '*  5554
1470 FOR C=0 TO 1:LOCATE 14-C,27+C:PRINT CHR$(219);:LOCATE 14-C,
     48-C:PRINT CHR$(219);:LOCATE 18+C,27+C:PRINT CHR$(219);:LOC
     ATE 18+C,48-C:PRINT CHR$(219);:NEXT                                '*  9510
1480 LOCATE 13,29:PRINT CHR$(223);:LOCATE 12,30:PRINT CHR$(220);
     STRING$(2,223);CHR$(30);STRING$(3,220);CHR$(219);STRING$(2,
     223);CHR$(219);STRING$(3,220);CHR$(31);STRING$(2,223);CHR$(
     220);CHR$(31);CHR$(223);                                           '* 11944
1490 LOCATE 19,29:PRINT CHR$(220);CHR$(31);CHR$(223);STRING$(2,2
     20);CHR$(31);STRING$(3,223);CHR$(219);STRING$(2,220);CHR$(2
     19);STRING$(3,223);CHR$(30);STRING$(2,220);CHR$(223);CHR$(3
     0);CHR$(220);                                                      '* 11185
1500 FOR ROW=17 TO 18:LOCATE ROW,51:PRINT CHR$(219);:NEXT:LOCATE
      16,52:PRINT CHR$(219);CHR$(223);CHR$(30);CHR$(219);CHR$(22
     3);CHR$(30);STRING$(3,220);STRING$(12,223);STRING$(3,220);C
     HR$(31);CHR$(223);CHR$(219);CHR$(31);CHR$(223);CHR$(219);          '* 13957
1510 FOR ROW=17 TO 18:LOCATE ROW,78:PRINT CHR$(219);:NEXT ROW:LO
     CATE 19,52:PRINT CHR$(219);CHR$(220);CHR$(31);CHR$(219);CHR
     $(220);CHR$(31);STRING$(3,223);STRING$(12,220);STRING$(3,22
     3);CHR$(30);CHR$(220);CHR$(219);CHR$(30);CHR$(220);CHR$(219
     );                                                                 '* 14241
1520 LOCATE 6,12:PRINT"1";:LOCATE 9,8:PRINT "RECTANGLE";:LOCATE
     6,39:PRINT"2";:LOCATE 9,31:PRINT"PARALLELOGRAM";:LOCATE 6,6
     6:PRINT"3":LOCATE 9,60:PRINT "TRAPEZOID";                          '* 10485
1530 LOCATE 19,18:PRINT"4":LOCATE 22,11:PRINT"TRIANGLE";:LOCATE
     19,38:PRINT"5":LOCATE 22,35:PRINT"CIRCLE";:LOCATE 19,65:PRI
     NT"6";:LOCATE 22,62:PRINT"ELLIPSE"                                 '*  9894
1540 INPUT"Select by number ";SHAPE                                     '*  2702
1550 IF SHAPE<1 OR SHAPE>6 THEN PRINT"Must be between 1 and 6":G
     OTO 1540                                                           '*  4975
1560 RETURN                                                             '*   716
```

End

Circle 299 on Reader Service card.

xT.CAD cut $100



xT.CAD Professional by Microdex: Computer Aided Drafting software for technical production and education. Create, edit, modify precise drawings, details. Features include overlays, grids, cursor snap, zoom, pan, block copy, enlarge, reduce, rotate, mirror, clip, merge, text labels, more. Requires hi-res screen and RS-232 interface. Output to pen plotters. Input from keyboard, or optional digitizer or mouse (yes, also on Models III and 4, see below). Friendly, competent support since 1984. Software is backup-free. Was $345 in 1986 catalog.

MODEL III (48K) $245.00
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xT.CAD Bill of Materials by Microdex: Software utilizes text labels from xT.CAD drawings in combination with user's master lists to automatically generate invoices, parts requests, shipping lists, etc. Includes a mini-editor for customizing of output to line printers.

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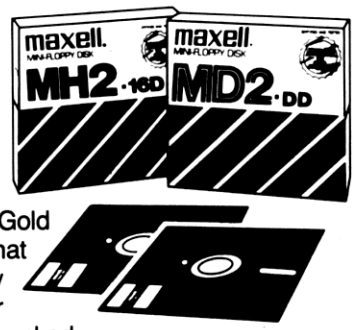

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MONTEZUMA MICRO

WOW! ANOTHER NEW PRODUCT FROM MONTE

PRESENTS

MONTE'S TOOLKIT $49

REQUIRES: Montezuma Micro CP/M® 2.2 version 2.21+

Monte's Toolkit is a collection of utilities that will prove useful to every owner of Montezuma Micro CP/M (you all are owners, aren't you?). It's a disk full of programs that perform functions that are difficult, cumbersome or expensive to do any other way. Monte has tried, in his own way, to briefly explain each function for you below. Read on and be saved.

DOUBLECROSS® allows unlimited file transfers between CP/M*, IBM-DOS and Model 3/4 LDOS® /TRSDOS® with unsurpassed ease and speed. In fact, you can move just about anything from any disk to any other disk but you might have to make changes for program operation. Lotus 123* just flat won't run on your Model 3 and I doubt that you could ever modify Scripsit* enough to run on the IBM. Simple menus guide you through the operation with minimal keystrokes. Just tag the files you want in the directory display and go. You won't get doublecrossed with **DBLCROSS.**

FREEFORM® formats and backs up Model 3/4 LDOS/TRSDOS and IBM MS & PC- DOS (versions 1.x, 2.x and 3.x), both single side and double side plus there is a special "clone" copy when you just don't know or care what you have. Just insert a disk and copy away. All you have to know about the disk is how to get it into the drive. The Analysis feature lets you look at and print the actual structure of a disk - even the ones with "funny" formats.

WSPR lets you print to almost any printer using almost any control code. It's nearly magic and does a whole lot more than I can talk about here including letting you print *anything* your printer can print.

FILEFIX® gives you the ability to "fix" your "files" by adding linefeeds when your files are going from CP/M or IBM-DOS to LDOS/TRSDOS or take them away if you are transferring the other way. You can remove the control codes from a WordStar* document thereby converting it to a non-document file. The fix will also fix up Scripsit files so they can be used by CP/M and IBM-DOS based wordprocessors (you know - the real ones). All this is accomplished with the use of simple menus and boy, it is fast.

SYS2M requires 128K and our CP/M. The CCP and the BDOS are moved to drive M and the BIOS is modified to allow a Warm Boot from Drive M. So what you say. Well, you still have to have a disk in drive A but it no longer has to have the CP/M system resident. It can be anything. This little jewel copies frequently used programs to drive M and searches there first for all program requests resulting in much faster program loading. Slick isn't it?

AUTO is a little goodie that lets you issue multiple commands from the command line. Eliminates the *pain* of Submit. As in all the other parts of **MONTE'S TOOLBOX**, complete and comprehensive instructions are included and it's available right now.

MONTEZUMA MICRO

PRESENTS

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Once Upon A Time,

Monte Zuma, our Founder, President and King, has always had trouble keeping his desk organized. The Sidekick™ from Borland International would solve the problem, but alas, it was not available for CP/M®. So Monte asked his favorite nephew, the legendary LaMont E. Zuma (distant cousin to Rondo Talbot, a direct descendant of Monte Zuma hisself) to work on the problem as best he could during recess at the home. LaMont, a true legend in his own time, really outdid himself this time. A touch of both shift keys halts your application program in its tracks and up pops **Monte's Window™** *ready to use. What could be simpler? Put an end to the fumbling and pawing around the pile of papers on your desk. You will find* **Monte's Window™** *indispensable. When you are finished, break back to your application program and it resumes without error.* **Monte's Window™** *is truly a breakthrough. See for yourself – Look through* **Monte's Window™** *on* **your** *Model 4. How did you ever get along without it? See the page opposite for order information.* **Monte's Window™** *is available right now.*

MONTEZUMA MICRO

PRESENTS

MONTE'S BASIC

Your TRSDOS BASIC (01.01.00) will work the same, for the most part, under CP/M as it does under TRSDOS. However, for the most part isn't good enough. But, with some changes provided by our **BASCON**® program, you can be 100% compatible with the standard BASIC used with CP/M. True, you lose some of the TRSDOS BASIC features while gaining new features such as FILES, NULL, RESET, etc. **BASCON** alters your TRSDOS BASIC, which was included with your Model 4 when you bought it, so that it will function under CP/M. You must have the unaltered original TRSDOS BASIC as above in order to convert with **BASCON**. The program operation is fully automatic and quick. The resulting BASIC runs any CP/M 2.2 BASIC program that previously required MBASIC*. Programs written for TRSDOS BASIC may require modification to run correctly under the converted BASIC. Fully compatible with MBASIC. We even provide for additional documentation that is keyed by page number to your TRSDOS BASIC manual. **MONTE'S BASIC** is available right now. **$49**

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Can we talk? CP/M vs TRSDOS

By moving to CP/M on your Model 4 you achieve two things. First you open the door to a wealth of existing software. More 8-bit software runs under CP/M than any other operating system. This includes virtually all of the "big name" programs which have set the standards by which all others are measured. Programs like **WordStar, dBASE II, and Turbo Pascal** are available for CP/M, but not TRSDOS. Public domain software, almost unknown under TRSDOS, fills hundreds of megabytes of disk space. Valuable public domain programs like the **Small C Compiler** are just a toll-free phone call away. Most importantly, hundreds of applications programs are available from a multitude of vendors. Many include the source code. Wouldn't you like to be able to choose from scores of Accounts Receivable or General Ledger programs, instead of the meager selection you now have? Circle our special Reader Service number 600 on the Reader Service Card to receive our comprehensive **free listing of suppliers of application programs that run under CP/M.**

What about the future?

When the time comes to move up to another computer it will almost certainly use MS-DOS. That's when CP/M users get a pleasant surprise. Since MS-DOS was a derivative of CP/M it operates in almost the same manner. Even better, most of the same software packages are available in 16-bit form and they operate in virtually the same way that they did under CP/M.

Is it easy to use?

Montezuma Micro's CP/M has been carefully crafted to present a maximum of features while taking a minimum of memory. It supports all of the standard features of the Model 4/4P/4D computers, as well as most of the optional ones. Our CP/M has been consistently been awarded the highest ratings in industry magazines. It is version 2.2, the most popular and reliable of all the versions of CP/M produced. Our CP/M has been made as easy to use as possible. All customer-selected features are chosen from simple menus in our CONFIG utility. This includes the ability to configure a disk drive to run like that of scores of other CP/M computers for maximum ease of software portability. Using the unique DBLCROSS program in our Monte's Toolkit utility package you can move files back and forth between CP/M, TRSDOS (1.3 and 6.x), and MS-DOS.

Why use Montezuma CP/M?

We have already told you why our CP/M is the best for the Radio Shack Model 4 computer. The only question left to answer is "Why buy CP/M at all?" Radio Shack has abandoned TRSDOS — all of their new machines use MS-DOS. Most of the software producers have followed, leaving no new software development and saddling the TRSDOS user with whatever software "leftovers" he can find. Which DOS do you want to head into the future with: the one originally written for the Model I or the one that served as the basis for MS-DOS? Make the right choice right now for just $169.

If I need support?

We don't forget you after the sale. If you have a problem you will find our phones are answered by people, not answering machines or hold buttons. Our philosophy is very simple — we want you to be happy and satisfied with your purchase. If you have a problem then we have a problem, and we'll do whatever we can to resolve it.

Cost to update?

Our owners are protected against instant obsolescence by our lifetime upgrade policy. At any time you can return your original CP/M disk to be upgraded to the latest version free of charge, except for a small shipping and handling fee. Periodically we publish NEW STUFF, a newsletter for registered users of Montezuma Micro CP/M. This publication carries news about new products, tips for getting more out of CP/M, and other valuable information for our users. It is sent free of charge to registered owners.

Can I use a hard disk drive?

CP/M hard disk drivers are available for Radio Shack, Aerocomp, and most other popular brands of hard disk drives. These drivers allow the hard drive to be partitioned into one to four logical drives of varying sizes. These drives may all be used by CP/M, or may be divided between CP/M and TRSDOS. A head-parking utility is included on the driver disk to minimize the risk of damage when the hard disk drive is not in use. Also included at no charge is a utility which will copy, compress, list, print, and delete files with ease. There isn't much you can say about a driver. It either works or it doesn't. Ours works supremely and it only costs $30.

Hard disk backup?

Unlike the high-priced, underpowered backup utilities available for backup of TRSDOS hard drives, our CP/M **HARDBACK** utility makes the backup of a hard disk to floppies quick and painless. Only **HARDBACK** gives you the choice of backing up the entire drive or only those files which it knows have been changed since the last backup. Daily backup is no longer a chore, since only new data must be copied. With **HARDBACK** you can quickly restore an entire drive, or only a single file if necessary. Only **HARDBACK** will perform a complete check of the hard disk drive and lock out tracks which have become flawed to prevent the use of those tracks for later data storage. Add this supreme program to your hard disk for just $49. Isn't your time and data worth it?

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Size of Transient Program Area (TPA): 56,070 bytes in a 64k system. 55,046 bytes in a 63k system (with optional hard disk driver). **CP/M IOBYTE:** Fully implemented. **Device Drivers:** Disk (35, 40, 77, & 80 track, single/double density single/double sided, 3, 5, or 8 inch. (More than 85 disk formats supported) **Maximum Disk Capacity:** 40T SS=220k, 40T DS=440k, 80T DS=880k **RS-232:** All word lengths, parity, & baud rates. **Parallel Printer:** With or without linefeed and/or formfeed. **Video:** 24 by 80 with reverse video. **Keyboard:** Full ASCII with 9 function keys. **RAM Disk:** 64k, automatic on 128k systems. **Hard Disk:** Optional drivers available at extra cost for most popular models. Standard CP/M programs included: **ASM, DDT, DUMP, ED, LOAD, MOVCPM, PIP, STAT, SUBMIT, SYSGEN, and XSUB.**

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The following items require Montezuma CP/M 2.2 version 2.20 or later.

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Changing of the Guard

Now you can choose a file's attribute byte from the directory.

An MS-DOS file's attribute byte specifies the allowable file operations. You must designate it while creating the file and live with your choice. With my assembly-language program, File It, you can change attributes at the directory.

File It works with the three most useful attributes: read only, hidden, and normal (archive). A read-only file allows exactly what its name implies—programs and DOS commands can't be used to delete from it or add to it. A hidden file is invisible from the directory, while a normal file appears in the directory and can be read from and written to. Three other attributes—system, volume label, and subdirectory—are used infrequently, so I haven't included them in the program.

Better Attributes

To create the program, type in and assemble Program Listing 1 with your editor/assembler. Be sure to create a COM file using the MS-DOS EXE2BIN utility. (If you don't have an editor/assembler, use Program Listing 2, a Basic program that creates File It for you.)

To begin execution, type FILEIT at the MS-DOS prompt. After the copyright notice appears, the program asks you to enter the name of the file you want to change. You can specify a file name stored under a subdirectory by inserting the subdirectory name and a backslash (\) before the file name.

Next, the program asks you to choose the new attribute by pressing the R, H, or N key. It then performs the change.

How It's Done

Since File It is short, I wrote it as a COM file, which is shorter and faster-loading than a regular EXE program and must fit inside a 64K memory segment. In following the rules for creating COM files, I didn't use data, code, or stack segments. I wrote the program as one segment containing embedded data definitions.

System Requirements

Tandy 1000
128K RAM
Editor/assembler (optional)

At the CHDOS label, the program makes sure the MS-DOS version being used is 2.0 or higher. If it isn't, an error message appears and control returns to the operating system.

File It works with three attributes: read only, hidden, and normal.

The INT 09H function call then displays the copyright message pointed to by the DX register. The file name you enter is converted to an ASCIIZ string (an ordinary string ending with a zero byte). To perform the conversion, the program gets the number of bytes from the FILESP + 1 input buffer and loads them in the 8-bit BL register. It then uses a pointer from the start of the input buffer to the end of the file name (mov [filesp + bx + 2],0) to construct the ASCIIZ string.

An Inkey routine gets the new file attribute, which is returned in the AL register and converted to uppercase for easier comparison. At the Read label, the program loads the DX register with the file name's address, the AH register with subfunction 43H (which changes the attribute), the AL register with the set function (01H), and the CX register with the read-only (01H) attribute. Finally, the program executes a DOS call via the INT 21H instruction and performs the actual modification. The same technique is used for the hidden (02H) and normal (20H) attributes, which are also loaded in CX.■

Contact Debbie Cooper at 2466 W. 13th Ave., Vancouver, British Columbia V6K 2S8.

Program Listing 1. Assembly version of File It.

```
;FILEIT.ASM - file attribute change utility
;<c> 1986 by Deborah L. Cooper
codesg  segment
        assume  cs:codesg
        org     100h
begin:  jmp     start
cmsg    db      0dh,0ah
        db      'File Attribute Change Utility',0dh,0ah
        db      '<c> 1986 by Deborah L. Cooper',0dh,0ah,'$'
msg     db      0dh,0ah
        db      'Enter name of file to change> ','$'
amsg    db      0dh,0ah,'New attribute <R>ead <H>idden <N>ormal ','$'
dmsg    db      0dh,0ah,07h,'Error - you must have MSDOS 2.0 or greater'
        db      0dh,0ah,'to use this utility',0dh,0ah,'$'
filesp  db      99              ;maximum filespec length
        db      ?               ;actual length
        db      100 dup(?)      ;filespec entered by user
start:
chdos:  mov     ah,30h          ;get MSDOS version we are using
        int     21h             ;call dos
        cmp     al,2            ;is it 2.0 or higher?
        jb      doserr          ;go if not
        lea     dx,cmsg         ;point to copyright message
        mov     ah,09h          ;display function
        int     21h             ;call dos
        lea     dx,msg          ;point to filename prompt
        mov     ah,09h          ;display functiom
        int     21h             ;call dos
        mov     dx,offset filesp;point to input buffer
        mov     ah,0ah          ;line input function
        int     21h             ;call dos
        mov     bx,offset filesp+1
        mov     al,[bx]         ;get actual # bytes entered
        cmp     al,0            ;was a filespec entered?
        je      exit            ;exit program if none there
        jmp     cont            ;else process it
doserr: lea     dx,dmsg         ;dos version error message
        mov     ah,09h          ;display function
        int     21h             ;call dos
exit:   mov     ah,4ch          ;terminate program function
        int     21h             ;call dos
```

Listing 1 continued

Listing 1 continued

```
cont:   mov     bl,filesp+1     ;now make this filespec
        mov     bh,0            ;an ASCIIZ string
        mov     [filesp+bx+2],0;ending in a zero byte
        lea     dx,amsg         ;prompt for attribute
        mov     ah,09h          ;display function
        int     21h             ;call dos
inkey:  mov     ah,00h          ;wait for inkey
        int     16h             ;call bios
        and     al,5fh          ;amke it uppercase
        cmp     al,'R'          ;read only?
        je      read            ;go if so
        cmp     al,'H'          ;hidden?
        je      hide            ;go if so
        cmp     al,'N'          ;normal?
        je      norm            ;go if so
        mov     al,07h          ;else sound a bell
        mov     ah,0eh          ;dispaly function
        int     10h             ;call bios
        jmp     inkey           ;back for more
read:   mov     dx,offset filesp+2
        mov     ah,43h          ;change attribute function
        mov     al,01h          ;to set a new attribute
        mov     cx,01h          ;read only attribute
        int     21h             ;call dos
        jmp     exit            ;and quit
hide:   mov     dx,offset filesp+2
        mov     ah,43h          ;change attribute function
        mov     al,01h          ;to set a new attribute
        mov     cx,02h          ;hidden attribute
        int     21h             ;call dos
        jmp     exit            ;and quit
norm:   mov     dx,offset filesp+2
        mov     ah,43h          ;change attribute function
        mov     al,01h          ;to set a new attribute
        mov     cx,20h          ;normal attribute
        int     21h             ;call dos
        jmp     exit            ;and quit
codesg  ends
        end     begin
```

End

Program Listing 2. Basic version of File It. (See p. 96 for information on using the checksums in this listing.)

```
10 REM program to create FILEIT.COM                                    '*  2814
20 OPEN "FILEIT.COM" AS #1 LEN=1                                       '*  1911
30 FIELD #1,1 AS A$                                                    '*  1009
40 FOR X=1 TO 458                                                      '*   981
50 READ B%                                                             '*   552
60 LSET A$=CHR$(B%)                                                    '*  1081
70 PUT #1                                                              '*   500
80 NEXT                                                                '*   455
90 CLOSE:END                                                           '*   784
100 DATA &hE9,&h37,&hl,&hD,&hA,&h46,&h69,&h6C,&h65,&h20                 '*  3264
110 DATA &h41,&h74,&h74,&h72,&h69,&h62,&h75,&h74,&h65,&h20              '*  3363
120 DATA &h43,&h68,&h61,&h6E,&h67,&h65,&h20,&h55,&h74,&h69              '*  3386
130 DATA &h6C,&h69,&h74,&h79,&hD,&hA,&h3C,&h63,&h3E,&h20                '*  3335
140 DATA &h31,&h39,&h38,&h36,&h20,&h62,&h79,&h20,&h44,&h65              '*  3354
150 DATA &h62,&h6F,&h72,&h61,&h68,&h20,&h4C,&h2E,&h20,&h43              '*  3395
160 DATA &h6F,&h6F,&h70,&h65,&h72,&hD,&hA,&h24,&hD,&hA                  '*  3244
170 DATA &h45,&h6E,&h74,&h65,&h72,&h20,&h6E,&h61,&h6D,&h65              '*  3414
180 DATA &h20,&h6F,&h66,&h20,&h66,&h69,&h6C,&h65,&h20,&h74              '*  3395
190 DATA &h6F,&h20,&h63,&h68,&h6l,&h6E,&h67,&h65,&h3E,&h20              '*  3413
200 DATA &h24,&hD,&hA,&h4E,&h65,&h77,&h20,&h61,&h74,&h74                '*  3296
210 DATA &h72,&h69,&h62,&h75,&h74,&h65,&h20,&h3C,&h52,&h3E              '*  3390
220 DATA &h65,&h61,&h64,&h20,&h3C,&h48,&h3E,&h69,&h64,&h64              '*  3393
230 DATA &h65,&h6E,&h20,&h3C,&h4E,&h3E,&h6F,&h72,&h6D,&h61              '*  3452
240 DATA &h6C,&h20,&h24,&hD,&hA,&h7,&h45,&h72,&h72,&h6F                 '*  3260
250 DATA &h72,&h20,&h2D,&h20,&h79,&h6F,&h75,&h20,&h6D,&h75              '*  3404
260 DATA &h73,&h74,&h20,&h68,&h61,&h76,&h65,&h20,&h4D,&h53              '*  3376
270 DATA &h44,&h4F,&h53,&h20,&h32,&h2E,&h30,&h20,&h6F,&h72              '*  3389
280 DATA &h20,&h67,&h72,&h65,&h6l,&h74,&h65,&h72,&hD,&hA                '*  3290
290 DATA &h74,&h6F,&h20,&h75,&h73,&h65,&h20,&h74,&h68,&h69              '*  3393
300 DATA &h73,&h20,&h75,&h74,&h69,&h6C,&h69,&h74,&h79,&hD               '*  3358
310 DATA &hA,&h24,&h63,&h0,&h0,&h0,&h0,&h0,&h0,&h0                     '*  2918
320 DATA &h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0                       '*  2791
330 DATA &h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0                       '*  2792
340 DATA &h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0                       '*  2793
350 DATA &h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0                       '*  2794
360 DATA &h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0                       '*  2795
370 DATA &h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0                       '*  2796
380 DATA &h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0                       '*  2797
390 DATA &h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0                       '*  2798
400 DATA &h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0,&h0                       '*  2790
410 DATA &h0,&h0,&h0,&h0,&hB4,&h30,&hCD,&h2l,&h3C,&h2                  '*  3122
420 DATA &h72,&h23,&h8D,&hl6,&h3,&hl,&hB4,&h9,&hCD,&h21                '*  3254
430 DATA &h8D,&hl6,&h44,&hl,&hB4,&h9,&hCD,&h2l,&hBA,&hD4               '*  3353
440 DATA &hl,&hB4,&hA,&hCD,&h2l,&hBB,&hD5,&hl,&h8A,&h7                 '*  3258
450 DATA &h3C,&h0,&h74,&hB,&hEB,&hD,&h90,&h8D,&hl6,&h8F                '*  3315
460 DATA &hl,&hB4,&h9,&hCD,&h2l,&hB4,&h4C,&hCD,&h2l,&h2E               '*  3364
470 DATA &h8A,&hlE,&hD5,&hl,&hB7,&h0,&h2E,&hC6,&h87,&hD6               '*  3368
480 DATA &hl,&h0,&h8D,&hl6,&h65,&hl,&hB4,&h9,&hCD,&h21                 '*  3207
490 DATA &hB4,&h0,&hCD,&hl6,&h24,&h5F,&h3C,&h52,&h74,&hl0              '*  3373
500 DATA &h3C,&h48,&h74,&hlA,&h3C,&h4E,&h74,&h24,&hB0,&h7              '*  3375
510 DATA &hB4,&hE,&hCD,&hl0,&hEB,&hE6,&hBA,&hD6,&hl,&hB4               '*  3409
520 DATA &h43,&hB0,&hl,&hB9,&hl,&h0,&hCD,&h21,&hEB,&hBF                '*  3304
530 DATA &hBA,&hD6,&hl,&hB4,&h43,&hB0,&hl,&hB9,&h2,&h0                 '*  3221
540 DATA &hCD,&h21,&hEB,&hBl,&hBA,&hD6,&hl,&hB4,&h43,&hB0              '*  3436
550 DATA &hl,&hB9,&h20,&h0,&hCD,&h21,&hEB,&hA3                         '*  2747
```

End

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Circle 297 on Reader Service card.

by David Goben

Switching Station

Gain memory by moving between RAM banks in Model III mode.

Yes, you *can* switch banks in the Model III mode on a 128K Model 4. In this kind of switching, data isn't exchanged between banks; each bank retains its data. The bank you select is switched into the addressable mode while the previous bank is switched into the unaddressable mode.

Banking Regulations

Bank switching is best used in machine-language programs, since Basic requires a high-memory setting of 7FFF hexadecimal (hex). Anything higher will be switched out when a new bank is selected.

You use port 84 hex (132 decimal) to switch banks (bits 4, 5, and 6 correspond to the three banks). For normal operations, reset bit 6 to zero. This ensures that addresses 0000–7FFF hex, which contain the ROM and DOS, will not be switched out.

Set bit 5 to switch in one of the alternate 32K banks; reset it to select the normally resident, primary upper bank (zero). With bit 5 set, bit 4 designates which of the alternate 32K banks is switched into use in the 8000–FFFF hex-address range.

Making the Transaction

Type in the Program Listing with an editor/assembler and assemble it with a name such as SELBNK/CMD. To use the program from DOS ready, type SELBNK followed by a space and a zero, 1, 2, or question mark (?). The digits indicate the chosen bank, while the question mark requests a display of the current bank number. To select bank 2, for example, enter SELBNK 2.

You can use Debug to verify that bank switching has taken place. First, display the memory above 8000 hex; from there, modify the memory to display a particular character or sequence. Leave Debug, select a different bank, and display the selected bank's memory above 8000 hex to verify that the switch has been made. Leave Debug again, switch back to the first bank, and verify that the modified data has been switched back in.

Use lines 1110–2040 in your programs as a subroutine. Lines 1160–1310 explain how to set up the various options. Once you have set the required registers, type CALL BANK to change the bank.■

You can contact David Goben at 67 Highland Road, Mansfield Center, CT 06250.

LOAD 80

System Requirements

Model 4 (Model III mode)
128K RAM
TRSDOS 1.3
Editor/assembler

Program Listing. Bank-switching demonstration program.

```
00100 ;       BANK SWITCHING DEMO
00110 ;       by David Goben
00120 ;             for 128K Model 4 in Model III mode
00130 ;
00140 ;       Demonstration of Bank Selecting on a 128K Model 4
00150 ;          in the Model III mode. Please note that
00160 ;          program lines 1110 through 2040 are designed
00170 ;          to be contained in a memory-resident program.
00180 ;          To use the banking routines in your own pro-
00190 ;          grams, delete lines 100-1100 and 2050-2060,
00200 ;          and merge it with your own program.
00210 ;       Remember to maintain this portion below address
00220 ;          8000H complete. Also remember to maintain your
00230 ;          stack area below 7FFFH.
00240 ;-------------------------------------------------------
00250 ;       EQUATES
00260 DSPLY   EQU     021BH   ;display a message
00270 EXIT    EQU     402DH   ;DOS exit
00280 CR      EQU     000DH   ;carriage return
00290 ;-------------------------------------------------------
00300         ORG     7E00H
00310 ;       MESSAGE AREA
00320 MSG1    DEFB    10      ;line feed
00330         DEFM    'Bank Selection Demo -- by David Goben'
00340         DEFB    10
00350         DEFB    CR
00360 MSG2    DEFM    'Bank '
00370 BANKX   DEFM    '0 is now available.'
00380         DEFB    CR
00390 MSG3    DEFM    'Current Bank is # '
00400 BANKY   DEFM    '0.'
00410         DEFB    CR
00420 MSG4    DEFM    'This Bank is already selected.'
00430         DEFB    CR
00440 MSG5    DEFM    'Parameter Error. Select 0,1,2 or ?'
00450         DEFB    CR
00460 MSG6    DEFM    'Stack pointer above 7FFFH. Aborting!'
00470         DEFB    CR
00480 ;-------------------------------------------------------
00490 ;          MAIN entry to demonstration program
00500 MAIN    PUSH    HL              ;save data pointer
00510         LD      HL,MSG1         ;sign on
00520         CALL    DSPLY
00530         LD      HL,$-$          ;test stack pointer
00540         ADD     HL,SP           ;to see if it is above
00550         BIT     7,H             ;7FFFH.
00560         LD      HL,MSG6         ;set up in case
00570         JR      NZ,OUTMSG       ;is! Abort
00580         POP     HL              ;else get pointer
00590         LD      A,(HL)          ;get byte there
00600         CP      CR              ;bad if CR
00610         JR      Z,PERR
00620         LD      B,A             ;else save data
00630         INC     HL              ;see if next is CR
00640         LD      A,(HL)
00650         CP      CR
00660         JR      Z,GOOD          ;data is good so far
00670 PERR    LD      HL,MSG5         ;indicate bad stuff
00680         JR      OUTMSG          ;out it and exit
00690 GOOD    LD      A,B             ;get data byte
00700         CP      '?'             ;bank check?
00710         JR      Z,CRNT          ;yes, return
00720         CP      '0'             ;check range
```

Listing continued

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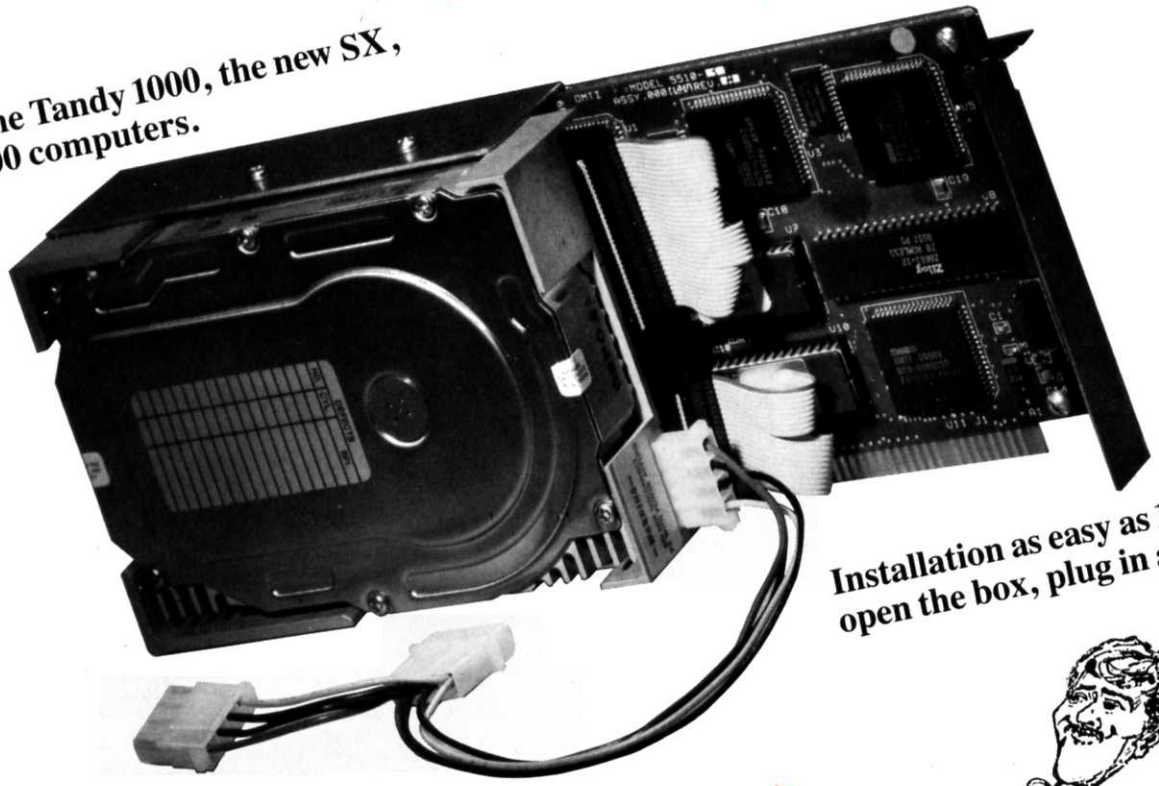

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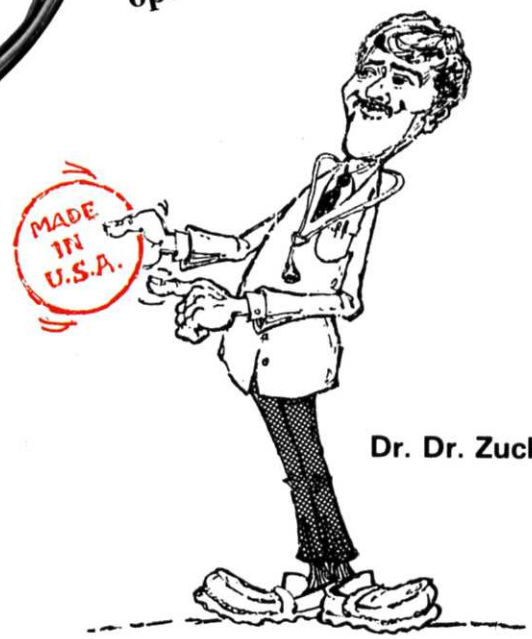

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Listing continued

```
00730           JR      C,PERR          ;bad data
00740           CP      '3'
00750           JR      NC,PERR
00760           SUB     30H             ;drop ASCII offset
00770           LD      B,A             ;save value
00780           LD      A,(BNKSAV)      ;see if already there
00790           CP      3               ;been selected before?
00800           JR      NC,REL1         ;no, ignore next
00810           LD      HL,MSG4         ;set up if same
00820           CP      B               ;equal?
00830           JR      Z,OUTMSG        ;yes, indicate so
00840 REL1      LD      A,B             ;get bank number
00850           LD      (BNKSAV),A      ;set new bank
00860           ADD     A,30H           ;add ASCII offset
00870           LD      (BANKX),A       ;set to message
00880           LD      C,B             ;set up for bank select
00890           LD      A,0             ;select bank and return
00900           CALL    BANK            ;perform subfunction
00910           LD      HL,MSG2         ;show what has happened
00920 OUTMSG    CALL    DSPLY           ;display message
00930           JP      EXIT            ;exit to dos
00940 ;*****************************************************
00950 ;         display current bank
00960 CRNT      LD      A,(BNKSAV)      ;get current bank
00970           CP      3               ;been used yet?
00980           JR      C,$+3           ;yes, display it
00990           XOR     A               ;no, indicate Bank 0
01000           ADD     A,30H           ;add ASCII offset
01010           LD      (BANKY),A       ;apply to message
01020           LD      HL,MSG3         ;display current bank
01030           JR      OUTMSG
01040 ;-----------------------------------------------------
01050 BNKSAV    EQU     $       ;bank data save area
01060           ORG     BNKSAV+1
01070 ;-----------------------------------------------------
01080 ;   What follows is the banks selection routines. Delete
01090 ;all of the above data to apply these subfunctions to
01100 ;your own programs which will use then banking functions.
01110 ;@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
01120 ;Bank switching routine -- by David Goben
01130 ;For the Model III mode Model 4 with 128K
01140 ;@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
01150 ;
01160 ;On entry, registers AF, BC, and HL are used. BANK is
01170 ;accessed by issuing CALL BANK, with the proper registers
01180 ;set. The definitions for the registers follow:
01190 ;
01200 ;   if A=0      :Select BANK and return to caller
01210 ;               :C=BANK number 0, 1, or 2 (0=normal bank)
01220 ;   if A=1      :Select BANK and go to HL address
01230 ;               :C=BANK number
01240 ;               :HL=transfer address
01250 ;   if A=2      :Return to previous calling BANK address
01260 ;               :This returns to a PREVIOUS A=1 or A=2
01270 ;               :operation.
01280 ;   if A=3      :Return current Bank number in register A
01290 ;
01300 ;   On exit from operations 0,1,and 2, the previous bank
01310 ;number is returned in register A.
01320 ;*****************************************************
01330 BNKSEL: EQU     84H     ;bank select port
01340 SETIMG  DEFB    0       ;port 84H image
01350 ;NOTE: If using in Model 4 mode: Change above line to:
01360 ;SETIMG EQU     78H     ;TRSDOS 6 port 84H image
01370 BANK      EQU     $       ;bank select routine
01380           CP      2       ;return to previous BANK call?
01390           JR      Z,OP2   ;yes, go to it
01400           CP      3       ;check legal values
01410           JR      C,BANKA ;ok
01420           JR      Z,OP3   ;if checking bank number
01430           LD      A,255   ;home-brew illegal op error flag
01440           AND     A       ;set NZ error state
01450           RET
01460 BANKA     LD      B,A     ;save operation
01470           LD      A,C     ;check bank select code
01480           CP      3       ;banks 0-2?
01490           JR      C,BANKB ;yes, ok
01500           LD      A,254   ;home-brew illegal bank error
01510           AND     A
01520           RET
01530 BANKB     LD      A,B     ;get operation
01540           CP      1       ;set type operation flag
01550           JR      C,OP0   ;operation zero
01560 ;-----------------------------------------------------
01570 ;Select BANK 'C' and go to HL transfer address
01580 OP1       LD      A,C     ;get memory bank
01590           LD      (OLDBNK+1),A
01600           LD      (OLDRET+1),HL
01610 ;now fall into next routine
01620 ;-----------------------------------------------------
01630 ;Select previous BANK and go to called address
01640 OP2       LD      (HLSAVE+1),HL   ;save HL value
01650 OLDRET    LD      HL,$-$          ;get old address
01660           LD      A,H
01670           OR      L
```

Listing continued

Listing continued

```
01680           JR      NZ,OLDBNK       ;ok if address present
01690           LD      A,253   ;home-brew no previous select
01700           AND     A
01710           RET
01720 OLDBNK    LD      C,0             ;get desired bank
01730 CURBNK    LD      A,0             ;get current bank
01740           LD      (OLDBNK+1),A    ;save as old
01750           LD      A,C
01760           LD      (CURBNK+1),A    ;set new current bank
01770           EX      (SP),HL     ;set transfer addr, get return
01780           LD      (OLDRET+1),HL   ;save it
01790 HLSAVE    LD      HL,$-$          ;get HL value back
01800 ;Fall into next operation
01810 ;---------------------------------------------------------
01820 ;Select BANK and return to caller
01830 OP0       INC     C               ;init for bank select
01840           LD      A,(SETIMG)      ;get port 84H image
01850           AND     8FH             ;make out bits 4,5,6
01860           DEC     C               ;bank 0 desired?
01870           JR      Z,SETBNK
01880           SET     5,A             ;set up for bank 1
01890           DEC     C               ;bank 1?
01900           JR      Z,SETBNK        ;yes
01910           SET     4,A             ;set for bank 2
01920 SETBNK    DI                      ;disable interrupts
01930           LD      (SETIMG),A      ;set new port image
01940           OUT     (BNKSEL),A      ;select new bank
01950           EI                      ;enable interrupts
01960           XOR     A               ;set Z flag for ok
01970           LD      A,(OLDBNK+1)    ;return old bank number
01980           RET     ;normal return or go to selected address
01990 ;---------------------------------------------------------
02000 ;return current bank number
02010 OP3       XOR     A               ;set Z flag for ok
02020           LD      A,(CURBNK+1)    ;get current bank
02030           RET
02040 ;END OF BANK ROUTINE
02050 ;---------------------------------------------------------
02060           END     MAIN
```

End

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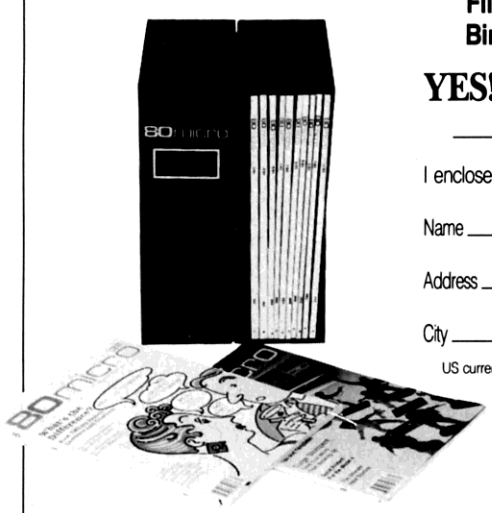

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by Christy Gemmell

Inner Vision

Page through memory on your Model 4 with this dynamic-memory monitor.

I bought my Model 4 after cutting my programmer's teeth on a Color Computer. Though the move to TRSDOS was mostly for the better, I missed being able to switch any part of memory into video RAM—a CoCo feature that helped me learn about 6809 architecture. With it, I could page through memory in 512-byte steps, observe programs while they ran, watch the activity of the stack, examine the ROM hook area in low memory, and see the contents of bytes change.

I wanted to duplicate this feature on my Model 4, but it wasn't quite so easy. Model 4 video isn't memory-mapped in the usual sense: It occupies a separate 2K block of dedicated RAM, which is bank-switched to the screen. The video isn't normally accessible to Basic or machine-language programs except through console-display statements.

A solution came to me after reading a Hardin Brothers article on Model 4 supervisor calls (SVCs) in which he explains how to use the @VDCTL SVC to examine video memory (see The Next Step, July 1984, p. 170). With the help of that article, and the @VDCTL-driver routine it included, I wrote Dynaram, a dynamic-memory monitor for the Model 4. It lets you page through Model 4 memory in 1K blocks while the display is continuously updated (see the Photo). The program is written in Basic and machine code; it runs under TRSDOS 6.0, 6.1, and 6.2. Memory above E000 hexadecimal (hex) is protected.

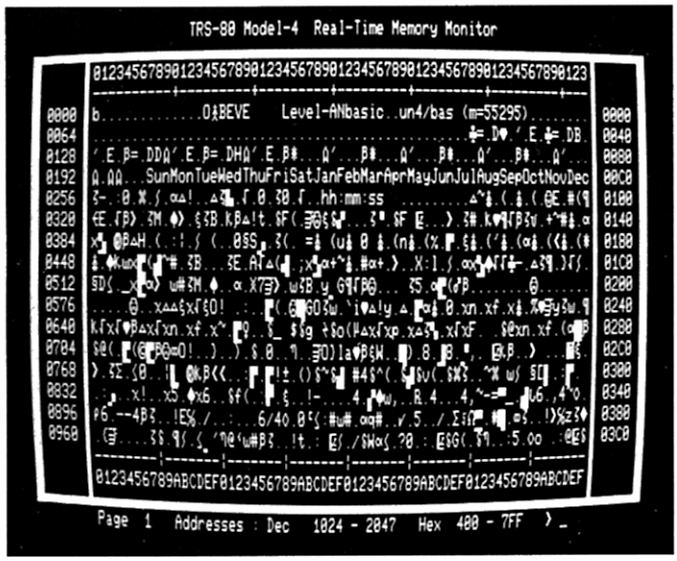

Photo. Dynaram lets you view a 1K block of memory.

Bytes Before Your Eyes

When you run Dynaram (see the Program Listing), it displays a 1K block of your computer's memory in a grid that is 64 columns wide by 16 rows deep. An index frames the grid and lists the offset address of each row in decimal and hex notation. At the bottom of the screen is the message "RAM page 1." The 64K Model 4 has 64 such pages, numbered zero to 63. RAM page 1 is located between 1024 and 2047 decimal.

At first glance, you might think the display is completely static (page 1 is usually a quiet part of memory), but if you look carefully, you'll observe changes in one or two of the characters. These are the Model 4's character representations of the ASCII values contained in those locations; a change means that the contents of the bytes have changed. (To find the actual value at a particular address, refer to the ASCII character chart in your TRSDOS manual or break out of the program and peek the address. Press the Q key to quit Dynaram.)

Press the up-arrow key. This puts you on page zero, the beginning of memory. Pressing the up-arrow key moves the display backward in memory; pressing the down-arrow key moves the display forward. Notice that the paging is circular. If you try to move below page zero, you'll find yourself back at page 63.

If you know where you want to go, you can move about in memory more quickly by pressing the P key and typing in a page number. Try typing in P and the number 32; then press enter. This puts you at the start of the Basic work space, where you can view Dynaram as it is stored in memory. Page forward a few screens (36) with the down-arrow key until you find the variable area at the end of the program. Watch the contents change as you press keys.

Further on, your RAM is probably empty, except for the remains of previous programs you might have run. Eventually, however, you'll come across another turbulent region when you meet the program stack (RAM page 53). At the very top of memory, you'll find the area where TRSDOS stores resident modules and device drivers. If you use a keystroke-multiply table, this is where you'll find it. You might have trouble recognizing it, as the assignment strings are stored backward.

Not all byte values can be displayed on screen. Values below 32 (20 hex) translate as control codes; in order to keep the display intact, the program replaces them with periods.

Putting It on Screen

The Basic program is simple. Its primary purpose is to draw the display template and process user input. I swiped the input routine in lines 560–790 from Jose E. Anaya's article "Restricted Entry" (*80 Micro*, May 1985, p. 70). The two string-formatting functions are from Lewis Rosenfelder's book *Basic Faster and Better* (Blue Cat Inc., 1985).

The real work is done by the two machine-language routines stored as Data statements at the end of the program. I adapted the first from Hardin Brothers' @VDCTL-driver routine. It uses @VDCTL SVC functions 5 and 6 to move a 1,920-byte block of data between video RAM and a memory buffer located at EC00 hex.

The second routine copies a 1K page of memory (starting at an address supplied by Basic) to the buffer. From there it is transferred to the screen. This two-stage process provides a continuously updated window into your computer's memory.

An alternative might have been to move the blocks of memory directly to the display, but I chose the former method for two reasons. First, the @VDCTL SVC only

LOAD 80

System Requirements

Model 4
64K RAM
Disk Basic

addresses memory between 23FF and EC01 hex, cutting out some of the most interesting areas of RAM. Second, I needed to filter out control codes and rearrange the format of the block so as to fit it into the display template.

Dynaram does not give you a guided tour of RAM, and I confess that much of what it uncovers is still a mystery to me. But the program can help you develop insight by opening up the inner workings of your computer for observation.■

Christy Gemmell is a computer instructor with the British Youth Training Scheme. Address correspondence to 22 Peake Road, Northfields, Leicester LE4 7DN, United Kingdom.

Program Listing. Dynaram. (See p. 96 for information on using the checksums in this listing.)

```
10 CLS:CLEAR,&HE000:PRINT CHR$(15);:DEFINT A-Z:OPTION BASE 1          '*  3784
20 DEF FNPL$(A$,A)=LEFT$(A$+STRING$(A,32),A)'Left Justify             '*  2528
30 DEF FNPR$(A$,A)=RIGHT$(STRING$(A,32)+A$,A)' Right Justify String   '*  2618
40 BUFFER=&HEC00:DIM CODE(8):GOSUB 670' Install @VDCTL SVC Driver     '*  2336
50 RAM=&HE000:MCODE=&HE002:GOSUB 710' Install RAM Copier Routine      '*  2171
60 R=1024:POKE RAM,R-INT(R/256)*256:POKE RAM+1,R/256                  '*  3104
70 T$="0123456789012345678901234567890123456789012345678901234567890
   123"                                                               '*  3732
80 H$="----------+---------+---------+---------+---------+---------
   +---"                                                              '*  3241
90 U$="0123456789ABCDEF0123456789ABCDEF0123456789ABCDEF0123456789AB
   CDEF"                                                              '*  4107
100 F$="--------|-------|-------|-------|-------|-------|-------|--
   -----"                                                             '*  3845
110 L$=CHR$(149):R$=CHR$(170):B$=CHR$(191):PT$=CHR$(95):P=1           '*  3303
120 NU$="0123456789 ":BS$=CHR$(8):CR$=CHR$(13)                        '*  2504
130 PRINT@(0,20),"TRS-80 Model-4  Real-Time Memory Monitor";          '*  4444
140 PRINT@(1,0),CHR$(188);STRING$(78,140);CHR$(188);                  '*  2975
150 PRINT@(2,8),T$;:PRINT@(21,8),U$;                                  '*  2120
160 FOR Y=2 TO 21:PRINT@(Y,0),B$;:PRINT@(Y,79),B$;:NEXT Y             '*  3506
170 PRINT@(22,0),CHR$(143);STRING$(78,140);CHR$(143);                 '*  3011
180 PRINT@(1,7),CHR$(156);:PRINT@(1,72),CHR$(172);                    '*  2865
190 FOR Y=2 TO 21:PRINT@(Y,7),L$;:PRINT@(Y,72),R$;:NEXT Y             '*  3535
200 PRINT@(22,7),CHR$(141);:PRINT@(22,72),CHR$(142);                  '*  2951
210 PRINT@(3,8),H$;:PRINT@(20,8),F$;                                  '*  2090
220 PRINT@(23,8),"Page      Addresses : Dec";:PRINT@(23,50),"Hex";     '*  4293
230 PRINT@(23,67),">";                                                '*  1210
240 RESTORE 740                                                       '*   917
250 FOR Y=4 TO 19                                                     '*   981
260   READ D$,H$:PRINT@(Y,2),D$;:PRINT@(Y,74),H$;                     '*  2861
270 NEXT Y                                                            '*   625
280 GOSUB 700' Move Display Template to High Memory Buffer            '*   753
290 PRINT@(23,13),"";:PRINT USING"##";P;                              '*  2358
300 SA!=P*1024:SA$=STR$(SA!):EA!=SA!+1023:EA$=STR$(EA!)               '*  3122
310 EL=LEN(EA$):IF EL>1 THEN EA$=RIGHT$(EA$,EL-1)                     '*  2899
320 PRINT@(23,34),FNPR$(SA$,6);" - ";FNPL$(EA$,6);                    '*  2767
330 SH$=HEX$(SA!):EH$=HEX$(EA!)                                       '*  1770
340 PRINT@(23,54),FNPR$(SH$,4);" - ";FNPL$(EH$,4);                    '*  2781
350 PRINT@(23,69),CHR$(14);:GOSUB 700                                 '*  2149
360 POKE RAM,SA!-INT(SA!/256)*256:POKE RAM+1,SA!/256                  '*  3052
370 R$=INKEY$                                                         '*   785
380 IF R$=CHR$(11) THEN P=P-1:GOTO 440                                '*  2214
390 IF R$=CHR$(10) THEN P=P+1:GOTO 440                                '*  2212
400 IF R$="Q" OR R$="q" THEN 500                                      '*  1784
410 IF R$="P" OR R$="p" THEN 470                                      '*  1789
420 GOSUB 720:GOSUB 690                                               '*  1384
430 GOTO 370                                                          '*   682
440 PRINT CHR$(15);:IF P<0 THEN P=63                                  '*  2146
450 IF P>63 THEN P=0                                                  '*  1163
460 GOTO 290                                                          '*   686
470 PRINT@(23,13),"  ";:PRINT@(23,13),CHR$(15);:VD$=NU$:LM=2          '*  3427
480 GOSUB 590:P=VAL(BF$):IF P<0 OR P>63 THEN 470                      '*  2856
490 GOTO 290                                                          '*   689
500 PRINT@(22,0),CHR$(14);:END                                        '*  1730
510 FOR X=1 TO 30                                                     '*   969
520 Z$=INKEY$:IF Z$<>"" THEN X=30                                     '*  1954
530 NEXT X                                                            '*   623
540 RETURN                                                            '*   665
550 PRINT PT$;:GOSUB 510                                              '*  1498
560 PRINT BS$;:IF Z$<>"" THEN RETURN                                  '*  2256
570 GOSUB 510:IF Z$="" THEN 550                                       '*  1763
580 RETURN                                                            '*   669
590 LN=0:BF$=""                                                       '*   812
600 GOSUB 550                                                         '*   752
610 IF Z$=CR$ THEN RETURN                                             '*  1577
620 IF Z$<>BS$ THEN 650                                               '*  1314
630 IF LN=0 THEN 600                                                  '*  1140
640 LN=LN-1:BF$=LEFT$(BF$,LN):PRINT BS$;:GOTO 600                     '*  3010
650 IF INSTR(VD$,Z$)=0 OR LN=LM THEN 600                              '*  2422
660 LN=LN+1:BF$=BF$+Z$:PRINT Z$;:GOTO 600                             '*  2506
670 RESTORE 730:FOR I=1 TO 8:READ CODE(I):NEXT I:RETURN               '*  3541
680 DEF USR0=VARPTR(CODE(1)):Q=USR0(0):RETURN' @VDCTL Video Driver    '*  2926
690 CODE(3)=5:CODE(7)=BUFFER:GOSUB 680:RETURN' Move Buffer to Display'*  2870
700 CODE(3)=6:CODE(7)=BUFFER:GOSUB 680:RETURN' Move Display to Buffer'*  2863
710 RESTORE 770:FOR I=MCODE TO MCODE+58:READ D:POKE I,D:NEXT I:RETU
   RN                                                                 '*  4516
720 DEF USR1=MCODE:U=USR1(0):RETURN                                   '*  2314
730 DATA 3902,1536,0,3584,0,8448,0,-13841                             '*  2095
740 DATA 0000,0000,0064,0040,0128,0080,0192,00C0,0256,0100,0320,014
   0,0384                                                             '*  3628
750 DATA 0180,0448,01C0,0512,0200,0576,0240,0640,0280,0704,02C0,076
   8,0300                                                             '*  3681
760 DATA 0832,0340,0896,0380,0960,03C0                                '*  1966
770 DATA 24,2,72,237,221,42,0,224,33,72,237,34,4,224,6,1,14,1,237,9
   1,4,224                                                            '*  3681
780 DATA 221,126,0,254,32,48,2,62,46,18,221,35,19,12,62,65,185,32,2
   37,237,91                                                          '*  3810
790 DATA 4,224,33,80,0,25,34,4,224,4,62,17,184,32,214,201             '*  2850
```

End

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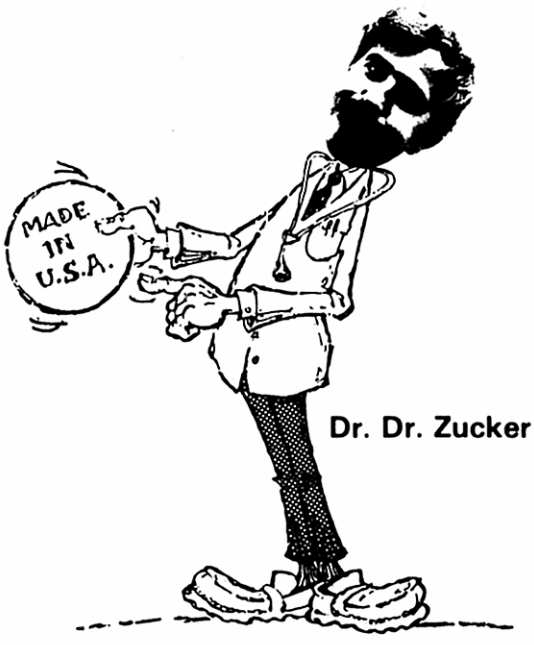

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Megamemory Madness

When RAM-resident utilities, RAM-hungry applications, and RAM-disk device drivers start pushing at your PC compatible's 640K memory limit, what can you do? Memory-board makers, always anticipating software's tendency to fill available space, have devised bank-switching schemes to expand far beyond IBM's 640K memory limit. You can fill your computer with as many chip-laden 2-megabyte (MB) memory boards as you have empty expansion slots and available cash.

I've been using two megaboards (at different times) in my Tandy 1000: a 1MB Master/Card from Automation Facilities Corp. (AFC) and a 2MB XRAM from PBJ Inc. (See the Product Index for price information and vendor addresses.) XRAM uses version 3.2 of the Lotus/Intel/Microsoft (LIM) Expanded Memory Specification (EMS), a bank-switching system that provides up to 8MB of expanded memory. (AST Research Inc., Quadram Corp., and Ashton-Tate have defined a competing and more capable specification, which is a superset of the LIM EMS.) Though Master/Card has its own bank-switching system that can handle up to 32MB, AFC also offers an emulator that simulates the EMS 3.2 interface. Before I describe the boards, let's take a quick look at bank switching.

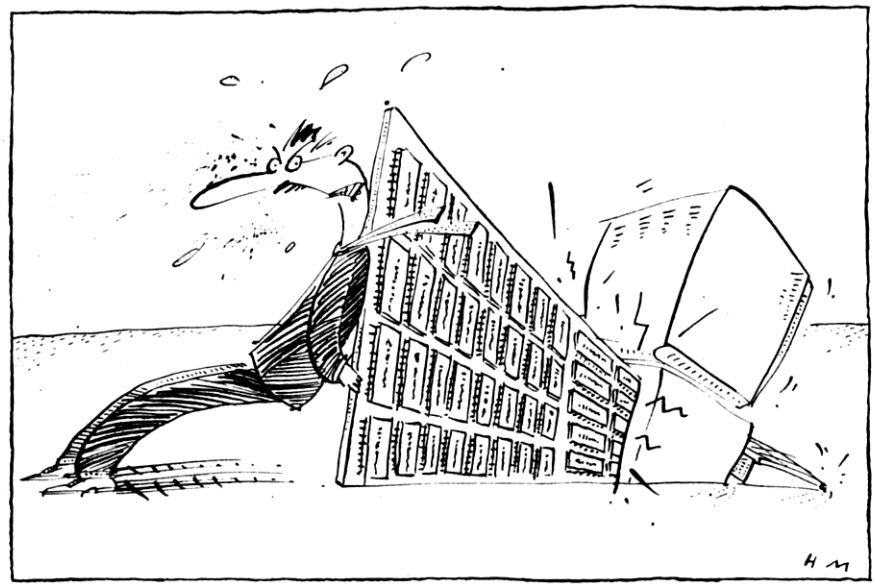

Illustration by Hal Mayforth

Banking Practices

How do you make many megabytes of memory available to a CPU (the 8088) that addresses only 1MB? You start with a memory board that can electronically plug any section of itself into a like-sized section of unused addressable memory. Called a page frame, this chunk of address space serves as a window into the extra memory board. You use the memory bank in the page frame until it's filled, then signal the memory board (via a specified hardware port) to throw a new bank of memory into the page frame. The contents of the old bank of memory are intact, but they're no longer addressable. To read or write that bank you must page it back into the page frame.

Master/Card, for instance, can make any one of its 256K banks plug into a 256K page frame starting at 4000:0000 hexadecimal (hex) or 256K decimal. Because the page frame is in the middle of the 640K user-memory space, the computer (at boot up) uses as standard memory the bank of Master/Card memory filling that space. XRAM uses 16K memory banks addressed through a 64K page frame (four pages at once) in system memory at D000:0000 hex (832K). (Since IBM reserved the D000 memory segment for PCjr ROM cartridges, few conflicts should exist for this address space.) Whereas Master/Card provides 256K or 512K of standard memory plus extra memory, XRAM supplies only expanded memory.

Using banked memory is not as simple as using standard RAM. A program must be designed to use a particular banking system, or the extra memory is useless. The program must know where in memory the page frame is and how to make the board switch banks. The program must also keep track of which bank given data occupies. To simplify the process, and to regulate use of banked memory by more than one program at the same time, banked-memory boards come with a software interface—a device driver loaded in Config.SYS.

By passing command requests to the bank-switching interface, an application receives memory banks for itself, pages its assigned banks as needed, and releases banks when they are no longer needed. The process is similar to disk input/output (I/O) where files are opened, information is read from or written to disk through an area of memory called an I/O buffer, and the file is closed when no longer needed.

An application doesn't have to keep track of where the information is stored on the disk or whether another file is being overwritten. The operating system handles these details. Unlike disk I/O, however, switching banks in and out of the page frame is almost instantaneous. (In fact, both Master/Card and XRAM provide fast RAM-disk programs that use banked memory.)

IBM has not sanctified bank switching for expanding RAM space, and most programs on the market aren't designed to use the technique. Lotus and Intel, joined later by Microsoft, created EMS 3.2 with the hope that it would become an industry standard. It appears they've succeeded, if the growing number of EMS-cognizant programs proves anything. Recent versions of 1-2-3, Framework II, and Windows, for example, can all access the expanded memory provided by both XRAM and Master/Card.

Master/Card Charged

Engineered by Matthew Electronics Inc. and marketed by AFC, Master/Card is a multifunction megaboard providing an RS-232 port (female), a battery-powered clock, and either 512K or 1MB of RAM. Master/Card works with PC-/MS-

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DOS 2.x or 3.x on PC compatibles. You can install it in either a 128K or 384K computer (Tandy 1000A, 1000 SX, or 1200), and it comes with or without a direct-memory access (DMA) chip. A 128K Tandy 1000, of course, requires the DMA chip. If you have a 256K 1000, you must fill the existing memory board to 384K before installing Master/Card. A 1MB Master/Card installed in a 384K 1000 leaves you with 768K of bank-switched memory.

Fitting all this hardware on a 10-inch board requires a few sandwiches. The optional DMA circuitry plugs on near the rear of the main board. To remove DMA, you pry off this sandwich and flip a dual in-line package (DIP) switch. DIP switches also configure the RS-232 for COM1 or COM2. A second optional sandwich plugs onto the main board at the front end and adds 512K to the 512K of RAM already on the board. Master/Card fits easily between other boards; the vertical mounting bracket at the rear of the board fits both the 1000 and the IBM PC. The rechargeable battery responsible for keeping the clock running when your computer is off refreshes itself when line power is on.

Master/Card's memory contents are not destroyed during a reboot—a feature I've had many occasions to praise. Both the Master/Card RAM-disk and print-spooler software recover completely after a reset. This ability is made possible by the Master/Card's non-EMS banking scheme.

Master/Card comes with 10 programs written by *80 Micro* columnist Hardin Brothers. Among them is an installation program that makes setting up quite painless. After determining your memory configuration, it asks what options (RAM disk, print spooler, and EMS emulator) you want installed and how much RAM to assign to each. You might be asked for additional information depending on the options you select. The program sets up or alters Config.SYS and Autoexec.BAT as needed, and it even sets buffers and files in Config.SYS to 10. It explains what is going to happen before it happens and always provides a way out. No files are changed or created until you give the word at the end.

The heart of the Master/Card system is its bank-switching program, through which the print spooler, RAM disk, and EMS emulator all work. This program takes memory requests from other programs, then does the dirty work with the hardware. A text file on the program disk outlines the Master/Card banking scheme for programmers who want to write their own banking applications.

The RAM disk, like most, is fast. I tested it for speed using the Norton Utilities Disktest as a rough measure. Disktest checked a 256K RAM drive at 31.62K per second, the rate of a slow hard drive. The RAM drive can use as many 256K chunks of banked memory as you have, and you can set up several RAM drives if you want. The RAM-drive contents are destroyed only when the power supply to your computer is shut off.

A page frame serves as a window into the extra memory board.

The Master/Card print spooler, like the RAM drive, loads as a device driver. It spoon-feeds data to your printer while you do other things. If you reboot during printing, the spooler recovers without losing characters. You can set the spooler to take up between 1 to 255K, but until Matthew Electronics develops more applications that can use a partial bank, it effectively takes up a whole 256K bank. You can run a related program (Spooler.EXE) to see the spooler status, flush the buffer, or change the spooler parameters any time after boot up. The spooler I tested did not work on my 1000 under Tandy's MS-DOS 3.2. This problem has since been fixed.

The non-system memory space of a Tandy 1000 divides into the original 128K (always the top 128K of user RAM) and two banks of 256K. Master/Card supplies one or both of the 256K banks; it uses the second area for bank switching. Matthew Electronics developed the Master/Card bank-switching system before EMS 3.2 appeared; only Master/Card software, such as the RAM disk and print spooler, know how to use it.

AFC does provide an EMS 3.2 emulator, however. Any program using EMS 3.2 can use Master/Card, but the translation to the Master/Card banking scheme slows things down somewhat. To get some idea of the overhead, I tested the speed of Microsoft Windows' EMS-using RAM drive with the Master/Card EMS emulator and then with XRAM's EMS driver. Again, I used the Norton Utilities Disktest program with the /D parameter (also known as the Doran test).

Using the Master/Card EMS emulator with the Microsoft RAM drive set for 128-byte sectors, Disktest produced a reading of .41K per second—1/10th the speed of a 1000 floppy drive. With 512-byte disk sectors, speed improved to 1.66K per second; if I removed two memory-resident utilities, I got a reading of 1.87K per second—almost half the speed of a floppy drive. Using XRAM's true EMS, and with the Microsoft RAM drive set for 512-byte sectors, the reading was 19.42K per second—still slow for a RAM disk, but 10 times faster than under the Master/Card EMS emulation.

Disktest is an intensive test of EMS function. A spreadsheet or data base might not show such a dramatic slowdown under the Master/Card EMS emulation.

Master/Card also comes with a clock program and a fast memory test. The clock program either sets the battery-powered clock using the current DOS date and time, or it does the reverse, setting the system time from the clock. Putting the line "MCCLOCK SYSTEM" in your Autoexec.BAT file sets the date and time whenever you boot up. The memory test ran through my 512K of banked memory in 10 seconds.

Master/Card has a detailed, well-organized set of instructions. Its approach is friendly, as indicated by the precautions for avoiding static. You aren't given details about what happens when you run the installation program, but instructions aren't really needed.

Matthew Electronics is working on an expansion chassis that will let you add boards to your heart's content. Maybe you *can* run 32MB on your Tandy 1000.

XRAM's Account

PBJ Inc.'s XRAM is a plain-and-simple expanded-memory board that holds 256K to 2MB on one thin card. It's meant to be added after you've brought your system to 640K through other means. It works in all PC compatibles, and PBJ will supply mounting brackets for installing the board in the 1000A, 1000 SX, 1200, 3000 HD, or 3000 HL. A pronged plug on the side of the board accepts a sandwich board that holds another 2MB. The XRAM system—boards and software driver—can handle up to 8MB.

The board has a six-levered DIP switch for setting port addressing and the number of XRAM boards. In the rare event that some other piece of expansion hardware uses the same port address as XRAM (01E0 hex), you can set the switches for alternate addresses. Two of the switches indicate the board number when you have more than one XRAM. If you have one board, chances are you won't have to touch the switches.

XRAM comes with an EMS 3.2 expanded-memory manager (EMM), a RAM disk, and a diagnostic program. Both the EMM and RAM disk are device drivers loaded in Config.SYS. The EMM driver checks XRAM's expanded memory during boot up at a rate of 1MB per 10 sec-

onds. You must load the EMM first for the RAM drive to work. You can set up several RAM disks using XRAM's memory. RAM disks also use some normal memory to store their directories; the default is 8K per directory. The RAM drive is slightly faster than Master/Card's; a 2MB RAM disk gets a reading of 33.6K per second under Disktest—almost as fast as an XT-type hard drive.

I was pleasantly surprised by the XRAM diagnostic program. It performs several types of expanded-memory tests and lets you examine the contents of expanded memory—much as Debug does for normal memory. The program also provides the framework for testing EMS functions: It lets you set up the appropriate CPU registers and then returns the EMM result code. A final touch: You can change the diagnostic program's display colors.

XRAM's instructions are straightforward and adequately detailed (they describe safe procedures for plugging in the board, for instance). You must add one or two device drivers to Config.SYS: the EMM program and an optional RAM-disk driver. If you're just adding one RAM drive that uses all of XRAM's memory, you don't have to set parameters in Config.SYS for either driver. Also included are instructions for adding your own RAM chips to XRAM, along with a list of acceptable chips (with part numbers). My XRAM came with 200-nanosecond, 256K Micron chips.■

Dave Rowell is an 80 Micro technical writer specializing in MS-DOS computing. Address correspondence to him c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.

Product Index

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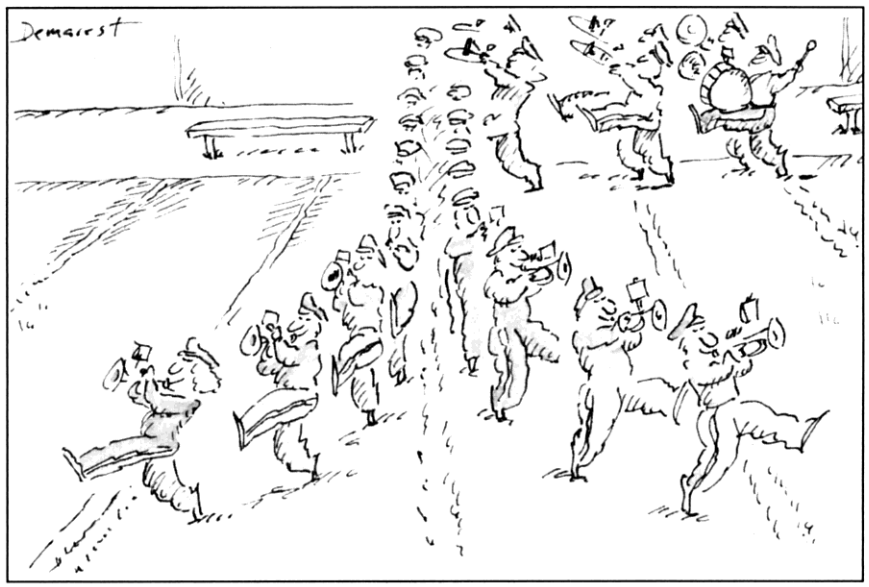

Subroutines that find data items or insert them in a particular record location are common in business programs. In a previous column, I discussed random file-access methods that allow you to do this. (See Random File Access: Reaching for the Record, October 1986, p. 140.)

The method I prefer is hashing. However, if you want to insert data in sequential order, or if the data is badly arranged, then hashing might not be suitable (in the latter case, finding a good hashing routine takes too much time). Another drawback is that hashing doesn't allow you to find the next and previous records in a file.

Binary-search routines overcome these disadvantages, though sometimes at a cost. This month, I'll step through the process, review the bonuses, and prepare you for the pitfalls associated with this programming technique.

Divide and Conquer

Binary searches are examples of systematic analysis. To find a data item, the search routine divides the search area in half and checks the midpoint to see if it is less than, greater than, or equal to the value you are searching for. If the midpoint value is less than the value you want, your new search area becomes the top half (in code, set BOTTOM = midpoint). If the midpoint value is greater than the value you want, the new search area becomes the bottom half (set TOP = midpoint). The process continues in this fashion until the routine finds the value or determines that it doesn't exist.

Most articles about binary-search routines emphasize how easy they are to program. My experience is that no other routine is so easy to write badly. For example, consider the following list of data:

```
A$(1) = "Bob":A$(2) = "Dave":A$(3) = "Eric"
:A$(4) = "Harry":A$(5) = "Jeff":A$(6) =
"John"
```

For the purposes of the example, I'll adopt the convention that A$(0) = " " (this uses no space, and a null string is less than anything). The items are in alphabetical order.

System Requirements

All systems
Basic

Suppose you want to find "Bob" in this list. To do so, the search routine sets the top to 6 and the bottom to zero. Then it sets the midpoint—in this case, 3. But what if the list had seven items instead of six? The midpoint value would be 3.5, which Model I and Model III Basic would truncate to 3. The version of Basic that comes with the Model 4 and newer Tandy machines rounds numbers, which means the midpoint could be either 3 or 4. That's a potential problem. You want a routine that works on any machine, not one that fails or gives different results depending on the language version or the computer hardware.

You could eliminate the problem by using integer arithmetic. In this case, the midpoint value would be 3. Item 3 would be "Eric," which is greater than "Bob." The program would then set the top to 3 and repeat the process. The new midpoint would become 1: INT((0 + 3)/2). Item 1 would be "Bob," so the search would be successful. (On the Model 4 and on MS-DOS machines, the backslash operator [\] forces integer division. The routine would calculate the midpoint as [0 + 3]\2 = 1 and get the same answer, only much faster.)

Using integer arithmetic works, so what's the problem? To answer that, suppose the first item in the list is "Bill." The process works fine up to the point of the last comparison. The routine sets the top to 3 and the bottom to zero, as before. It checks item 1 and finds "Bill." Since "Bill" is less than "Bob," it sets the bottom to 1, checks item 2, and finds "Dave." "Bob" is less than "Dave," so the routine sets the top to 2. The new midpoint becomes 1 ([1 + 2]\2 = 1), so the routine checks item 1 again. Since "Bill" is less than "Bob," it sets the bottom to 1. But the bottom has already been set to 1! You're stuck in an infinite loop.

As long as the data you're looking for is actually in the file, the routine works correctly. If the data isn't there, the routine never returns. Infinite loops are not examples of efficient programming, at least where searching is concerned.

Exit, Stage Right

You have several ways out of the problem. You could set a flag variable to be zero at the beginning of the subroutine and increment it each time the difference between the top and bottom values is 1. When the flag variable becomes greater than 1, the routine returns with a "Not found" message. This solution isn't very efficient, though. You might know the item isn't in the file, but you want to know where it should go.

The routine has another bug: Suppose you're looking for "John." In the first check, the routine looks at "Eric" and sets the bottom to 3. On the second check, the midpoint becomes 4 ([3 + 6]\2 = 4), and the routine checks "Harry." The next midpoint is 5, and it checks "Jeff." At this point, the top is 6 and the bottom is 5. The next midpoint becomes 5 ([5 + 6]\2 = 5); but the routine just checked 5. You're in an infinite loop again.

The only way out is to put the largest conceivable value at the top. This wastes

Illustration by Chris Demarest

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With the BITD method, the return values give no hint as to how you should insert the item.

space, though, and is a kludge. A null string is less than anything you might add, but what's the largest value you might add? Instead of making the top equal the midpoint, suppose you make it one less than the midpoint; after all, you've checked the midpoint value already. Likewise, suppose you make the bottom value one more than the midpoint. You can return when the top equals the bottom.

The code for this technique might look like the sample in Program Listing 1, where the maximum (MAX) equals the number of items in the list, and FIND$ is the name you're searching for. Using the routine, let's see what happens with the names I listed earlier, only this time, "Bill" is first. Again, the name you're looking for is "Bob" and the first item checked is "Eric." This time, the top equals 2 instead of 3. The next item checked is "Bill," which is less than "Bob." As before, the routine sets the bottom to 1. The next pass sets the midpoint to 1 ([1 + 2]\2 = 1), and the routine checks "Bill" again. "Bill" is less than "Bob," so the bottom becomes 1; but it was already 1. Once again, you're in an infinite loop.

Now what? You can use the same routine but set:

BOTTOM = REC + 1

Or you can modify the record number so that when the top and the bottom are one value apart, the top value becomes the midpoint. The routine either determines that the top value is the one you're looking for or it decrements the value until it equals the bottom, forcing a return. To do this, you must code in:

REC = (TOP + BOTTOM + 1)\2

To increment the bottom and decrement the top, your code would look like the sample in Program Listing 2. As before, the item checked is "Eric." The value returned is greater than what you're looking for, so the top becomes 2 and the routine checks "Bill." This is less than the value you want, so the bottom is incremented to 2. Since the top equals the bottom, the routine terminates. "Dave" doesn't equal "Bob," so you know the name you're looking for isn't in the list.

Program Listing 1. Code to make the top one less than the midpoint and the bottom one more than the midpoint.

```
10 TOP=MAX:BOTTOM=0
20 WHILE TOP>BOTTOM
30 REC=(TOP+BOTTOM)\2 'note the integer division
40 IF A$(REC) > FIND$ THEN TOP=REC-1:
     ELSE IF A$(REC) < FIND$ THEN BOTTOM=REC:
     ELSE TOP=REC:BOTTOM=REC
50 WEND:RETURN
```

End

Program Listing 2. Code to increment the bottom and decrement the top.

```
10 TOP=MAX:BOTTOM=0
20 WHILE TOP>BOTTOM
30 REC=(TOP+BOTTOM)\2 'note the integer division
40 IF A$(REC) > FIND$ THEN TOP=REC-1:
     ELSE IF A$(REC) < FIND$ THEN BOTTOM=REC+1:
     ELSE TOP=REC:BOTTOM=REC
50 WEND:RETURN
```

End

Program Listing 3. Code to modify the record number.

```
10 TOP=MAX:BOTTOM=0
20 WHILE TOP>BOTTOM
30 REC=(TOP+BOTTOM+1)\2 'note the integer division
40 IF A$(REC) > FIND$ THEN TOP=REC-1:
     ELSE IF A$(REC) < FIND$ THEN BOTTOM=REC:
     ELSE TOP=REC:BOTTOM=REC
50 WEND:RETURN
```

End

The other method would be coded as shown in Program Listing 3. The first item picked is [0 + 6 + 1]\2, or item 3—"Eric." Since "Eric" is greater than what you're looking for, the top is set to 2. The next midpoint is 1; "Bill" is less than "Bob," so the bottom becomes 1. The next midpoint is 2 ([1 + 2 + 1]\2 = 2), and "Dave" is checked. Since "Dave" is greater than "Bob," the top is set to 1. At that point, the top equals the bottom, so the routine terminates.

Both of these methods work, but which one is preferable? The answer depends on your search objective. Suppose your objective is to add an item to the list if it is not found by the binary search. With the bottom-increment and top-decrement (BITD) method, two possibilities might account for an item not being found: Either the top value was decremented to be equal to the bottom, or the bottom value was incremented to be equal to the top.

If the item you're looking for is "Jill," the BITD method would set the top to 6 and the bottom to 4 after the first check. It would then check entry 5 and set the bottom to 6, since "Jeff" is less than "Jill." The top would then equal the bottom, so the routine exits. Both the top and the bottom would point to "John," item 6.

If you're looking for "Jane," the BITD method would likewise set the top to 6 and the bottom to 4 after the first check. It would then check item 5, only this time the top would become 4, since "Jane" is less than "Jeff." Again, the routine would exit, since the top and bottom would equal 4. Both would point to item number 4, "Harry."

In the first case, the return values pointed to the item *before* which "Jill" should be inserted. In the second case, the return values pointed to the item *after* which "Jane" should be inserted. The return values give no hint as to how you should insert the item; the program must do an extra comparison to determine if the new item should go before or after the item in question.

BITD, Meet DARU

Now consider the second method, which I call the "divide and round up" (DARU) method, since that's what it does when finding the midpoint. Again, I'll assume you're looking for "Jill." The first check is item 3, "Eric." That's too small, so the bottom becomes 3, and the top remains 6. The next midpoint is 5. "Jill" is greater than "Jeff," so the bottom becomes 5. This time the program performs another comparison and sets the midpoint to 6 ([6 + 5 + 1]\2 = 6). Since "Jill" is less than "John," the top is decremented to 5. The routine exits with the top and bottom both set to 5 and pointing to "Jeff."

Suppose you look for "Jane." The method proceeds as before, up to the point where item 5 becomes the midpoint. Since "Jane" is less than "Jeff," the top is decremented to 4. The routine checks item 4 ([3 + 4 + 1]\2 = 4). Since

"Jane" is greater than "Harry," the bottom is set to 4 and the routine exits. Both the top and bottom are set to 4 and point to "Harry."

Using the DARU method, the routine exits with the top and bottom indexes pointing to the place *after* which the new item should be inserted. You acquire this added information at a small cost, however. On average, the DARU method requires one-half a comparison more than the BITD method requires for an identical list.

If all you need to do is look for an item, and if you need to do many lookups in succession, then the BITD method appears to be more efficient. On the other hand, if your application relies heavily on data insertion, the DARU method is more efficient.

Programming decisions are not always black and white, however. Recently, I wrote a spelling-checker program using a B-tree index to store words and a binary search to look up words. The program stores groups of words in 128-byte records. The spelling checker is frequently run on floppy disks, and the dictionary contains over 55,000 words.

With this program, looking up data is likely to be more common than inserting data. Even so, I decided to use the DARU method. The reason has to do with the way the words are packed. The first word in each record isn't packed, though successive words in the same record are. Unpacking words is extremely time-consuming.

The DARU method lets me quickly determine which record should contain the word being looked up without having to do an extra comparison, which might force an additional disk read. The BITD method would only indicate where the search failed (as it almost always must). On average, for this dictionary I saved approximately one-half a disk read for each word looked up.

If you want your software to run fast, you must think of these things when you design and write it. In my comparisons, DARU runs fractionally faster than BITD. However, you might want to compare performances for your application before making a decision.■

Bruce Tonkin is an independent software developer and industry critic. Write to him at 34069 Hainesville Road, Round Lake, IL 60073. You can also contact Bruce through Syslink and BIX.

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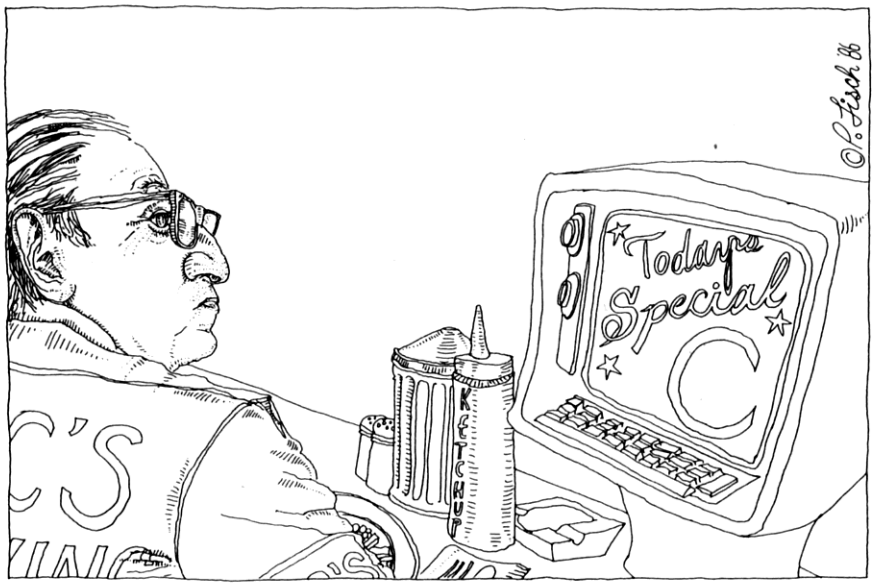
Programs in the Key of C



The C programming language has gained a large following in recent years. Enthusiasts tout C's portability and its highly structured design, which encourages modular programming.

If you haven't used C, you might wonder what the fuss is about. This month's Public Works gives you a chance to find out by pointing the way to a C interpreter and a slew of C routines, functions, and libraries. As always, the programs mentioned are available on the *80 Micro* BBS (see p. 10 for BBS information).

Starting Small

Small C Interpreter (SCI) is an interactive C interpreter loosely based on James Hendrix's Small C. Because it is an interpreter, you can run programs without going through the sometimes lengthy steps (link, compile, edit, fix, and so forth) required by a compiler. The interpreter includes both a line editor and a trace utility (see Table 1).

SCI assigns memory to the program code segment (containing the tokenized version of your program code), the variable table (containing information about all active variables), the function table, and the memory stack. You can tell SCI how much memory to assign each of the four code segments. The total, however, can't exceed 64K.

The interpreter imposes certain rules for assigning variables. It assumes, for instance, that global variables are always active. Also, it considers local variables active as long as the function in which they are declared remains active.

Functions have constraints, too. A function remains active even while it is waiting for a called function to return to it. Also, each function takes one entry in the function table.

Commands execute through the interpreter's shell, which loads automatically when you invoke SCI. The shell contains operating-system interface functions. You can call a different program as long as it duplicates these functions.

The edit, list, load, save, core (free), and exit commands are available from the command line and operate like their Basic counterparts. All other commands pass to the interpreter as arguments. You can pass arguments to the shell with the -A parameter. All subsequent arguments then automatically pass to the start-up program.

SCI reserves the keywords break, entry, return, char, if, sys, else, int, and while for specific program functions. The entry keyword tells SCI which function to execute first (usually, loading the shell). You can have only one entry to a program; if you declare functions and libraries before the entry, SCI considers them globally known library functions.

SCI's line editor is serviceable, though it's no replacement for Wordstar. You can insert or delete text a line at a time or a character at a time. SCI saves text as an ASCII file, so you can use your favorite word processor instead of the line editor.

Because it is an interpreter, SCI operates differently from standard C compilers. Statements can terminate with either an end-of-line marker or a semicolon. Standard C practice is that all statements end with a semicolon. Also, SCI statements must be on one line: Keep your statements short and to the point.

Comments must be preceded by a pound symbol (#) and end at the current program line. SCI doesn't recognize the standard C delimiters (/* and */); using them to bracket comments produces a syntax error. Identifiers have a maximum of eight characters, with the first being either a letter or an underscore.

SCI supports decimal-integer constants from −32,707 to 32,766 and standard C notation for integer, hexadecimal (hex), and octal. Strings must have null (zero) bytes marking their ends. SCI supports only int and char data types (characters equal 1 byte and integers equal 2 bytes). The interpreter treats int and char as signed quantities and supports pointers and arrays of both. It also supports binary and unary operators. The comma operator is a function argument and variable separator.

The trace library function lets you enable or disable the program trace/debug feature. While in trace mode, you can set and remove breakpoints, examine and modify program variables, and control program execution.

The documentation thoroughly describes SCI's library functions, the syntax for each, and possible variations. A lengthy error section details the causes and solutions to problems. The documentation also explains the differences between SCI and Small C.

Library Research

MSCTools is a Microsoft C Compiler 4.0 function library. It gives you functions for clearing the screen, determining the current drive, turning the cursor on and off, checking equipment availability, framing boxes, checking the current video mode, checking serial status, setting the serial port, and rebooting. MSCTools has a locate function similar to Basic's and a light-pen function. The documentation tells you how to link and

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compile functions and gives you the proper syntax for each. To obtain the complete source code, send $25 to the author, Lynn Long.

C-Windows is a set of screen-manipulation and window-making functions. The former let you print, set the color, scroll, save, and restore your program's screen. The program also includes a function for printing horizontal and vertical bars of characters. With the window-making functions, you can define as many as 255 windows. The program treats each as a separate screen, which you can scroll, locate in, color, blank, print in, move, open, close, and relocate. The program uses a set of primitives to call functions (see Table 2).

You can layer windows, one on top of the other, and reactivate hidden ones at any time. The documentation describes how to compile and link functions. The syntax for handling color and screen location is similar to Basic's.

The program comes with a demonstration that displays the results you can achieve. Unfortunately, as in other window demonstrations I've seen, the author goes overboard. Windows flit around on screen in a confusing, and eventually tiresome, fashion.

C-Windows was written with Lattice C 2.12 and I suggest using that compiler. If you use a different compiler, you'll need to modify the source code. For $30, the author, Glenn Boyd, will send you the complete source code.

Graphics is a set of functions for use with the Microsoft C Compiler 4.0, Microsoft Fortran, or Pascal 3.31. It provides mode- and palette-control functions for simple and complex graphics. You can define colors, change screen modes, return to the current screen mode, locate and move the cursor, clear the screen, set pixels, and restore the color of pixels. You also can draw colored lines, boxes, and circles. The program supports both CGA-standard (set by the IBM Color Graphics Adapter) and enhanced color graphics (available on the Tandy 1000).

CStuff is a set of assembly- and C-language routines that you can incorporate with either the Microsoft or Lattice C compiler. The assembly routines must be assembled with Microsoft's Macro Assembler. The set includes Poke (for writing directly to an area of memory), Peek (for retrieving the contents of a memory location), Fwrite (for writing directly to the screen buffer), and Cursor (for turning the cursor on and off). Other routines let you turn the caps lock and number lock keys on and off, clear the screen, find the cursor, and clear to the end of the current line.

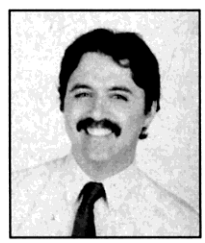
The documentation provides only brief descriptions of the routines. You're not told how to link the routines into your programs.■

Command	Description
.b#	Sets a breakpoint at a line in your program. The pound symbol (#) represents the line number at which the program will halt.
.B	Displays set breakpoints.
.c	Continues program execution until the next breakpoint.
.d#	Deletes the breakpoint at line number #. The breakpoint must have been previously set with a .b command.
.D	Deletes all breakpoints.
.e#	Lets you examine the program with the program editor. Disables editor commands that normally modify the program.
.g	Displays the program's global variables and their values. If the variable is an array, its address and the first 10 elements of the array are printed.
.G	Same as .g but also displays the first line and line number of every function in the program.
.q	Quits program execution and returns to the shell program.
.s#	Steps through the program without displaying each line as it executes. The # is the number of lines to be executed before control returns to the debugger.
.t	Displays the list of active functions with the current one at the top of the list.
.T	Same as .t but also displays each function's local variables and their values.
return	Repeats the last .s or .c command entered.
escape	Disables the Trace/Debug facility and continues normal execution.

Table 1. SCI's Trace/Debug commands.

Function	Description
color( )	Sets the default color
locate( )	Positions the cursor on screen
place( )	Prints a single character
cls( )	Clears the entire screen
v_bar( )	Prints a vertical bar of characters
h_bar( )	Prints a horizontal bar of characters
scroll( )	Scrolls any part of the screen
printf( )	Standard C printf rewritten in assembly
box( )	Draws a box using double line-drawing characters
minor_box( )	Draws a box using single line-drawing characters
window( )	Makes an exploding box
save_restore( )	Saves and restores portions of the screen
activate( )	Makes a window active on screen
open_window( )	Opens a window
close_window( )	Closes a previously opened window
scroll_window( )	Scrolls the text inside a window
locate_window( )	Locates the cursor inside a window
print_window( )	Allows you to print in a window
cls_window( )	Clears a window
move_window( )	Moves a window
color_window( )	Sets the color in a window

Table 2. C-Windows library functions.



As a technical writer for 80 Micro, *Ryan Davis-Wright covers TRS-80 and MS-DOS computers. Write to him c/o* 80 Micro, *80 Pine St., Peterborough, NH 03458.*

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Forms Finder (see the Program Listing) sets the Model 4 Forms parameters, tests the parameters to establish when a top-of-form (TOF) has been called, and reads the current settings without leaving Basic.

Locations x'0200'–x'0315' store the device index, with 8 bytes for each device. Byte 1 indicates if the device can handle input, output, or both, and if it is active. Bytes 2 and 3 give the address of the next device in the bit-stream chain (the program outputs to Forms/FLT, which outputs to the printer driver). Bytes 7 and 8 store the device's two-letter name (e.g., PR, FF, or DO).

To adapt this routine to any other program, delete the CLS from line 20 and delete line 120. Remove lines 170–420 and move the error routine to your own error-trapping routine, or remove lines 480–510 and replace the Goto 480 in lines 80 and 110 with SYSTEM"BOOT". Place this routine at the beginning of your program, and when a Forms parameter is required, use Peek or Poke to access the parameter at address PROW% + offset (e.g., POKE PROW% + 2,54).

Roy G. Manuell
Lac du Bonnet, Manitoba

Program Listing. Forms Finder. (See p. 96 for information on using the checksums in this listing.)

```
20 CLS:'Locate Forms Filter                                          '*  414
40 NM$="FF":NM1$="PR":MD$="FORMS FILTER":MD1$="PRINTER DRIVER"       '*  3883
50 FOR LOOP%=1 TO 2                                                  '*  1134
60 IF LOOP%=2 THEN SWAP NM$,NM1$:SWAP MD$,MD1$                       '*  2820
70 L%=518:WHILE LK$<>NM$                                             '*  1434
80 IF L%<789 THEN L%=L%+8 ELSE 480                                   '*  1922
90 LK$=CHR$(PEEK(L%))+CHR$(PEEK(L%+1))                               '*  2170
100 WEND:PROW%=(PEEK(L%-4)*256+PEEK(L%-5))+6                         '*  2552
110 IF CHR$(PEEK(PROW%))+CHR$(PEEK(PROW%+1))<>NM1$ THEN 480          '*  3527
120 PRINT " *";NM1$;"==> x'";HEX$(PROW%);"'"                         '*  1478
130 NEXT LOOP%:PROW%=PROW%+6                                         '*  1828
170 V%=PEEK(PROW%+7)                                                 '*  1205
180 O$=" on":F$="off"                                                '*  1290
190 IF V%=0 THEN AD$=F$:FF$=F$:TA$=F$                                '*  2107
200 IF V%=1 THEN AD$=O$:FF$=F$:TA$=F$                                '*  2109
210 IF V%=2 THEN AD$=F$:FF$=O$:TA$=F$                                '*  2111
220 IF V%=3 THEN AD$=O$:FF$=O$:TA$=F$                                '*  2122
230 IF V%=4 THEN AD$=F$:FF$=F$:TA$=O$                                '*  2115
240 IF V%=5 THEN AD$=O$:FF$=F$:TA$=O$                                '*  2126
250 IF V%=6 THEN AD$=F$:FF$=O$:TA$=O$                                '*  2128
260 IF V%=7 THEN AD$=O$:FF$=O$:TA$=O$                                '*  2139
280 PRINT:PRINT "Forms=x'";HEX$(PROW%);"'":PRINT                     '*  1804
290 PR$="\     \=###"                                                '*   992
300 PR1$="\    \=\   \"                                              '*  1176
310 PR2$="Xlate=X'\\'=>X'\\'"                                        '*  1182
320 PRINT USING PR$;"page",PEEK(PROW%)                               '*  2553
330 PRINT USING PR$;"lines",PEEK(PROW%+2)                            '*  2773
340 IF PEEK(PROW%+8)=0 THEN PRINT USING PR1$;"chars","off" ELSE
    PRINT USING PR$;"chars",PEEK(PROW%+8)                            '*  6801
350 PRINT USING PR$;"margin",PEEK(PROW%+9)                           '*  2881
360 PRINT USING PR$;"indent",PEEK(PROW%+6)                           '*  2883
370 PRINT USING PR1$;"addlf",AD$                                     '*  2131
380 PRINT USING PR1$;"ffhard",FF$                                    '*  2251
390 PRINT USING PR1$;"tab",TA$                                       '*  1953
400 PRINT:PRINT USING PR2$;HEX$(PEEK(PROW%+4)),HEX$(PEEK(PROW%+5
    ))                                                               '*  4198
420 PRINT:PRINT USING PR$;"prtrow",PEEK(PROW%+1):END                 '*  3647
480 PRINT@(21,0),CHR$(16);"  "MD$;" not resident.  ";CHR$(17)        '*  3779
500 PRINT"Press any key to continue...";                             '*  3249
510 ANS$=INPUT$(1):SYSTEM"boot"                                      '*  2118
```

End

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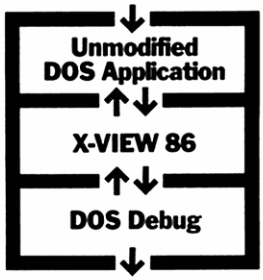

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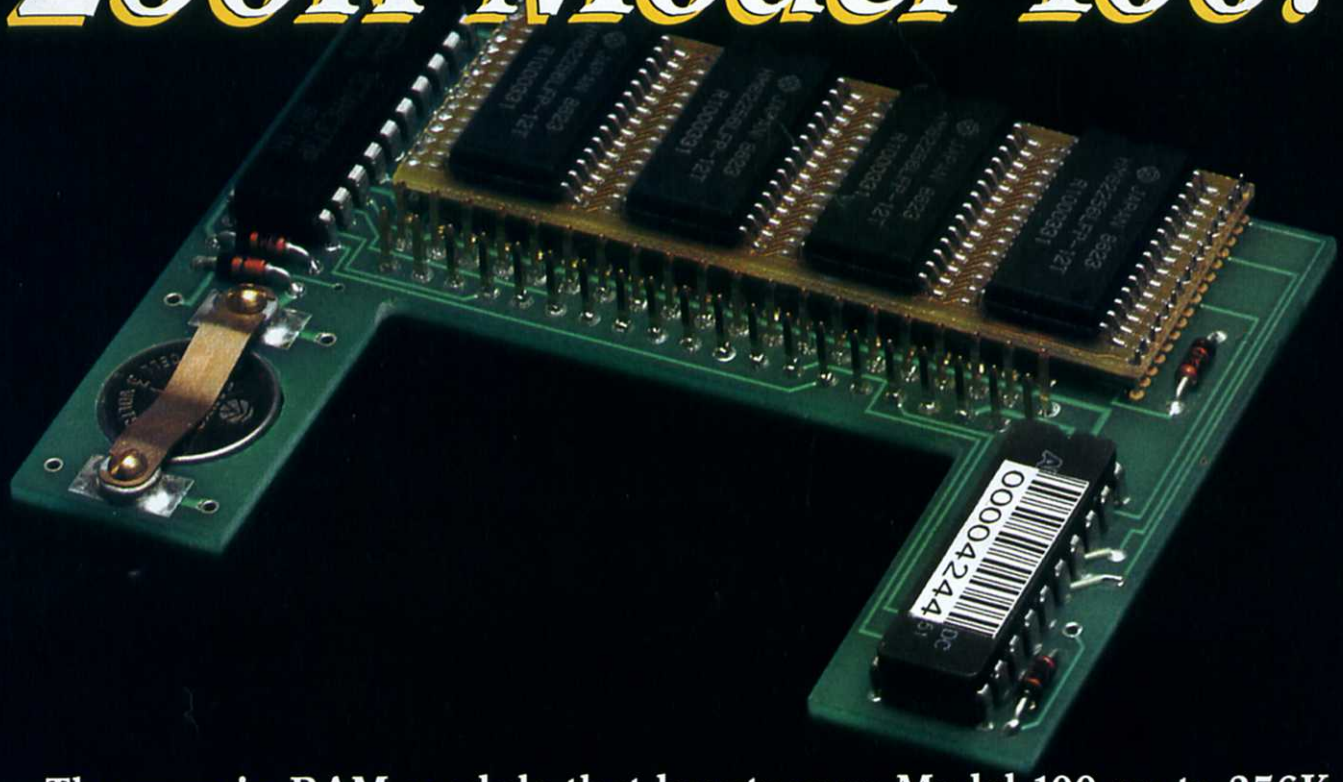

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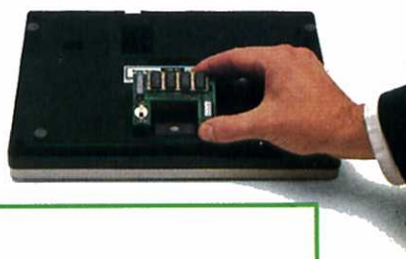

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Track Records

If you had to manage every sector of every disk yourself, deciding where to store and find individual files, you'd soon drown under the details of disk allocation. Disk operating systems are meant to do the work for you.

It is sometimes important, however, to know exactly where a file is stored. If you are trying to recover data from a bad disk, for example, knowledge of the directory structure (or having a utility that deciphers the directory) is vital. You can also speed up programs noticeably by optimizing the file arrangement on disk.

TRSDOS's directory format provides a lot of information about a file: how large it is, how many records it contains, and how many extents it uses. The Free command adds to that information by drawing a map of which disk granules are in use and which are free. But these TRSDOS commands provide no information about the actual location of a file, although such information is made available on a system level so that files can be found and used.

Illustration by Yvonne Buchanan

Fragmented Files

Whenever you save a new file or a new part of an old one, TRSDOS places it in the lowest possible disk position (it puts nothing except Boot/SYS on track zero until the rest of the disk is full). If you often save or expand some files on a disk and remove others, the remaining files can become fragmented, a fact the directory listing shows when it reports the number of extents, or separate storage areas, that a file uses.

As long as the number of extents is four or fewer, you won't notice much change in disk access times. But as soon as a file has five or more extents, especially if it is organized as a record or random-access file, access times can increase enormously. Also, the disk seems to run faster when your most-used programs are closest to the directory.

There is an easy way to reduce fragmentation on a data disk. Format a new disk and back up the files from the old disk to the new disk using the New parameter. TRSDOS will copy one file at a time, allocating the smallest number of extents possible for each.

You can control the placement of files by changing the value of AFlag$ before saving a new file to disk. The AFlag$ value tells TRSDOS the starting cylinder to use when looking for new disk space to allocate.

It is also possible to make a highly optimized disk by studying the size requirements of each file and formatting a new disk. You can then change the AFlag$ value with the TRSDOS Memory command, copy one file, change the value again, copy another file, and so on until you have placed each file where you want it. Misosys Inc.'s Pro-IFC utility does essentially the same thing without the hassle.

Learning by Example

This month's demonstration program shows you where a file is stored on a disk. It doesn't move anything, but it determines whether a disk or file has become unreasonably fragmented. It can also help recover data from a bad disk.

By assembling the program with the name Map/CMD, you can invoke it from TRSDOS Ready by typing MAP followed by the filespec. A display like that produced by the Free command will appear on screen showing where the file is located. The granules used by the file's first extent are labeled "A," those of its second extent are labeled "B," and so on. (The display becomes a little confusing if the file has more than 26 extents.) When you are done looking at the display, press any key to return to TRSDOS Ready.

The program is also a good example of how to pull together information from many different TRSDOS functions. To identify the granules used by a file, the program must open the file and extract information from its file-control block (FCB), find the drive-control table (DCT) for the drive to get still more information, and decipher entries in the disk directory.

Program Listing 1 is the source code for this utility; it makes extensive use of assembly macros from my library. The macros used are in Program Listing 2 (MACLIB/ASM). If you read last month's column (p. 106), you should have little trouble understanding the macros that are new this month.

Fact-Finding Mission

When the macros in Listing 1 are fully expanded (but unused conditional commands are suppressed), the program

LOAD 80

System Requirements

Model 4, 4P, or 4D
Assembly language
Editor/assembler
(Pro-Create 4.3a or MRAS)

stretches out to nearly 1,300 lines. The combination of a strong top-down structure and heavy reliance on macro commands should make it relatively easy to understand, however.

The program begins by reading in the macro library and defining the carriage-return and ETX characters (the latter is an ASCII function that puts the cursor at the end of the display line). Then it calls four subroutines and ends. The first subroutine checks to see if the user pressed the break key while the program was loading; if so, the program aborts. The second subroutine collects information about the file, the disk, and the drive. The third subroutine builds an allocation table for the file and the last subroutine displays that information.

Program Listing 1. File-map utility.

```
00100 ;------------------------------------------------------------
00110 ;       TRSDOS 6.2   File Map Utility
00120 ;
00130 ;       Uses several commands from MACLIB
00140 ;------------------------------------------------------------
00150 *LIST OFF                       ;Read in MACLIB/ASM
00160 *GET MACLIB
00170 *LIST ON
00180 ;
00190         DEFINE  ETX,03H
00200         DEFINE  CR,0DH
00210 ;
00220         ORG     3000H
00230 START   CALL    CHKBRK          ;Check for <Break> key
00240         CALL    GET_INFO        ;Information about file and drive
00250         CALL    SET_ALLOC       ;Build allocation table for file
00260         CALL    DISPLAY         ;Display map of file allocation
00270         @@EXIT                  ;Return to TRSDOS
00280 ;
00290 ;-----------
00300 ;  Check for <Break> key
00310 ;  Take error exit to TRSDOS if <Break> pressed
00320 ;-----------
00330 ;
00340 CHKBRK:
00350         @@CKBRKC                ;Use TRSDOS to check
00360         RET     Z               ;Return if no <Break>
00370 ERROUT:
00380         @@EXIT  -1              ;Else report error and leave
00390 ;
00400 BADFILE LD      HL,BADFILE$     ;HL ==> message
00410         DB      0DDH            ;IX prefix (ignore next instr.)
00420 BADDCT  LD      HL,BADDCT$      ;HL or IX==> message
00430         @@DSPLY                 ;Display HL message
00440         JR      ERROUT          ;Abort program
00450 ;----------
00460 ;  Get information about file and drive
00470 ;----------
00480 ;
00490 GET_INFO:
00500         LD      A,(HL)          ;Get first character of file name
00510         IFLT_JR 'A',BADFILE     ;Leave if no file name
00520         @@FSPEC HL,FCB          ;Move and test filespec
00530         @@OPEN  FBUFFER         ;Open file
00540         LD      IY,FCB          ;IY ==> File control block
00550         LD      A,(IY+7)        ;Get file's DEC
00560         LD      (DEC),A         ;And save it
00570         LD      A,(IY+6)        ;Get drive number
00580         AND     07H             ;Mask off bits 3 - 7
00590         LD      (DRV),A         ;And save it
00600         LD      C,A             ;Move drive number to C
00610         @@CLOSE                 ;Close the file & clear FCB
00620 ;
00630         @@GTDCT                 ;IY ==> DCT entry
00640         LD      A,(IY)          ;Test first byte
00650         IFNE_JR 0C3H,BADDCT     ;Go if invalid DCT
00660         LD      A,(IY+6)        ;Get max cylinder number
00670         INC     A               ;Make relative to 1
00680         LD      (MAXCYL),A      ;And save it
00690         LD      A,(IY+8)        ;Get grans/cylinder in bits 7 - 5
00700         AND     0E0H            ;Mask off other bits
00710         RLCA                    ;Move to bits 2 - 0
00720         RLCA
00730         RLCA
00740         INC     A               ;Make relative to 1
00750         BIT     5,(IY+4)        ;Check DBLBIT
00760         JR      Z,GET1          ;Go if not doubled
00770         ADD     A,A             ;Else double the count
00780 GET1    LD      (GRANS),A       ;Save total
00790         RET                     ;And return
00800 ;
00810 DRV     DB      0               ;Drive number
00820 DEC     DB      0               ;DEC number
00830 MAXCYL  DB      0               ;Total number of cylinders
00840 GRANS   DB      0               ;Granules per cylinder
00850 ;
00860 ;----------
00870 ;  Find file's allocation space and mark each granule
00880 ;  in the GRANTBL buffer.
00890 ;----------
00900 ;
00910 SET_ALLOC:
00920         CALL    MAKE_TBL        ;Clear the gran table
00930 SET1    LD      BC,(DRV)        ;C = drive; B = DEC
00940         @@DIRRD                 ;Get directory sector in sys buffer
00950         LD      BC,22           ;Offset to first extent
00960         ADD     HL,BC           ;HL==> first extent
00970         PUSH    HL              ;Move pointer
00980         POP     IY              ;  to IY
```

Listing 1 continued

The GET_INFO routine (line 500) begins by making sure the user entered a filespec when the program was invoked. If so, the filespec is transferred to an FCB and the file is opened. If no filespec was entered, or if an error occurs while the file is being opened, the program stops and displays an error message.

The process of opening a file under TRSDOS is simple. First, the @FSPEC supervisor call (SVC) moves the filespec to the 32-byte FCB buffer. @FSPEC converts the filespec to uppercase and checks its syntax. Next, the @Open SVC opens the file by using the FCB as a link between the operating system and the file on disk.

The FCB is TRSDOS's only link to a file. If you change disks while a file is open and being written to, TRSDOS has no way of knowing that you have done so. Two ruined disks can result.

There are several pieces of information in an open FCB, all of which are detailed in the *Model 4 Technical Reference Manual* and the *Programmer's Guide to LDOS/TRSDOS 6*. This month's program only needs to collect two of the pieces. First, it reads the file's directory-entry code (DEC) from the FCB and stores it in memory. Then it gets the drive number and closes the file.

During operation of the @Close SVC, TRSDOS returns the file's name and drive number to the FCB (but not the file's copyright—that name will be useful later).

Using the drive number that it found in the FCB, the program turns to another SVC to get the address of the drive's DCT. There is a DCT for each of the eight possible logical drives accessible by TRSDOS. Like an open FCB, the DCT is a complex data structure that condenses 21 pieces of information into 10 bytes. For Listing 1, we need only two of those pieces: the number of cylinders on the disk and the number of granules per cylinder.

Normally, a program should call the @CKDRV SVC to make sure a drive number is valid before using @GTDCT to find the address of a DCT. But since Listing 1 opens a file and finds its drive number immediately before asking for the DCT address, the drive number must be valid and the intermediate step can be skipped.

Making the Presentation

Once the program has the file's name, the file's DEC, and the file's drive number, the number of cylinders on the disk, and the number of granules per cylinder,

it can build a table of the granules allocated to the file with the SET_ALLOC routine (line 910). The program begins this process by filling a memory section with periods standing for each granule on the disk. Each unchanged period stands for a granule not used by the file.

The program passes the file's DEC and drive number to the @DIRRD SVC, which reads the directory sector containing the file's primary entry and places the sector in one of TRSDOS's internal buffers. @DIRRD then points the HL register pair at the correct directory entry. Listing 1 needs the directory entry to determine where the file is stored on the disk, but it has to use a roundabout method to find it.

The method used in Listing 1 to find a directory entry for a program is analogous to, but not the same as, the process TRSDOS uses to find a file on disk. TRSDOS first looks through the drive-code tables for active disks, then reads a hash-index table (HIT) from the disk's directory (the HIT contains a 1-byte code for each active entry in the directory). These codes are checked against a hash code for the file that TRSDOS is searching for. When TRSDOS finds a matching hash code, it looks at the directory entry to see if the file names match. If they do, it reads information from the directory entry into the FCB and opens the file. This sounds like an unnecessarily complex method of finding a file on a disk, but it is quite efficient in terms of memory use and speed.

The directory entry contains information about the file's status, name, record length, physical length, passwords, and the date it was last written to, along with four 2-byte extents. Each extent contains three pieces of information about one of the file's allocation blocks: the starting cylinder, the starting granule within that cylinder, and the number of consecutive granules allocated to the file. Listing 1 uses this information to replace periods in its table with letters indicating which granules are allocated to the file.

If a file has more than four extents, the last 2 bytes in its file primary-directory entry (FPDE) point to another directory entry—the file extended-directory entry (FXDE)—containing the next four extents. The FXDE can point to a second FXDE, which can point to a third, and so on. Because TRSDOS uses a chained list from one directory entry to another, the only limitations on a file's size and number of extents are the number of free directory entries and the size of the disk.

The last major section of Listing 1 (beginning on line 1780) displays the information collected by the rest of the program. It begins by displaying information

Listing 1 continued

```
00990 ;
01000           REPT    4               ;Write code 4 times
01010             LD      A,(IY)        ;Get cylinder number
01020             CP      -1            ;Is this extent used?
01030             RET     Z             ;No -- return
01040             CALL    ONE_EXT       ;Else find allocation for this one
01050             INC     IY            ;And point to
01060             INC     IY            ;  next extent
01070           ENDM                    ;End of repeated code
01080 ;
01090           LD      A,(IY)          ;Get FXDE flag
01100           CP      -1              ;Is there an FXDE?
01110           RET     Z               ;No -- return
01120           LD      A,(IY+1)        ;Else get new DEC
01130           LD      (DEC),A         ; and save it
01140           JR      SET1            ;Then loop back and start again
01150 ;
01160 ;----------
01170 ;  Clear the gran table before starting to work
01180 ;----------
01190 MAKE_TBL:
01200           LD      A,(MAXCYL)      ;Get number of cylinders
01210           LD      L,A             ;  into HL
01220           LD      H,0
01230           LD      A,(GRANS)       ;Get number of grans
01240           LD      C,A             ;Prepare for HL * C
01250           @@MUL16
01260           LD      H,L             ;Move product to HL
01270           LD      L,A
01280           PUSH    HL              ;Transfer product
01290           POP     BC              ;  to BC
01300           DEC     BC              ;# of grans - 1
01310           LD      HL,GRANTBL      ;HL ==> table
01320           LD      DE,GRANTBL+1    ;DE ==> 2nd byte of table
01330           LD      A,'.'           ;Clear with periods
01340           LD      (HL),A          ;Store the first one
01350           LDIR                    ;Clear entire table
01360           RET
01370 ;----------
01380 ;  Mark allocated granules for one extent
01390 ;----------
01400 ONE_EXT:
01410           LD      L,A             ;Get cylinder number
01420           LD      H,0             ;HL = cylinder
01430           LD      A,(GRANS)       ;A = grans per cylinder
01440           LD      C,A             ;For HL * C
01450           @@MUL16
01460           LD      H,L             ;Move product
01470           LD      L,A             ;  to HL
01480           LD      A,(IY+1)        ;Get starting gran
01490           AND     0E0H            ;Mask off bits 0 - 4
01500           RLCA                    ;Move gran to bits 0 - 2
01510           RLCA
01520           RLCA
01530           ADD     A,L             ;Add to HL
01540           LD      L,A             ;  LSB to L
01550           JR      NC,EXT1         ;Jump if no carry
01560           INC     H               ;  else add carry
01570 EXT1      LD      DE,GRANTBL      ;DE ==> table of grans
01580           ADD     HL,DE           ;HL ==> first allcoated gran
01590           LD      A,(IY+1)        ;Get number of grans
01600           AND     1FH             ;Mask off bits 5 - 7
01610           INC     A               ;Make relative to 1
01620           LD      B,A             ;Store count in B
01630           LD      A,(CHAR)        ;Get character for this gran
01640           INC     A               ;Add one for next time
01650           LD      (CHAR),A        ;  and save again
01660 EXT2      LD      (HL),A          ;Mark this gran
01670           INC     HL              ;Point to next gran
01680           DJNZ    EXT2            ;Loop for all grans
01690           RET
01700 ;
01710 CHAR      DB      'A'-1           ;Display character
01720 ;----------
01730 ;  Display map of grans.
01740 ;  Mimic the "FREE" map
01750 ;----------
01760 DISPLAY:
01770           @@CLS
01780           CALL    INFOLINE        ;Show file info
01790           DASHLINE  '='           ;Line of dashes on screen
01800           LD      HL,GRANTBL      ;HL ==> table of used grans
01810 DISP1     CALL    ONELINE         ;Display one line of map
01820           JR      NZ,DISP1        ;Return of ZF = end of map
01830           CURSLOC                 ;Get cursor location
01840           LD      A,L             ;Cursor column in A
01850           IFEQ_JR 0,DISP2         ;Jump if if's 0
01860           @@DSP   CR              ;Else move to next line
01870 DISP2     DASHLINE  '='           ;Another line of dashes
01880           @@KEY                   ;Wait for a key
01890           RET                     ;We're done
01900 ;-----------
01910 ;  Display information about the file
01920 ;-----------
01930 INFOLINE:
01940           LD      DE,LINEBUF      ;DE==> line buffer
01950           LD      HL,FCB          ;Closed FCB has file name
01960 INFO1     LD      A,(HL)          ;Get a byte
01970           IFEQ_JR ETX,INFO2       ;Go if end of filespec
01980           LD      (DE),A          ;Else move character
01990           INC     DE              ;Bump pointers
02000           INC     HL
02010           JR      INFO1           ;And loop back
02020 ;
```

Listing 1 continued

Listing 1 continued

```
02030 INFO2   LD      A,CR            ;Mark end with <CR>
02040         LD      (DE),A          ;Save it
02050         @@DSPLY LINEBUF         ;Display the line
02060         RET
02070 ;----------
02080 ;  Display one line of gran map
02090 ;  Enter with HL ==> current loc in GRANTBL
02100 ;----------
02110 ONELINE:
02120         PUSH    HL              ;Save pointer
02130         CALL    MAKENUMS        ;Make line-number display
02140         LD      HL,CYL_NUMS     ;HL==> ASCII cylinder numbers
02150         LD      DE,LINEBUF      ;DE==> buffer for building line
02160         LD      BC,8            ;Numbers + space = 8 chars
02170         LDIR                    ;Move it
02180         POP     HL              ;Recover GRANTBL pointer
02190         LD      B,8             ;Up to 8 cylinders per line
02200 LINE1   CALL    MOVCYL          ;Move one cylinder & spaces to linebuf
02210         JR      Z,LINE2         ;Go if short line
02220         DJNZ    LINE1           ;Else loop back
02230 ;  Line is built -- display it
02240 LINE2   LD      A,ETX           ;Line is 80 characters long
02250         LD      (DE),A          ;Terminate the line
02260         PUSH    AF              ;Save the flags
02270         @@DSPLY LINEBUF         ;Put it on screen
02280         POP     AF              ;Recover Carry flag
02290         RET                     ;Send the flags back to caller
02300 ;----------
02310 ;  Move info for one granule to LINEBUF
02320 ;  Test for end of valid list & set ZF to show "done"
02330 ;----------
02340 MOVCYL:
02350         PUSH    BC              ;Save counters
02360         LD      A,(GRANS)       ;Get grans per cylinder
02370         LD      C,A             ;Move to C for block move
02380         LD      B,0             ;BC = grans per cylinder
02390         LDIR                    ;Move the markers
02400         LD      A,9             ;9 chars. per cylinder
02410         LD      IX,GRANS        ;IX ==> grans per cylinder
02420         SUB     (IX)            ;A = number of spaces to add
02430         LD      B,A             ;Put in B for looping
02440         LD      A,' '           ;Space char. for padding
02450 MOV1    LD      (DE),A          ;Save this char.
02460         INC     DE              ;Point to next space
02470         DJNZ    MOV1            ;Loop for all spaces
02480         LD      A,(MOVDCYLS)    ;Get count of number moved
02490         INC     A               ;Add one
02500         LD      (MOVDCYLS),A    ;And save it
02510         LD      IX,MAXCYL       ;IX ==> Maximum cylinders on disk
02520         CP      (IX)            ;Done? -- set Z flag
02530         POP     BC              ;Clean the stack
02540         RET                     ;Send Zflag back for testing
02550 ;
02560 MOVDCYLS DB     0
02570 ;----------
02580 ;  Make ASCII number heading for each display line
02590 ;  Form: 'nnn-nnn ' in CYL_NUMS
02600 ;----------
02610 MAKENUMS:
02620         LD      A,(MOVDCYLS)    ;Get next cylinder number
02630         LD      DE,CYL_NUMS     ;DE ==> destination buffer
02640         CALL    ONE_NUM         ;Convert & store value in A
02650         LD      A,'-'           ;Dash between numbers
02660         LD      (DE),A          ;Store it
02670         INC     DE              ;Bump pointer
02680         LD      A,(MOVDCYLS)    ;Get number again
02690         ADD     A,7             ;Last cylinder in line
02700         LD      IX,MAXCYL       ;IX ==> Maximum number of cylinders
02710         IFLT_JR (IX),MAKE2      ;Jump if not the end
02720         LD      A,(MAXCYL)      ;Else get top number
02730         DEC     A               ;Make relative to 0
02740 MAKE2   CALL    ONE_NUM         ;Convert & store value in A
02750         LD      A,' '           ;Space for end of string
02760         LD      (DE),A          ;Store it
02770         RET
02780 ;----------
02790 ;   Convert value in A to ASCII and store last 3 digits at (DE)
02800 ;   then increment DE to next location.
02810 ;----------
02820 ONE_NUM:
02830         PUSH    DE              ;Save pointer
02840         LD      L,A             ;Move value to HL
02850         LD      H,0             ;HL = value to convert
02860         @@HEXDEC  NUMBUF        ;Convert & store in NUMBUF
02870         LD      HL,NUMBUF+2     ;Point to last 3 chars
02880         POP     DE              ;Recover destination pointer
02890         LD      BC,3            ;Move 3 characters
02900         LDIR                    ;Move them
02910         RET
02920 ;----------
02930 ;  Message area
02940 ;----------
02950 BADFILE$  DB    'Missing or illegal filespec on command line',CR
02960 BADDCT$   DB    'Drive Code Table corrupted',CR
02970 ;----------
02980 ;  Buffer areas
02990 ;----------
03000 FCB     DS      32
03010 FBUFFER DS      256
03020 LINEBUF DS      81
03030 NUMBUF  DS      5
03040 GRANTBL DS      256*8
03050 CYL_NUMS DB     '   -   '
03060 ;
03070         END     START
```

End

about the file; in the current version, only the file's name and drive number are displayed, but it would not be difficult to add the number of extents, the record size, and the file size.

The program then enters a loop, building and displaying each line of the allocation map. I found this to be the most difficult part to write. There is no requirement that the number of cylinders on a disk be evenly divisible by eight. The program must check for the end of the granule table after moving each block of information and be prepared to exit the Display routine when the end of the table is reached.

Pseudo-Operation

Another part of Listing 1 deserves mention. At the end of the program are several buffers defined with the DS assembler pseudo-op. I didn't want to include the buffers, and especially the GRANTBL buffer, in the CMD file because they would increase the program's disk size without serving a useful purpose (the GRANTBL buffer would fill eight sectors). On the other hand, I'd rather not have to check High$ to make sure there is enough room for the buffers, even though there is little chance a program this small would run out of room.

The solution is to use the define space (DS) pseudo-op followed by something that must be saved on disk: the GYL_NUMS buffer. The assembler won't include any of the buffers defined with DS on the disk, but it will put the GYL_NUMS buffer in the correct place. When the program is loaded, TRSDOS has the responsibility to ensure that everything, including the last literal buffer, fits below High$ so the program is freed from that responsibility.

There is a lot of information about the structure of opened FCBs, DCTs, and directory records in both the *Model 4 Technical Reference Manual* and the *Programmer's Guide to LDOS/TRSDOS 6*. Some of it only applies to system routines, but other information can be useful in utility programs. Once you define a problem to solve, it is likely that the information you need is available somewhere inside TRSDOS.■

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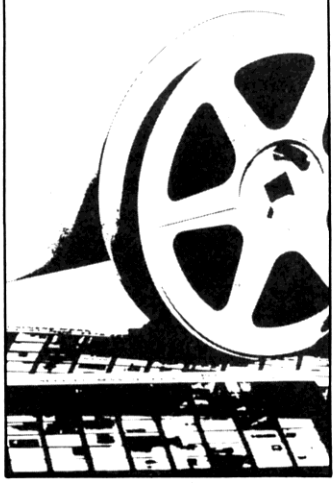

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Program Listing 2. Library of macros used in Listing 1.

```
00100 ;-----------------------------------------
00110 ;  @@CKBRKC -- Check & clear <Break> bit
00120 ;-----------------------------------------
00130 @@CKBRKC  MACRO
00140         DEFINE  @CKBRKC,6AH
00150         SVC     @CKBRKC
00160         ENDM
00170 ;
00180 ;-----------------------------------------
00190 ;   @@CLOSE -- Close a file or device
00200 ;   #FCB defaults to value in DE
00210 ;   AF is altered
00220 ;-----------------------------------------
00230 @@CLOSE MACRO   #FCB
00240         DEFINE  @CLOSE,3CH
00250         IFEQ    %%,1
00260           PUSH    DE
00270           LD      DE,#FCB
00280         ENDIF
00290         SVC     @CLOSE,CHECK
00300         IFEQ    %%,1
00310           POP     DE
00320         ENDIF
00330         ENDM
00340 ;
00350 ;-----------------------------------------
00360 ;   @@CLS -- Clears the screen
00370 ;-----------------------------------------
00380 @@CLS   MACRO
00390         DEFINE  @CLS,69H
00400         SVC     @CLS,CHECK
00410         ENDM
00420 ;
00430 ;-----------------------------------------
00440 ;  @@DIRRD -- Reads directory sector to SYSBUF
00450 ;   and points HL to entry.  If #DRIVE and #DEC
00460 ;   aren't specified, defaults to current values
00470 ;   in BC
00480 ;-----------------------------------------
00490 @@DIRRD MACRO   #DRIVE,#DEC
00500         DEFINE  @DIRRD,57H
00510         IFEQ    %%,2
00520           PUSH    BC
00530           LD      A,#DRIVE
00540           LD      B,A
00550           LD      A,#DEC
00560           LD      C,A
00570         ELSE
00580         IFNE    %%,0
00590           ERR     'Illegal number of args for @@DIRRD'
00600         ENDIF
00610         ENDIF
00620         SVC     @DIRRD,CHECK
00630         IFEQ    %%,2
00640           POP     BC
00650         ENDIF
00660         ENDM
00670 ;
00680 ;-----------------------------------------
00690 ;  @@DSP -- Display one character on the screen
00700 ;      #CHAR defaults to value in C register
00710 ;-----------------------------------------
00720 @@DSP   MACRO   #CHAR
00730         DEFINE  @DSP,02H
00740         PUSH    DE
00750         IFEQ    %%,1
00760           LD      A,#CHAR
00770           LD      C,A
00780         ENDIF
00790         SVC     @DSP,CHECK
00800         POP     DE
00810         ENDM
00820 ;-----------------------------------------
00830 ;   @@DSPLY -- Displays line of text
00840 ;   LINE defaults to value in HL
00850 ;-----------------------------------------
00860 @@DSPLY MACRO   #LINE
00870         DEFINE  @DSPLY,0AH
00880         IFEQ    %%,1
00890           RPUSH   DE,HL
00900           LD      HL,#LINE
00910           SVC     @DSPLY,CHECK
00920           RPOP    HL,DE
00930         ELSE
00940           PUSH    DE
00950           SVC     @DSPLY,CHECK
00960           POP     DE
00970         ENDIF
00980         ENDM
00990 ;
01000 ;-----------------------------------------
01010 ;  @@EXIT -- Exits program
01020 ;  #RETCOD defaults to 0 (no error)
01030 ;-----------------------------------------
01040 @@EXIT  MACRO   #RETCOD
01050         DEFINE  @EXIT,16H
01060         IFEQ    %%,1
01070           LD      HL,#RETCOD
01080         ELSE
01090           LD      HL,0
01100         ENDIF
01110         SVC     @EXIT
01120         ENDM
```

Listing 2 continued

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Listing 2 continued

```
01130 ;
01140 ;-----------------------------------------
01150 ;   @@FSPEC -- Move filespec or devspec
01160 ;       to an FCB or DCB
01170 ;   Test Z / NZ after using!
01180 ;   #Fname and #FCB are both required.
01190 ;   If #Fname is already in HL, use HL as filename
01200 ;   DE is set to #FCB
01210 ;   AF is altered.
01220 ;-----------------------------------------
01230 @@FSPEC MACRO   #FNAME,#FCB
01240         DEFINE  @FSPEC,4EH
01250         RPUSH   BC,HL
01260         IFNE$   #FNAME,HL
01270           LD      HL,#FNAME
01280         ENDIF
01290         LD      DE,#FCB
01300         SVC     @FSPEC
01310         RPOP    HL,BC
01320         ENDM
01330 ;
01340 ;-----------------------------------------
01350 ;  @@GTDCT -- Loads IY with address of drive's DCT
01360 ;     #Drive defaults to value in C
01370 ;-----------------------------------------
01380 @@GTDCT MACRO   #DRIVE
01390         DEFINE  @GTDCT,51H
01400         IFEQ    %%,1
01410           PUSH    BC
01420           LD      A,#DRIVE
01430           LD      C,A
01440         ENDIF
01450         SVC     @GTDCT
01460         IFEQ    %%,1
01470           POP     BC
01480         ENDIF
01490         ENDM
01500 ;
01510 ;-----------------------------------------
01520 ;  @@HEXDEC -- #Value to ASCII & stores at #BUFFER
01530 ;      If #Value not specified, defaults to present value of HL
01540 ;      If no args, #BUFFER defaults to present value of DE
01550 ;-----------------------------------------
01560 @@HEXDEC MACRO  #ARG1,#ARG2
01570         DEFINE  @HEXDEC,61H
01580         PUSH    BC
01590         IFEQ    %%,2            ;;If 2 arguments
01600           RPUSH   DE,HL
01610           LD      HL,#ARG1
01620           LD      DE,#ARG2
01630         ENDIF
01640         IFEQ    %%,1
01650           PUSH    DE
01660           LD      DE,#ARG1
01670         ENDIF
01680         SVC     @HEXDEC
01690         IFEQ    %%,1
01700           POP     DE
01710         ENDIF
01720         IFEQ    %%,2
01730           RPOP    HL,DE
01740         ENDIF
01750         POP     BC
01760         ENDM
01770 ;
01780 ;-----------------------------------------
01790 ;  @@KEY -- Waits for key at *KI device
01800 ;          keystroke returned in A
01810 ;-----------------------------------------
01820 @@KEY   MACRO
01830         DEFINE  @KEY,01H
01840         PUSH    DE
01850         SVC     @KEY,CHECK
01860         POP     DE
01870         ENDM
01880 ;
01890 ;-----------------------------------------
01900 ;  @@MUL16 -- Multiplies 16-bit by 8-bit value
01910 ;     If values aren't specified, defaults to
01920 ;     values in HL and C
01930 ;     Result in HL and A
01940 ;-----------------------------------------
01950 @@MUL16 MACRO   #VAL16,#VAL8
01960         DEFINE  @MUL16,5BH
01970         PUSH    DE
01980         IFEQ    %%,2
01990           LD      HL,#VAL16
02000           LD      A,#VAL8
02010           LD      C,A
02020         ENDIF
02030         SVC     @MUL16
02040         POP     DE
02050         ENDM
02060 ;
02070 ;-----------------------------------------
02080 ;   @@OPEN -- Opens an existing file
02090 ;       or device
02100 ;   Aborts on all errors except changed LRL
02110 ;   #Buffer is required.
02120 ;   #LRL defaults to 0 (256)
02130 ;   #FCB defaults to current value in DE
02140 ;   AF is altered.
02150 ;-----------------------------------------
02160 @@OPEN  MACRO   #BUFFER,#LRL=0,#FCB
```

Listing 2 continued

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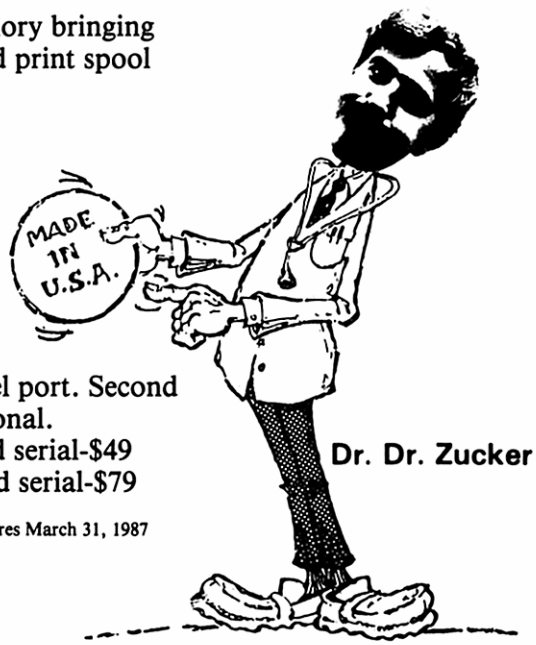

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Listing 2 continued

```
02170           DEFINE  @OPEN,3BH
02180           RPUSH   BC,HL
02190           LD      HL,#BUFFER
02200           LD      B,#LRL
02210           IFEQ    %%,3
02220             LD      DE,#FCB
02230           ENDIF
02240           SVC     @OPEN
02250           RPOP    HL,BC
02260           JR      Z,$1?
02270           CP      2AH             ;;Check for LRL change
02280           JR      Z,$1?
02290           LD      C,A             ;;Else error code to C
02300           LD      A,1AH           ;;@ERROR SVC number
02310           RST     28H
02320 $1?       EQU     $
02330           ENDM
02340 ;
02350 ;-----------------------------------------
02360 ;  CURSLOC -- Return current cursor location
02370 ;     in HL
02380 ;-----------------------------------------
02390 CURSLOC MACRO
02400           DEFINE  @VDCTL,0FH
02410           PUSH    BC
02420           LD      B,4
02430           SVC     @VDCTL
02440           POP     BC
02450           ENDM
02460 ;
02470 ;-----------------------------------------
02480 ;  DASHLINE -- Displays line of dashes or
02490 ;    specified character.  Assumes cursor is
02500 ;    at beginning of line.
02510 ;-----------------------------------------
02520 DASHLINE  MACRO #CHAR
02530           DEFINE  @DSP,02
02540           RPUSH   BC,DE
02550           IFEQ    %%,1
02560             LD      C,#CHAR
02570           ENDIF
02580           LD      B,80    ;;80 characters per line
02590 $1?       SVC     @DSP,CHECK
02600           DJNZ    $1?
02610           RPOP    BC,DE
02620           ENDM
02630 ;
02640 ;-----------------------------------------
02650 ;   DEFINE -- Define a lable unless it
02660 ;       is already defined.
02670 ;-----------------------------------------
02680 DEFINE  MACRO   #LABEL,#VALUE
02690           IFNDEF  #LABEL
02700 #LABEL  EQU     #VALUE
02710           ENDIF
02720           ENDM
02730 ;
02740 ;-----------------------------------------
02750 ;  IFEQ_JR -- Performs a JR if A = #Value
02760 ;-----------------------------------------
02770 IFEQ_JR MACRO   #VALUE,#JUMP
02780           CP      #VALUE
02790           JR      Z,#JUMP
02800           ENDM
02810 ;
02820 ;-----------------------------------------
02830 ;  IFLT_JR -- Performs a JR if A < #Value
02840 ;-----------------------------------------
02850 IFLT_JR MACRO   #VALUE,#JUMP
02860           CP      #VALUE
02870           JR      C,#JUMP
02880           ENDM
02890 ;
02900 ;-----------------------------------------
02910 ;  IFNE_JR -- Performs a JR if A <> #Value
02920 ;-----------------------------------------
02930 IFNE_JR MACRO   #VALUE,#JUMP
02940           CP      #VALUE
02950           JR      NZ,#JUMP
02960           ENDM
02970 ;
02980 ;-----------------------------------------
02990 ;   RPOP -- Version 2
03000 ;     Pops 0 to 6 registers from the stack
03010 ;     Example:  RPOP   BC,DE,HL,IX
03020 ;-----------------------------------------
03030 RPOP      MACRO   #R1,#R2,#R3,#R4,#R5,#R6
03040           IFGT    %%,0
03050             POP     #R1
03060           ENDIF
03070           IFGT    %%,1
03080             POP     #R2
03090           ENDIF
03100           IFGT    %%,2
03110             POP     #R3
03120           ENDIF
03130           IFGT    %%,3
03140             POP     #R4
03150           ENDIF
03160           IFGT    %%,4
03170             POP     #R5
03180           ENDIF
03190           IFGT    %%,5
03200             POP     #R6
03210           ENDIF
```

Listing 2 continued

Listing 2 continued

```
03220          ENDM
03230 ;
03240 ;-----------------------------------------
03250 ;   RPUSH -- Version 2
03260 ;     Pushes 0 to 6 registers onto the stack
03270 ;     Example:  RPUSH   BC,DE,HL,IX
03280 ;-----------------------------------------
03290 RPUSH    MACRO   #R1,#R2,#R3,#R4,#R5,#R6
03300          IFGT    %%,0
03310            PUSH    #R1
03320          ENDIF
03330          IFGT    %%,1
03340            PUSH    #R2
03350          ENDIF
03360          IFGT    %%,2
03370            PUSH    #R3
03380          ENDIF
03390          IFGT    %%,3
03400            PUSH    #R4
03410          ENDIF
03420          IFGT    %%,4
03430            PUSH    #R5
03440          ENDIF
03450          IFGT    %%,5
03460            PUSH    #R6
03470          ENDIF
03480          ENDM
03490 ;
03500 ;-----------------------------------------
03510 ;     Invoke a TRSDOS 6 SVC
03520 ;     If "check" is specified, exit
03530 ;     through @ERROR if NZ flag is returned
03540 ;     from TRSDOS.
03550 ;-----------------------------------------
03560 SVC      MACRO   #NUM,#CHECK
03570          LD      A,#NUM          ;;A = SVC number
03580          RST     28H             ;;Perform SVC
03590          IFGT    %%,1            ;;More than one argument?
03600            JR      Z,$1?         ;;Go if no error
03610            LD      C,A           ;;Put error code in C
03620            LD      A,1AH         ;;@ERROR SVC number
03630            RST     28H           ;;Exit through @ERROR
03640 $1?        EQU     $             ;;Here if no error
03650          ENDIF
03660          ENDM
03670 ;
```

End

Bad Connections

Marty Miller of Addison, IL, writes that we had our wires crossed in Rod and Joyce Kreuter's "Let There Be Light Pens," (November 1986, p. 54). Rod Kreuter says Fig. 1 on p. 56 incorrectly shows how to connect the four wires to pins 1–4 of the 9-pin "D" connector. Reading from top to bottom, the correct pin order is 1, 4, 3, and 2.

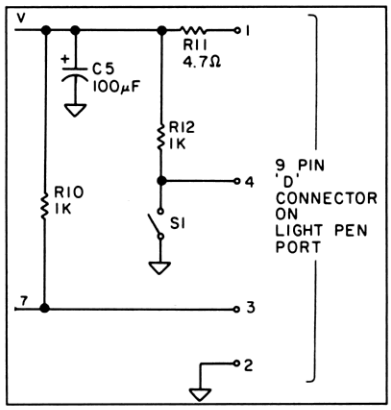

Figure. Correct placement of wires to the 9-pin "D" connector.

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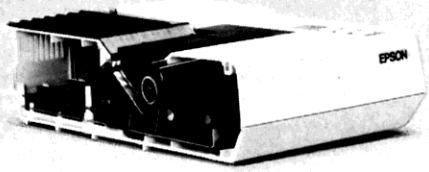

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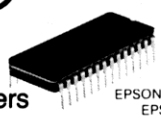

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How to Read *80 Micro*

If you're new to computing, you might be overwhelmed by some of the articles and programs in *80 Micro*. We admit that most of our articles assume you know something about how to use your machine. But we also don't think you should be intimidated by all of the jargon and odd-looking programming code. You can use many of the programs in *80 Micro* even if you only know how to turn on your machine and boot up a disk.

The following guide will help you to get started. We'll take you step by step through the process of entering a program into your computer and running it. (If you have any trouble with the terms, refer to the Glossary.)

First Things First

Let's say you've found a program in *80 Micro* that you'd like to use. Your first step is to determine whether you can use the program on your computer. The information you need is in the System Requirements box, usually toward the front of the article. Figure 2 is the box for a mythical program we'll call Sample/BAS.

The first line of the box tells you what computer the program runs on. Sample/BAS runs on the Model 4. The next line tells you how much memory you need—in this case, 128 kilobytes (K). Line 3 tells you that you must have the TRSDOS 6.2 disk operating system (DOS); in other words, the program won't run under TRSDOS 6.0. (The version should be stamped on the disk Tandy provides with the machine.) The fourth line says that the program is written in Basic.

Let's look at each line in more depth.

The computer. We will always tell you whether the program runs on the III, 4, or 1000. (The Model 4 includes the 4P and the 4D.) If the box says "Model III," the program will not run on the 4 or 1000. If it says "Model 4" and "Tandy 1000," the program won't work on the Model III.

We test our programs only on the III, 4, and 1000. A Tandy 1000 program will probably run on the 1200, 2000, and 3000, but we can't guarantee it. Many of our programs—particularly ones written in Basic—will run on other systems, such as the Models I, II, 12, 100, or the Color Computer, but again, you'll have to find out for yourself. The number of Tandy and TRS-80 computers currently in use prohibits us from testing our programs on every machine.

Occasionally, you'll see a line that reads something like "Model 4 with changes." This means that you'll have to change some of the original program lines (we tell you what to change) to make it work on the 4.

Memory requirements. This is simple enough; it tells you how much memory you need to accommodate the program. If the box says "128K RAM," the program won't work on a 64K machine.

Operating system. We'll only give you this information if the program is specific to a particular operating system or systems. Otherwise, you can assume that the program will work with all DOSes for the pertinent machines.

The language. In the majority of cases, this line will tell you that the program is written in Basic, Disk Basic, assembly language, or a combination of Basic and assembly.

A Basic program will run under any Basic provided by Tandy with your machine. In other words, if it's a Model III program, it'll work with Level II Basic or Disk Basic.

If the box says "Disk Basic," the program will not run on a cassette system. This applies only to Model III owners.

If the box says "Assembly language," the program is written in assembly code. You might need an editor/assembler to use the program (more on editor/assemblers below).

If the box says "Disk Basic" and "Assembly language," the program combines both. Again, you might need an editor/assembler.

If you need an editor/assembler, the next line will tell you so. An editor/assembler is a special piece of software you use to enter, save, and run assembly-language programs. Occasionally, we will include a Basic program that will create the assembly-language program for you. If so, we'll tell you that the editor/assembler is optional.

The System Requirements box will sometimes give you other information, such as whether the program requires a printer or a particular piece of hardware.

Entering the Program

You've read the System Requirements box and are certain that the program will run on your computer. What's next? Let's use the Basic program in Program Listing 1, called Guess/BAS, as an example. It will run on the Models III and 4 as well as the Tandy 1000.

First, turn the machine on, insert a DOS disk in drive zero, and press the reset button. (Do not use your original DOS disk; make a backup. See the manual for instructions.) Answer the date and time prompts if necessary. At the TRSDOS Ready prompt (>A on the 1000), type BASIC (you can type it in lowercase if you want). The disk-drive light will go on, meaning that the computer is retrieving the program Basic from your disk and putting it into memory. After a few seconds, a copyright notice will appear on the screen, along with a Ready prompt and a cursor. (The notice and prompt will vary slightly among machines.)

Below is a short, two-line program to warm you up for entering longer listings. Type the lines exactly as presented, pressing the enter key after each one.

```
10 CLS <enter>
20 PRINT "Hello" <enter>
```

Now type LIST. The two lines you just typed will appear on the screen. This means that the program

```
00220 UP        EQU     $
00230           LD      A,(IX+TOP_ROW)
00240           LD      (IX+CUR_ROW),A
00250           CR_2_NL
```

Fig. 1. Example of assembly-language code.

System Requirements

Model 4
128K
TRSDOS 6.2
Basic

Fig. 2. System Requirements box for Sample/BAS.

Glossary

Assembly language. This programming language looks like the sample in Fig. 1. If you're a beginner, we recommend that you stay away from assembly language until you become familiar with your computer.

You'll need an editor/assembler to enter and save assembly-language programs. You cannot enter an assembly-language program into Basic.

Basic. This is the most commonly used programming language among Tandy and TRS-80 users. A Basic program will look like the example in Program Listing 1.

Many forms of Basic exist; some are alike and some aren't. For instance, a program written in Apple Basic won't run on the 4 or 1000. However, many Model 4 programs will run on the 1000. Some Basics you might encounter are:

- Level II Basic. This Basic is built into the Models I and III, and the Model 4 in Model III mode. You can access it by holding down the break key while pressing the reset button. You must have a cassette player to store programs and data in Level II Basic.
- Disk Basic. The common term for the Basic provided on Model I, III, and 4 DOS disks.
- GW-Basic. A more advanced version of the language that comes with MS-DOS machines.
- BasicG. The Basic that comes with Tandy's high-resolution board for the Models III and 4.
- BasicA. Standard IBM PC Basic.

Debugging. The process of removing errors from a program so that it will run properly.

DOS. This is a disk operating system, which is the software that lets you communicate with the computer. The Model 4 uses TRSDOS 6.2, and the Tandy 1000 uses MS-DOS. The Model III uses TRSDOS 1.3. To use the Model 4 in Model III mode, you must buy a Model III DOS.

Model III and 4 owners can buy several DOSes made by companies other than Tandy. Many Model 4 users buy LDOS for the Model III mode, since you can access LDOS data from TRSDOS 6.2 and vice versa.

Other DOSes Model III and 4 owners might run into are Dosplus, Newdos, and Multidos, although only Dosplus is still available.

Model 4 and Tandy 1000 owners get a DOS disk with their computers. When you put your DOS disk in your disk drive and push the reset button, the computer looks for the DOS and loads it automatically into memory. Without a DOS on your disk, you cannot access the information on that disk or use most programs.

Many DOSes are machine specific. For example, you cannot use TRSDOS on a Tandy 1000.

Editor/assembler. See assembly language.

Program. A program comprises the instructions that tell the computer to do something. A program can be simple, like the one in Program Listing 1, which asks you to guess a number from 1 to 10. On the other hand, it can be vastly complex, like most commercial software.

Programming language. The programming language is what the programmer uses to write programs. Like human languages, a programming language has a vocabulary and a syntax. The computer "reads" the language and translates it into an action.

RAM. Random-access memory is empty until you put something in it. For example, when you load a DOS, you put it into RAM. When you turn your machine off, data in RAM disappears.

ROM. This is read-only memory. A ROM has a program or programs permanently burned into it; the code sits there whether or not the computer is on.■

is now in memory. To run it, simply type RUN. The computer will execute the program.

Let's go on to Listing 1. Type NEW to erase the above program from memory. Now, using the procedure described above, enter Guess/BAS. Be sure to type everything—spaces and all—*exactly* as they appear in the listing.

Use the backspace (4D and 1000) or left arrow (III, 4, and 4P) to correct errors while typing. If you've already pressed the enter key and see a mistake, the easiest solution is to simply retype the entire line. There are much simpler and more sophisticated ways to correct errors; refer to your manual for instructions on program editing (Chapter 3 of the *Model 4 Disk System Owner's Manual*, Chapter 23 of the *Model III Operation and Basic Language Reference Manual*, and Chapter 4 of the *Tandy 1000 Basic Reference Manual*).

Press enter at the end of the program line, not at the end of the printed line.

When you're done, list the program and proofread it. Reenter or edit lines containing typographical errors. If you have a printer and would like a paper copy to proof, type LLIST.

Program Listing 1. Guess/BAS.

```
10 'The computer picks a number, and
you must guess it.
20 'After 10 rounds, the computer wi
ll print your totals and average.
30 AVERAGE$=" .###"
40 FOR LOOP=1 TO 10
50 CLS
60 NUMBER=RND(10)
70 LINE INPUT "Pick a number from 1
to 10: ";GUESS$
80 PRINT:IF VAL(GUESS$)=NUMBER THEN
PRINT "That's correct!":RIGHT=RIGHT+
1: ELSE PRINT "Sorry, but that's wro
ng!":WRONG=WRONG+1
90 FOR TIMER=1 TO 800:NEXT TIMER:NEX
T LOOP
100 CLS:PRINT "Correct guesses: ";RI
GHT
110 PRINT "Wrong guesses: ";WRONG
120 PRINT:PRINT "Your Average: ";
:PRINT USING AVERAGE$;RIGHT/10
130 GOTO 130
```

End

Once you're certain that you've typed in the program accurately, save it to disk (type SAVE "GUESS/BAS"). Always save your programs before you run them; this will protect you should running the program cause your computer to lock up. (When the computer locks up, it won't respond to any keyboard input and usually requires that you press the reset button.)

Now type RUN and press the enter key. If all is well, you'll get to play a little guessing game with the computer. To exit the program, press the break key; the Ready prompt should return.

That, in a nutshell, is how you enter, save, and run a Basic program.

Debugging

Nobody's perfect when it comes to entering program listings. Unfortunately, even the slightest typographical error can cause your program to malfunction.

In most cases, you'll have no trouble identifying such malfunctions. The program will usually stop running and the computer will flash an error message on the screen. Sometimes the program will run but won't do what it's supposed to do. In extreme cases, the program might cause your computer to lock up.

Sometimes the computer will help you out by telling you the line in which the error occurred ("Syntax error in 20," for example). Other times you'll have to do some careful proofreading to find the mistake. In either case, once you find the error you'll have to fix it. See your manual for instructions on editing.

Typos can be infuriatingly difficult to root out. You'll be amazed at how well they hide. Here are some common errors to look for:

- A colon where a semicolon should be, or vice versa.
- A comma in place of a period, or vice versa.
- A minus sign (–) in place of an equals sign (=), or vice versa.
- Swapped greater-than (>) and less-than (<) signs.
- A missing parenthesis.
- A missing quotation mark (").
- Mixed-up operators (*, /, +, –).
- Swapped characters; for example, B's instead of 8's, zeros for O's, and the letter l for the number 1.

We don't have room here to go into a lengthy discussion on debugging techniques. But the above hints should get you started.

A Little Help

Program Listing 2, Checksum/BAS, is a simple program proofer that will help you check your listing after you've entered it. It uses the checksum values at the far right of each program listing to identify typographical errors. The text accompanying Listing 2 will tell you how to use it. Checksum/BAS appears each month on Load 80 (see p. 6 for ordering information).

Another program that might be helpful is MakeData, which appeared on p. 64 of the June 1986 issue. This utility lets you automatically enter long Data statements (a Data statement looks like this: DATA 12,233,45,65,121), thus reducing the possibility of a costly error. MakeData is also available on the June edition of Load 80.

Finally, Model III owners can use Loc-Editor, a proofing program originally published on p. 206 of the April 1982 *80 Micro*. Loc-Editor traps errors and displays the line in which the error occurred. It is available each month on Load 80.

Got a Problem?

80 Micro's technical staff checks and double-checks all programs before they're published. The listings are printed out directly from disk, thus eliminating input errors. The listings in the magazine are therefore debugged, and the programs will run if typed in correctly.

Alas, no one is perfect, and occasionally a rare production goof will cause a program to act up. If you're completely convinced that the error is ours and not yours, write or call our technical staff (*80 Micro*, 80 Pine St., Peterborough, NH 03458, 603-924-9471).■

Program Listing 2. Checksum/BAS. Use this to check programs you've entered from 80 Micro *for typographical errors.*

```
10 'CHECKSUM/BAS by Beve Woodbury  --  2/7/86                    '*    97
20 CLEAR 1000:CLS:PRINT@140,"VERIFY CHECKSUMS ON PROGRAM"        '*  3714
30 PRINT:PRINT:INPUT "Enter name of File to verify";F$           '*  4278
40 PRINT:PRINT:PRINT "List Checksums to:"                        '*  3234
50 PRINT TAB(20) "<P>rinter":PRINT TAB(20) "<S>creen"            '*  3629
60 PRINT:PRINT:PRINT TAB(30);"? ";                               '*  2149
70 K$=INKEY$                                                     '*   727
80 IF K$="P" OR K$="p" OR K$="S" OR K$="s" THEN 90 ELSE 70       '*  3272
90 PRINT K$:IF K$="P" OR K$="p" THEN LP=1                        '*  2440
100 OPEN "I",1,F$                                                '*   899
110 IF EOF(1) THEN CLOSE:END                                     '*  1715
120 LINE INPUT#1,L$:L=VAL(LEFT$(L$,6))                           '*  2276
130 IF Z=2 AND L=0 THEN 110                                      '*  1529
140 A=VARPTR(L$):GOSUB 280:Q=PEEK(A)                             '*  2246
150 LS=PEEK(A+1):MS=PEEK(A+2):A=MS*256+LS:GOSUB 280              '*  3117
160 IF INSTR(L$,"'") THEN GOSUB 300                              '*   988
165 IF RIGHT$(L$,1)=" " THEN IQ=Q:GOSUB 320                      '*  2514
170 Z=2                                                          '*   385
180 FOR K=1 TO Q:P=PEEK(A):CS=CS+P:A=A+1:NEXT K                  '*  2946
190 IF CS=0 THEN 110                                             '*  1133
200 IF CS<100000! THEN D$="-"                                    '*  1530
210 IF CS<10000 THEN D$="- "                                     '*  1482
220 IF CS<1000 THEN D$="-  "                                     '*  1467
230 IF CS<100 THEN D$="-   "                                     '*  1452
240 IF LP=1 THEN LPRINT "Line";L;D$;CS,:CS=0:GOTO 110            '*  3372
250 PRINT "Line";L;D$;CS:CS=0:X=X+1                              '*  2283
260 IF X=14 THEN X=0:PRINT TAB(30) "Press <ENTER> to continue."
    ELSE 110                                                     '*  4929
270 K$=INKEY$:IF K$<>CHR$(13) THEN 270 ELSE 110                  '*  2708
280 IF A>32767 THEN A=(65536!-A)*-1                              '*  1871
290 RETURN                                                       '*   667
300 I=INSTR(L$,"'"):IQ=I-1                                       '*   943
310 IF LEN(L$)=INSTR(L$,"'") THEN RETURN                         '*  1462
320 FOR I=IQ TO 1 STEP -1                                        '*  1482
330 C=ASC(MID$(L$,I,1))                                          '*  1263
340 IF C<33 THEN NEXT I                                          '*  1378
350 RL$=LEFT$(L$,I):Q=LEN(RL$):RETURN                            '*  2320
```

End

Using the Checksum Program

Basic program listings in *80 Micro* include a checksum value at the end of each line. This value is the sum of the ASCII values of all characters and spaces in the line, excluding remarks. You can use these values to test the accuracy of your typing after you copy listings from the magazine.

To check your typing, follow these steps:

- Type in program code *exactly* as listed, omitting the indentations (when program lines continue to a second or third magazine line), the '* characters and checksum values, and comments.
- Save the program in ASCII format with the command SAVE "file name",A.
- Load and run Checksum (see Program Listing 2). The program will prompt you for the name of the file to be verified and give you the option of sending the line numbers and checksum values to the printer or to the screen. Enter P for printer, S for screen.

When printing to the screen, Checksum lists 14 lines and then waits for you to press the enter key. You can type in comment lines.

- Compare the displayed line numbers and checksum values with the checksums shown in the listing. Find and correct errors in lines having checksum values that don't match.

—Beverly Woodbury
Technical Editor

Continued from p. 39

Publish It Yourself
by Jeffrey Parker

★★★★

Clickart Personal Publisher runs on the Tandy 1000, 1200, or 3000 (512K) and requires two disk drives or one disk drive and a hard drive. Software Publishing Inc., 1901 Landings Drive, P.O. Box 7210, Mountain View, CA 94039-7210, 415-962-8910. $185.

A mouse is a mouse, pictures are pictures, and text is text, you say. Many do not realize the difference between desktop-publishing software and a plain PC Paint-type program. But there *is* a difference. A desktop-publishing program is designed to make what you write look professional, like a commercial product. It lets you play with text and graphics, although not in the same framework. Just try to reproduce a page of the daily newspaper with a paint program.

Enter Clickart Personal Publisher: It's born for the Mac, bred for the MS-DOS market, and easy to run on your Tandy machine. Personal Publisher is not geared to crank out *The Wall Street Journal*, but it can produce small-scale jobs such as a souped-up sales letter, fancy memos, or a multipage newsletter with graphics. If you are an experienced user, this program can reward you with attractive reports and announcements. If you are an amateur, it can be perfect for a club newsletter, a school project, or any other task that combines printed material and pizazz.

Personal Publisher has several powerful features and some of the best documentation I have ever seen. It comes with a tutorial containing realistic examples of how to operate the program, including accurate reproductions of what you should see on screen. The manual has an index, a trouble-shooting guide, a glossary, and a catalog of printer options that includes laser-printer support.

Separation Is the Key

Pretend that you are looking at an overhead slide projection of text. Overlay the text with a diagram of a car and realign the text to wrap around the diagram so both text and car are still on their own overlays. Change the type style and shift the line spacing accordingly, and you should have an idea of how Personal Publisher operates. It works on a separation model—a true publishing concept—and this is where it gets its graceful handling. Continue the above scenario by putting a hand icon in a box around the car and stretching the box to encompass the car; the text is neatly wrapped around the car in less time than it takes to read this.

Unlike paint programs, Personal Publisher keeps the text and the graphics entirely separate. You can easily jump between the overlays but can't manipulate text while moving an image. Far from a limitation, this is the only sensible way to handle these separate elements.

Personal Publisher comes with a unique feature called Snapshot, a command argument that lets you take a picture of any screen image from any software and convert it into an art file that Personal Publisher can read. I was a little startled when it actually worked. Also included is a built-in image editor to reconfigure the snapshot to the correct display parameters, such as a 40- or 80-column image, black and white or color, and so on. This feature alone is worth the program's price.

To get the most out of Personal Publisher, you need an enhanced graphics adapter (EGA) or Hercules graphics card, but it works with the standard IBM color graphics adapter (CGA) supplied with Tandy's PC compatibles. It supports many popular printer drivers (including Tandy printers), as well as the Microsoft or Mouse Systems mouse or an equivalent. A "no mouse" command hands control to the cursor arrows on the keyboard, while the F10 key acts as a toggle for the mouse button. Whether or not you use the mouse, the keyboard is always available.

Publisher comes with several macro art files from which you cull images and then use them on screen. Imagine going to that paint program now and taking a snapshot of all your graphic images or a font you like that Publisher does not include, and then using it as a transformed Clickart file. It's really as clean and easy as I have described. Personal Publisher comes with 12 fonts; more are available, but you must purchase them separately.

Conclusion

If I had to pick a major drawback to this program, it would be the time necessary to call up images and redo a screen. Also, the package and documentation give conflicting memory requirements. Some places indicate 384K RAM is required, and elsewhere it is 512K. Be advised that this program runs in a 512K environment only.

I tested Personal Publisher on a Tandy 1200 HD with a high-resolution RGB monitor and standard graphics card; it worked fine. Whether you want to experience a versatile desktop-publishing package or just want to put out an attractive club newsletter, this program is a best buy. While Personal Publisher is a serious program for professionals, it is also a lot of fun.■

Cross Yourself
by David Engelhardt

★★★★

TRSCROSS runs on the Tandy 1000, 1200, or 3000 (128K) and requires one disk drive. Powersoft Products, 17060 Dallas Parkway, Suite 114, Dallas, TX 75248, 214-733-4475. $89.95.

If you have access to both MS-DOS and Model I, III, or 4 computers, you might someday want to transfer a file or program from one machine to the other. The most laborious and time-consuming method is transferring one line at a time by hand. Alternatives include sending information via the RS-232 ports—a long and involved process—or finding a utility program that does it for you. An example of the latter is TRSCROSS by Breeze/QSD.

TRSCROSS runs on an MS-DOS machine, regulating the disk-controller chip to read from and write to a TRS-80 double density disk. Using a standard Model I doesn't work unless it has the double-density-controller upgrade. ANSI.SYS should be installed in your Config.SYS file if you're using MS-DOS version 2.11, or TRSCROSS crashes. The program is not copy-protected and runs on any MS-DOS computer equipped with the memory-expansion card holding a DMA controller chip.

Simple Conversions

TRSCROSS does not accurately convert Basic programs from one machine to another, although it does perform minor conversions when moving from the TRS-80 disk to an MS-DOS system disk. It converts the Print Using command and changes Print@ statements to Locate and Print. Once the program is in the target machine, any major conversion is up to you.

When testing TRSCROSS, I transferred Basic programs and data files between TRS-80 and MS-DOS disks. The programs ended up with alterations and syntax errors that were, nonetheless, easy to locate and fix. Remember that you should carefully watch the conversion process when moving Basic programs from one format to another. I found no problems in transferring data files, and you can port Superscripsit files to an MS-DOS machine if you have saved them in ASCII format.

Transfer Options

TRSCROSS is menu-driven. Copy the TRSCROSS files onto an MS-DOS disk containing an operating system and install it in drive A. The Radio Shack TRS-80 disk goes in drive B. The main menu

contains six options: copy to or from a TRS-80 disk, format TRS-80 disks, purge programs, display directories, or exit. You make menu selections using number, function, and cursor-control keys. Home, end, and page keys scroll through options and commands. Some screens incorporate a help text should you run aground or need a quick reminder.

You can transfer most files across systems as long as they have ASCII, Basic, DAT, or MP-type file-name extensions. TRSCROSS keys on the extension and automatically marks the file type, or you can suppress this function. You can mark files as ASCII, binary, Basic, or supers, or use no mark for no transfer.

You should not move machine-dependent object files, as they won't run on different operating systems. Transferring binary data-disk files results in a mirror image of the original. TRSCROSS supports the use of wild-card mask characters (*.*) for multiple transfers in some cases. Copying files with TRSCROSS is slow because of the complex actions required to access a TRS-80 disk. To keep you from wringing your hands during the wait, an interactive information line monitors the source drive, providing a constant update on the file and disk location.

Another useful option purges unwanted programs from the TRS-80 disk. If you've done a lot of transferring and run out of space, it's much easier to delete files with TRSCROSS than by booting up your Model I, III, or 4. TRSCROSS also displays directories and free space left on either TRS-80 or MS-DOS disks.

The program lets you format disks in TRSDOS 6/LDOS, TRSDOS 1.3, and Newdos/80 configurations. Options include the number of cylinders (35 or 40) and single- or double-sided formatting. TRSCROSS verifies the disk in the format process and displays errors should they occur. TRSCROSS must format a TRS-80 disk before the transfer process can begin. It formats using a gap-patch method, meaning that a gap exists between the disk index hole and its first sector. The gap-patch installation has no discernible effect when a TRS-80 accesses the disk in normal operation.

Although TRSCROSS had no problem reading a Model III disk, it could not read Model 4 disks without using the TRSCROSS format process. Transfer your Model 4 files to the newly formatted disk and use TRSCROSS to move files to another computer. You can try moving files without formatting a disk, but you might get an error message for your trouble.

I was impressed with TRSCROSS and its capabilities, keeping in mind that it wasn't designed to convert programs but to easily transfer programs and files. As such, it's a super time-saver.■

Ztime1

★★★

Ztime1 runs on the Model III, 4, 4D, or 4P with CP/M 2.2. Kenmore Computer Technologies, P.O. Box 635, Kenmore, NY 14217, 716-877-0617. $69 for the kit, $89 assembled and tested, $29 for the bare board, $14 for the extender cable.

Ztime1 is a hardware clock board that requires no external ports, unlike those that use the expansion port connector, and is small enough (½ by 2 by 3 inches) to fit into any computer. You insert the clock into your computer's Z80 socket on the main circuit board. A small button-style watch battery provides power backup; according to KCT it should last at least one year.

To install Ztime1, carefully remove the Z80 chip from your computer and plug it into the clock board; then insert the board into the Z80 socket. You must also change the port addressing on the clock board. As delivered by KCT, Ztime1 uses the base port address of E0 hexadecimal (hex); for a TRS-80 computer, you must change this address to 20 hex. To do this, cut the trace between the two points labeled E0 and then add a jumper wire between the points labeled 20 hex.

The accompanying documentation includes circuit diagrams, parts lists, and the clock chip's data specifications, as well as a standard instruction manual. Unfortunately, it doesn't directly address the peculiarities of the TRS-80 line because Ztime1 is designed for *all* Z80 computers.

Ztime1 includes software to set and read the time and date on the clock; it also includes source code for Basic, Pascal, and C. The problem for TRSDOS users is that the programs are CP/M-based and come in 8-inch IBM, 5¼-inch Kaypro, Xerox 820, or Osborne format. A utility program configures the C and Pascal versions to a base port address other than E0 hex, eliminating the need to recompile them. If you have Montezuma Micro's CP/M 2.2, the programs will work fine. If you don't have CP/M capability, don't despair. The source code also comes on a convenient printout.

In TRSDOS, you must use the Basic program listing to set the date and time and to read it later. If you're a Basic programmer, it's easy to take KCT's 6K program and trim it down to a more efficient 1.5K. You can even disable the TRSDOS date and time prompts, use the Auto command to run a Basic program that reads the date and time, and poke it into the TRSDOS clock area. Machine-language programmers should be able to write a routine to do this from DOS. You can also create a Basic, C, or Pascal routine in your programs to get the exact date and time for any purpose.

With Ztime1, you'll never have to mess with DOS date and time prompts again. It is reasonably priced, easy to install, and should work with any software.

—Terry Kepner

Scenery Disks

★★★

Flight Simulator Scenery Disks run on the Tandy 1000, 1200, or 2000 and require one disk drive and Flight Simulator II, Microsoft Flight Simulator, or Jet. Sublogic Corp., 713 Edgebrook Drive, Champaign, IL 61820, 217-359-8482. $19.95 each.

★★★★

Star Scenery Disks run on the Tandy 1000, 1200, or 2000 and require one disk drive and the above-mentioned simulator programs. Sublogic Corp. $19.95 each.

If you were thrilled by Flight Simulator, you've probably been awaiting with high expectations the arrival of Sublogic's new scenery disks. Although I was impressed with the original program's scenic details, I wanted more. The 12 new scenery disks cover the 37 NOAA (National Oceanic and Atmospheric Administration) sectional aeronautical charts for the U.S. Now you can fly all over the country.

The IBM PC version works fine on Tandy hardware. You must have already loaded Flight Simulator II, Microsoft Flight Simulator, or Jet in order to use a scenery disk. A brief manual covers differences between Flight Simulator versions and their use on specific computers. You also get a directory of airports and navigation aids, including navigational charts of each sectional on the disks.

You enter Flight Simulator as you normally would; then insert a scenery disk and press control-E. After you load the scenery data, choose the sectional you want to play and re-enter the simulator. First, you'll notice that most of the neat details from Flight Simulator—roads, mountains, bridges, buildings, airport taxiways, and smaller local airports—are not present on the scenery disks. For a non-pilot type like myself, this was a letdown.

On the plus side, the scenery disks provide a much wider flight area with several destinations. For those who enjoy charting a flight path, the possibilities have expanded considerably. For those who fly by the seats of their pants, the horizons are actually narrowed by the lack of topological detail.

When I contacted Sublogic, they explained that it was too difficult to include

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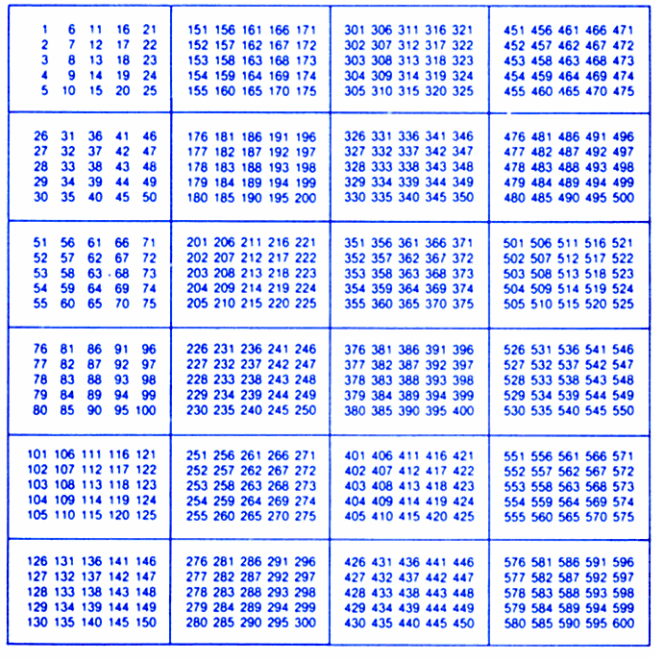

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Dalton, MA 01227

scenery details as originally planned due to memory constraints on some computers; instead, they focused on cross-country navigation features. As a consolation prize, the company has issued the Star scenery disks for those who would rather go sight-seeing than solve navigational problems.

The Star series offers detailed scenery for much smaller sectional areas. The Star scenery disk for San Francisco, for example, delivers the additional scenery details one would expect, such as the Golden Gate Bridge, neighboring mountains, and skyscrapers. You can even buzz Alcatraz Island in the bay. Load and operate the Star disks as you would the other scenery disks.

Flight Simulator and Jet pilots now have a distinct choice in how to expand upon the original programs. If you enjoy the navigational and technical aspects of flying, Sublogic's scenery disks will satisfy you. However, if you enjoy looking out the windows, skip the other set and snatch up the Star scenery disks.

—Robert Keller

Memcheck

★★

Memcheck runs on the Model 4, 4P, or 4D and requires one disk drive and TRSDOS 6.2. RSI Software, P.O. Box 6094, Deltona, FL 32728, 305-574-6469. $29.95.

If you suspect that your Model 4 is losing its memory, Memcheck can verify or dispell your fears. This inexpensive diagnostic program examines a Model 4's RAM for potential hardware problems and can test up to 1 megabyte (MB), in case you have one of the newer extended memory boards.

Diagnostic utilities fall into two classes: one looks at hardware and displays its findings in depth on the screen, and the other goes through the motions and signs off with an unsatisfying "you have passed the test." Since Memcheck falls into the latter category, it's usefulness is tough to assess.

Initially, Memcheck lets you run a simple, complex, or combination test; change the amount of recognized memory; or exit from the program. In the menu's upper right corner is a memory-size display. If the stated amount disagrees with the computer's actual memory size, select the option to change recognized memory. Choose one of six preset memory increments (64, 128, 256, 512, 768, or 1,024K) or instruct the program to recalculate the amount of memory. A simple memory test involves setting and checking for all bits on and off. A complex test consists of setting and checking for two alternating bit patterns; a combination test diagnoses RAM in both modes.

After completing these tests, Memcheck presents a display informing you whether your memory banks have passed or failed. If any bank fails, Memcheck moves into the extended checking mode, investigating failed memory banks for all possible bit-image combinations. Memcheck then presents a display for determining the bad bits in the RAM bank.

Memcheck works as a simple peek inside your computer but is not without problems. My Model 4 has 1MB of RAM and, even after repeated attempts, Memcheck refused to automatically recognize more than 64K. While I could manually set the proper amount, correct automatic recognition would be helpful.

Unless you suspect a memory problem or have just completed a memory upgrade, a memory-checking utility is of no practical use. Although Memcheck works and does not cost too much, you will probably use it once and then put it on your shelf to collect dust.

—Mark D. Goodwin

Opt-Tech Sort's real strength lies in its large number of sorting and merging options.

Opt-Tech Sort

★★★★★

Opt-Tech Sort runs on the Tandy 1000, 1200, or 3000 and requires two disk drives. Opt-Tech Data Processing, P.O. Box 678, Zephyr Cove, NV 89448, 702-588-3737. $149.

Writing a simple sort routine in most languages is not difficult. Creating a complex routine to handle records of various lengths, merging files as they are sorted, sorting information in non-standard sequences, and doing it all conveniently is not easy. But that is what Opt-Tech Sort can do, and more. It is a collection of programs and subroutines for use either from MS-DOS or inside a program written in one of more than 40 programming languages. It includes a large number of features and options, and yet the program rarely feels complicated to use.

If you use Opt-Tech Sort with MS-DOS, it seems like a powerful utility program. It prompts you for the name of an input, output, and control file. Instead of sending output to a file, you can instruct Opt-Tech Sort to send its output directly to a printer or the screen. If your sorting specifications are simple, enter them directly from the keyboard instead of having Opt-Tech Sort read a control file. Once it has all the necessary information, Opt-Tech Sort starts to work. In one of my tests, it sorted a file of 10,000 random words in about 100 seconds—a respectable speed. On-line help is available for each choice.

Running a sort from DOS is useful, but it's often preferable to do the sorting from inside another program. Depending on the programming language you're working with, you can include Opt-Tech Sort in your own programs in one of two ways.

If you use a compiled language supported by Opt-Tech Sort and the compiler uses the DOS linker to create a finished program, you add a few set-up lines to your program, perform a call to the sort routine, and link your finished program to the Opt-Tech Sort library. For example, writing a complete program to call Opt-Tech Sort from Microsoft's C requires only 16 lines of source code, including printf statements, to report the sort's start and conclusion.

If the language you use does not incorporate the DOS linker (Turbo Pascal or interpretive Basic, for instance), load the memory-resident version of Opt-Tech Sort before starting your program, then call the sorting routine from within your program. This procedure usually requires that you also load a short linkage program into memory to form the appropriate interface between your program and the sorting routine.

The Opt-Tech Sort manual includes instructions for calling the library and memory-resident versions of the program from assembly language. If you are using a language not directly supported by Opt-Tech Sort and know how to write an assembly module to work with that language, you'll have no trouble using Opt-Tech Sort.

Opt-Tech Sort's real strength lies in the large number of sorting and merging options that it supports. You can base the sort on up to 10 fields per record by defining the starting position, length, field type, and sorting order for each field. Opt-Tech Sort supports 17 different data field types, including 2- and 4-byte integers; IEEE, Microsoft, and Borland real-number formats; character strings; and ASCII numbers stored in a variety of formats. You can also specify whether each key field should be used to sort in as-

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Some of this is software you promised yourself a long time ago and just never got around to treating yourself to. Some of what we list below we only have a few of, so first requests only will be honored. Most is fun stuff for your kids, so go for it!! Some is very good stuff that has had little exposure.

Two or more titles—$4.00 each.

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Geography Explorer Series		
Mid-East	Disk	Mod 1 & 3 32K dd
Europe	Disk	Mod 1 & 3 16K
Europe	Tape	Mod 1 & 3 16K
USA	Disk	"w/converter
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Dragonquest	Disk	Mod 1 & 3
Key Commander	Tape	Mod 1 & 3 16-48K
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Temple of the Sun	Tape	Mod 1 & 3
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Alien Attack Force	Tape	Mod 1 & 3 Level 2 16K
Cosmic Patrol	Disk	Mod 1 Level 2
Cosmic Patrol	Tape	Mod 1 & 3 (PMC)
Investors Paradise	Tape	Mod 1 & 3 Level 2 16K
Gomuku & 3D Tic Tac Toe	Tape	Mod 1 & 3 Level 2 16K
House of Thirty Gables	Tape	Mod 3 Level 2
Omni Converter	Tape	Mod 3 Level 2
Archemedes Apprentice		Mod 1 & 3 Level 3
Renum/Compress	Tape	Level 2 16K
Terminal Program	Tape	Mod 1 & 3 Level 2 16K
Programmers Converter	Tape	Mod 1 & 3 Level 2 16K
Programmers Primer	Tape	Level 2
Compression Utility Pack	Tape	Level 2
Airmail Pilot	Tape	Mod 1 & 3 Level 2 16K
Music Master	Tape	Mod 1 & 3 Level 2
Adventure	Tape	Mod 1 & 3 16K
Little Red Riding Hood	Tape	Mod 1 & 3 16K
Everyday Russian	Tape	Level 2 16K
Interactive Fiction	Disk	Mod 1 Only 32K
Savage Island	Disk	Mod 1 Only 32K
Domes of Kilgari	Disk	Mod 1 & 3 2 Drives
Advanced Basic Editor	Disk	Mod 1
Galactic Saga	Disk	Mod 1 only
Interactive Fiction	Disk	Mod 1 only
Startrek 3.5	Disk	Mod 1 only
Startrek 3.5	Tape	Mod 1 & 3..16K
Dynamic Device Drivers	Disk	Mod 1 Level 2 16K
Dynamic Device Drivers	Tape	Level 2 16K
QSL Manager	Disk	Level 2 32K
Disk Scope	Disk	Level 2 16K
(Fileloc;CDisk;Password)		
Teachers Aid	Disk	Level 2 32K
Typing Teacher	Tape	Color Computer
Typing Teacher	Tape	Mod 1 & 3 Level 2 16K (PMC ok)
Weather Watch	Disk	Mod 1 & 3 Level 2 16K
The Wordslinger	Tape	Mod 1 Level 2 16K(PMC)
Disk Based Labeling Disassembler		Mod 1 Level 2 16K
TRS-80 Utility II	Tape	Level 2 16K
Russian	Disk	Mod 3 Level 2 32K
Life	Tape	Level 2 16K
Disk Editor 1.3	Disk	Level 2 32K
Night Flight	Tape	Level 2 16K
The Flying Circus	Disk	Mod 1 Level 2 16K
The Elements	Tape	Mod 1 & 3 Level 2 16K
Enhanced Basic	Tape	Mod 1 Level 2
Disk-Tape Exchanger	Disk	Level 2 2 Drives 16K
Surveyors Apprentice	Tape	Level 2 16K
Energy Audit	Tape	Level 2 16K
Astrology	Tape	Mod 1 & 3 Level 2 16K
The Communicator		Level 2 16-32-48K
Scriptr	Disk	Mod 1 & 3 32-48K (needs Scripsit)
Santa Paravia &	Tape	Color Mod 1 & 3 Level 2
Cassette Scope	Tape	TRS-80
Master Reversi	Tape	Mod 1 & 3 16K
Mystery Fun House	Disk	32K
The All Stars	Disk	Mod 1 & 3 Level 2 16K
Omni Calculator	Disk	Mod 1 & 3 Level 2 16K
Mountain Pilot	Tape	Color Computer Extended Basic 16K
Phaser Blast	Disk	Mod 1 & 3 16K 1 DD
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cending or descending order, and you can define an alternate sorting sequence (such as EBCDIC) for comparing character fields.

You can direct Opt-Tech Sort to create a new file of all sorted records, if that is what you want. However, it can also create two kinds of index files for your data, so you don't need to actually move any records in either memory or on disk. If your data file contains header information, set the sorting routine to ignore it or copy it to the output file. If a file contains data of variable length, define the delimiter character used to separate fields.

Opt-Tech Sort can handle over a dozen kinds of data files, including those produced by Basic, Btrieve, Dbase II, Dbase III, and most other programming languages. You must specify the file type when you call the sort routine.

There are times when you might want to sort a file and retrieve only certain records, leaving the rest untouched. Opt-Tech Sort lets you specify up to 10 conditions to decide whether or not each record should be included in the output file. You can also determine a limit on the number of records you want the sorting routine to process or include in its output.

One of Opt-Tech Sort's most powerful features creates a new record format for its output file. You can sort a file and reassemble its information in a new form or extract selected information from the original file.

To take advantage of all these options, you must write a number of control statements for each sorting operation. Either enter the control statements directly from the keyboard or place them in a separate control file that the sorting routine can read. If the control statements are in a separate file, it is easy to set up a batch file to call the sort routine and re-sort a data file at the end of each work session.

Opt-Tech Sort is impressive software and includes a clear, thorough manual. Many sample programs will help you get the most from Opt-Tech Sort with a minimum of fuss. It is not copy-protected and runs smoothly from a hard disk or a RAM disk.

I have only two criticisms of this package. I would appreciate an index for the manual, as it is difficult to find information a second time. Also, you cannot include the sorting subroutines in programs you distribute without paying a licensing fee to Opt-Tech Data Processing. Otherwise, this excellent package is a welcome friend for any programmer who needs to keep a lot of complex data in order.

—Hardin Brothers

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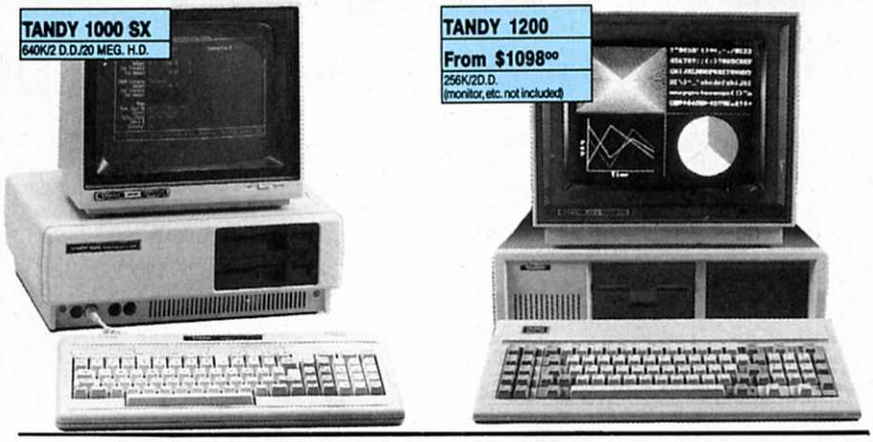

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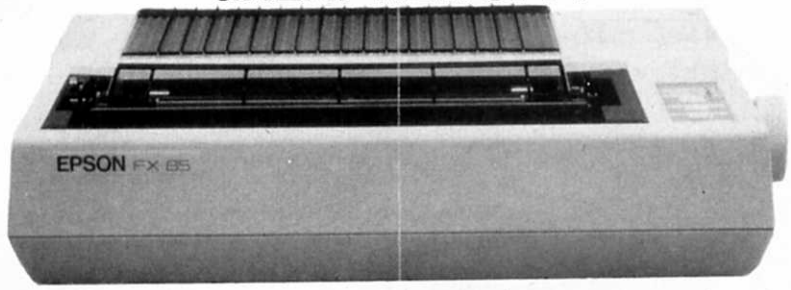

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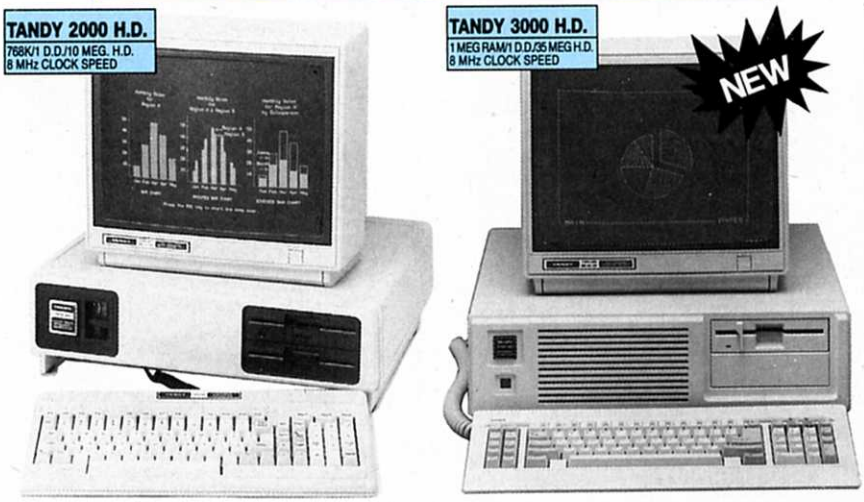

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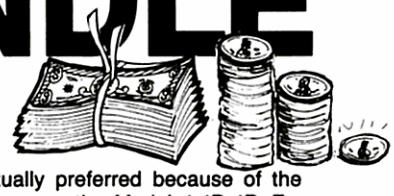

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Listing continued

```
650 LINE INPUT #1,TEXT$(I)                                              '*  1590
660 I=I+1                                                               '*   487
670 WEND                                                                '*   491
680 PRINT"Too many lines in this outline file!":BEEP                    '*  4343
690 CLOSE                                                               '*   565
700 GOSUB 8960:CLS:GOTO 550                                             '*  1655
710 IF ERR=53 THEN PRINT"No files in directory.":RESUME 580             '*  4359
720 'doneread:
730 IF ERR=62 OR ERR=53 THEN 780                                        '*  1908
740 PRINT"Bad file name, bad disk, or drive error."                     '*  4145
750 CLOSE:BEEP                                                          '*   904
760 PRINT"Please try again."                                            '*  2229
770 GOSUB 8960:CLS:RESUME 550                                           '*  1814
780 TOP=I-1:IF TOP<1 THEN TOP=1                                         '*  1967
790 'current line, screen position, outline level
800 'If at level 13, all lines will be displayed.
810 'If at level N, only levels 1 through N will be displayed.
820 'Starts at level 5.
830 CURRENT=1:CURSORLINE=FIRSTLINE:CURSORCOL=1:LEVEL=5                   '*  3841
840 CLOSE 1:GOSUB 8330                                                  '*  1323
850 FOR CURSORLINE=FIRSTLINE TO LASTLINE                                '*  2806
860 CURRENT=WHAT(CURSORLINE)                                            '*  1961
870 GOSUB 6750                                                          '*   817
880 NEXT CURSORLINE                                                     '*  1317
890 CURSORLINE=FIRSTLINE:CURRENT=1                                      '*  2431
900 RESUME 8440                                                         '*   890
910 'getcommand:
920 ON ERROR GOTO 8000                                                  '*  1347
930 IF CURSORCOL<1 THEN CURSORCOL=1                                     '*  2349
940 IF CURSORLINE<FIRSTLINE THEN CURSORLINE=FIRSTLINE                   '*  3776
950 IF TOP<1 THEN TOP=1                                                 '*  1437
960 CURRENT=WHAT(CURSORLINE)                                            '*  1962
970 IF CURRENT<=MAXLINES THEN 1020                                      '*  2206
980 TEMP=1:WHILE WHAT(TEMP)<MAXLINES AND TEMP<LASTLINE:TEMP=TEMP
    +1:WEND                                                             '*  4888
990 WHAT(CURSORLINE)=WHAT(TEMP-1)+1                                     '*  2303
1000 CURRENT=WHAT(CURSORLINE)                                           '*  1996
1010 IF CURRENT>TOP THEN TOP=CURRENT:GOSUB 8690                         '*  3160
1020 LOCATE CURSORLINE,CURSORCOL,1                                      '*  2310
1030 'Check to see if deferred commands are waiting for execution.
1040 'this string can be used as part of implementing keyboard macros.
1050 IF TEXT$(0)="" THEN 1140                                           '*  1589
1060 IF ASC(TEXT$(0))<>0 THEN 1100                                      '*  1923
1070 CMD$=LEFT$(TEXT$(0),2)                                             '*  1541
1080 TEXT$(0)=MID$(TEXT$(0),3)                                          '*  1704
1090 GOTO 1160                                                          '*   779
1100 CMD$=LEFT$(TEXT$(0),1)                                             '*  1534
1110 TEXT$(0)=MID$(TEXT$(0),2)                                          '*  1697
1120 GOTO 1160                                                          '*   773
1130 'if no pending commands, wait for one.
1140 CMD$=INKEY$:WHILE CMD$="":CMD$=INKEY$:WEND                         '*  2950
1150 'execute:
1160 IF LEN(CMD$)=2 THEN 2640                                           '*  1641
1170 IF CMD$<" " THEN 2360                                              '*  1386
1180 'entry presumably a character key for entry.
1190 'Text is entered at a particular level starting at the first possible
1200 'position for that level.  If the entry goes more than one line, the
1210 'line will do a word-wrap.  The next line that's a part of the entry will
1220 'start indented two characters to the right of the first line, as will
1230 'all subsequent lines.  Each level of indentation for each full level
1240 'of the outline is fixed at 5 spaces.  Thus, the maximum number of levels
1250 'is set at 12, for an 80 column display. Level 13 shows levels 1-12.
1260 '
1270 'When the text does a word-wrap, the whole word on which you're working
1280 'will wrap down to the next line.  If the line is at the very bottom of
1290 'the screen, the screen will scroll up two lines, speeding up subsequent
1300 'entry.
1310 'Text entry at end of current line, no word-wrap necessary.
1320 IF CURSORCOL>LEN(TEXT$(CURRENT)) AND CURSORCOL<=MARGIN THEN
     TEXT$(CURRENT)=TEXT$(CURRENT)+CMD$:PRINT CMD$;:CURSORCOL=C
    URSORCOL+1:GOTO 920                                                 '*  9662
1330 'Text entry within current line, no word-wrap necessary.
1340 IF CURSORCOL<=LEN(TEXT$(CURRENT)) AND CURSORCOL<=MARGIN THE
    N TEXT$(CURRENT)=LEFT$(TEXT$(CURRENT),CURSORCOL-1)+CMD$+MID
    $(TEXT$(CURRENT),CURSORCOL):GOSUB 6750:CURSORCOL=CURSORCOL+
```

Listing continued

Listing continued

```
    1:GOTO 920                                                          '* 12978
1350 'Text entry within or at end of current line at critical point;
1360 'word-wrap may be necessary with next character but not yet.  Current
1370 'character entered is a space.
1380 IF CMD$=" " THEN IF CURSORCOL=MARGIN+1 THEN PRINT CMD$;:TEX
    T$(CURRENT)=LEFT$(TEXT$(CURRENT),CURSORCOL-1)+CMD$+MID$(TEX
    T$(CURRENT),CURSORCOL):CURSORCOL=CURSORCOL+1:GOTO 920               '* 11686
1390 'Text entry with word-wrap.  First, insert the character.
1400 TEXT$(CURRENT)=LEFT$(TEXT$(CURRENT),CURSORCOL-1)+CMD$+MID$(
    TEXT$(CURRENT),CURSORCOL)                                           '*  5924
1410 I=CURSORCOL:OFFSET=0                                               '*  1686
1420 'Starting with current character, look backwards for a space.
1430 WHILE MID$(TEXT$(CURRENT),I,1)<>" " AND I>1                        '*  2856
1440 I=I-1:OFFSET=OFFSET+1                                              '*  1655
1450 WEND                                                               '*   536
1460 'Space found at position i.  Divide line accordingly.
1470 TEMP$=MID$(TEXT$(CURRENT),I+1)                                     '*  2176
1480 'temp$ holds remainder of string.
1490 TEXT$(CURRENT)=LEFT$(TEXT$(CURRENT),I)                             '*  2810
1500 'Fix screen display.
1510 GOSUB 6750                                                         '*   857
1520 'temp$ holds right part of line just wrapped.
1530 'If next line indented with two more spaces than the previous
1540 'line, it's part of the current sub-topic and at the same level.
1550 'If the indentation is different, insert a whole new line and
1560 'update what() and current.
1570 'Because indentation is so critical, check temp$.
1580 'If it starts with one or more blanks, delete them.
1590 I=1                                                                 '*   422
1600 WHILE MID$(TEMP$,I,1)=" " AND I<=LEN(TEMP$)                        '*  2811
1610 I=I+1:OFFSET=OFFSET-1                                              '*  1654
1620 WEND                                                               '*   535
1630 IF I>1 THEN TEMP$=MID$(TEMP$,I)                                    '*  2165
1640 'Check location. If on last line of screen, scroll the screen.
1650 'Look at text. Is there a further line displayable at this level?
1660 IF CURSORLINE<>LASTLINE THEN 1890                                  '*  2489
1670 FOR I=FIRSTLINE TO LASTLINE-2                                      '*  2249
1680 WHAT(I)=WHAT(I+2)                                                  '*  1317
1690 NEXT I                                                             '*   664
1700 X=WHAT(LASTLINE-2)+1:I=LASTLINE-1                                  '*  2451
1710 WHILE I<=LASTLINE                                                  '*  1440
1720 IF LEFT$(TEXT$(X),5*LEVEL)=STRING$(5*LEVEL,32) THEN 1750           '*  3707
1730 WHAT(I)=X                                                          '*   846
1740 I=I+1                                                              '*   535
1750 X=X+1                                                              '*   566
1760 WEND                                                               '*   540
1770 IF X>TOP THEN TOP=X                                                '*  1566
1780 VIEW PRINT 9 TO 24                                                 '*  1402
1790 LOCATE LASTLINE,80:PRINT:PRINT                                     '*  2375
1800 GOSUB 8690:VIEW PRINT                                              '*  1666
1810 FOR CURSORLINE=LASTLINE-1 TO LASTLINE                              '*  2861
1820 CURRENT=WHAT(CURSORLINE)                                           '*  2006
1830 GOSUB 6750                                                         '*   862
1840 NEXT CURSORLINE                                                    '*  1362
1850 CURSORLINE=LASTLINE-2                                              '*  1772
1860 'Check if next line begins with the exact number of blanks required.
1870 'Must be precisely the number of blanks on the present line, or
1880 'the number of blanks on the present line, plus two.
1890 CURRENT=WHAT(CURSORLINE):GOSUB 6750                                '*  2697
1900 I=1                                                                '*   417
1910 WHILE MID$(TEXT$(CURRENT),I,1)=" ":I=I+1:WEND                      '*  3056
1920 I=I-1                                                              '*   537
1930 'I is the number of blanks on the current line.
1940 X=I MOD 5                                                          '*   801
1950 I=I\5                                                              '*   591
1960 'If x=2, on a line previously wrapped and part of current level
1970 'f x=0, on the first line of a topic.
1980 'I indicates level. If I=0, on the first level.
1990 'If I=1, on the first sub-topic, etc.
2000 'Put temp$ on the front of the next line
2010 'if the next line is the same level and x=2 for the next line; or,
2020 'if the next line is empty and the last line of the outline.
2030 'Compute statistics for the next line.
2040 X1=1                                                               '*   477
```

Listing continued

Listing continued from p. 45

Listing continued

```
2050 IF CURRENT>MAXLINES THEN WHAT(CURSORLINE)=WHAT(CURSORLINE-1
     )+1                                                    '*  4564
2060 WHILE MID$(TEXT$(CURRENT+1),X1,1)=" ":X1=X1+1:WEND     '*  3337
2070 X1=X1-1                                                '*   662
2080 IF X1=0 AND CURRENT>=TOP THEN X1=2:TEXT$(CURRENT+1)="  ":WH
     AT(CURSORLINE+1)=CURRENT+1:TOP=TOP+1                   '*  6500
2090 IF X1\5<>I OR X1 MOD 5<>2 THEN 2160                    '*  2330
2100 TEXT$(CURRENT+1)=LEFT$(TEXT$(CURRENT+1),X1)+TEMP$+MID$(TEXT
     $(CURRENT+1),X1+1)                                     '*  5168
2110 CURSORLINE=CURSORLINE+1                                '*  1929
2120 CURSORCOL=X1+OFFSET+1                                  '*  1717
2130 TEMP$="":CURRENT=WHAT(CURSORLINE)                      '*  2534
2140 GOSUB 6750:GOSUB 8690:GOTO 920                         '*  2104
2150 'The next line not at the same level. Insert a new line for temp$
2160 CURRENT=WHAT(CURSORLINE)                               '*  2004
2170 FOR K=TOP TO CURRENT+1 STEP -1                         '*  2216
2180 SWAP TEXT$(K+1),TEXT$(K)                               '*  1752
2190 NEXT K                                                 '*   662
2200 FOR K=LASTLINE TO CURSORLINE+2 STEP -1                 '*  2799
2210 IF WHAT(K-1)<MAXLINES THEN WHAT(K)=WHAT(K-1)+1         '*  3173
2220 NEXT K                                                 '*   656
2230 TOP=TOP+1                                              '*   870
2240 TEXT$(CURRENT+1)=STRING$(5*I+2,32)+TEMP$               '*  2757
2250 CURSORLINE=CURSORLINE+1                                '*  1934
2260 WHAT(CURSORLINE)=CURRENT+1                             '*  2097
2270 CURSORCOL=5*I+LEN(TEMP$)+3:TEMP$=""                    '*  2484
2280 TEMP=CURSORLINE                                        '*  1381
2290 FOR CURSORLINE=TEMP TO LASTLINE                        '*  2476
2300 CURRENT=WHAT(CURSORLINE)                               '*  2000
2310 IF CURRENT<>MAXLINES+1 THEN GOSUB 6750                 '*  2768
2320 NEXT CURSORLINE                                        '*  1356
2330 CURSORLINE=TEMP:CURRENT=WHAT(CURSORLINE)               '*  3206
2340 GOSUB 8690:GOTO 920                                    '*  1422
2350 'control key:
2360 CMD=0                                                  '*   556
2370 IF CMD$=CRETURN$ THEN CMD=13                           '*  2043
2380 IF CMD$=HOMEKEY$ THEN CMD=71                           '*  2031
2390 IF CMD$=ENDKEY$ THEN CMD=79                            '*  1958
2400 IF CMD$=SAVEDOC$ THEN CMD=61                           '*  2010
2410 IF CMD$=QUIT$ THEN CMD=27                              '*  1819
2420 IF CMD$=LEFTLEVEL$ THEN CMD=67                         '*  2176
2430 IF CMD$=RIGHTLEVEL$ THEN CMD=68                        '*  2261
2440 IF CMD$=UP$ THEN CMD=72                                '*  1664
2450 IF CMD$=UPSCREEN$ THEN CMD=73                          '*  2114
2460 IF CMD$=DOWN$ THEN CMD=80                              '*  1812
2470 IF CMD$=DOWNSCREEN$ THEN CMD=81                        '*  2262
2480 IF CMD$=RIGHTCHAR$ THEN CMD=77                         '*  2176
2490 IF CMD$=RIGHTTAB$ THEN CMD=9                           '*  2053
2500 IF CMD$=LEFTCHAR$ THEN CMD=75                          '*  2084
2510 IF CMD$=BACKSPACE$ THEN CMD=75                         '*  2137
2520 IF CMD$=RIGHTWORD$ THEN CMD=6                          '*  2145
2530 IF CMD$=LEFTWORD$ THEN CMD=1                           '*  2058
2540 IF CMD$=DELCHAR$ THEN CMD=83                           '*  2001
2550 IF CMD$=DELWORD$ THEN CMD=200                          '*  2071
2560 IF CMD$=DELLINE$ THEN CMD=201                          '*  2053
2570 IF CMD$=INSERTLINE$ THEN CMD=202                       '*  2311
2580 IF CMD$=LOADDOC$ THEN CMD=203                          '*  2050
2590 IF CMD$=REFORM$ THEN CMD=2                             '*  1909
2600 IF CMD$=NULL$ THEN CMD=204                             '*  1857
2610 IF CMD THEN 2670                                       '*  1194
2620 BEEP:GOTO 920                                          '*  1076
2630 'functionkey:
2640 CMD$=RIGHT$(CMD$,1)                                    '*  1385
2650 CMD=ASC(CMD$)                                          '*  1054
2660 'This part of the program takes action on the commands given.
2670 IF CMD>58 AND CMD<69 THEN GOSUB 6580:GOTO 920          '*  3007
2680 'carriage return.  Put cursor at start of current line indent level,
2690 'go down to next line, insert a new line and leave cursor at the present
2700 'level of indent.
2710 IF CMD<>13 THEN 2780                                   '*  1419
2720 I=1:WHILE MID$(TEXT$(CURRENT),I,1)=" ":I=I+1:WEND      '*  3297
2730 I=I\5:CURSORCOL=1                                      '*  1456
2740 TEXT$(0)=TEXT$(0)+DOWN$+INSERTLINE$                    '*  2513
2750 WHILE I>0:TEXT$(0)=TEXT$(0)+RIGHTTAB$:I=I-1:WEND       '*  3324
2760 GOTO 920                                               '*   739
```

Listing continued

Listing continued

```
2770 'home
2780 IF CMD<>71 THEN 2820                                   '*  1425
2790 I=1:WHILE MID$(TEXT$(CURRENT),I,1)=" ":I=I+1:WEND      '*  3304
2800 CURSORCOL=I:GOTO 920:                                  '*  1684
2810 'end key
2820 IF CMD=79 THEN CURSORCOL=FNMIN(MARGIN+1,LEN(TEXT$(CURRENT))
     +1):GOTO 920                                           '*  4906
2830 'quit
2840 IF CMD<>27 THEN 2960                                   '*  1428
2850 GOSUB 7150                                             '*   860
2860 LOCATE 6,1:BEEP                                        '*  1201
2870 PRINT"Do you really want to quit (Y/N)? ";             '*  3644
2880 GOSUB 8850                                             '*   871
2890 IF TEMP$="n" OR TEMP$="N" THEN GOSUB 8690:GOTO 920     '*  3337
2900 LOCATE 7,1                                             '*   855
2910 PRINT"You asked to quit.  Do you want to save your outline
     (Y/N)? ";                                              '*  5954
2920 GOSUB 8850                                             '*   866
2930 IF TEMP$="n" OR TEMP$="N" THEN END                     '*  2358
2940 GOTO 6930                                              '*   794
2950 'up arrow
2960 IF CMD<>72 THEN 3120                                   '*  1420
2970 CURRENT=WHAT(CURSORLINE)                               '*  2013
2980 IF CURSORLINE<=FIRSTLINE THEN 3020                     '*  2565
2990 CURSORLINE=CURSORLINE-1:CURRENT=WHAT(CURSORLINE)       '*  3776
3000 CURSORCOL=FNMIN(CURSORCOL,LEN(TEXT$(CURRENT))+1)       '*  3574
3010 GOSUB 8690:GOTO 920                                    '*  1417
3020 IF CURRENT=1 THEN 920                                  '*  1583
3030 'go up one line at current level.
3040 X=CURRENT-1:TEMP$=STRING$(5*LEVEL,32)                  '*  2690
3050 WHILE MID$(TEXT$(X),1,5*LEVEL)=TEMP$ AND X>1:X=X-1:WEND '*  3744
3060 IF MID$(TEXT$(X),1,5*LEVEL)=TEMP$ THEN 920             '*  2810
3070 FOR I=LASTLINE TO FIRSTLINE+1 STEP -1:WHAT(I)=WHAT(I-1):NEX
     T I                                                    '*  4335
3080 WHAT(FIRSTLINE)=X:CURRENT=X                            '*  2215
3090 CURSORCOL=FNMIN(CURSORCOL,LEN(TEXT$(CURRENT))+1)       '*  3583
3100 GOSUB 6660:GOSUB 8690:GOTO 920                         '*  2101
3110 'down arrow
3120 IF CMD<>80 THEN 3360                                   '*  1414
3130 IF CURSORLINE<>LASTLINE THEN 3310                      '*  2472
3140 VIEW PRINT 9 TO 24                                     '*  1394
3150 LOCATE LASTLINE,80:PRINT                               '*  1912
3160 GOSUB 8690:'view print                                 '*   923
3170 FOR I=FIRSTLINE TO LASTLINE-1                          '*  2245
3180 WHAT(I)=WHAT(I+1)                                      '*  1313
3190 NEXT I                                                 '*   661
3200 CURSORLINE=CURSORLINE-1                                '*  1932
3210 CURRENT=WHAT(CURSORLINE):X=CURRENT+1                   '*  2847
3220 IF X>TOP THEN 3280                                     '*  1371
3230 TEMP$=STRING$(5*LEVEL,32)                              '*  1843
3240 WHILE MID$(TEXT$(X),1,5*LEVEL)=TEMP$ AND X<=TOP AND TEMP$<>
     ""                                                     '*  4060
3250 X=X+1                                                  '*   563
3260 WEND                                                   '*   537
3270 WHAT(LASTLINE)=X:CURRENT=X                             '*  2132
3280 IF X>TOP THEN TOP=X:WHAT(LASTLINE)=TOP:CURRENT=X       '*  3673
3290 TEMP=CURSORLINE:CURSORLINE=LASTLINE:GOSUB 6750         '*  3564
3300 CURSORLINE=TEMP                                        '*  1375
3310 CURSORLINE=CURSORLINE+1:CURRENT=WHAT(CURSORLINE)       '*  3761
3320 IF CURRENT>TOP THEN WHAT(CURSORLINE)=WHAT(CURSORLINE-1)+1:T
     OP=CURRENT                                             '*  5108
3330 CURSORCOL=FNMIN(CURSORCOL,LEN(TEXT$(CURRENT))+1)       '*  3580
3340 GOSUB 8690:GOTO 920                                    '*  1423
3350 'up page
3360 IF CMD<>73 THEN 3550                                   '*  1423
3370 CURRENT=WHAT(FIRSTLINE):CURSORLINE=FIRSTLINE:CURSORCOL=1 '*  4371
3380 IF CURRENT=1 THEN GOSUB 8690:GOTO 920                  '*  2626
3390 Y=LASTLINE-FIRSTLINE:X=CURRENT-1:TEMP$=STRING$(5*LEVEL,32) '*  4243
3400 WHILE Y>0                                              '*   839
3410 WHILE MID$(TEXT$(X),1,5*LEVEL)=TEMP$ AND X>1:X=X-1:WEND '*  3744
3420 IF MID$(TEXT$(X),1,5*LEVEL)=TEMP$ THEN 3490            '*  2863
3430 FOR I=LASTLINE TO FIRSTLINE+1 STEP -1                  '*  2716
3440 WHAT(I)=WHAT(I-1)                                      '*  1314
3450 NEXT I                                                 '*   660
3460 WHAT(FIRSTLINE)=X:CURRENT=X                            '*  2217
```

Listing continued

Listing continued

```
3470 X=X-1                                                              '*  569
3480 IF X<1 THEN Y=1                                                    '* 1177
3490 Y=Y-1                                                              '*  573
3500 WEND                                                               '*  534
3510 CURSORLINE=FIRSTLINE:CURRENT=WHAT(FIRSTLINE)                       '* 3499
3520 CURSORCOL=FNMIN(CURSORCOL,LEN(TEXT$(CURRENT))+1)                   '* 3581
3530 GOSUB 6660:GOTO 8440                                               '* 1472
3540 'down page
3550 IF CMD<>81 THEN 3770                                               '* 1427
3560 TEMP=LASTLINE                                                      '* 1213
3570 CURRENT=WHAT(TEMP)                                                 '* 1546
3580 WHILE CURRENT>MAXLINES:TEMP=TEMP-1:CURRENT=WHAT(TEMP):WEND         '* 4425
3590 IF TEMP<LASTLINE THEN CURSORLINE=TEMP:CURSORCOL=1:GOSUB 869
     0:GOTO 920                                                         '* 5017
3600 Y=LASTLINE-FIRSTLINE:X=CURRENT+1:TEMP$=STRING$(5*LEVEL,32)         '* 4235
3610 WHILE Y>0                                                          '*  842
3620 WHILE MID$(TEXT$(X),1,5*LEVEL)=TEMP$ AND X<=TOP:X=X+1:WEND         '* 3998
3630 IF MID$(TEXT$(X),1,5*LEVEL)=TEMP$ THEN 3700                        '* 2860
3640 FOR I=FIRSTLINE TO LASTLINE-1                                      '* 2247
3650 WHAT(I)=WHAT(I+1)                                                  '* 1315
3660 NEXT I                                                             '*  663
3670 WHAT(LASTLINE)=X:CURRENT=X                                         '* 2136
3680 X=X+1                                                              '*  570
3690 IF X>TOP THEN Y=0                                                  '* 1375
3700 Y=Y-1                                                              '*  567
3710 WEND                                                               '*  537
3720 CURSORLINE=FIRSTLINE:CURRENT=WHAT(FIRSTLINE)                       '* 3502
3730 CURSORCOL=FNMIN(CURSORCOL,LEN(TEXT$(CURRENT))+1)                   '* 3584
3740 IF CURRENT>TOP THEN TOP=CURRENT                                    '* 2483
3750 GOSUB 6660:GOTO 8440                                               '* 1476
3760 'right a character
3770 IF CMD<>77 THEN 3900                                               '* 1431
3780 IF CURSORCOL<=LEN(TEXT$(CURRENT)) AND CURSORCOL<=MARGIN THE
     N CURSORCOL=CURSORCOL+1:GOTO 920                                   '* 6551
3790 IF CURSORLINE>=LASTLINE THEN 3870                                  '* 2496
3800 CURSORLINE=CURSORLINE+1                                            '* 1936
3810 CURRENT=WHAT(CURSORLINE)                                           '* 2007
3820 I=1:WHILE MID$(TEST$,I,1)=" ":I=I+1:WEND                           '* 2666
3830 CURSORCOL=FNMIN(I,MARGIN+1)                                        '* 2111
3840 GOTO 920                                                           '*  739
3850 'Go down a line and put the cursor at first non-blank.
3860 'with a down-home command.
3870 TEXT$(0)=DOWN$+HOMEKEY$                                            '* 1750
3880 GOTO 920                                                           '*  743
3890 'right one tab stop
3900 IF CMD<>9 THEN 4000                                                '* 1365
3910 X=CURSORCOL                                                        '* 1086
3920 CURRENT=WHAT(CURSORLINE)                                           '* 2009
3930 CURSORCOL=5*(CURSORCOL\5)+6                                        '* 2118
3940 IF CURSORCOL>MARGIN THEN CURSORCOL=X                               '* 2839
3950 X=LEN(TEXT$(CURRENT))                                              '* 1683
3960 IF CURSORCOL>X THEN TEXT$(CURRENT)=TEXT$(CURRENT)+STRING$(C
     URSORCOL-X-1,32)                                                   '* 5376
3970 GOSUB 8690                                                         '*  874
3980 GOTO 920                                                           '*  744
3990 'left a character
4000 IF CMD<>75 THEN 4120                                               '* 1411
4010 IF CURSORCOL<=1 THEN 4040                                          '* 1841
4020 IF MID$(TEXT$(CURRENT),1,CURSORCOL-1)=STRING$(CURSORCOL-1,3
     2) THEN CURSORCOL=1:GOSUB 8690:GOTO 920                            '* 6672
4030 CURSORCOL=CURSORCOL-1:GOSUB 8690:GOTO 920                          '* 3033
4040 IF CURSORCOL=1 AND CURSORLINE>FIRSTLINE THEN CURSORLINE=CUR
     SORLINE-1:CURRENT=WHAT(CURSORLINE):CURSORCOL=FNMIN(MARGIN+1
     ,LEN(TEXT$(CURRENT))+1):GOSUB 8690:GOTO 920                    '* 11405
4050 IF CURSORLINE>FIRSTLINE THEN CURSORCOL=CURSORCOL-1:GOSUB 86
     90:GOTO 920                                                        '* 5101
4060 'Go up a line and to the right margin or line end.
4070 'we'll use an up-end command for that.
4080 CURRENT=WHAT(CURSORLINE)                                           '* 2007
4090 IF CURRENT<>1 THEN TEXT$(0)=UP$+ENDKEY$:ELSE CURSORCOL=1           '* 3973
4100 GOTO 920                                                           '*  729
4110 'right a word
4120 IF CMD<>6 THEN 4220                                                '* 1361
4130 WHILE MID$(TEXT$(CURRENT),CURSORCOL,1)<>" " AND CURSORCOL<=
     MARGIN                                                             '* 4566
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Listing continued

Listing continued

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4140 CURSORCOL=CURSORCOL+1                                              '* 1786
4150 WEND                                                               '*  536
4160 WHILE MID$(TEXT$(CURRENT),CURSORCOL,1)=" " AND CURSORCOL<=M
     ARGIN                                                              '* 4508
4170 CURSORCOL=CURSORCOL+1                                              '* 1789
4180 WEND                                                               '*  539
4190 IF CURSORCOL>MARGIN OR CURSORCOL>LEN(TEXT$(CURRENT)) THEN T
     EXT$(0)=DOWN$+HOMEKEY$                                             '* 5776
4200 GOTO 920                                                           '*  730
4210 'left a word
4220 IF CMD<>1 THEN 4370                                                '* 1363
4230 IF CURSORCOL<>1 THEN 4260                                          '* 1850
4240 IF WHAT(CURSORLINE)=1 THEN 920                                     '* 2204
4250 TEXT$(0)=UP$+ENDKEY$+LEFTWORD$:GOTO 920                            '* 2766
4260 CURSORCOL=CURSORCOL-1                                              '* 1791
4270 WHILE MID$(TEXT$(CURRENT),CURSORCOL,1)=" " AND CURSORCOL>1         '* 4054
4280 CURSORCOL=CURSORCOL-1                                              '* 1793
4290 WEND                                                               '*  541
4300 IF CURSORCOL=1 THEN TEXT$(0)=UP$+ENDKEY$+LEFTWORD$:GOTO 920        '* 4114
4310 WHILE MID$(TEXT$(CURRENT),CURSORCOL,1)<>" " AND CURSORCOL>1        '* 4110
4320 CURSORCOL=CURSORCOL-1                                              '* 1788
4330 WEND                                                               '*  536
4340 IF MID$(TEXT$(CURRENT),CURSORCOL,1)=" " THEN CURSORCOL=CURS
     ORCOL+1                                                            '* 4652
4350 GOTO 920                                                           '*  736
4360 'delete a character
4370 IF CMD<>83 THEN 4670                                               '* 1430
4380 CURRENT=WHAT(CURSORLINE)                                           '* 2010
4390 IF CURSORCOL>LEN(TEXT$(CURRENT)) THEN 4430                         '* 3040
4400 TEXT$(CURRENT)=LEFT$(TEXT$(CURRENT),CURSORCOL-1)+MID$(TEXT$
     (CURRENT),CURSORCOL+1)                                             '* 5728
4410 GOSUB 6750                                                         '*  859
4420 GOTO 920                                                           '*  734
4430 X=1                                                                '*  433
4440 WHILE MID$(TEXT$(CURRENT),X,1)=" ":X=X+1:WEND                      '* 3102
4450 X1=1                                                               '*  484
4460 WHILE MID$(TEXT$(CURRENT+1),X1,1)=" ":X1=X1+1:WEND                 '* 3343
4470 IF X<>X1 AND X+2<>X1 THEN 4640                                     '* 2049
4480 TEXT$(CURRENT)=TEXT$(CURRENT)+MID$(TEXT$(CURRENT+1),X1)            '* 3919
4490 TEXT$(CURRENT+1)=""                                                '* 1451
4500 FOR I=CURRENT+1 TO TOP                                             '* 1739
4510 SWAP TEXT$(I),TEXT$(I+1)                                           '* 1747
4520 NEXT I                                                             '*  659
4530 TOP=TOP-1                                                          '*  877
4540 FOR I=CURSORLINE+1 TO LASTLINE                                     '* 2331
4550 WHAT(I)=WHAT(I+1)-1                                                '* 1409
4560 NEXT I                                                             '*  663
4570 WHAT(LASTLINE)=MAXLINES+1                                          '* 1995
4580 X1=WHAT(LASTLINE-1)+1                                              '* 1618
4590 WHILE X1<=TOP AND WHAT(LASTLINE)>MAXLINES                          '* 3091
4600 IF MID$(TEXT$(X1),1,5*LEVEL)<>STRING$(5*LEVEL,32) THEN WHAT
     (LASTLINE)=X1                                                      '* 4815
4610 X1=X1+1                                                            '*  662
4620 WEND                                                               '*  538
4630 GOSUB 6660:GOSUB 8690:GOTO 920                                     '* 2110
4640 BEEP                                                               '*  522
4650 GOTO 920                                                           '*  739
4660 'delete a word to the right
4670 IF CMD<>200 THEN 4850                                              '* 1472
4680 CURRENT=WHAT(CURSORLINE)                                           '* 2013
4690 IF CURSORCOL>LEN(TEXT$(CURRENT)) THEN TEXT$(0)=TEXT$(0)+DEL
     CHAR$:GOTO 920                                                     '* 5017
4700 X=CURSORCOL                                                        '* 1084
4710 IF MID$(TEXT$(CURRENT),X,1)=" " THEN 4790                          '* 2700
4720 X=X+1                                                              '*  566
4730 WHILE MID$(TEXT$(CURRENT),X,1)<>" " AND X<=LEN(TEXT$(CURREN
     T))                                                                '* 4195
4740 X=X+1                                                              '*  568
4750 WEND                                                               '*  542
4760 TEXT$(CURRENT)=LEFT$(TEXT$(CURRENT),CURSORCOL-1)+MID$(TEXT$
     (CURRENT),X)                                                       '* 5033
4770 GOSUB 6750                                                         '*  868
4780 GOTO 920                                                           '*  743
4790 X=X+1                                                              '*  573
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Listing continued

Listing continued

```
4800 WHILE MID$(TEXT$(CURRENT),X,1)=" ":X=X+1:WEND                    '*  3102
4810 TEXT$(CURRENT)=LEFT$(TEXT$(CURRENT),CURSORCOL-1)+MID$(TEXT$
     (CURRENT),X)                                                     '*  5029
4820 GOSUB 6750                                                       '*   864
4830 GOTO 920                                                         '*   739
4840 'delete line
4850 IF CMD<>201 THEN 5110                                            '*  1463
4860 CURRENT=WHAT(CURSORLINE)                                         '*  2013
4870 TEXT$(CURRENT)=""                                                '*  1361
4880 FOR I=CURRENT TO TOP-1                                           '*  1752
4890 SWAP TEXT$(I),TEXT$(I+1)                                         '*  1758
4900 NEXT I                                                           '*   661
4910 TOP=TOP-1                                                        '*   879
4920 FOR I=CURSORLINE TO LASTLINE-1                                   '*  2335
4930 IF WHAT(I+1)<MAXLINES THEN WHAT(I)=WHAT(I+1)-1                   '*  3176
4940 NEXT I                                                           '*   665
4950 WHAT(LASTLINE)=MAXLINES+1                                        '*  1997
4960 X1=WHAT(LASTLINE-1)+1                                            '*  1620
4970 WHILE X1<=TOP AND WHAT(LASTLINE)>MAXLINES                        '*  3093
4980 IF MID$(TEXT$(X1),1,5*LEVEL)<>STRING$(5*LEVEL,32) THEN WHAT
     (LASTLINE)=X1                                                    '*  4826
4990 IF TEXT$(X1)="" THEN WHAT(LASTLINE)=X1                           '*  2687
5000 X1=X1+1                                                          '*   656
5010 WEND                                                             '*   532
5020 CURSORCOL=FNMIN(LEN(TEXT$(WHAT(CURSORLINE)))+1,CURSORCOL)        '*  4194
5030 IF CURSORLINE=LASTLINE THEN 5070                                 '*  2417
5040 VIEW PRINT 9 TO 24                                               '*  1395
5050 GOSUB 6660:'locate lastline,80:print                             '*   918
5060 VIEW PRINT                                                       '*   979
5070 CURRENT=WHAT(LASTLINE)                                           '*  1837
5080 TEMP=CURSORLINE:CURSORLINE=LASTLINE:GOSUB 6750:CURSORLINE=T
     EMP                                                              '*  4766
5090 CURRENT=WHAT(CURSORLINE):GOSUB 8690:GOTO 920                     '*  3256
5100 'insert line before present line
5110 IF CMD<>202 THEN 5230                                            '*  1457
5120 CURRENT=WHAT(CURSORLINE)                                         '*  2003
5130 FOR I=TOP TO CURRENT STEP -1                                     '*  2121
5140 SWAP TEXT$(I+1),TEXT$(I)                                         '*  1747
5150 NEXT I                                                           '*   659
5160 TOP=TOP+1                                                        '*   875
5170 FOR I=LASTLINE TO CURSORLINE+1 STEP -1                           '*  2805
5180 IF WHAT(I-1)<MAXLINES THEN WHAT(I)=WHAT(I-1)+1                   '*  3176
5190 NEXT I                                                           '*   663
5200 CURSORCOL=1                                                      '*  1041
5210 GOSUB 6660:GOSUB 8690:GOTO 920                                   '*  2105
5220 'load a document outline
5230 IF CMD<>203 THEN 5350                                            '*  1464
5240 BEEP:GOSUB 7150                                                  '*  1198
5250 LOCATE 6,1                                                       '*   855
5260 PRINT"Warning! Loading a new document will destroy the pres
     ent one!";                                                       '*  6463
5270 LOCATE 7,1                                                       '*   858
5280 PRINT"Continue? (Y/N): ";                                        '*  2080
5290 GOSUB 8850                                                       '*   869
5300 IF TEMP$="n" OR TEMP$="N" THEN GOSUB 7150:GOTO 920               '*  3316
5310 GOSUB 7150                                                       '*   854
5320 FOR I=0 TO TOP:TEXT$(I)="":NEXT I                                '*  2333
5330 GOTO 480                                                         '*   736
5340 'reformat a section beginning at current line
5350 IF CMD<>2 THEN 6560                                              '*  1372
5360 CURRENT=WHAT(CURSORLINE)                                         '*  2009
5370 IF LEN(TEXT$(CURRENT))=0 THEN 920                                '*  2338
5380 X=1:TEMP=CURRENT                                                 '*  1414
5390 WHILE MID$(TEXT$(CURRENT),X,1)=" ":X=X+1:WEND                    '*  3107
5400 IF CURRENT=TOP THEN 5520                                         '*  1830
5410 TEMP=TEMP+1:X1=1                                                 '*  1312
5420 WHILE MID$(TEXT$(TEMP),X1,1)=" ":X1=X1+1:WEND                    '*  3011
5430 'note: x and x1 point to the first non-blank character here!
5440 WHILE (X1=X+2 OR (X1=X AND X MOD 5=3)) AND TEMP<TOP              '*  3402
5450 TEMP=TEMP+1:X1=1                                                 '*  1316
5460 WHILE MID$(TEXT$(TEMP),X1,1)=" ":X1=X1+1:WEND                    '*  3015
5470 WEND                                                             '*   542
5480 IF X1<>X+2 OR (X1<>X AND X MOD 5=3) THEN TEMP=TEMP-1             '*  3467
5490 'Temp is the last line to include in the reformatting and
5500 'current is the first line to include.  If temp=current, and if
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Listing continued

Listing continued

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5510 'the line already fits the margins, there's no reformatting to do.
5520 IF TEMP=CURRENT AND LEN(TEXT$(CURRENT))<=MARGIN THEN 920:         '*  4044
5530 'Reformat. Remember how many lines originally, then move all text after
5540 'the reorganize block to the end of memory.  That way, they'll
5550 'be out of the way. Reformat the block of text, compare
5560 'how many lines now have to how many originally, move the
5570 'other text back to the end of the block, and fix the where()
5580 'pointers and the top of the form accordingly.
5590 'Do this without creating any line long enough
5600 'to exceed the 255 characters possible for the Model 4.
5610 X1=MAXLINES:X2=TOP                                                '*  1543
5620 WHILE X2>TEMP                                                    '*  1156
5630 SWAP TEXT$(X2),TEXT$(X1)                                         '*  1788
5640 TEXT$(X2)=""                                                     '*   948
5650 X1=X1-1:X2=X2-1                                                  '*  1158
5660 WEND                                                             '*   543
5670 LINESMOVED=TOP-TEMP                                              '*  1659
5680 STARTLINE=CURRENT                                                '*  1545
5690 ENDLINE=TEMP                                                     '*  1126
5700 'Text has been moved out of the way. Now reformat:
5710 'The variable x indicates where the text starts and
5720 'if in the middle of a section or at the first line.
5730 'Verify each line in the section except for last one
5740 'has a trailing space, so there are spaces between words
5750 'when lines are joined.
5760 FOR I=STARTLINE TO ENDLINE-1                                     '*  2165
5770 IF RIGHT$(TEXT$(I),1)<>" " THEN TEXT$(I)=TEXT$(I)+" "            '*  3348
5780 NEXT I                                                           '*   668
5790 'too long:
5800 WHILE (LEN(TEXT$(CURRENT))=MARGIN+1 AND RIGHT$(TEXT$(CURREN
     T),1)=" ") OR LEN(TEXT$(CURRENT))=MARGIN                         '*  6661
5810 CURRENT=CURRENT+1                                                '*  1485
5820 WEND                                                             '*   541
5830 'If line too long, split it and make room for it.
5840 X1=LEN(TEXT$(CURRENT))                                           '*  1732
5850 IF X1>MARGIN+1 OR (X1=MARGIN+1 AND RIGHT$(TEXT$(CURRENT),1)
     <>" ") THEN X1=X1:ELSE 6010                                      '*  5562
5860 FOR I=TEMP TO CURRENT+1 STEP -1                                  '*  2290
5870 SWAP TEXT$(I+1),TEXT$(I)                                         '*  1757
5880 NEXT I                                                           '*   669
5890 X1=MARGIN+1                                                      '*   982
5900 WHILE MID$(TEXT$(CURRENT),X1,1)<>" " AND X1>X:X1=X1-1:WEND       '*  3876
5910 TEMP$=MID$(TEXT$(CURRENT),X1+1)                                  '*  2243
5920 TEXT$(CURRENT)=LEFT$(TEXT$(CURRENT),X1)                          '*  2876
5930 CURRENT=CURRENT+1                                                '*  1488
5940 TEMP=TEMP+1                                                      '*  1015
5950 X1=1:WHILE MID$(TEMP$,X1,1)=" ":X1=X1+1:WEND                     '*  2918
5960 IF X1>1 THEN TEMP$=MID$(TEMP$,X1,1)                              '*  2396
5970 TEXT$(CURRENT)=STRING$(5*(X\5)+2,32)+TEMP$                       '*  2919
5980 TEMP$=""                                                         '*   721
5990 'tooshort:
6000 'Is the line too short?  If so, pull text from the next line (if any).
6010 X1=LEN(TEXT$(CURRENT))                                           '*  1722
6020 IF X1<MARGIN AND CURRENT<>TEMP THEN X1=X1:ELSE 6260              '*  3599
6030 TEMP$=MID$(TEXT$(CURRENT+1),X)                                   '*  2188
6040 X2=1:WHILE MID$(TEMP$,X2,1)=" ":X2=X2+1:WEND                     '*  2913
6050 IF X2>1 THEN TEMP$=MID$(TEMP$,X2)                                '*  2296
6060 X2=LEN(TEMP$)                                                    '*  1085
6070 IF X2<>0 THEN 6130                                               '*  1289
6080 FOR I=CURRENT TO TEMP-1                                          '*  1813
6090 SWAP TEXT$(I),TEXT$(I+1)                                         '*  1752
6100 NEXT I                                                           '*   655
6110 TEXT$(TEMP)="":TEMP=TEMP-1                                       '*  1946
6120 GOTO 6010                                                        '*   777
6130 X2=MARGIN-X1+1                                                   '*  1153
6140 IF X2<=LEN(TEMP$) THEN 6210                                      '*  1887
6150 TEXT$(CURRENT)=TEXT$(CURRENT)+TEMP$                              '*  2664
6160 TEXT$(CURRENT+1)=""                                              '*  1447
6170 FOR I=CURRENT+1 TO TEMP                                          '*  1811
6180 SWAP TEXT$(I),TEXT$(I+1)                                         '*  1752
6190 NEXT I                                                           '*   664
6200 TEMP$="":TEMP=TEMP-1:GOTO 6010                                   '*  2142
6210 WHILE MID$(TEMP$,X2,1)<>" " AND X2>1:X2=X2-1:WEND                '*  3193
6220 TEXT$(CURRENT)=TEXT$(CURRENT)+LEFT$(TEMP$,X2)                    '*  3260
6230 TEXT$(CURRENT+1)=STRING$(5*(X\5)+2,32)+MID$(TEMP$,X2+1)          '*  3610
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Listing continued

Listing continued

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6240 CURRENT=CURRENT+1:GOTO 5800                                        '*  2091
6250 'are we done reformatting?
6260 X1=LEN(TEXT$(CURRENT))                                             '*  1729
6270 IF CURRENT<TEMP THEN 5800                                          '*  1903
6280 IF LEN(TEXT$(CURRENT))>MARGIN+1 THEN 5800                          '*  2880
6290 IF LEN(TEXT$(CURRENT))=MARGIN+1 THEN IF RIGHT$(TEXT$(CURREN
     T),1)<>" " THEN 5800                                               '*  5225
6300 'End reformatting. Move everything back where it's supposed to be
6310 'startline is the first line of the old block, endline is the last
6320 'line of the old block, and linesmoved is the number of lines moved
6330 'to top of memory.
6340 TOP=TOP+TEMP-ENDLINE                                               '*  1693
6350 X=MAXLINES-LINESMOVED+1                                            '*  1891
6360 FOR I=TEMP+1 TO TOP                                                '*  1508
6370 SWAP TEXT$(I),TEXT$(X)                                             '*  1676
6380 TEXT$(X)=""                                                        '*   900
6390 X=X+1                                                              '*   571
6400 NEXT I                                                             '*   658
6410 'If the block still has the same lines in it, redisplay and continue.
6420 IF TEMP=ENDLINE THEN GOSUB 6660:GOTO 920                           '*  2844
6430 'If the block has different lines in it, recompute what().
6440 WHAT(CURSORLINE)=STARTLINE                                         '*  2156
6450 X=CURSORLINE+1:STARTLINE=STARTLINE+1                               '*  2853
6460 WHILE X<=LASTLINE AND STARTLINE<=MAXLINES                          '*  3161
6470 IF MID$(TEXT$(STARTLINE),1,5*LEVEL)<>STRING$(5*LEVEL,32) TH
     EN WHAT(X)=STARTLINE:X=X+1                                         '*  5807
6480 STARTLINE=STARTLINE+1                                              '*  1783
6490 WEND                                                               '*   545
6500 'Fix the what() array if not enough lines and verify cursorcol is legal.
6510 'Fix screen and get ready for next command.
6520 WHILE X<=LASTLINE:WHAT(X)=MAXLINES+1:X=X+1:WEND                    '*  3503
6530 CURSORCOL=FNMIN(MARGIN+1,CURSORCOL)                                '*  2738
6540 CURSORCOL=FNMIN(CURSORCOL,LEN(TEXT$(STARTLINE))+1)                 '*  3733
6550 GOSUB 6660:GOSUB 8690:GOTO 920                                     '*  2113
6560 GOTO 920                                                           '*   741
6570 'perform a function-key action
6580 ON CMD-58 GOTO 6610,6650,6850,6930,6970,7070,7200,7300,7410
     ,7570                                                              '*  3644
6590 END                                                                '*   459
6600 'help:
6610 'display a help screen
6620 RETURN                                                             '*   718
6630 'redisplay : Top of Outline
6640 'redisplay the screen from the top of text to lastline.
6650 GOSUB 8330:GOSUB 8440                                              '*  1545
6660 X$=STRING$(MARGIN,32)                                              '*  1606
6670 FOR I=FIRSTLINE TO LASTLINE                                        '*  2159
6680 LOCATE I,1                                                         '*   882
6690 LSET X$=TEXT$(WHAT(I)):X=LEN(TEXT$(WHAT(I)))                       '*  3093
6700 PRINT X$;" ";:LOCATE I,MARGIN+1                                    '*  2193
6710 IF X>MARGIN THEN IF X>MARGIN+1 OR MID$(TEXT$(WHAT(I)),MARGI
     N+1,1)<>" " THEN PRINT"+";                                         '*  5534
6720 NEXT I:X$=""                                                       '*   974
6730 RETURN                                                             '*   720
6740 'redisplay a single line
6750 X$=STRING$(MARGIN,32)                                              '*  1606
6760 LSET X$=TEXT$(CURRENT)                                             '*  1761
6770 LOCATE CURSORLINE,1                                                '*  1583
6780 PRINT X$;                                                          '*   857
6790 IF LEN(TEXT$(CURRENT))<=MARGIN THEN PRINT" ";:RETURN               '*  3742
6800 IF LEN(TEXT$(CURRENT))>MARGIN+1 THEN PRINT"+";:RETURN              '*  3778
6810 IF MID$(TEXT$(CURRENT),MARGIN,1)<>" " THEN PRINT"+";               '*  3477
6820 X$=""                                                              '*   493
6830 RETURN                                                             '*   721
6840 'save a document outline
6850 GOSUB 7150                                                         '*   864
6860 LOCATE 7,1                                                         '*   864
6870 PRINT"Saving ";F$                                                  '*  1523
6880 OPEN"O",1,F$                                                       '*   942
6890 FOR I=1 TO TOP:PRINT #1,TEXT$(I):NEXT I                            '*  2775
6900 CLOSE                                                              '*   613
6910 GOSUB 7150:GOSUB 8690                                              '*  1550
6920 RETURN                                                             '*   721
6930 GOSUB 6850                                                         '*   869
6940 CLS:END                                                            '*   742
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Listing continued

Listing continued

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6950 RETURN                                                             '*   724
6960 'rename current file in memory
6970 GOSUB 7150                                                         '*   867
6980 LOCATE 6,1:PRINT"Current file name is: ";F$;                       '*  3591
6990 LOCATE 7,1:PRINT"New file name will be:";                          '*  3406
7000 GOSUB 8880                                                         '*   863
7010 IF ANS$>" " THEN F$=ANS$                                           '*  1627
7020 GOSUB 7150                                                         '*   854
7030 GOSUB 8690                                                         '*   865
7040 RETURN                                                             '*   715
7050 'disk:
7060 'rename current disk file
7070 GOSUB 7150                                                         '*   859
7080 LOCATE 6,1:PRINT"Current disk file is: ";F$                        '*  3534
7090 LOCATE 7,1:PRINT"New disk file name will be: ";                    '*  3889
7100 GOSUB 8880                                                         '*   864
7110 IF ANS$>" " THEN NAME F$ AS ANS$                                   '*  2100
7120 GOSUB 7150:GOSUB 8690                                              '*  1544
7130 RETURN                                                             '*   715
7140 'clear last two lines of information display
7150 VIEW PRINT 6 TO 7                                                  '*  1349
7160 LOCATE FIRSTLINE-3:PRINT STRING$(79,32):LOCATE FIRSTLINE-2:
     PRINT STRING$(79,32);:'cls                                         '*  5588
7170 VIEW PRINT                                                         '*   983
7180 RETURN                                                             '*   720
7190 'clear all memory
7200 GOSUB 7150:LOCATE 7,1                                              '*  1532
7210 BEEP                                                               '*   518
7220 PRINT"Warning! You asked to delete all text from memory! Do
      this (Y/N)?";                                                     '*  6438
7230 GOSUB 8850                                                         '*   865
7240 IF TEMP$="n" OR TEMP$="N" THEN GOSUB 8690:RETURN                   '*  3311
7250 FOR I=0 TO MAXLINES:TEXT$(I)="":NEXT I                             '*  2703
7260 LEVEL=13:CURRENT=1:CURSORLINE=1:CURSORCOL=1:TOP=1                  '*  3712
7270 GOSUB 7150:GOSUB 6660:GOSUB 8690                                   '*  2234
7280 RETURN                                                             '*   721
7290 'delete current file from disk
7300 GOSUB 7150                                                         '*   855
7310 BEEP                                                               '*   519
7320 LOCATE 6,1                                                         '*   855
7330 PRINT"Do you really want to delete the current file from di
     sk (Y/N)?";                                                        '*  6315
7340 IF TEMP$="n" OR TEMP$="N" THEN GOSUB 8690:RETURN                   '*  3312
7350 GOSUB 7150                                                         '*   860
7360 LOCATE 7,1:PRINT"Deleting ";F$                                     '*  2392
7370 KILL F$                                                            '*   679
7380 GOSUB 7150:GOSUB 8690                                              '*  1552
7390 RETURN                                                             '*   723
7400 'move up one level; display more text on the screen.
7410 IF LEVEL>12 THEN RETURN                                            '*  1795
7420 LEVEL=FNMIN(LEVEL+1,13)                                            '*  1743
7430 'Keep current line on screen in same position.
7440 X=WHAT(CURSORLINE)-1:X1=CURSORLINE-1                               '*  2769
7450 WHILE X>0 AND X1>FIRSTLINE-1                                       '*  2103
7460 IF MID$(TEXT$(X),1,5*LEVEL)<>STRING$(5*LEVEL,32) THEN WHAT(
     X1)=X:X1=X1-1                                                      '*  4744
7470 X=X-1                                                              '*   573
7480 WEND                                                               '*   545
7490 X=WHAT(CURSORLINE)+1:X1=CURSORLINE+1                               '*  2770
7500 WHILE X<=TOP AND X1<=LASTLINE                                      '*  2234
7510 IF MID$(TEXT$(X),1,5*LEVEL)<>STRING$(5*LEVEL,32) THEN WHAT(
     X1)=X:X1=X1+1                                                      '*  4738
7520 X=X+1                                                              '*   567
7530 WEND                                                               '*   541
7540 GOSUB 6660:GOSUB 8690                                              '*  1555
7550 RETURN                                                             '*   721
7560 'move down one level; display less text on the screen.
7570 IF LEVEL<1 THEN RETURN                                             '*  1750
7580 LEVEL=FNMAX(LEVEL-1,0)                                             '*  1702
7590 X=WHAT(CURSORLINE):X1=CURSORLINE                                   '*  2587
7600 WHILE X>0 AND X<MAXLINES+1 AND X1>FIRSTLINE-1                      '*  3224
7610 IF MID$(TEXT$(X),1,5*LEVEL)<>STRING$(5*LEVEL,32) THEN WHAT(
     X1)=X:X1=X1-1                                                      '*  4741
7620 X=X-1                                                              '*   570
7630 WEND                                                               '*   542
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Listing continued

Listing continued

```
7640 'If x=) and xl is still at firstline or more, move all what() entries
7650 'down accordingly.
7660 WHILE Xl>FIRSTLINE-1                                              '*  1633
7670 FOR I=FIRSTLINE TO CURSORLINE-1                                   '*  2424
7680 WHAT(I)=WHAT(I+1)                                                 '*  1322
7690 NEXT I                                                            '*   670
7700 CURSORLINE=CURSORLINE-1                                           '*  1941
7710 Xl=Xl-1                                                           '*   668
7720 WEND                                                              '*   542
7730 'Look at entries at or past the current line.
7740 'The check at the current line is necessary if no lines are
7750 'at the current level at or before the current line position.
7760 X=WHAT(CURSORLINE):Xl=CURSORLINE                                  '*  2586
7770 WHILE X<=TOP AND Xl<=LASTLINE                                     '*  2243
7780 IF MID$(TEXT$(X),1,5*LEVEL)<>STRING$(5*LEVEL,32) THEN WHAT(
     Xl)=X:Xl=Xl+1                                                     '*  4747
7790 X=X+1                                                             '*   576
7800 WEND                                                              '*   541
7810 'If at end of text and still what() entries unfilled,
7820 'set them to point to an empty string.
7830 WHILE Xl<=LASTLINE                                                '*  1513
7840 WHAT(Xl)=MAXLINES+1                                               '*  1531
7850 Xl=Xl+1                                                           '*   671
7860 WEND                                                              '*   547
7870 'If current line is empty, backtrack.  If there are no lines in
7880 'the what() array, there are no lines in the outline at this level.
7890 'This would be very unusual, but still possible.
7900 WHILE WHAT(CURSORLINE)=MAXLINES+1                                  '*  2574
7910 CURSORLINE=CURSORLINE-1                                           '*  1944
7920 WEND                                                              '*   544
7930 IF CURSORLINE>=FIRSTLINE THEN 7970                                '*  2585
7940 CURSORLINE=FIRSTLINE:WHAT(1)=1:LEVEL=FNMIN(LEVEL+1,12)            '*  3936
7950 TEXT$(0)=UPLEVEL$:CURSORLINE=FIRSTLINE:GOTO 920                   '*  3512
7960 'Done.
7970 GOSUB 6660:GOSUB 8690                                             '*  1562
7980 RETURN                                                            '*   728
7990 'fatal errors of various kinds
8000 BEEP:GOSUB 7150                                                   '*  1195
8010 LOCATE 6,1                                                        '*   852
8020 IF ERR<>7 AND ERR<>14 THEN 8100                                   '*  2118
8030 PRINT"Out of memory! Unable to continue without deleting te
     xt!";                                                             '*  6051
8040 LOCATE 7,1                                                        '*   856
8050 PRINT"Your outline WILL BE DAMAGED!";                             '*  3051
8060 CLOSE:TEMP$=""                                                    '*  1145
8070 WHILE FRE("")<256:TEXT$(TOP)="":TOP=TOP-1:WEND                    '*  3166
8080 CURRENT=1:CURSORLINE=1:CURSORPOS=1:LEVEL=13                       '*  3322
8090 GOSUB 6660:RESUME 920                                             '*  1577
8100 IF ERR=24 THEN PRINT"Device time-out.  Printer off, or off-
     line.";:CLOSE:GOSUB 8960:RESUME 920:                              '*  7388
8110 IF ERR=25 THEN PRINT"Device fault.  Hardware problem!";:CLO
     SE:GOSUB 8960:RESUME 920                                          '*  6434
8120 IF ERR=53 THEN PRINT"That file was not found!";:CLOSE:GOSUB
      8960:RESUME 920                                                  '*  5716
8130 IF ERR=57 THEN PRINT"Device I/O error; serious hardware mal
     function!";:CLOSE:GOSUB 8960:RESUME 920                           '*  7940
8140 IF ERR=58 THEN PRINT"That file already exists!";:GOSUB 8960
     :RESUME 920                                                       '*  5461
8150 IF ERR=61 THEN PRINT"Disk is full!  Replace the disk and tr
     y again!";:CLOSE:GOSUB 8960:RESUME 920                            '*  7554
8160 IF ERR=64 THEN PRINT"That is an illegal file name!  Change
     name and try again!";:GOSUB 8960:RESUME 920                       '*  8082
8170 IF ERR=67 THEN PRINT"There's no more room for more file names on this disk!
";:CLOSE:GOSUB 8960:RESUME 920                                         '*  2120
8180 IF ERR=68 THEN PRINT"That device is not available!";:CLOSE:
     GOSUB 8960:RESUME 920                                             '*  6214
8190 IF ERR=70 THEN PRINT"That disk is write-protected!";:CLOSE:
     GOSUB 8960:RESUME 920                                             '*  6283
8200 IF ERR=71 THEN PRINT"The door is open or there's no disk in that drive!";:C
LOSE:GOSUB 8960:RESUME 920                                             '*  3905
8210 IF ERR=72 THEN PRINT"Disk has bad sector.  Replace disk and
      try again!";:CLOSE:GOSUB 8960:RESUME 920                         '*  7857
8220 PRINT"Fatal error.  Error";ERR                                    '*  2699
8230 CLOSE                                                             '*   611
8240 ON ERROR GOTO 0                                                   '*  1246
8250 END                                                               '*   454
8260 'initilize:
```

Listing continued

Listing continued

```
8270 ' "seed" the what() array with the first few lines of the file
8280 'that fall into the correct levels for display. The what() array
8290 'contains the line numbers of the lines in the file that are at
8300 'or below the current level.  The starting level is 5; so, all lines at
8310 'level 5 or below will be inserted into the what() array until the array
8320 'entries have been filled or the top of the form has been reached.
8330 FOR X=1 TO 25:WHAT(X)=MAXLINES+1:NEXT X                           '*  2823
8340 WHAT(CURSORLINE)=1                                                '*  1512
8350 X=1:CURRENT=FIRSTLINE                                             '*  1792
8360 WHILE CURRENT<=LASTLINE                                           '*  1922
8370 IF MID$(TEXT$(X),1,5*LEVEL)<>STRING$(5*LEVEL,32) OR TEXT$(X
     )="" THEN WHAT(CURRENT)=X:CURRENT=CURRENT+1                       '*  6857
8380 X=X+1                                                             '*   572
8390 WEND                                                              '*   546
8400 IF TOP=0 THEN WHAT(FIRSTLINE)=1:TOP=1                             '*  2728
8410 CURRENT=WHAT(FIRSTLINE)                                           '*  1922
8420 RETURN                                                            '*   718
8430 'display:
8440 VIEW PRINT 1 TO 8                                                 '*  1348
8450 FOR X=1 TO FIRSTLINE-1:LOCATE X,1:PRINT STRING$(79,32);:NEX
     T X:'cls                                                          '*  4368
8460 LOCATE 1,1,0                                                      '*   948
8470 PRINT TAB(55);"Function key assignments:"                         '*  3686
8480 LOCATE 2,1                                                        '*   859
8490 PRINT"F1=Help          F2=Top of Outline    F3=Save       F
     4=Save and exit"                                                  '*  5432
8500 LOCATE 3,1                                                        '*   853
8510 PRINT"F5=Rename file   F6=Rename disk file  F7=Clear mem  F
     8=Delete disk file"                                               '*  6564
8520 LOCATE 4,1                                                        '*   856
8530 PRINT"F9=Move to next outline level         F10=Move to pre
     vious outline level"                                              '*  6881
8540 LOCATE 5,1                                                        '*   859
8550 PRINT"Current file=";F$;".";                                      '*  2352
8560 IF CURRENT>TOP THEN CURRENT=TOP:WHAT(CURSORLINE)=TOP              '*  4013
8570 PRINT TAB(40);TOP;"lines in file, now on line";CURRENT            '*  4463
8580 LOCATE 8,1:PRINT STRING$(79,205);                                 '*  2307
8590 VIEW PRINT                                                        '*   990
8600 LOCATE 7,1                                                        '*   858
8610 X=1:WHILE MID$(TEXT$(CURRENT),X,1)=" ":X=X+1:WEND                 '*  3361
8620 X=X\5+1:X=FNMIN(X,13)                                             '*  1610
8630 PRINT"Current line is level";X;                                   '*  2927
8640 PRINT TAB(47);"Current maximum levels=";LEVEL;"   ";              '*  4199
8650 LOCATE ,,1                                                        '*   852
8660 IF CMD-58=2 THEN RETURN                                           '*  1743
8670 GOTO 920                                                          '*   745
8680 'show the current outline status
8690 VIEW PRINT 1 TO 8                                                 '*  1355
8700 LOCATE 1,1,0                                                      '*   945
8710 'x1=fre("")
8720 LOCATE 5,1,0                                                      '*   951
8730 PRINT"Current file=";F$;".";                                      '*  2352
8740 IF CURRENT>TOP THEN CURRENT=TOP                                   '*  2488
8750 PRINT TAB(40);TOP;"lines in file, now on line";CURRENT            '*  4463
8760 LOCATE 7,1                                                        '*   865
8770 X=1:WHILE MID$(TEXT$(CURRENT),X,1)=" ":X=X+1:WEND                 '*  3368
8780 X=X\5+1:X=FNMIN(X,13)                                             '*  1617
8790 PRINT"Current line is level";X;                                   '*  2934
8800 PRINT TAB(47);"Current maximum levels=";LEVEL;"   ";              '*  4197
8810 VIEW PRINT                                                        '*   985
8820 LOCATE ,,1                                                        '*   851
8830 RETURN                                                            '*   723
8840 'get a yes or no answer
8850 TEMP$=INKEY$:WHILE INSTR(" YyNn",TEMP$)<2:TEMP$=INKEY$:WEND       '*  4263
8860 RETURN                                                            '*   726
8870 'get input:
8880 X=CSRLIN:XX=POS(0):XXX=XX:ANS$="":X$=""                           '*  2841
8890 WHILE XX<MARGIN+1 AND X$<>CHR$(13)                                '*  2391
8900 X$=INKEY$                                                         '*   846
8910 IF X$>=" " THEN ANS$=ANS$+X$:PRINT X$;:XX=XX+1                    '*  3116
8920 IF X$=CHR$(8) THEN IF XX>XXX THEN XX=XX-1:LOCATE X,XX:PRINT
     " ";:LOCATE X,XX                                                  '*  5205
8930 WEND                                                              '*   546
8940 RETURN                                                            '*   725
8950 'delay
8960 T!=TIMER:WHILE TIMER-T!<2:WEND                                    '*  2294
8970 RETURN                                                            '*   728   End
```

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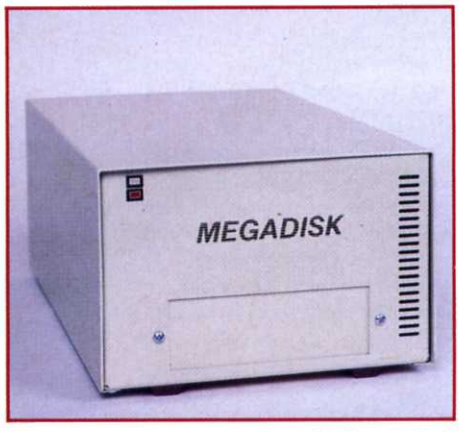

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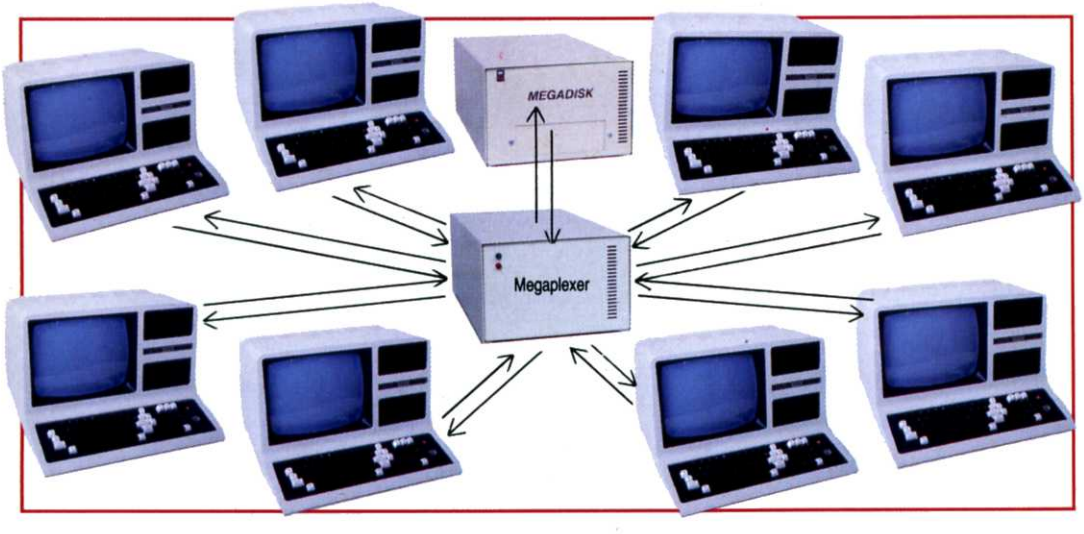

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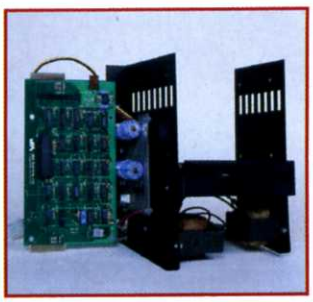

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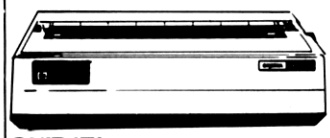

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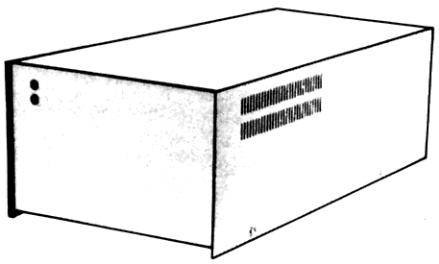

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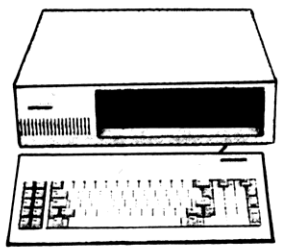

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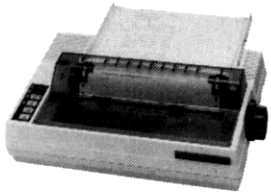

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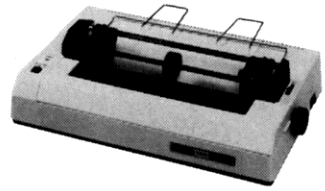

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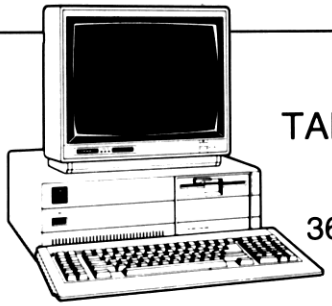

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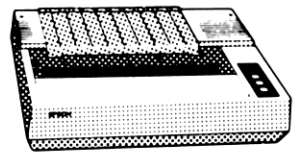

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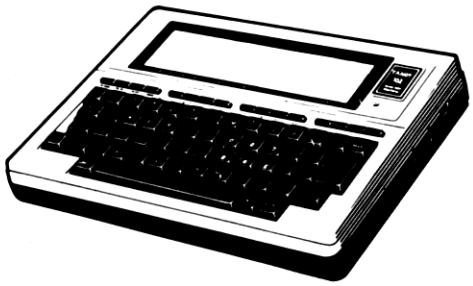

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- 26-3805 Tandy 100,102,200 Acoustic Coupler
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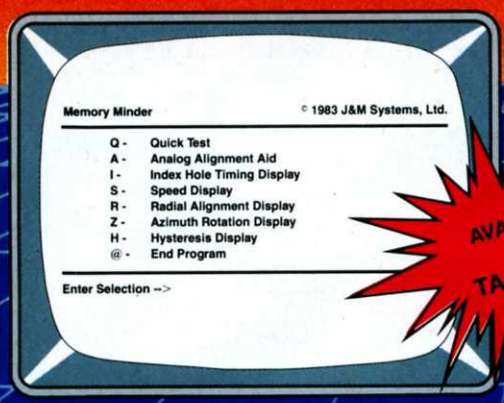
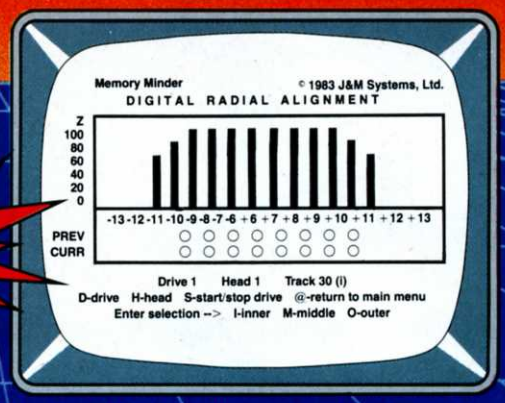
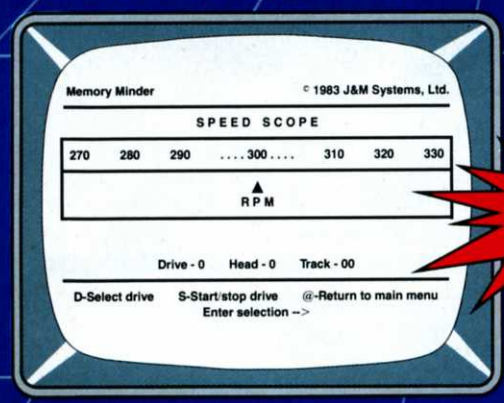


AVAILABLE For TANDY 1000!

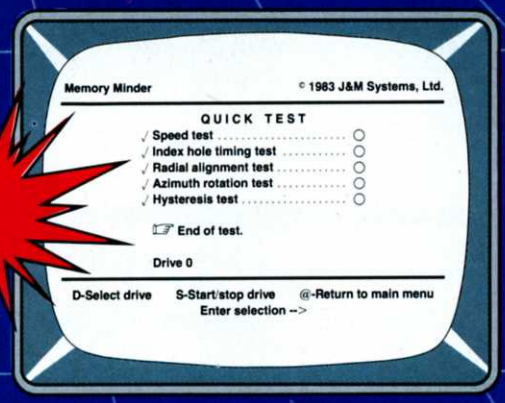


Select any one of seven tests to perform preventive maintenance or to isolate problems. Simple, single-letter commands make MM easy to use! Use MM to align the head, adjust the index hole detector, or adjust the speed.

Use the MM Radial Alignment Test to check the head alignment of your drives. No need for an oscilloscope or other expensive test equipment!



3.5 DRIVES NOW AVAILABLE!



Check the motor speed of your drives. Or, you can even use the Speed Test to adjust the drive speed. No need for any test equipment!

Use the Quick Test to quickly and automatically test five of the most important performance parameters of your drive. Monitor your drives for long term drift. Isolate problems quickly and automatically!

PROTECT YOUR DATA.

Now you can make sure your data is being recorded properly by the use of the revolutionary ***Memory Minder.***

The Memory Minder from J & M Systems, tests your disk's performance and calibration without any additional equipment! It measures your disk's performance and displays it on your screen.

This is the most comprehensive disk diagnostic program available for your TRS-80 microcomputer. You can even adjust drive alignment while watching the display!

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The Numeric Keypad - ~~$89.95~~ ★ Now $59.95

The NumberJack is a self-contained, cable-connected keypad for heavy-duty number-crunchers. Besides the number keys, it has all the cursors, symbols and math keys, including autoshifted (one-touch) ADD and MULTIPLY. Comes complete with 3-foot cable and all necessary connectors for quick and easy installation without soldering.

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This universal driver works with all monochrome monitors, and is easily installed without clips, jumpers or soldering (except in some later CoCo 2s with soldered-in video chips). Here's crisp, clear, flicker-free monitor output with all the reliability you've come to expect from HJL Products.

The Monitor - $89.95

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The BASIC Utility - ~~$25.95~~ ★ Now $19.95

Quick Basic Plus, a high-performance programming utility, can be used with any color computer that has four function keys. 26 pre-defined BASIC statements, 10 user-defined macros at a time (you can save as many sets of macros as you like), automatic line-numbering, word wrap, global search, and instant screen dump to printer, make this software the BASIC programmer's dream come true. Comes with re-legendable 3-way reference chart. Specify disk or cassette.

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software for the Color Computer 3™

An "enhanced" version of DeskMate?

That's right. DeskMate 3 is the latest version of our popular DeskMate integrated software program. It was created exclusively for the power of our new Color Computer 3 and features seven of the most commonly used personal-productivity programs—all on one diskette!

DeskMate 3 (26-3262, $99.95) is designed for maximum efficiency and simplicity. There are no complicated commands to memorize, so you can begin working on your Color Computer 3 from the very first day.

Get seven applications ...on one diskette

DeskMate 3 offers you seven program options that you will find useful for both your business and your personal household needs. You can select an application by simply using your mouse, joystick or keyboard. The applications are identified by name and icon and are arranged on an easy-to-read menu.

TEXT lets you compose, edit and print letters, reports on a 40/80-column switchable display.

TEXT is a general-purpose word processor that allows you to write reports, letters, resumes and other correspondence or text. You can edit your work with a few simple commands, perform search and replaces, merge files, select blocks, copy and delete and more.

LEDGER is a simple spreadsheet program that includes automatic column formatting and a 40/80-column switchable display. *LEDGER* is perfect for budgeting, sales forecasting, profit-and-loss projections and many other "What if . . . ?" calculations.

INDEX CARDS turns your Color Computer 3 into a personal filing system. Organize those important names and addresses or other pertinent information and easily keep track of them. Enter and edit and perform simple sorts and searches as your needs dictate.

INDEX CARDS allows you to keep important names and addresses in an efficient filing system.

PAINT allows you to take advantage of the superior color graphics of the Color Computer 3. With *PAINT* you can create brilliant drawings, charts and other graphic images on your screen and then print a copy on a dot-matrix printer. Create impressive proposals or "paint" just for fun!

*TELECOM** puts a world of information at your disposal on a 40/80-column switchable display. This program lets you access national information services, or exchange information with other computers by phone.

With *CALENDAR* you need never worry about missing those important engagements and dates. This simple-to-use monthly calendar program displays all your "to do's" throughout each day. It's a great way to organize your busy schedule.

Finally, *CALCULATOR* is a four-function mathematic problem solver with memory that can be accessed within any application without interrupting the program you are currently using.

Enhanced software for a powerful machine

Our sharp Color Computer 3 (26-3334, $219.95) is a powerful 128K Extended BASIC personal computer with superb graphics resolution and a choice of up to 64 colors. You get the power and dependability of a more expensive personal computer at a much lower price. The Color Computer 3 can be used in a variety of applications and is expandable to 512K. It's flexible, too—it grows as your computing needs grow.

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MS-DOS

Turn of the Key

The Gold Key Converser is a parallel-to-serial port converter that lets you drive a serial printer on an IBM PC or compatible. Featuring an internal data buffer to store computer output, the Gold Key Converser connects directly onto a parallel-printer cable and eliminates serial interface cards.

The device is completely transparent to a computer and printer and supports the most common serial protocols. Two versions are being offered: the PS-16 with 16K bytes of buffer memory ($149) and PS-64 with 64K ($229).

Contact Gold Key Electronics Inc., 11 Cote Ave., P.O. Box 186, Goffstown, NH 03045, 800-325-0150 (603-625-8218 in New Hampshire).

Circle 557 on Reader Service card.

Gold Key Converser lets you drive a serial printer on an IBM PC or compatible.

Mirror Image

Mastersoft has released Word for Word, a word-processing utility that supports two-way file conversions between Wordstar, Wordperfect, Multimate, PFS:Write, IBM Writing Assistant, Volkswriter, ASCII, and EBCDIC (extended binary-coded decimal interchange code) formats.

Word for Word produces mirror-image conversions of the original document. The converted file can be edited and printed by any of the supported word-processing packages. Word for Word also generates a special format for transmitting documents over normal communications lines without the need for special terminal software.

Word for Word runs on an IBM PC/XT/AT or compatible (256K) running DOS 2.0 or later. The single-copy price is $149, with volume discounts available upon request. For information contact Mastersoft Inc., 909 Electric Ave., Seal Beach, CA 90740, 800-654-5301 (213-493-2471 in California).

Circle 561 on Reader Service card.

Publisher's Aid

Professional Publisher lets you create professional-looking documents faster and less expensively than with typesetting systems. Users with publishing or graphics-design experience can produce newsletters, brochures, manuals, price lists, or proposals using text created by the program or a word processor.

Professional Publisher's batch-layout option preformats long documents and quickly makes global format changes. An interactive on-screen editor lets you make short documents or specific changes. Other features include algorithmic and dictionary hyphenation, best-fit justification, word and letter spacing, kerning and tracking, widow and orphan control, adjustable leading, vertical justification, and automatic column balancing. You can also design pages using built-in style sheets.

The program imports text files in DCA or ASCII formats. Charts can be added from Harvard Presentation Graphics and Lotus's 1-2-3, and graphic images can be integrated from PC Paintbrush, Dr. Halo, and Microsoft Windows Paint. Photographs and other images can be scanned, too.

Professional Publisher supports the Hewlett-Packard Laserjet, Apple Laserwriter, and other Postscript devices. It works with scanners such as Datacopy, Dest, and Compuscan, and it can share peripherals on the IBM PC, Novell Netware, and 3Com 3+ networks. It runs on the IBM PC/AT and compatibles (640K) and requires an IBM Enhanced Graphics Adapter (EGA). A mouse and laser printer are recommended. It costs $695. Contact Software Publishing Corp., 1901 Landings Drive, Mountain View, CA 94043-7210, 415-962-8910.

Circle 565 on Reader Service card.

Chart Your Course

Progressive Peripherals & Software's Add Graph produces graphics, transparencies, and slides for business presentations. It lets you display up to 30 windows simultaneously and can produce an assortment of three-dimensional graphs. You can also create and store custom textures and backgrounds for later use.

Add Graph reads 1-2-3, Open Access, Dbase, DIF, and Visicalc files. It fully supports laser printers, plotters, the Polaroid Palette, and the Canon Inkjet printer. Low-resolution dot-matrix printers, such as the Epson FX and RX series, are also supported.

The program runs on an IBM PC/XT/AT or compatible (256K) and requires an IBM, STB, EGA, Hercules, or compatible graphics card. It costs $149.95. Contact Progressive Peripherals & Software Inc., 464 Kalamath St., Denver, CO 80204, 303-825-4144.

Circle 563 on Reader Service card.

List Manager

Arc Tangent Inc. has released Arclist, a list-management program offering mainframe list-management features on the IBM PC/XT/AT and compatible computers (640K) with a hard-disk drive. Arclist can manage up to 20 million names, merge-purge up to five lists at once, and recognize near-duplicate entries using match-code or algorithm techniques. It can create and print any kind of mailing label, packing slip, or form letter, as well as five basic types of reports, including sheet and subheaded listings, list profiles, financial reports, duplication reports, and bar charts.

Arclist offers built-in routines that correctly convert full or misspelled state names and irregular abbreviations to proper two-character abbreviations. It can change uppercase entries to mixed case and vice versa. The Nth Sampling feature tests a list before committing to a full-scale mailing; labels can be sorted and printed according to postal-service presort specifications. Arclist also calculates postage, prints mailing-analysis reports, and creates mail-tray labels.

Arclist includes help screens, password protection, an activity log, and automatic file repair. It comes with a 300-page manual and retails for $595, although a demonstra-

Circle 232 on Reader Service card.

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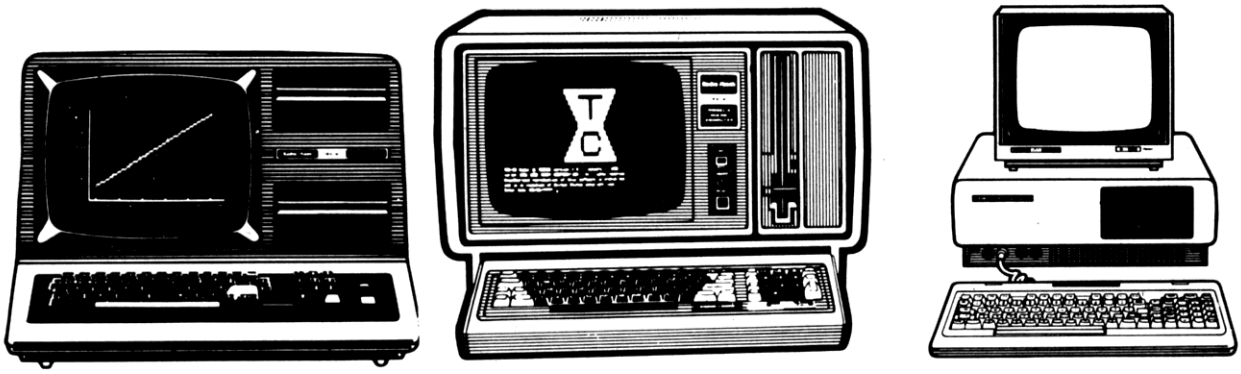

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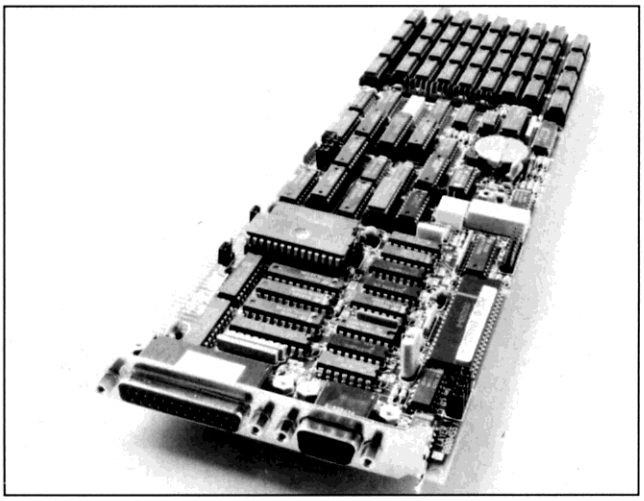
tion copy is available for $49.95. Contact Arc Tangent Inc., 232 Anacapa St., P.O. Box 2009, Santa Barbara, CA 93120, 805-965-7277.

Circle 551 on Reader Service card.

The One-Board Solution

The Persyst Division of Emulex Corp. has released the SB-III, an EMS (expanded-memory specification) and I/O expansion board for the IBM PC/XT/AT and compatibles. It offers up to 2MB of expanded memory, serial/parallel ports, calendar/clock, and a game-port interface.

Using one expansion slot, the SB-III provides 1MB of extra memory using 256K RAM chips; another 1MB can be added by attaching a daughterboard to the SB-III. The board fits into any PC or AT long slot (Tandy 1200 or 3000 only) and includes software with utilities such as a RAM-disk emulator and print spooler. The RS-232-compatible serial port has a programmable baud rate (50–9,600 baud) and full modem (DTE) support.



The SB-III offers up to 2MB of expanded memory, serial/parallel ports, calendar/clock, and game-port interface.

Retail price for the SB-III is $399. Contact Emulex Corp., 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, CA 92626, 714-662-5600.

Circle 555 on Reader Service card.

Up and Running

Jumpstart is a program for business professionals who need an introduction to computers and telecommunications but don't have the time to pore over manuals and tutorials. It combines an address book, appointment calendar, text editor, financial calculator, file utilities, and a terminal program. Numerous help screens are available with a single keystroke.

For frequently performed communications tasks, you can build macros that automatically dial a phone number, log onto a network, transfer a file, log off, and hang up. You can exchange groups of files with a remote computer that is also running Jumpstart, and manage data and text files with the ASCII text editor and file utilities. Jumpstart is not copy-protected, comes with a 60-day money-back guarantee, and costs $66.

Contact Ascent Inc., 190 Sobrante Way, Suite 201, Sunnyvale, CA 94086, 800-367-5867 (408-720-9200 in California).

Circle 552 on Reader Service card.

Circle 86 on Reader Service card.

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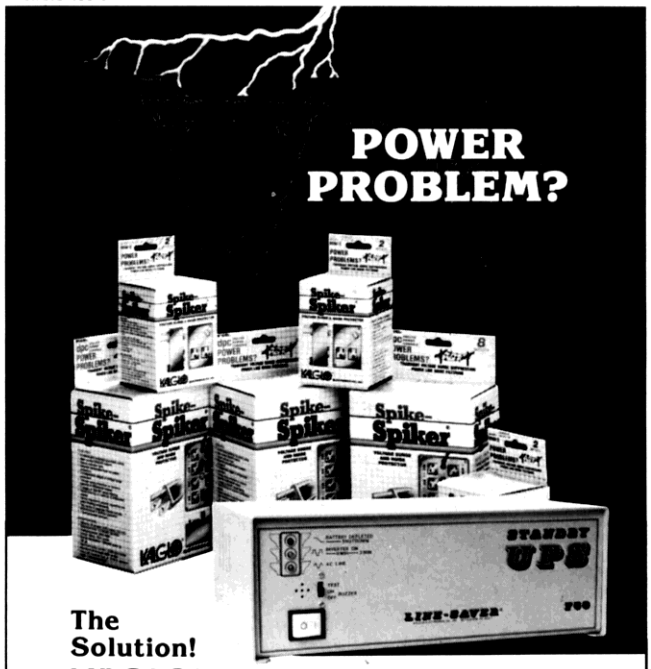

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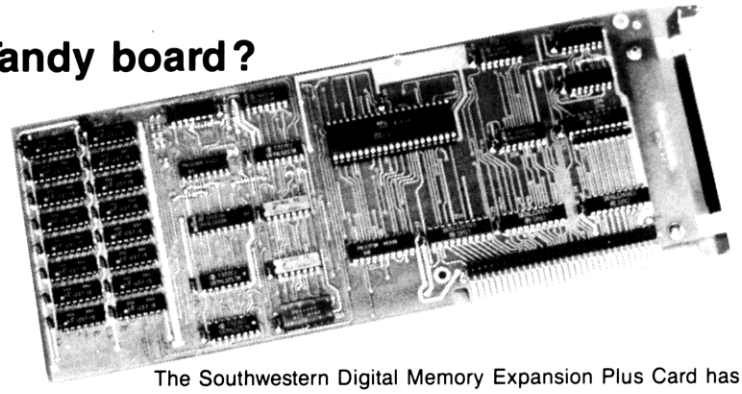

The Southwestern Digital Memory Expansion Plus Card has all the features of the Radio Shack Board but the price; you save almost $400. Features include 512K installed, burned in, and tested to give you a total of 640K, a DMA circut that is fully tested for hard drive operation, and an expansion port that will work with any of the Radio Shack Memory Plus Expansion Card options. High quality manufacturing, and features such as gold plated card edges make this the logical choice in upgrading your memory.

Tandy 1000 Add on Boards
Serial, Clock, or Both

The Southwestern Digital new Add-On boards were developed for use with the Plus Card Port, (a piggy-back type, add on port established by Tandy to eliminate the need for an additional card slot). These cards are fully compatible with the Memory Expansion Plus Card from Southwestern Digital and the Memory Expansion Plus Board from Tandy.

RS232C PLUS Option Board

Mounts on a PLUS expansion board, and features selectivity between COM Port 1 and COM Port 2. The RS232C output connector is the standard Tandy female DB25, and is fully compatible with the Tandy output. $85.

Clock/Calendar PLUS Option Board

Mounts on a Plus expansion board, and features selectivity between two ports so that you can run two clocks at one time. The Clock Calendar Board gives you perpetual time/date so that you don't have to re-input time and date into your application programs as part of your power up routine. $85.

RS232C-Clock/Calendar PLUS Option Board

Features options of both of the above boards on just one board. $170.

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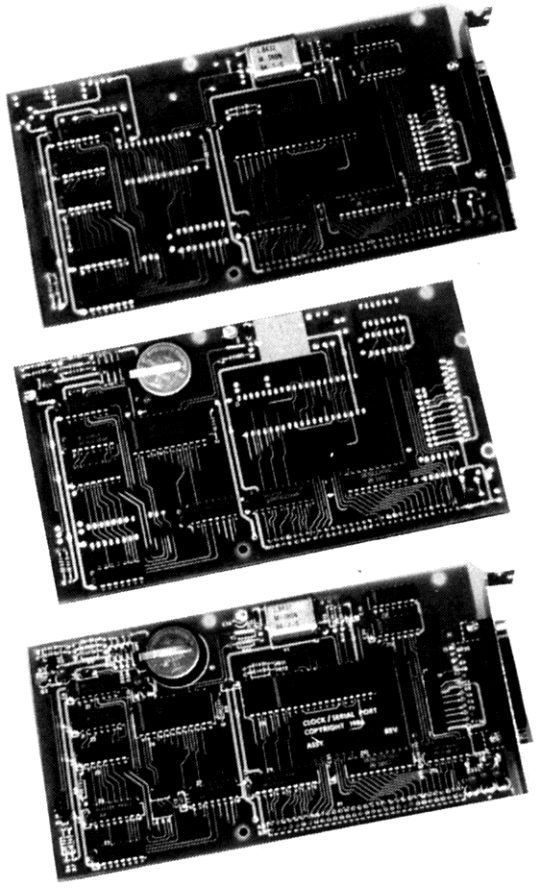

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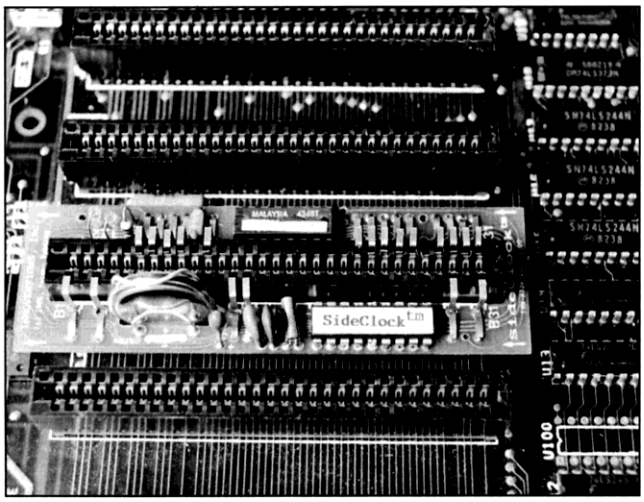
20 Megabytes to Go

Maynard Electronics has announced Maynstream Plus 20/20, a combination half-height, 20-megabyte (MB), hard-disk drive and tape back-up system that comes in a portable case.

The Maynstream Plus 20/20 controller card takes only one slot and is attached to the hard drive by a quick-release cable. The drive runs on its own power supply, so the only power drawn from a computer is for the controller card. It backs up 20MB in under five minutes, file by file, onto 4- by 2½-inch tape cassettes. A file-splitting option lets you put data on a second or third cassette when the first one is full. The hard drive has an average seek time of 60 milliseconds (ms).

The hard-drive and tape back-up system is designed to be ported between IBM PCs and ATs. It costs $2,400 and comes with a manual. Contact Maynard Electronics, 460 E. Semoran Blvd., Casselberry, FL 32707, 305-331-6402.

Circle 562 on Reader Service card.



Innoventions' Sideclock lets you add clock/calendar functions without wasting an expansion slot.

Ticked Off

Sideclock is a miniature clock card for the IBM PC and compatibles that lets you add clock/calendar functions without wasting an expansion slot. Measuring 1½ by 3⅝ inches and having a rectangular hole in its center, Sideclock mounts horizontally on any of the motherboard's expansion slots, and it can share the same slot with another expansion card.

In typical applications, Sideclock shares the expansion slot used for the video adapter or the floppy-disk controller. It comes with control software and a five-year lithium battery. The cost is $59.95. Contact Innoventions Inc., 1669 S. Voss, Suite #880, Houston, TX 77057, 713-728-0938.

Circle 559 on Reader Service card.

Gothic Trappings

Infocom's new interactive game, Moonmist, is a Gothic mystery set in fog-shrouded Tresyllian Castle, which houses hidden treasure, puzzling riddles, and a ghost.

When admitted to the castle, you meet a cast of eccentric characters ranging from a blue-blooded debutante to an overly helpful butler. Most have seen the ghostly figure in the tower window. You learn that a valuable object is hidden in the castle and soon find yourself involved in a

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PC (Standard Paper) (5152)	1/2 x 20	$14/2	$36/6	$ 66/12	$7/1	$6 ea	2 or more	$15/3	$54/12	$288/72
RADIO SHACK-TOSHIBA-COMMODORE-PANASONIC-RICOH		RS LP-I-II-IV, CENTRON			730-737-739-779 (Zip Pack)			$12/3	$45/12	$252/72
Carbon Film - DWP 210, DIABLO HYTYPE II Black (1445)	5/16 x 145	$18/3	$60/12	$342/72	$5 ea 3-11	$4 ea	12 or more	$24/6	$42/12	$234/72
DW II, DWP 410-510, RICOH 1200-1300-1600 Black (1419)	1/4 x 145	$18/3	$60/12	$342/72	$5 ea 3-11	$4 ea	12 or more	$24/6	$42/12	$234/72
Red, Green, Blue, Brown Colors (1419)	1/4 x 130	$21/3	$72/12	$414/72	$6 ea 3-11	$5 ea	12 or more	$30/6	$54/12	$234/72
Fabric (Long Life), DWP 210, DIABLO HYTYPE II Black (1458)	5/16 x 17 NOT EZ LOAD	$18/2	$51/6	$ 96/12	$8/1	$7 ea	2 or more	$21/3	$78/12	$432/72
DW II, DWP 410-510, RICOH 1200-1300-1600 Black (1449)	1/4 x 25	$18/2	$51/6	$ 96/12	$8/1	$7 ea	2 or more	$21/3	$78/12	$432/72
DMP-100, LP VII, COMMODORE 1525, GORILLA BANANA (1424)	Inker Loop	$18/2	$51/6	$ 96/12	.....			.....		
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MX-FX-RX 70-80-85, LX 80-90 (5/16 x 7)	1/2 x 20	$14/2	$36/6	$ 66/12	$7/1	$6 ea	2 or more	$15/3	$54/12	$288/72
MX-FX-RX 100-185-286, LQ 800 (1/2 x 18) LQ 1500 (1/2 x 14)	1/2 x 30	$18/2	$51/6	$ 96/12	$8/1	$7 ea	2 or more	$18/3	$66/12	$360/72
DX 20-35 Carbon Film (Multistrike), OLIVETTI ET-121-221	5/16 x 290	$21/3	$72/12	$414/72	(Call for Correctable Prices)			.....		
NEC Spinwriter-Carbon Film - 2000-3500 (Reloads BCCOMPCO Only)	5/16 x 145	$18/3	$60/12	$342/72	$5 ea 3-11	$4 ea	12 or more	$24/6	$42/12	$234/72
- 5500-7700 (Can Reload Most Types)	NOT EZ LOAD 1/4 x 145	$18/3	$60/12	$342/72	$5 ea 3-11	$4 ea	12 or more	$24/6	$42/12	$234/72
-Fabric - 2000-3500 (Can Reload All)	1/2 x 14	$18/2	$51/6	$ 96/12	$8/1	$7 ea	2 or more	$15/3	$54/12	$288/72
- 5500-7700 (Can Reload All)	1/2 x 13	$15/2	$42/6	$ 78/12	$8/1	$7 ea	2 or more	$15/3	$54/12	$288/72
Pinwriter P1-P2-P6, P-5 (1/2 x 14)	1/2 x 20	$25/2	$69/6	$126/12	$7/1	$6 ea	2 or more	$15/3	$54/12	$288/72
P3-P7	1/2 x 27	$30/2	$84/6	$156/12	$8/1	$7 ea	2 or more	$18/3	$66/12	$360/72
OKIDATA Pacemark 2350-2410 Black	1/2 x 100		$25 each		$20/1	$18 ea	2 or more	$36/3	$132/12	$720/72
Microline 182-183-192-193 (Call for 292-293 prices)	Inker Loop	$20/2	$57/6	$108/12						
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MANNESMAN-TALLY MT-160, RITEMAN INFORUNNER (Inker Loop)	9mm x 11	$19/2	$54/6	$102/12						
MT-180-290	9mm x 13	$20/2	$57/6	$108/12						
-SPIRIT 80 (SP80) COMMODORE 1526 (Multistrike)	1/2 x 35	$16/2	$45/6	$ 84/12						
PANASONIC KXP-1080-1090-1091-1092-1592-1595	Inker Loop	$20/2	$57/6	$108/12						
BROTHER HR-15-25-35 / COMREX DX-15, II — Carbon Film (Multistrike)	5/16 x 82	$18/3	$60/12	$342/72						
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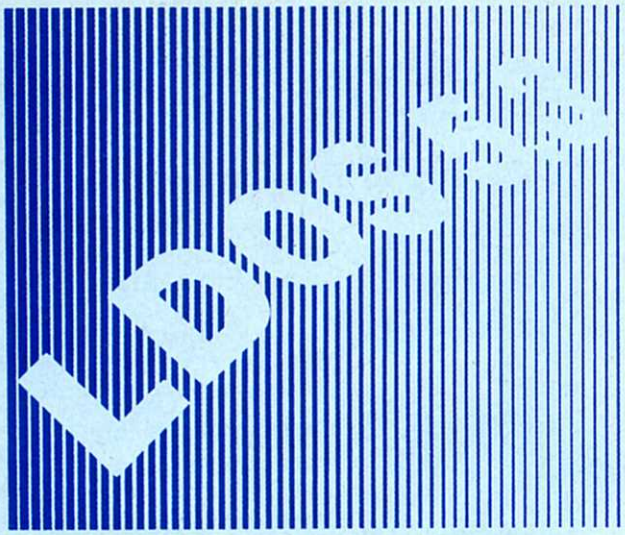

The LDOS 5.3 upgrade kit is now available to take your Model III or 4 (in 3 mode) to the year 2000. LDOS 5.3 provides complete media compatibility with LS-DOS 6.3, the newest Model 4 DOS released by Logical Systems, Inc. With LDOS 5.3, you can add 12 years to the life of your software. Just look at these improvements over version 5.1.4!

DOS Enhancements:

- Date support through December 31, 1999; time stamping for files.
- Enhancements to LDOS now free up 14 additional file slots for data disks.
- On-line HELP facility for DOS and BASIC – 117 screens of help.

LIBRARY Enhancements:

- New FORMS, lets you change printer filter parameters.
- New SETCOM, lets you change RS-232 parameters.
- Improvements to LIST add paged displays, full-screen hex mode, and flexible tab expansion.
- MEMORY displays directory of terminate and stay resident modules.
- SYSTEM lets you direct the SYSGEN to any drive; adds a flexible drive swap subcommand; SMOOTH for faster disk throughput.
- DIRectory display enhanced with time stamps, file EOF, and more.
- We've also improved: AUTO, COPY, CREATE, DEBUG, DEVICE, DO, FREE, KILL, and ROUTE; and added CLS and TOF commands.

UTILITY Enhancements:

- We've added TED, a full screen text editor for ASCII files.
- LCOMM now gives you access to LDOS library commands while in terminal mode.
- PATCH supports D&F patch lines with REMOVE capabilities.
- DATECONV has been added to convert older disks to the new date convention.

BASIC Enhancements:

- Improvement to line editing with the addition of line COPY and MOVE.
- Very flexible INPUT@ added for screen fielded input.
- We've added a CMD"V" to dump a list of active variables with values – including arrays.

For $24.95 (+S&H), the LDOS 5.3 upgrade kit includes a DOS disk and documentation covering the enhancements. Specify Model 3/4 or MAX-80.
P.S. – Don't return you old disk!

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PO Box 239
Sterling, VA 22170-0239
703-450-4181 MC, VISA, CHOICE
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VA residents add sales tax. S&H: US $2, Canada $3, Foreign $6.

treasure hunt. Clues are given in the form of riddles, which hold the answers to the truth behind Tresyllian Castle.

Four variations of Moonmist are contained on the same disk, each with separate puzzles, treasure, and solutions to the mystery. Moonmist comes with an illustrated copy of *Legendary Ghosts of Cornwall*. It costs $39.95. Contact Infocom Inc., 125 Cambridge Park Drive, Cambridge, MA 02140, 617-492-6000.

Circle 558 on Reader Service card.

What's On the Menu?

Hot is a DOS file utility that lets you customize menus, bypass the complexities of DOS, and locate and edit any file with single keystrokes. Hot sets up a series of menus from which you can access all files. The program includes eight utilities: 1Word, a text editor; File Finder, a file and directory locator; Hot Menus, a menuing system; Popup Hot Menus, a keyboard macro program similar to Superkey; Hot Build, a menu-maker; Run File; Hotime Calendar; and Command Shell, a DOS-like command line with system statistics and command history.

Hot requires an IBM PC/XT/AT or compatible (256K) running MS-DOS 2.0 or later, although 512K and MS-DOS 3.0 are recommended. It costs $75 and is not copy-protected. Contact Executive Systems Inc., 15300 Ventura Blvd., Suite 305, Sherman Oaks, CA 91403, 818-990-3457.

Circle 556 on Reader Service card.

Upgraded C

Lifeboat Associates' Advantage C++ is an implementation of AT&T's C++ programming language for the IBM PC and compatibles. This upgraded language has a variety of constructs to help you define data types or classes, and it offers strong type checking to keep you from making data-type errors. Existing C source code can be passed through Advantage C++, read, combined with other C code, and used with the Lattice C or Microsoft C compilers.

Advantage C++ supports enhanced data abstraction by letting you define new types called classes. These are similar to structures except that they have function members as well as data members. The concept lets you determine how programs deal with procedures that operate on data and with the data itself. Classes, member and friend functions, constructors and destructors, overloaded operators, and virtual functions account for the language's support of data abstraction. New notational convenience and derived classes make masses of code more understandable.

Advantage C++ comes on two disks. The package includes a user's guide, a copy of *The C++ Programming Language* by its creator, Bjarne Stroustrup, and an abridged version of *Unix System V AT&T C++ Translator Release Notes*. The package sells for $495. For more information, contact Lifeboat Associates Inc., 55 S. Broadway, Tarrytown, NY 10591, 800-847-7078 (914-332-1875 in New York).

Circle 560 on Reader Service card.

Swing Both Ways

The Blue Thunder Z80 coprocessor, with the included CP/M emulator software, allows you to run CP/M-80 software on an IBM PC/AT/XT or compatible. All CP/M files are kept in MS-DOS format and the same files can be processed by MS-DOS or CP/M programs. For example, you can take a file created with a CP/M word processor and run it through an MS-DOS spelling checker. You can also bind a header to a CP/M program, which turns a CP/M program into an MS-DOS program and starts execution automatically.

The Blue Thunder regular version runs at 5MHz ($249.95), the high-speed version at 10MHz ($399.95), with the host PC providing additional power to buffer the I/O (input/output). The transient program area (TPA) is 63K. The board emulates a Kaypro

CP/M computer and comes with a utility for converting Kaypro-formatted disks.

The hardware package comes with a 40-page instruction manual and a 30-day money-back guarantee. Contact Z-World, 2065 Martin Ave., Suite 110, Santa Clara, CA 95050, 408-980-1678.

Circle 566 on Reader Service card.

Managing Accounts

Signature Solutions has released the Job Tracking System, an accounting package for the IBM PC/XT/AT and compatibles (256K). Designed for use in bookkeeping firms, the program maintains information about current accounts, including client name, job description, rates, date in/out, budget, and time and billing records.

Several job-control and management reports are available to track the progress of accounts. A system tutorial and context-sensitive help function are provided in place of a manual. An automatic back-up facility maintains the daily processing of jobs and reminds you if you don't back up often enough.

The Job Tracking System is priced at $595. Contact Signature Solutions Inc., 454 Kenneth Ave., Campbell, CA 95008, 800-327-6111 (408-378-8177 in California).

Circle 564 on Reader Service card.

New Development

Beacon Street Software has released PC/Power, a program-development system incorporating several functions to help you create and test applications. The development system provides an environment in which you can run compilers and linkers, create screens, and test your programs. A run-time system supports the applications you develop.

PC/Power supports applications in a variety of languages, including C, Pascal, Basic, and assembly, and it lets you use different languages in the same application. A command-line function lets you test programs during development with the option of calling your favorite debugger from a pop-up menu. You can also build indexes of applications and programs for integrating existing programs into an application.

The run-time system is royalty free and can be distributed with your applications. PC/Power costs $95 and runs on the IBM PC and compatibles. Contact Beacon Street Software Inc., P.O. Box 216, Boston, MA 02133, 800-628-2828, ext. 712.

Circle 554 on Reader Service card.

TRS-80

Logical Upgrade

Logical Systems Inc.'s LS-DOS 6.3 is an update of the TRSDOS 6.x operating system for the Model 4 and is upwardly compatible with other TRSDOS 6.x versions. LS-DOS 6.3 modifies the time stamp, as well as the date, and expands the date range through 1999. It includes the Dateconv program for updating TRSDOS 6.x or earlier disks to the LS-DOS 6.3-style dating.

Other features include new supervisor calls (SVCs) for screen-print and decimal display, one-pass format and disk-duplication programs, and a variable and line-number cross-reference utility for Basic programs. It also includes such Basic enhancements as line copy and block move with automatic line-reference renumbering; search and display variable, line numbers, and keywords; selective block renumbering; faster load and save functions; direct access to DOS SVCs; and single-letter abbreviations for Auto, Delete, Edit, and List commands.

LS-DOS 6.3 also includes TED, a text editor that stores files in standard ASCII format. The system upgrade costs $29.95. Contact Logical Systems Inc., P.O. Box 55235, Grand Junction, CO 81505, 303-243-7070.

Circle 567 on Reader Service card.

Meet the Tax Man

Try-O-Tax is a program to assist you in preparing a

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H.D. Card (20 meg) **$609**

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$499.00

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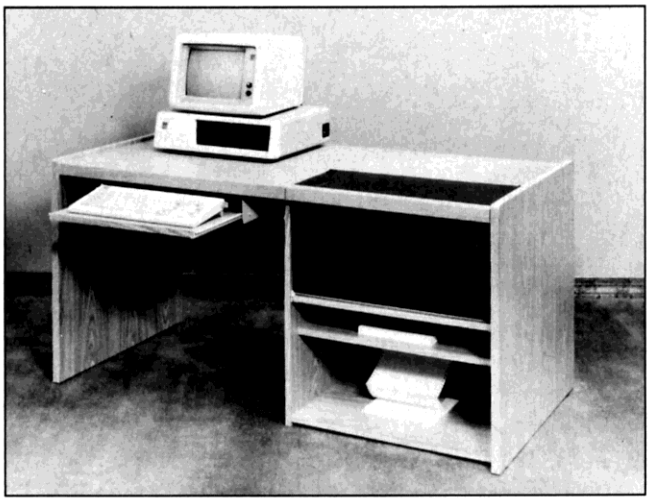

Grolen Inc.'s Ulta-Mate work center.

1986 federal tax return. It calculates and prints schedules A, B, C, D, E, F, G, SE, and W, as well as forms 1040, 2106, 2441, and 6552. Also provided is a stand-alone program for estimating your 1986 tax liability.

Try-O-Tax uses menu prompts to guide you through the preparation process, which can be completed over several sessions rather than all at once.

Try-O-Tax is available for the TRS-80 Models III and 4 (running under TRSDOS 1.3); Color Computer; and Tandy 1000, 1200, and 3000. It costs $39.99 (plus $3 shipping and handling). Contact Try-O-Byte, 1008 Alton Circle, Florence, NC 29501, 803-662-9500.

Circle 568 on Reader Service card.

Etc.

Stay in Touch

The Word/Processing Users' Group (W/PUG) has announced Scroll, a national bulletin-board system for writers, secretaries, educators, and other users of word processing.

Scroll allows the uploading and downloading of documents for evaluation and review, and it invites users to download special programs for word processing. The system is named after the W/PUG newsletter, which attracts writers from all parts of the world. W/PUG also maintains a library of public-domain disks, which are available in more than 100 computer formats.

To sign onto Scroll, call 516-294-9724. No password is needed; the annual membership fee is $25. For more information, contact Word/Processing Users' Group Inc., Box 144, Malverne, NY 11565, 516-746-0056.

Circle 578 on Reader Service card.

Space Saver

Grolen Inc. has developed the space-efficient Ulta-Mate work center. The Ulta-Mate integrates a desk, computer work station, and printer stand with sound enclosure. Optional accessories include a disk catalog/file system and a monitor stand with copy tray.

Grolen's Return-a-Form paper-handling method feeds forms from the shelf under the printer and uses a baffle design to return and stack forms at the front of the work center. The Sound Trap printer enclosure reduces printer noise and is hinged to allow printer access.

Circle 534 on Reader Service card.

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3.5" Disk Drive for the Tandy 100 and 200
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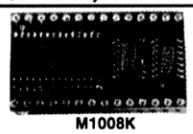
SOFTWARE for the FD-103 Disk Drive (Software needed for operation)
TS1 Tandy 100 TSDOS Disk Operating System Software..... $44.95
TS2 Tandy 200 TSDOS Disk Operating System Software..... $44.95


M1008K

TRS-80 Model 100 • NEC • Olivetti
TRS-80 Model 100 8K Expansion — M1008K..... $19.95 ea. or 3/$54.95
TRS-80 Model 102 8K Expansion — M1028K..... $9.95

M200R

NEC Model PC8201A 8K Expansion — NEC8KR..... $19.95 ea. or 3/$54.95
Olivetti Model M10 8K Expansion — OM108K..... $19.95 ea. or 3/$54.95
TANDY 200 — Tandy Model 200 24K Expansion — M200R..... $59.95 ea. or 2/$109.95

TRS-80 MODEL I, III 16K EXPANSION
TRS-16K3 200ns (Model III) (8 ea. 5290N-3 Dynamic RAMs).... $5.95
TRS-16K4 250ns (Model I) (8 ea. 5290N-4 Dynamic RAMs).... $5.49

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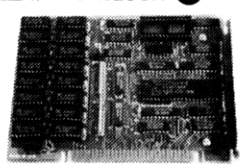
New Models only —
TRS-Co-Co Includes (2) 50464's (41464's) Dynamic RAMs..... $10.95

TRS-80 MODEL 4, 4P AND 4D 64K/128K EXPANSION
TRS-64K-2 Expands Model 4 from 16K to 64K or Model 4 (Gate Array Version), 4P and 4D from 64K to 128K (8 ea. 4164-200 Dynamic RAMs) $7.95
TRS-64K-2PAL Expands Model 4 (Non-Gate Array Version)..... from 64K to 128K (8 each 4164-200 Dynamic RAMs plus PAL Chip) $14.95

TANDY 1000 OWNERS!!

ZUCKERBOARD Expansion Memory Half Card and Clock/Calendar for the Tandy 1000



The **Zuckerboard Expansion Memory Board** allows you to expand the memory of your Tandy 1000 (128K System) as much as 640K. 256K DRAM chips increase your computer's memory by either 256K or 512K, bringing your total system memory up to either 384K or 640K. The memory board also includes a DMA controller chip. Optional clock/calendar plugs directly onto the memory board. Manual included.

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Circle 464 on Reader Service card.

Graphics Solutions

High-Resolution Software and Hardware

GBASIC 3.0 - Radio Shack Model 4/4D/4P/III hi-res board owners take note of an enhanced graphics Basic: GBASIC 3.0 It not only provides an equivalent for each of the BASICG commands but adds a number of important new ones while using less memory. Without having to exit Basic, the hi-res screen can be saved to disk, loaded from disk, or printed on any of 30 popular printers: Epson, Star Micronics, Radio Shack, Okidata, C. Itoh, NEC, etc. The software works with TRSDOS 1.3, 6.1.2, 6.2; DOSPLUS 3.4, 3.5, 4; LDOS; and NEWDOS80. The disk contains 40 graphics programs/files. Also included is a detailed manual with assembly language entry addresses. $49.95. (Specify Model 4 or III mode or add $10 for both.)

The following eleven programs run on a Model 4/4D/4P/III equipped with a Radio Shack graphics board and GBASIC 3.0 or a Micro-Labs Grafyx Solution board:

DRAW - A powerful full screen graphics drawing and editing program. $39.95.

BIZGRAPH - Create business graphs from hand-entered or VisiCalc data. $75.00.

xT.CAD - Professional drafting aid which outputs to a printer or plotter. $345.00.

SURFACE PLOT - Plot three-dimensional equations of the form Z=F(x,y). $39.95.

3D-PLOT - View three-dimensional data from any perspective or angle. $39.95.

MATHPLOT - Plot equations of the form Y=F(x) with auto scaling. $39.95.

CHESS - A very powerful program with 10 skill levels, 40 play options. $49.95.

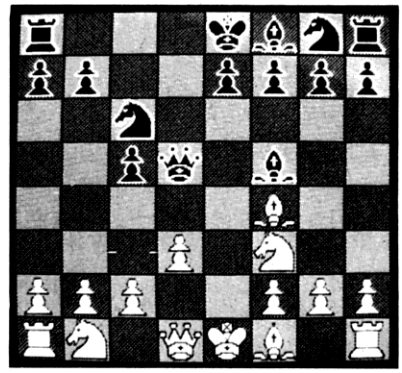
REVERSI - Play Othello with 10 skill levels, 20 execution options. $29.95.

3D Tic-Tac-Toe - Play the computer or a friend on a $4 \times 4 \times 4$ matrix. $19.95.

SLIDESHOW - Create a sequence of hi-resolution picture displays. $19.95.

Biorhythm/USA - Plot your biorhythm or learn the states and capitols. $19.95.

JOY-MOUSE - Allows a Radio Shack Color Computer joystick, mouse, or touch pad to be connected to any Model 4/4D/4P/III. Hardware provides X, Y position values from 0 to 255. $129.95.



GRAFYX SOLUTION - A plug-in, clip-on board enhances any Model 4/4D 4P/III to provide 640 × 240 dot graphics. (512 × 192 on a Model III) The board comes with a 56 page manual and a disk containing both model 3 and 4 mode versions of over 40 programs and files including GBASIC 3.0 which adds over 20 graphics commands to Basic. $199.95.

Please specify your exact system configuration when ordering or requesting information. Payment may be by check, Visa, Mastercard, or COD. Domestic shipping is free on pre-paid orders. Texas residents add 5⅛% sales tax.

MICRO-LABS, INC. 214-235-0915
902 Pinecrest, Richardson, Texas 75080

The Ulta-Mate is available in light-oak or walnut finishes. It comes in 48-inch, 60-inch, and 66-inch widths. All models are 30 inches deep and are available in two heights: 30 and 27 inches. The 30-inch model includes a sliding shelf for keyboard use and storage, freeing desktop space for other uses. Prices start at $549.

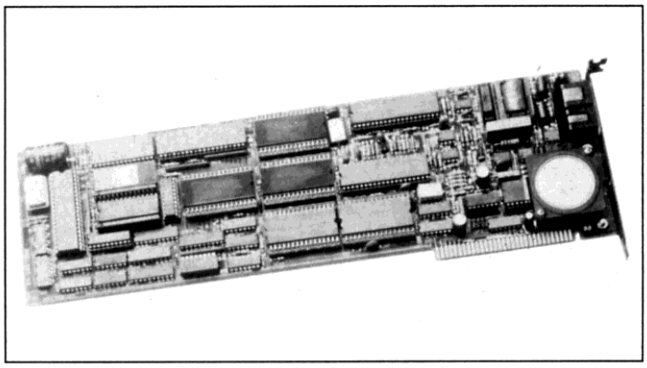
Contact Grolen Inc., 1100 E. Hector St., Conshohocken, PA 19428, 215-825-7213.

Circle 571 on Reader Service card.

In the Cards

Three new PC-card modems—the PC/9624c, the PC/2400c, and the PC/2400—are available from Microcom Inc. The modems feature error-free communications through the Microcom networking protocol (MNP).

The top-of-the line model is the PC/9624c ($1,749), an asynchronous internal modem for the IBM PC/XT/AT and compatibles. It is capable of throughput up to 19,200 bits per second (bps) over a dial-up link using MNP class 6, the highest protocol level. The modem is compatible with existing software applications.



Microcom's PC/2400 modem.

The PC/2400c ($799) bridges the gap between 2,400-baud products and the PC/9624c. It achieves throughput of 5,000 bps or higher over a 2,400-baud asynchronous link using the MNP class 5. The PC/2400c also supports lower levels of MNP, as well as 300-, 1,200-, and 2,400-baud transmission rates. It can be upgraded to a PC/9624c.

The PC/2400 ($699) provides throughput up to 2,900 bps over a 2,400-baud connection when communicating with another MNP class 4 modem. It can be upgraded to a PC/2400c or a PC/9624c.

All Microcom PC modems are single-slot, full-card modems (Tandy 1200 and 3000 only) and include standard phone-line interfaces. They employ a superset of the Hayes AT commands, making them compatible with auto-dial, auto-answer, and other functions supported by popular communications software.

Contact Microcom Inc., 1400 Providence Highway, Norwood, MA 02062, 800-822-8224 (617-762-9310 in Massachusetts).

Circle 573 on Reader Service card.

Laser Prints

Office Automation Systems Inc. (OASYS) announces the Laserpro Express, an eight-page-per-minute laser printer with 384K of standard memory. The Laserpro Express has 10 bit-mapped fonts that yield 72 font variations, including boldface, italic, and compressed type.

The printer has a 250-sheet paper cassette for 8½- by 11-inch and A4 paper (a 250-sheet cassette for legal paper is optional), a 100-sheet output tray, and a 50-sheet adjustable

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For more information, put down the wolves and turn to the Classified page in this issue.

The slide switch on the bottom of the new RT-101+ keyboard determines what system you are using.

paper stacker that accepts paper as small as 4¼ by 5½ inches and as large as legal size. Both the cassette and the paper stacker accept various weights of bond stock.

Most popular word-processing and spreadsheet programs—including Wordstar, Wordstar 2000, 1-2-3, and Symphony—are compatible with the Laserpro Express. The suggested retail price is $1,895.

Contact Office Automation Systems Inc., 8352 Clairemont Mesa Blvd., San Diego, CA 92111, 619-576-9500.

Circle 575 on Reader Service card.

Two-Wire Modem

Telebyte Technology Inc. has introduced the Model 86, a power-stealing, full-duplex, short-haul modem that requires only two wires or one coaxial cable. The Model 86 is designed to replace conventional four-wire, full-duplex, short-haul modems requiring external power sources. The modem transmits data at 9,600 baud over distances up to 3,000 feet.

The Model 86 has two-wire capability, letting it link to the twisted-pair wiring of another device and support two independent communications channels. Thus, in an existing system, the host can support another remote terminal, printer, or plotter without the expense or effort of installing new wiring. Power stealing allows the modem to operate without a dedicated ac or dc power supply.

Packaged in a DB-25 case, the Model 86 has a DTE/DCE (data-terminal equipment/data-communications equipment) selector switch for easy installation at either the host or peripheral port. It is available in three output configurations: terminal screw for single twisted-pair installations; BNC connector for single coaxial-cable sites; and RJ-11 modular telephone for use with modular cables. The terminal-screw and modular telephone-jack units cost $140 per pair. Units with BNC connectors for coaxial installations cost $178 per pair.

For further information, contact Telebyte Technology Inc., 270 E. Pulaski Road, Greenlawn, NY 11740, 800-835-3298 (516-423-3232 in New York).

Circle 577 on Reader Service card.

The Right Touch

Hi-Tek Corp. has released the RT-101+ keyboard, an IBM PC/XT/AT plug compatible unit featuring the new 101 keyswitch layout. A slide switch on the bottom of the keyboard automatically determines whether you are using a PC, XT, or AT system.

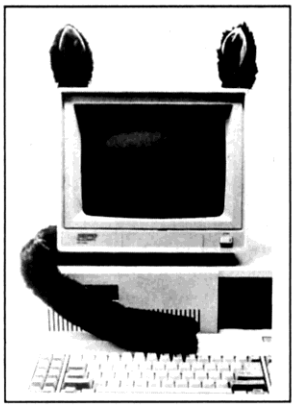
The RT-101+ features an 8-foot DIN cable which exits from the keyboard on the right or left side for optimal keyboard placement, and includes separate numeric and cursor keypads.

The RT-101+ costs $133.33 (discounts are available for OEM and volume purchases) and is distributed by Toptronics, 5443 D. La Palma Ave., Anaheim, CA 92807, 714-777-1631.

Circle 572 on Reader Service card.

DIFFERENT TRACK

Get Out the Whip And Chair



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P.C. Beast costs $14.95. For more information, contact Fundamental Design Group, P.O. Box 1399, Cambridge, MA 02142, 617-354-5715.

Circle 570 on Reader Service card.

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Towering Solutions

If every computer language has its particular strengths, the opposite is certainly true. One thing for which Basic was never intended is recursion, the technique required for solving our Tower of Brahma challenge. Yet more of you than I expected managed solutions in spite of Basic's limitations, proving there's no challenge too great for an *80 Micro* reader.

NesNestedted Gosubs

The best physical description of the recurring patterns in the tower solution came from Barry Mitchel of Reading, MA. If you imagine the three spindles set in a circle, he tells us, you'll move odd-numbered disks from spindle to spindle in one direction and even-numbered disks in the opposite direction. Also, you'll move each n-numbered disk on moves numbered 2 to the n – 1 power times the series of odd integers. In other words, you'll move disk 1 on moves 1, 3, 5, 7, and so on; disk 2 on moves 2, 6, 10, 14, and so on; disk 3 on moves 4, 12, 20, 28, and so on. Finally, to move a stack of n disks from one spindle to another takes 2 to the n power minus 1 moves. That means three disks require seven moves; five disks will take 31 moves.

Using nested Gosubs was the method of choice for coaxing recursion out of Basic. Both of this month's winning programs are good examples of the technique. Notice how the nesting levels quickly become deep as the number of disks increases. That's a fundamental fact of recursion, and it shows why a language such as Lisp, in which recursion is an important feature, requires very large, very fast computers.

Mathew Englander (Toronto, Ontario) calculated that the legendary temple priests, working with 64 disks at a pace of one move a day, will need some 50 billion years to finish the job and end the world. He'd like to know when they started. Come to think of it, so would I. We could be getting close.

Mathew's solution, Spindledisk (Program Listing 1), uses numbers in a horizontal display to represent the disks. In this way the program can represent the movement of all 64 disks on screen at once. Theoretically, the program can handle more disks than that—up to the limit of the Model 4's memory overhead for variable storage and its stack space for storing Return addresses. On the other hand, at about two moves per second, it will still take years to move a 64-disk tower. This column's deadline prevented me from waiting long enough to see what the program's real capacity might be.

Andrew Sun (Trenton, NJ) came up with the exact number of moves for transferring a 64-disk tower: 18,446, 744,073,709,551,615. His solution for the Models I and III (Program Listing 2) sports excellent graphics, which limits the practical size of the tower to 10 disks. However, Andrew lets you choose which spindles the tower starts and finishes on, displays a running count, and provides concurrent commentary on moves, all in three short lines. It's impressive to watch.

Program Listing 1. Mathew Englander's Spindledisk for the Model 4.

```
0 DEFINT A-Z:A$=CHR$(30)+CHR$(13):CLS:PRINT"SPINDLEDISK!  by Mathew Englander":I
NPUT"Number of disks";N:PRINT CHR$(15):DIM S(2,N),T(2):FOR J=0 TO N-1:S(0,J)=N-J
:NEXT:T(0)=N:CLS:GOSUB 2:B=(N AND 1)+1:GOSUB 2:F=0:B=(N+1 AND 1)+1:GOSUB 2
1 F=0:IF T(2)<N THEN Q=W=Y:R=W=Z:S=X=Y:T=X=Z:A=-X*(Q OR R)-W*(S OR T):B=-Y*(R OR
 T)-Z*(Q OR S):IF T(B) THEN IF T(A) THEN IF S(A,T(A)-1)>S(B,T(B)-1) THEN SWAP A,
B:GOSUB 2 ELSE GOSUB 2 ELSE SWAP A,B:GOSUB 2 ELSE GOSUB 2 ELSE END
2 IF F THEN 1 ELSE WHILE A<>B:F=1:T(A)=T(A)-1:S(B,T(B))=S(A,T(A)):T(B)=T(B)+1:W=
Y:X=Z:Y=A:Z=B:B=A:WEND:PRINT@0,;:FOR J=0 TO 2:PRINT USING "Spindle #: ";J;:FOR K
=0 TO T(J)-1:PRINT S(J,K);:NEXT:PRINT A$;A$;:NEXT:FOR J=0 TO 350:NEXT:RETURN
```

End

Program Listing 2. Andrew Sun's Model I/III solution.

```
1 INPUT"STACK SIZE, FROM PEG, TO PEG";N,T,F:CLS:W=64:FORI=1TO3:READL(I):PRINT@L(I)
,"-"CHR$(48+I)"-";:NEXT:DATA714,754,990:P(F)=N:F(N)=T:T(N)=F:FORN=NTO1STEP-1:GOSUB
3:NEXT:N=P(T):GOSUB2:FORI=1TO2:I=1:NEXT
2 IFN,F(N-1)=F(N):T(N-1)=6-F(N)-T(N):N=N-1:GOSUB2:F=F(N):T=T(N):M=M+1:PRINT@W*15,"
MOVE"M@W*14-12,"DISK"N@W*15-12,"FROM PEG"F@W*16-12,"TO PEG"T;:GOSUB3:N=N-1:F(N)=6-
F-T:T(N)=T:GOSUB2:N=N+1:RETURNELSEN=1:RETURN
3 FORI=1TO300:NEXT:P(T)=P(T)+1:PRINT@L(F)-W*P(F)-N,STRING$(2*N+3,32)@L(T)-W*P(T)-N
,STRING$(2*N+3,140);:P(F)=P(F)-1:RETURN
```

End

Program Listing 3. 80 Micro*'s Little Cryptographer.*

```
10 DIM C(127):FOR Y=32 TO 127:C(Y)=Y:NEXT:Y=90:WHILE Y>64:WHILE Y:IF C(Y)=Y THEN
 SWAP C(Y),C(64+RND(26)):WEND ELSE Y=Y-1:WEND:FOR Y=65 TO 90:C(Y+32)=C(Y)+32:NEX
T:LINE INPUT">";Q$:FOR Y=1 TO LEN(Q$):MID$(Q$,Y)=CHR$(C(ASC(MID$(Q$,Y)))):NEXT:P
RINT">"+Q$
```

End

Secret Service

Ld b dxxi qzxkc b cvhmva, sv avtic la tvhbrcv sv lc b dxxi; ld b qzbyv qzxkc xzv, sv avtic la ksvmvyvm la lc lz slc lzavmvca ax avti la.

That pithy observation from Lord Chesterfield was obscured by *80 Micro*'s Little Cryptographer (Program Listing 3). The one-line program randomly generates a shuffled alphabet, which it uses in the simplest kind of substitution cipher, sibilantly speaking. Each letter in the cryptogram above consistently stands for a letter in the plaintext original, and no letter stands for itself. That makes a nice puzzle (the solution to which will *not* appear next month), but it has little practical value.

As we store more data in computer files and send even more of it singing over telephone lines, programs that turn private files into gibberish become more and more attractive. To be useful, however, such programs must be able to rescue the concealed information and faithfully restore its meaning.

To capture a coveted *80 Micro* T-shirt, show us a program that will read a plain text file from disk, write an enciphered file, read the "secret" file, and reproduce the original text. Take up to three lines of Basic (as always, the shorter the better) to create a practical program based on any reliable cipher.

The rules:

1. Write your solution(s) in any TRS or Tandy Basic, except Pocket Computer Basic.
2. This month's entries must reach us by Feb. 15, 1987. This doesn't give everyone the same amount of time, we know, and we apologize to our overseas readers especially.
3. This month's winners will appear in the May 1987 issue.
4. Employees of CW Communications are not eligible.
5. Send your entry to: *80 Micro*, Fine Lines, 80 Pine St., Peterborough, NH 03458. We will not be able to return entries.
6. Specify your T-shirt size. Bumper size not required. ■

Harry Bee is a freelance writer, puzzle creator, programmer, and dreamer. Contact him at P.O. Box 567, Cornish, ME 04020.

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PC WORLD
October 1986

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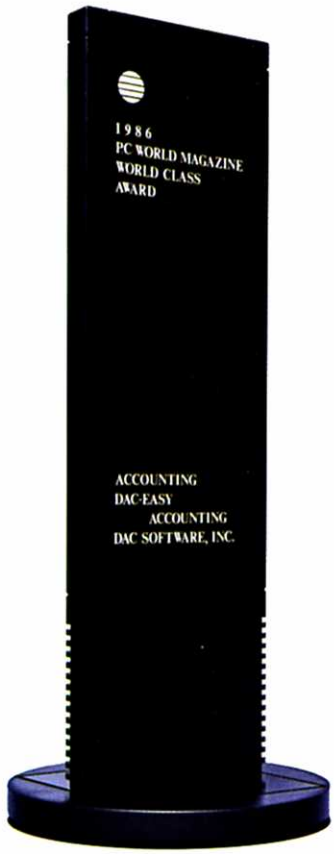

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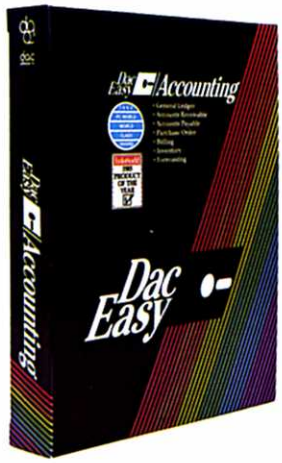

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