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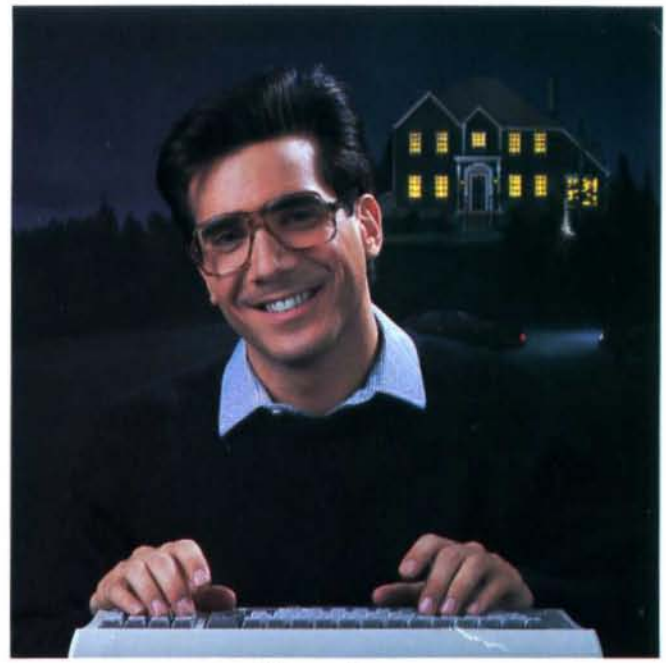

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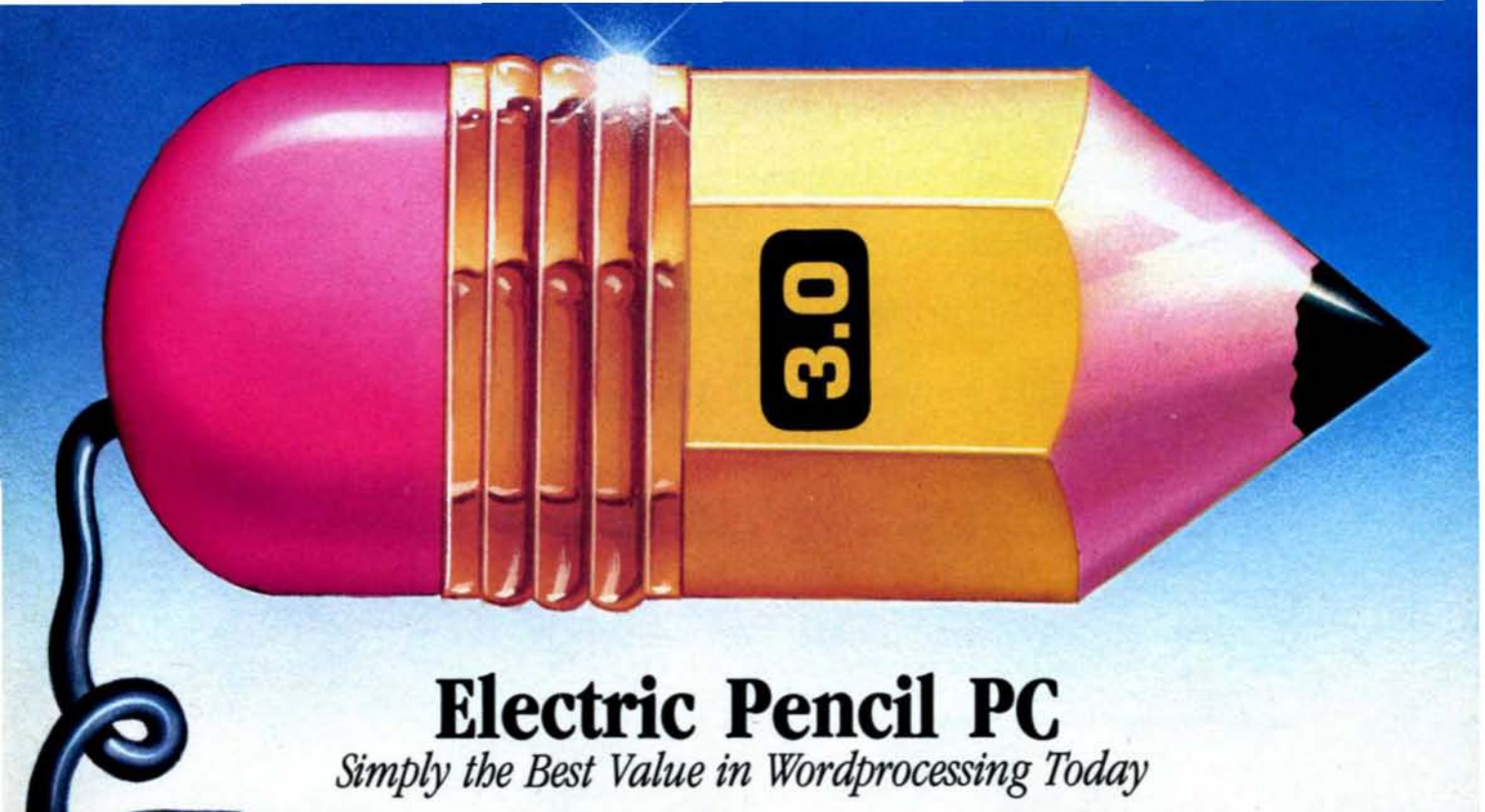

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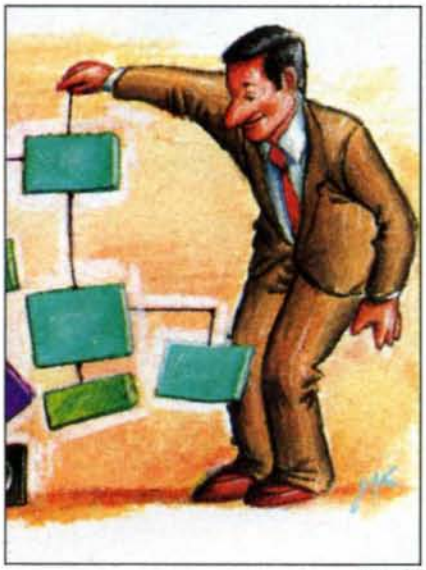

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Features

Departments

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.

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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.

Directory

Financial Planning
Article: So You Want to Buy a House (p. 54).
System: Model 4, 64K RAM.

House can help you assess your financial situation and enable you to determine the cost of the home you can afford.
Language: Basic.
Filespec: HOUSE/BAS.

Expand Files
Article: KSM Helper (p. 66).
System: Models III, 4, 48K RAM.

Add Strip with the proper patch will enable you to expand and edit keystroke-multiply files quickly and easily.
Language: Basic.
Filespecs: ADDSTRIP/BAS, JLH6/FIX, JLH51/FIX.

Best Solution
Article: Easy Interpolation (p. 72).
System: Model 4, 64K RAM; Model III, 48K RAM.

Interpolate computes random, linear, exponential, logarithmic and normal functions for pairs of data points (x,y) and determines which function best interpolates the data on a graph.
Language: Basic.
Filespecs: INTERP4/BAS, INTERP3/BAS.

Correcting Input Errors
Article: Routine Plays (p. 78).
System: Models I, III, and 4, 32K RAM.

These three programs help you find and correct errors in your data-base files.
Language: Basic.
Filespecs: TALLY/BAS, SWEEP/BAS, LOOKUP/BAS.

Screen Effects
Article: The Next Step (p. 95).
System: Model 4, 64K RAM.

See screen effects in your Model 4 programs that you've never seen before.
Language: Basic.
Filespecs: SETUP/BAS, DEMO/BAS.

Checksum
Article: How to Use *80 Micro* Program Listings (p. 116).
System: Models I, III, and 4, 32K RAM.

Use our checksum program to check the accuracy of the Basic listings you type in.
Language: Basic.
Filespec: CHECKSUM/BAS.

Loc-Editor
System: Models I and III, 32K RAM.

A program that finds errors for you.
Language: Basic.
Filespec: LOCEDITR/BAS.

BAS = Basic, FIX = Patch file

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80 MICRO Review, November 1985

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TRS-80 Model 1/3/4/4D/4P: One disk drive and 48K memory.

80 Micro Gives Birth

For most of 1986 the better minds at *80 Micro* debated how to reconcile our coverage of Tandy's TRSDOS and MS-DOS systems. One, the other, or both?

I can't say that we're closer to a solution than we were a year ago. But the time and energy we spent flailing around for some answers did have one result: an idea for a new magazine. It's called *PC Resource* (*PCR*), and you'll want to know about it if you're an MS-DOS user.

Before I launch into a brazen and unabashed advertisement for *PCR*, though, I want to tell you about how the new magazine is going to affect *80 Micro*.

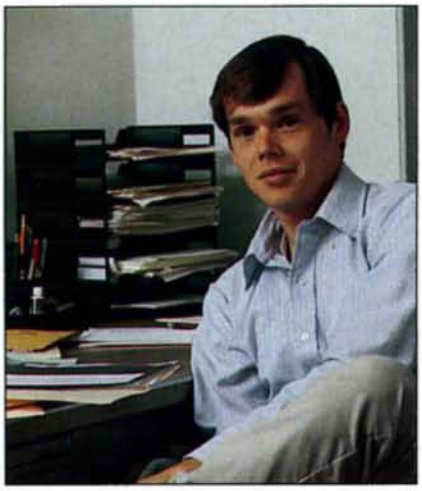
First, *80 Micro*'s editorial staff is moving over to *PCR*, with a few exceptions. Michael Nadeau will be staying at *80* as executive editor. Also, technical editors Beve Woodbury and Marc-Anne Jarvela will split their time between the two magazines. Finally, Anne Fleming and I will be handling art director and editor-in-chief duties, respectively, for both.

This shift means that starting this and next month you'll see several columns with new bylines. In April Dave's MS-DOS Column will become John's MS-DOS Column, John being MS-DOS expert and long-time *80 Micro* contributor John B. Harrell III. (John couldn't change his name to Dave, so we had to change the name of the column.)

To give you an idea of how far back John goes with *80 Micro*, his first article, in the January 1981 issue, was an assembly-language monitor for the 16K cassette Model I. He's written everything from a cover story on I/III/4 DOSes to our ill-fated Model 2000 column, 2000 Plus.

CP/M Plus haters remember him for his laudatory review of that product when everyone else was using the disks for skeet-shooting. We remember him for his vigorous rebuttal of the many readers' letters asking for his head on a platter. He's not afraid to speak his mind, even at the risk of antagonizing a lot of people who think they know more, so expect his column to be lively and occasionally irreverent.

Public Works, which had been written by Technical Writer Ryan Davis-Wright, falls to Tom Quindry. Tom is another long-time *80 Micro* contributor (is anyone out there still using NODOS 80, his Model I cassette operating system?), with experience in the TRSDOS and MS-DOS arenas. The column will continue to cover important public-domain software for users of Z80 and 8088 computers.



Photograph by Frank Cordelle

Pulse Train, also written by Ryan Davis-Wright, will now be handled by David Essex. David, one of the *80* staffers moving to *PCR*, was an award-winning newspaper reporter before he came to *80*.

In addition to the above changes, Bruce Tonkin's The Art of Programming will be moving to *PC Resource*. For the time being we're not going to replace the column, instead using the space for more articles and programs. We'd be happy to entertain readers' suggestions, though.

And what about *80 Micro*'s coverage? *PC Resource*'s arrival will not change the machines we cover. We will continue to address the needs of the ever-increasing number of Tandy MS-DOS users. If you own a 1000, look forward to a number of important articles and tutorials on your machine, as well as more reviews of Tandy 1000-related products.

On the other hand, while the Model 4 has ceased to sell in significant quantities (10,000 for 1986 is the last figure we've heard), we recognize that we're the only source of information for that machine and will continue to write about it.

If response to past Side Tracks is any indication, I'm sure now to get a bunch of letters encouraging us to drop coverage of one system or the other, depending on which computer the writer owns. If one side had a significant advantage in numbers over the other, we'd consider it. But as long as *80 Micro*'s readers are split down the middle between TRSDOS and MS-DOS machines, *80 Micro* will include material for both groups.

Now, a Word from Our Sponsor

If you're as skeptical as I am, you've already asked whether the world needs another MS-DOS magazine. The important question, though, is whether the current periodicals satisfy the needs of all MS-DOS users. We don't think so.

The major PC magazines address the corporate user. This person is interested in high-end computing and expensive products (after all, it's somebody else's money he's spending). He tends to use his computer for a handful of major applications but has no significant interest in computing itself.

PC Resource is for the home and small-business user who is using a PC or compatible for home management, personal finance, telecommunications, and entertainment. It's for the person who is interested in computer technology and who isn't afraid to write his own programs and modify or upgrade his computer. And finally, it's for the user who is spending his own money and is interested in finding inexpensive, high-quality products.

PC Resource includes tutorials on programming in Basic, C, Pascal, and assembly; articles on hardware maintenance, modification, and repair; utility and applications programs; and reviews of budget-priced software, peripherals, and add-ons.

PCR's columnists are familiar to long-time *80 Micro* readers. Hardin Brothers writes a column similar to The Next Step called PC Techniques. Roger Alford, former author of the Project 80 series, writes about hardware modification and repair in Hardware Helper. Charlie Bowen, who coauthored BBS Express, covers telecommunications in Connect Time. And, as mentioned above, Bruce Tonkin continues his column The Art of Programming.

In addition, *PCR* features a column called Make It Compatible, which offers solutions to incompatibility problems among various hardware and software configurations. And the magazine gives extensive reviews to low- and medium-priced PC compatibles.

Well, enough of the hard-sell. Look for *PC Resource* to debut in April.■

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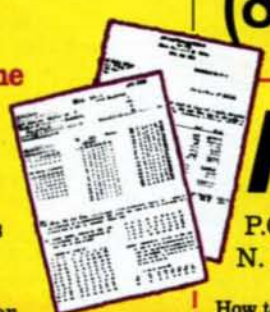

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Language Barrier

Surely Cobol deserves more than a brief and largely misleading paragraph at the end of John Harrell's "A Language of Choice" (November 1986, p. 40).

The author should know that Radio Shack has offered Cobol for all its machines except for Color Computers and laptops. The major business packages listed in the Tandy catalog are all written in Cobol, and many consultants who write programs for small-business users of Tandy computers do all their work in that language. Under these circumstances, it is inappropriate to dismiss Cobol as being "verbose" and "used mostly by programmers who have access to a minicomputer or mainframe system."

Cobol offers many unique features to micro users. Among these are a complete indexed-sequential (ISAM) file system not normally included with either C or Basic, and the ability to perform calculations of 18-digit precision without special accommodation.

Cobol will never be everyone's favorite language. There is a persistent tendency, however, among those trained in Fortran-derived languages to understate the importance of Cobol or ignore its unique advantages for business applications. Your author manages to do both. The many readers who use micros for business deserve a more complete and balanced presentation of the premier business language.

John Culleton
President, Culleton Group Inc.
Sykesville, MD

I hope John Harrell knows more about other languages than he does about Fortran, which was developed in the late 1950s, not the late 1960s. It has been a mainstay of scientific computing for three decades, not two.

I first encountered the language in 1965 or so, when it was already Fortran II. The original version of Daniel D. McCracken's classic text, *A Guide to Fortran Programming*, bears a 1961 date. Perhaps Harrell was thinking of Fortran IV, which was the popular name for the language described by the 1966 ANSI standard.

Whether or not the Do statement executes once really depends on whether you have the 1977 ANSI version (also called Fortran 77), which won't allow the Do loop to execute properly if the initial

value is greater than the limit.

Fortran 77 also allows the structured If. . .Then. . .Else form of the If statement, each branch of which may contain as many statements as the situation requires. The three-way switch variety that Harrell mentions is an original feature retained to accommodate a huge body of software. It is one of the worst features of the language.

The author's sample program is illegal in either the 1966 ANSI version or Fortran 77 and will fail with a subscript-range error on systems that do subscript-range checking. The program uses zero in the subscript—also illegal in 1966 Fortran. Fortran 77 does allow a zero or negative subscript, but the Flags declaration must read INTEGER FLAGS(0:8190).

Using the Common statement is tricky coding that makes programs difficult or impossible to maintain. It serves to force storage allocation so that Flag0 immediately precedes Flags, effectively becoming Flags(0). This provides an array element that the illegal zero subscript can address.

While I found the article interesting in spite of its flaws, I think it could have been more carefully researched.

Richard B. Gilbert
Trenton, NJ

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.

Something to Emulate

After reading Eric Maloney's comments about the need for a Model 4 emulator board for MS-DOS machines (Side Tracks, November 1986, p. 8) I was prompted to write. I am one of the people who would move to a newer machine if a Model 4 board were available. I have too much software that can't be moved to MS-DOS for me to give it up.

What would I like to see in a Model 4 emulator board? Obviously, it must emulate the Model III (as the 4 does) and the 4's native mode, and run CP/M to be considered truly compatible. Enhancements should include selectable higher clock speed possibly teamed with the HD64180 chip (which is to the Z80 chip what the V20 is to the 8088), 256K of bank-switched expandable RAM, and high-resolution graphics.

It might be asking too much to have all this on one board, but I think one with the faster clock speed and more bank-switched RAM could be done for a reasonable price.

George Madison
Claremont, CA

This Is Progress?

It is unfortunate Tandy didn't stay with the Z80 microprocessor. I recently placed binary-coded decimal routines on both the Z80 and 8086 chips and found the former to be slightly more efficient in a speed comparison.

The Z80-based Model 4 can be expanded to 1 megabyte (MB). I also find accessing the optional banks on my 128K Model 4 to be more efficient than selecting memory on the 8086. Certainly, assembly-language programming is far less tedious on the Z80 than the 8086.

Edward S. Fraser
Cape Coral, FL

Correction

In January 1987 Reviews (p. 27) we neglected to include a five-star, superior rating for Mace+. We apologize for the omission.

—Eds.

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Multiplan to Scripsit

Q: How do I include a Multiplan spreadsheet in a Scripsit document? *(Ann Miller, Houston, TX)*

A: While using Multiplan, save your worksheet in the symbolic (SYLK) format. Press "T" for transfer, "O" for options, "S" for symbolic, and save the file. Multiplan puts the SL extension at the end of the file name.

Boot up Scripsit and load the file (don't forget to type the new extension). It should load, but you will have to edit out the Multiplan control codes.

Model 4 Locksmith

Q: We use a Basic program to create invoices on a Model 4 running under TRSDOS 6.01 and store the details on a data disk in a random-access file. After writing a random number of records, we get a "File access denied" message when trying to enter the next record. The DIR command produces a directory showing the locked files with a question mark (?) instead of a plus sign (+).

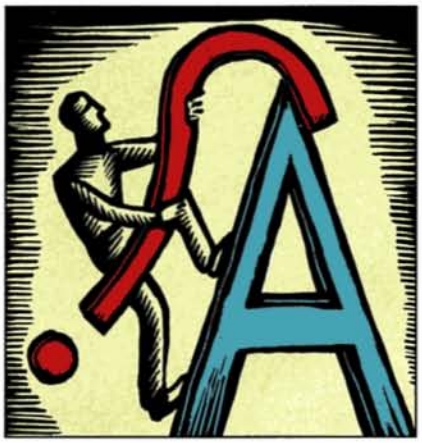
Does this mean the file was somehow left open? The Close command won't close the files or permit access to them. Is there any way to get into these locked-out files? *(E.R. Needham, Mansfield, GA)*

A: The question mark indicates the file was left open. Use the TRSDOS Reset command to reset the file (see p. 1-123 in the *TRSDOS Version 6 Disk Operating System and Basic Interpreter* manual).

Losing the Picture

Q: I've had trouble with one of the techniques suggested in *The Fully Powered PC*, a book from the *PC World* people.

When I go from DOS to Basic, use the BLoad command to produce a binary menu screen, return to DOS via a System call, and use batch files and macros to control the computer, my Tandy 1000 clears the screen when it returns to DOS. The IBM doesn't do this. The screen clear doesn't occur when I load Borland International's Sidekick; it does, however, if I subsequently load public-domain or commercial software. It's



obvious that I can prevent the screen clear, but how? *(Richard J. Butterer, Sussex, NJ)*

A: Whether or not GW-Basic clears the screen on returning to DOS depends on the video mode that MS-DOS is in when you load Basic—80-column black and white or 80-column color. To stop the screen from clearing, change the video mode to black and white before loading Basic and leave Basic in text mode (screen zero).

MS-DOS boots in black-and-white mode, but other programs might change the mode to color. You can use the MS-DOS Mode command to put the screen in black and white (MODE BW80) before loading Basic, but this adds six seconds to a batch file running from a floppy drive.

I wrote a small subroutine (B&W.COM) that does the same thing quicker because it's smaller than Mode. Use Debug to create B&W.COM. Type Debug at the DOS prompt, then enter the following commands after the Debug prompt (your screen should look like this):

```
C>debug
-n b&w.com
-a
3D1B:0100 mov ax,2
3D1B:0103 int 10
3D1B:0105 mov ax,4c00
3D1B:0108 int 21
3D1B:010A
-rcx
CX 0000
:0a
-w
Writing 000A bytes
-q
```

The first four hexadecimal (hex) numbers in the eight-number sequences on five of the lines will be different on your computer, but the second set of four numbers (after the colons) should be the same. Press the enter key after the fifth set of hex numbers to end assembly mode. You must also enter the 0a after the colon on the fourth line from the end.

A Peek into the Cursor

Q: I purchased my Model 4 at a hot discount for what is now twice the price of the Tandy 1000. I turn to your expertise for the documentation I cannot find for my "older," heavily used machine.

I am helping a friend convert a Model III program to an IBM, and I need to know the purpose of the Peek(16418) command. I know that the two lower locations are the least-significant and most-significant bytes of the cursor location and that the higher location holds the cursor's ASCII code, but I can't find reference material on how to use 16418. *(Michael H. Oxley, Au Gres, MI)*

A: Location 16418 contains the cursor's on/off flag. When it contains a zero, the cursor is off. A non-zero number is the ASCII code of the character under the cursor.

Excuse the Delay

Q: The last paragraph in the sample session on p. 9 of the Deskmate manual states that if there is no activity for 10 minutes, the contents of the screen disappear and a scrolling message appears. On my Model 4P, the function takes 64 minutes to activate. What's wrong? *(John B. Hemminger, Sturgeon, MO)*

A: The Model 4 has the same problem. Patch the DMRES2/CMD file with the following patches:

```
D0A,24 = 14:F0A,24 = 50
D0A,35 = 0D 20 ED 05:F0A,35 = 1D 20 ED 0D
D0A,39 = 20 EA 1D 20 E4:F0A,39 = 20 EA 05
  20 E7
```

Overwrite Protection

Q: I have a two-drive, 64K Model 4. When I try to save a program having the same name as one already on the disk, the old file is gone, of course. How can I make my computer warn me about the existence of a program with the same name as the one I'm about to copy? *(Vassilis Piniatoros, Cephalonia, Greece)*

A: You need a fairly involved patch, which I do not have, to actually warn you of impending disaster. Use the directory command (DIR) to list existing files before you save a program to see if it already exists. In Model 4 Basic, use SYSTEM "DIR :0"; if you have TRSDOS 6.2

Illustration by Anthony Russo

or higher, use SYSTEM "CAT :0" for a wide listing of file names only. In Model III Basic, use CMD"D:0". You can use these commands as program lines to display a directory before you input a file name to a program.

Busy Signals

Q: When I use TRSDOS 6.x to print a long document and the printer falls behind, my Model 4 gets a printer-busy signal, waits 10 seconds, and aborts the operation. In the December 1984 *80 Micro*, you printed an article by David A. Williams (p. 118) giving a TRSDOS 6.1 patch to replace the delay with code that freezes the computer and then allows printing to resume when the printer buffer is free.

Do you know of a patch that will do the same thing for TRSDOS 6.2.1? *(Paul Cleu, Fremont, CA)*

A: Set up a boot/fix file with the BUILD BOOT/FIX command, then enter the following code:

```
D0C,21 = 3E 08 EF FE 80
F0C,21 = C5 01 08 00 CD
D0C,26 = 00 00 00 00 00 00
F0C,26 = 82 03 C1 1B 7A B3
```

Press control-shift-@ ("at" sign) to end the file, then enter the following line:

```
PATCH BOOT/SYS.LSIDOS USING BOOT/FIX
```

Reset the computer to install the fix.

Fine-Tuning Deskmate

Q: I have two questions about using Tandy's Deskmate 01.00.00 on a Model 4P.

1. In the Telcom program, can I enlarge the terminal RAM buffer?
2. The Alarm function produces three rapid tones that are difficult to hear because they are so close together. Can I separate them more? *(John Hemminger, Sturgeon, MO)*

A: 1. The buffer for the Telcom program is limited to addresses BD7F hex through high memory. The Telcom program resides immediately below that. You can try replacing the buffer-capture feature with the send and receive commands to transmit data directly to and from the disk.

If you require a larger buffer, try downloading XTERM4 from the Model I, III, and 4 special-interest group (SIG) on the *80 Micro* BBS (603-924-6985; settings are 8-bit words, 1 stop bit, no parity). This terminal program has a larger buffer and uses the extra 64K if you have 128K.

2. It's true that the three beeps of the alarm are so close they sound like one beep. Normal patching won't work because the file must be extended. The Program Listing installs a patch that makes the tones distinctly separate, spacing them about a half-second apart.

Decision Science

Q: I have owned a Model 4P since it first came on the market and write all my own Basic programs, which has taught me how to read manuals and to understand the abilities and limitations of the computer.

I am considering buying a new Tandy 1000 SX to expand my programming into color graphics. My plan is to get the manuals first to determine if the computer is what I want. I especially need to know about Basic commands, RAM-disk availability and memory, Basic memory, and so on. Which of the manuals listed in the Tandy Computer Catalog provides such information? *(Paul R. Hunter, Jensen Beach, FL)*

A: The *MS-DOS/GW-Basic Reference Guide* (catalog no. 25-1508; $29.95) has the information you need to evaluate the abilities of the 1000 SX. Regarding the particulars you mentioned: MS-DOS 3.2 comes with a RAM disk (VDisk), but Basic provides only 60K of program space.

Abandoning Ship

Q: I've stuck with Tandy since I bought a Level I Model I in 1977. I later upgraded to a Model III and converted most of my software.

I am now thinking of going to a Model 1000, but I have a lot of Model III software. Tandy reluctantly tells me there is a non-Tandy program to convert Model III software for Model 1000 use. Can you tell me what the program is and where I can obtain it? *(William B. Mahaffey, Norfolk, VA)*

A: Educational Micro Systems' Convert 3 to PC converts Model III Basic programs to GW-Basic. (The company also sells programs that convert from the Model III to the 4, and from the 4 to the PC.) Convert 3 to PC was reviewed in our May 1985 issue (p. 114) under the name Convert 3 to 2000. It's the same product and runs on Tandy 1000s.

One Convert 3 to PC program transfers Basic files in ASCII to a 1000-formatted disk on your Model III. On the 1000 and other PC compatibles, another program automatically translates the Model III code to equivalent GW-Basic. What can't be easily translated is flagged as a potential trouble area. The manual contains all you need to know about translating Model III Basic to GW-Basic.

DMP 200 Graphics

Q: I purchased my Tandy 1000 more than a year ago and got a "bargain" close-out on a DMP 200 dot-matrix printer. Both the 1000 and the printer work fine until I try to print out a graphics screen, at which time the DMP 200 begins to suck paper at an astonishing rate, leaving a few mysterious characters on each page. Neither the shift-print keys nor the Graphics command get my image on paper. Can you help? *(Dan Flasar, Clayton, MO)*

A: The Graphics command that comes with MS-DOS 2.11.22 does support the DMP 200. If you're still using the now unsupported MS-DOS 2.11.00, stop by a Tandy dealer with your original DOS disk and have the free upgrade copied onto it. The newer Graphics command provides a menu from which you select printer type. You should now be able to dump graphics screens to your DMP 200.

Colorful 4

Q: Is it possible to add a color monitor and light pen to my Model 4? *(Carl Obermeier, Garibaldi, OR)*

A: While it might be possible, it isn't practical. Check out the May 1983 *80 Micro* article on adding a color monitor to the Model III ("The 80 Goes Color," by James W. Cole, p. 90). As far as adding a light pen is concerned, Micro-Labs Inc. (902 Pinecrest, Richardson, TX 75080, 214-235-0915) can help you. The company sells an interface box that lets you use a mouse with the Models III and 4. You might be able to attach a light pen to it.

Printer Problems

Q: How do I keep my Epson FX-80 printer from skipping two lines at the top of every page when I run Microsoft Word on my Tandy 1000? I have no problem printing from Deskmate on the 1000 or using Superscripsit and the Epson Power Driver with the FX-80 from a Model III. The Microsoft Word program

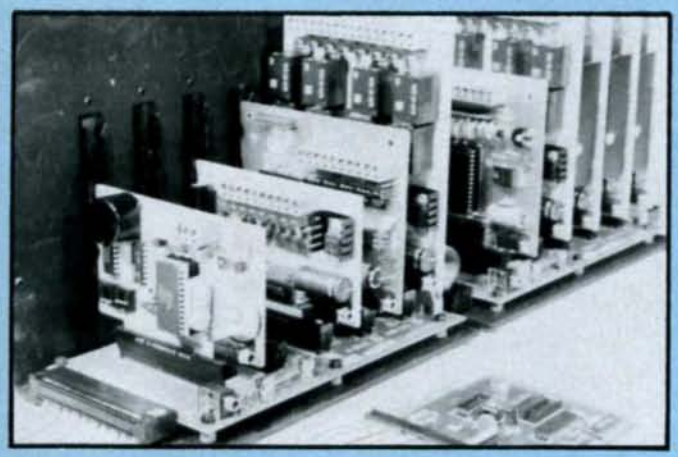
Program Listing. Program that separates alarm beeps on Model 4 Deskmate.

```
10 CLS:PRINT"FIX MODEL 4 DESKMATE 1.00.00 TO ALLOW SLOWER BEEPS
   DURING ALARM"                                              '*  4984
15 PRINT:PRINT"ALTERING DMRES2/CMD"                           '*  2372
20 OPEN"I",1,"DMRES2/CMD":CLOSE                               '*  1902
25 OPEN"R",1,"DMRES2/CMD":FIELD 1,1 AS A$                     '*  2385
30 A=(PEEK(VARPTR(A$)+1)+256*PEEK(VARPTR(A$)+2))-65536!       '*  3178
35 GET 1,6:FOR X=0 TO 10:READ B:POKE A+X,B:NEXT:PUT 1,6       '*  3383
40 GET 1,49:FOR X=56 TO 76:READ B:POKE A+X,B:NEXT:PUT 1,49    '*  3560
45 CLOSE:PRINT"ALTERATION COMPLETE..."                        '*  2560
50 DATA 14,0,229,38,3,205,240,47,225,0,0                      '*  2008
55 DATA 1,15,240,47,65,62,184,239,6,96,62                     '*  2087
60 DATA 16,239,37,32,244,201,2,2,0,48                         '*  1869
```

End

The Amazing A-BUS

NEW



An A-BUS system with two Motherboards
A-BUS adapter (IBM) in foreground

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The complete set of A-BUS User's Manuals is available for $10.

About the A-BUS:

- All the A-BUS cards are very easy to use with any language that can read or write to a Port or Memory. In BASIC, use INP and OUT (or PEEK and POKE with Apples and Tandy Color Computers)
- They are all compatible with each other. You can mix and match up to 25 cards to fit your application. Card addresses are easily set with jumpers.
- A-BUS cards are shipped with power supplies (except PD-123) and detailed manuals (including schematics and programming examples).

Relay Card — RE-140: $129

Includes eight industrial relays, (3 amp contacts, SPST) individually controlled and latched. 8 LED's show status. Easy to use (OUT or POKE in BASIC). Card address is jumper selectable.

Reed Relay Card — RE-156: $99

Same features as above, but uses 8 Reed Relays to switch low level signals (20mA max). Use as a channel selector, solid state relay driver, etc.

Analog Input Card — AD-142: $129

Eight analog inputs. 0 to +5V range can be expanded to 100V by adding a resistor. 8 bit resolution (20mV). Conversion time 120us. Perfect to measure voltage, temperature, light levels, pressure, etc. Very easy to use.

12 Bit A/D Converter — AN-146: $139

This analog to digital converter is accurate to .025%. Input range is −4V to +4V. Resolution: 1 millivolt. The on board amplifier boosts signals up to 50 times to read microvolts. Conversion time is 130ms. Ideal for thermocouple, strain gauge, etc. 1 channel. (Expand to 8 channels using the RE-156 card).

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

Connect 24 input or output signals (switches or any TTL device) to your computer. The card can be set for: input, latched output, strobed output, strobed input, and/or bidirectional strobed I/O. Uses the 8255A chip.

Clock with Alarm — CL-144: $89

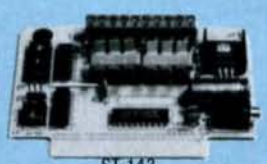
Powerful clock/calendar with: battery backup for Time, Date and Alarm setting (time and date); built in alarm relay, led and buzzer; timing to 1/100 second. Easy to use decimal format. Lithium battery included.

Touch Tone® Decoder — PH-145: $79

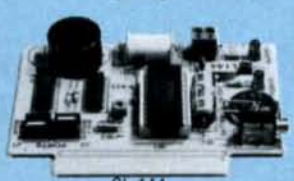
Each tone is converted into a number which is stored on the board. Simply read the number with INP or POKE. Use for remote control projects, etc.

A-BUS Prototyping Card — PR-152: $15

3½ by 4½ in. with power and ground bus. Fits up to 10 I.C.s



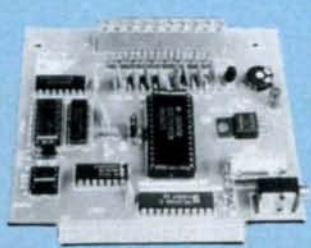
ST-143



CL-144

RE-140

IN-141



AD-142

Smart Stepper Controller — SC-149: $299

World's finest stepper controller. On board microprocessor controls 4 motors simultaneously. Incredibly, it accepts plain English commands like "Move arm 10.2 inches left". Many complex sequences can be defined as "macros" and stored in the on board memory. For each axis, you can control: coordinate (relative or absolute), ramping, speed, step type (half, full, wave), scale factor, units, holding power, etc. Many inputs: 8 limit & "wait until" switches, panic button, etc. On the fly reporting of position, speed, etc. On board drivers (350mA) for small steppers (MO-103). Send for SC-149 flyer.

Remote Control Keypad Option — RC-121: $49
To control the 4 motors directly, and "teach" sequences of motions.

Power Driver Board Option — PD-123: $89
Boost controller drive to 5 amps per phase. For two motors (eight drivers).

Breakout Board Option — BB-122: $19
For easy connection of 2 motors. 3 ft. cable ends with screw terminal board.

Stepper Motor Driver — ST-143: $79

Stepper motors are the ultimate in motion control. The special package (below) includes everything you need to get familiar with them. Each card drives two stepper motors (12V, bidirectional, 4 phase, 350mA per phase).

Special Package: 2 motors (MO-103) + ST-143: **PA-181: $99**

Stepper Motors — MO-103: $15 or 4 for $39

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Apple II, II+, IIe. Uses any slot	AR-134...$49
TRS-80 Model 102, 200 Plugs into 40 pin "system bus".	AR-136...$69
Model 100. Uses 40 pin socket. (Socket is duplicated on adapter).	AR-135...$69
TRS-80 Mod 3,4,4D. Fits 50 pin bus. (With hard disk, use Y-cable).	AR-132...$49
TRS-80 Model 4P. Includes extra cable. (50 pin bus is recessed).	AR-137...$62
TRS-80 Model I. Plugs into 40 pin I/O bus on KB or E/I.	AR-131...$39
Color Computers (Tandy). Fits ROM slot, Multipak, or Y-cable.	AR-138...$49

A-BUS Cable (3 ft, 50 cond.) — CA-163: $24

Connects the A-BUS adapter to one A-BUS card or to first Motherboard.

Special cable for two A-BUS cards: CA-162: $34

A-BUS Motherboard — MB-120: $99

Each Motherboard holds five A-BUS cards. A sixth connector allows a second Motherboard to be added to the first (with connecting cable CA-161: $12). Up to five Motherboards can be joined this way to a single A-BUS adapter. Sturdy aluminum frame and card guides included.

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(purchased from Tandy) doesn't have an Epson Power Driver, so I had to modify TTY.PRD to drive the printer.

When loading MS-DOS on the Tandy 1000, I have to issue the LPINST command to institute Autoexec.BAT to keep the printer from double spacing, but then I also have to call for the date and time to update MS-DOS. This is extra effort not required in normal loading of MS-DOS when the date and time are automatically called up. Can you help? *(Will M. Heiser, Pittsboro, NC)*

A: Your printer problem sounds like the old Tandy-Epson line 14 problem (see Dave's MS-DOS Column, September 1985, p. 82 for more details). After you disable line 14 of your printer cable with a small piece of tape at the printer end, your 1000 will print just like an IBM PC. You'll no longer need that Autoexec batch file with the LF and Mode LFOFF statements in it.

To answer your second question anyway: Running an Autoexec batch file disables the date and time prompts unless you add the DOS Date and Time commands to Autoexec.BAT. If you still need an Autoexec batch file that configures the 1000 to prevent a Tandy printer from double spacing, you can use the following lines and still get date and time prompts:

```
LF
MODE LFOFF
DATE
TIME
```

Discounting Economics

Q: Why do Nocona Electronics and Perry Computers sell Tandy/Radio Shack equipment for prices sometimes as much as $1,000 less than Tandy's? Does the price difference represent just a portion of the markup and profit? Is it the same hardware you would buy from Tandy? *(H.E. Lamb, Camp Hill, PA)*

A: Nocona and Perry, like other mail-order firms selling Tandy/Radio Shack equipment, hold Radio Shack franchises and sell the equipment however they want. It is 100-percent Tandy/Radio Shack equipment if it is labeled as such. The difference in pricing between the mail-order companies and your local Radio Shack does reflect the difference in markup and profit between them.

The Integration Question

Q: I am looking for a good integrated program (word processing, spreadsheet, data base) for the Model 4. Deskmate won't do. Are there any programs available for TRSDOS 6.x or CP/M? *(Nancy McKown, Allegan, MI)*

A: The only integrated program for the Model 4 is T/Maker, which runs under TRSDOS 6.x, CP/M, and MS-DOS. It combines a word processor, data base, spreadsheet, and graphics, all operating in a like manner. It comes with complete documentation and four disks. Data files are the same for the TRSDOS and MS-DOS versions, so you can upgrade to MS-DOS later. The program is available for $295 directly from T/Maker Research Co. (1973 Landings Drive, Mountain View, CA 94043, 415-962-0195) or for $275 by mail order from Diskcount Data (2701-C W. 15th, Suite 612, Plano, TX 75075, 214-680-8268).

4P Printer's Apprentice

Q: I have been using The Printshop from Broderbund Software on an Apple IIe. The possibilities for making cards, banners, letters, and so on seem endless. Is there a comparable program I can use on my Model 4P with TRSDOS 6.2? The people at the local Radio Shack store said they didn't have any such program. *(D.E. Shepard, Muscatine, IA)*

A: The only comparable program is Prosoft's Dotwriter (P.O. Box 560, North Hollywood, CA 91603, 800-824-7888; $99.95). It can do many types of lettering, banners, catalogs, and letterheads. You can also buy additional fonts. As long as your printer is Epson compatible, you can use Dotwriter.

Faster and Faster

Q: I have seen advertisements in your magazine for microprocessor speed-up boards. Seatronics offers an 8MHz speedup, while Compu-Clinic offers a 6MHz speedup. Which is better? Seatronics says its product is software or hardware controlled. What does that mean? Also, can I use either board with Montezuma Micro's CP/M? *(Taylor Goss, Dayton, TX)*

A: Both companies use Z80 chips for their speedups: The 6MHz chip is a Z80B, while the 8MHz is a Z80H. The Seatronics speedup requires installation, while the Compu-Clinic product is simply a plug-in replacement for your Z80. One isn't necessarily better than the other, just different in price and implementation. You can control the Seatronics either by changing the DIP switches on the board or by issuing commands from TRSDOS Ready. As far as I know, both boards are compatible with Montezuma Micro's CP/M.

Piecemeal Memory

Q: I have heard there is a motherboard that takes both 64K and 256K memory chips, making it possible to have a full 640K RAM without using expansion cards. I own a Tandy 1000A with an 8087 slot. Can I install 256K chips in place of the 64K chips on either the motherboard or expansion board?

Also, where can I find a schematic for the 1000A? Although Radio Shack sells a repair manual for the 1000 that has such information, there is no equivalent manual for the 1000A.

Finally, I have a solution for those who have tried to run a program on a color monitor from the composite video jack and can't get color support. Press the F12 key after boot-up when the computer first accesses the disk. The computer then adjusts for composite color on a TV monitor. I have found this method to work on King's Quest versions 1 and 2 and on Tandy's Deskmate with 80 columns. *(Adam Borin, Cheyenne, WY)*

A: You can't put 256K RAM chips on the motherboard of the Tandy 1000 and 1000A. (You can on the 1200 and the new 1000 SX.) You must use an expansion board containing a DMA (direct-memory access) chip and room to bring memory up to 640K.

You can order schematics for the 1000A from Radio Shack's National Parts department by calling 817-870-5600 (the 1000A supplement has stock number NS-250-1000A). In addition, you'll probably want the *Tandy 1000 Technical Reference Manual* (catalog no. 25-1504; $29.95 from Tandy Computer Centers) or the *Tandy 1000 Service Manual* (catalog no. NS-250-1000 from National Parts) both of which still have the original 1000 schematics.

Thanks for the tip on composite color monitors.

SEEKING HELP

►Russell Gladstone (2200 Avenue Road #801, Toronto, Ontario, Canada M5M 4B9) is looking for a chess game and an RS-232 serial interface to use with his terminal software on a Model I with a 10-megabyte hard disk and Dosplus.

►Lance K. Mertz (Snohomish Publishing Co., Box 499, 114 Avenue C, Snohomish, WA 98290) is running Accounting Partner II on a Tandy 1200 HD and needs help speeding up part of the program. The accounts-receivable software works except for one major flaw: It takes too long (up to three minutes) to find an account when you are entering invoices or searching for a customer record for any other reason. Mr. Mertz has tried Disk Optimizer and the system's own restore utility, but neither has increased the speed.

►Jeff Saylor (5421 S.W. 31st St., Ocala, FL 32674) wants to hear from anyone with experience interfacing a US Robotics 300/1,200 Baud Core Modem (sold by Jameco Electronics, inventory no. USM1) to a Model I, III, or 4.

►E.R. Engdahl (P.O. Box 394, Waynesville, NC 28786) is interested in selling a set of *80 Micro* back issues (January 1981 through December 1984).

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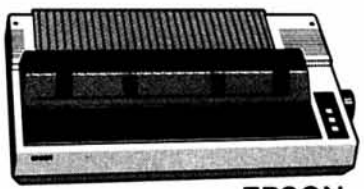
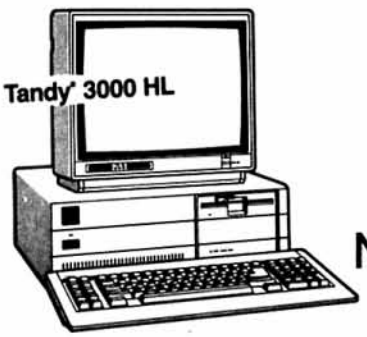


EPSON



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Going for the Business Market

Tandyland

Wooing the business user away from IBM is perhaps Tandy's most fervent mission. By last November's Comdex/Fall, it looked as if the company was increasingly willing to shed old-style thinking to become more competitive in an increasingly crowded market. Tandy agreed to distribute the new version of Open Systems Inc.'s Harmony accounting and productivity software under the Minneapolis firm's name. *Micro Marketworld* reported that the deal marked the first time Radio Shack Computer Centers will stock non-Tandy software that doesn't carry the Tandy label. The people in Fort Worth, however, don't agree with that interpretation.

Photo 1. Armies amassed at Novell's LAN shootout.

Open Systems President Peter Davis describes Harmony as an integrated "work processor" for automating most functions of small- and medium-sized businesses. Version 2.0 adds five new modules to the original seven; now available are modules for system installation, purchasing, inventory, ordering, and a "super" general ledger for professional accountants. The package might be available in Computer Centers by May, according to Open Systems spokesperson Neal Kielar, who added that most modules will probably be priced in the $599–$799 range.

Tandy refused to talk about its pricing plans, although a spokesperson did say the company decided to carry Harmony because of its strong brand-name recognition. Kielar said Tandy contacted 29 companies last summer about marketing an integrated business program and got responses from 23. Tandy apparently agreed with Open Systems' belief that accounting software is the key to capturing the growing small- and medium-size business market, Kielar said.

Tandy has long been criticized for making TRS-80 and IBM-compatible owners look elsewhere for third-party software. A notable exception has been the 3-year-old Express Order Software (EOS) service, which lets customers order hundreds of non-Tandy programs—including the first version of Harmony—through Radio Shack stores.

Does the Open Systems deal represent a change in policy for the 7,000-plus Radio Shack stores? Tandy Marketing Director Ed Juge says no; if anything, the turning point came more than two years ago when Tandy first authorized Radio Shack Computer Center managers to stock a select number of EOS programs if local demand warranted it. Third-party products appeared in Radio Shack stores long before the Harmony deal, according to Juge, contrary to the *Micro Marketworld* report.

Open Systems will teach Radio Shack salespeople how to steer customers toward the implementation that best suits their needs. The training program *does* represent the first time Tandy has committed its sales force to fully supporting another company's software, Kielar said.

Further proof of Tandy's eagerness to serve the business user also came out of Comdex/Fall, when 3Com Corp. announced that 500 Computer Centers will carry its Ethernet adapter products and 3+ software for local-area networks (LAN). Tandy hopes the 3Com products will complement Vianet, its own low-level networking system, by providing access to token-ring technology and the widely used Ethernet standard. Tandy will not market 3Com's file servers and token-ring card-key products, however.

The Tandy deal comes none too soon for 3Com, which is ending a distribution agreement with Microage Computer Stores of Tempe, AZ. The word is that both parties were disappointed by sales and that 3Com has been losing distributors by requiring them to carry 3Com products exclusively.

The ten-gallon-hat folks in Fort Worth might have had second thoughts about their new networking partner when 3Com lost a "shootout" Dec. 2 in Santa Clara, CA, to Novell, a LAN software maker out of Orem, UT (see Photo 1). Novell challenged 3Com to a series of independently run benchmark tests. "The law of the west is clear," Novell bellowed in ads announcing the event. "When there's a disagreement to be settled, the only honorable method is a showdown. Face to face. Where actions do the talking."

When the smoke cleared, Novell proclaimed itself the winner, saying that only its system showed no "speed degradation" in configurations of up to 10 IBM computers. Novell's "victory" was tainted, however, by the refusal of 3Com and IBM to attend. Both claimed the benchmarks were chosen to make Novell look good, and even representatives from the two consulting groups that ran the tests admitted speed isn't the only factor affecting a LAN's performance.

Photo courtesy of Novell Inc.

As of last fall, Tandy's bottom line looked good despite the shipping delay that resulted when the Federal Communications Commission temporarily withheld certification of the new 1000 SX and 1000 EX.

Net income for the first quarter that ended Sept. 30 was $43.7 million, up from $41.7 million for the same period in 1985. Sales and revenues rose 14 percent to $742.6 million.

A comparison of the year ending Sept. 30 with the previous year revealed steady sales growth for Tandy but somewhat meager profits. Sales of $3.1 billion were up more than 16 percent, while income rose 3 percent to about $200 million. Tandy President John Roach explained that investment and operating losses associated with Intertan, Tandy's new spin-off company for overseas operations, and the FCC approval delay held down profit gains.

Business kept chugging along well into the start of the holiday rush, when Tandy reported that sales for October and November rose more than 14 percent above those in the same period of the previous year.

Update

A quiet confrontation took place in Littleton, CO, where Richard Bilancia, owner of a consulting firm called Computer Guidance & Support, performed benchmark tests on the Tandy 3000 HD and Model 6000 to see which one ran Xenix operations the fastest. Xenix is Microsoft's version of AT&T's Unix operating system.

Not surprisingly, the 3000 HD came out on top every time. But when Bilancia ran the tests several times simultaneously to simulate a multiuser environment, he concluded that "neither machine is more of a multiuser computer than the other."

Bilancia ran the following benchmark:

```
$ cd/usr/dict
$ time grep fast words
```

The commands display the time it takes to load a program containing Xenix's grep command (which searches for patterns in files), sequentially read a long file, compare expressions, and display the output. The 3000 HD did the job in an average of 9.12 seconds while the 6000 took 15.5 seconds.

Photo 2. PC Life's readable graphics displays.

The Table shows comparative average times for running the same benchmarks three and five times simultaneously; "real" is the elapsed time between initiation and completion, "user" is the time the CPU takes to execute the command, and "system" is CPU time spent setting up the command.

Both machines lost time in the five-user simulation, but the 3000 HD was still faster than the 6000.

Writing in his newsletter *Filters, Pipes, and Shells*, Bilancia noted that he'd have a tough time choosing between the 6000 and the 3000 HD because the former is more affordable, while the latter offers more features and greater expandability.

Tandy's holiday catalog showed a multiuser system built around the 6000 for $6,199 (including Xenix/68000) and a similar 3000 HD-based configuration (including Xenix V/286) for $7,999.

MicroTrends

Marvels of miniaturization have become so routine in the computer industry that it is easy to forget how amazing it is that a fingernail-size chip can perform complex calculations, and that all of America's phone directories might someday be squeezed onto a set of compact discs. I was impressed, though, by news of a 7,000-word spelling checker in a chip for Tandy laptops.

Traveling Software's Sardine is a plug-in ROM chip that lets you check word-processor files against a list of the 7,000 most frequently misspelled words in business correspondence named in a study by Wang Laboratories Inc. The package also includes a 3½-inch disk version of the 33,000-word Random House American Dictionary and a copy of the original. Traveling Software's T-word word-processing program is also included on the ROM chip.

The company claims the spelling checker will go through a 25K file in less than three minutes and automatically insert corrections. The first version was released in early December for the Tandy 100, 102, 200, and NEC PC-8201; a new version for MS- and PC-DOS-based laptops should be available by the time you read this. The ROM-chip package retails for $169.95 and the disk-only version goes for $99.95.

Traveling Software has been a leader in overcoming the memory limitations of laptops by placing software on chips. Besides marketing its own software, the company will convert any Basic or machine-language program into a ROM chip for $500.

It seems nary a hamlet or mall in America doesn't have a Radio Shack outlet. The giant distribution network has always given Tandy's computer division an advantage in getting new machines to the marketplace (Commodore, of course, is no slouch in that respect). However, Sears, Roebuck & Co. may help little-known Franklin Computer steal part of the pie away from Fort Worth.

Sears now sells a line of four Franklin personal computers, including two Apple II clones and two IBM compatibles, in 500 stores and through its catalog. Franklin's PC-8000 has 512K RAM, two floppy-disk drives, and sells for $949.99. The newer PC-6000 has one less drive and a suggested retail price of $899. The monitor costs extra.

Is Tandy shaking in its boots? Not according to Juge. "We've got 7,000 stores," Juge noted. "Sure, they're going to get their share of the business, but the customer who would buy from them is not the guy who would buy from us."

"Printing presses are being thrown into the rivers nightly in South Jersey and being replaced by sleek, silent disk drives. . ." So noted an editor of a new disk-based magazine for IBM compatibles. While I have yet to see an issue of this latest incarnation of "the future of publishing"—a monthly called *Uptime* published by Viking Technologies in Newport, RI—I have enjoyed paging through Microstar Graphics Ltd.'s *PC Life* (see

	Model 6000			Tandy 3000 HD		
Simultaneous runs	1	3	5	1	3	5
Real	15.50	40.4	68.7	9.12	24.6	42.5
User	11.95	11.5	12.1	7.06	7.2	7.2
System	2.79	2.1	2.6	1.59	0.9	0.9

Table. Xenix benchmark results, Tandy 3000 HD versus Model 6000.

You can compose letters on screen and transmit them to the magazine's office.

Photo 2). It's an eye-pleasing, well-edited package that takes good advantage of the computer's graphics features.

The first issue (July/August 1986) featured a profile of Philip D. Estridge, the late IBM vice president who headed the team that developed the PC; an interview with Stan Feingold, founder of the Visual Horizons computer-graphics company; reviews of Microsoft Windows and the Epson Equity I; a feature explaining networks; a field-goal-kicking game; and standard departments that include an editor's column and letters section. If you have a modem, you can compose letters on screen and transmit them to the magazine's Syracuse, NY, office.

The standard keys (page up, page down, arrows, and so on) let you move through the text, and you can go directly to articles from the table of contents. The screens mix red, white, and blue graphics with oversized white characters on a black background. It isn't hard to imagine bleary-eyed programmers browsing through *PC Life* at the end of the day.

Some of the images move. Stan Feingold blinks at you, a mouse clicks as a Windows screen changes, and a racing car whizzes by in the networking feature.

Folio, the magazine about magazines, reported last November ("PC Magazines Walk and Talk," p. 60) that most of the 13 or so existing disk magazines aren't advertiser supported. The first issue of *PC Life* had only one outside ad, but the editorial quality is good. A single copy costs $7.95; a one-year subscription (six issues) is $29.95. Contact *PC Life*, University Building, Suite 413, Syracuse, NY 13202, or ask for it at your local software dealer.

Editor and publisher Mike Sullivan seems to know he's on to a good thing. In his column, Sullivan writes that "for users of personal computers, the need for information about PCs often exceeds the limits of what a print magazine can do. The recent shakeout in the computer magazine market has made it painfully clear that PC users had many needs not adequately addressed by the scores of magazines that have perished."

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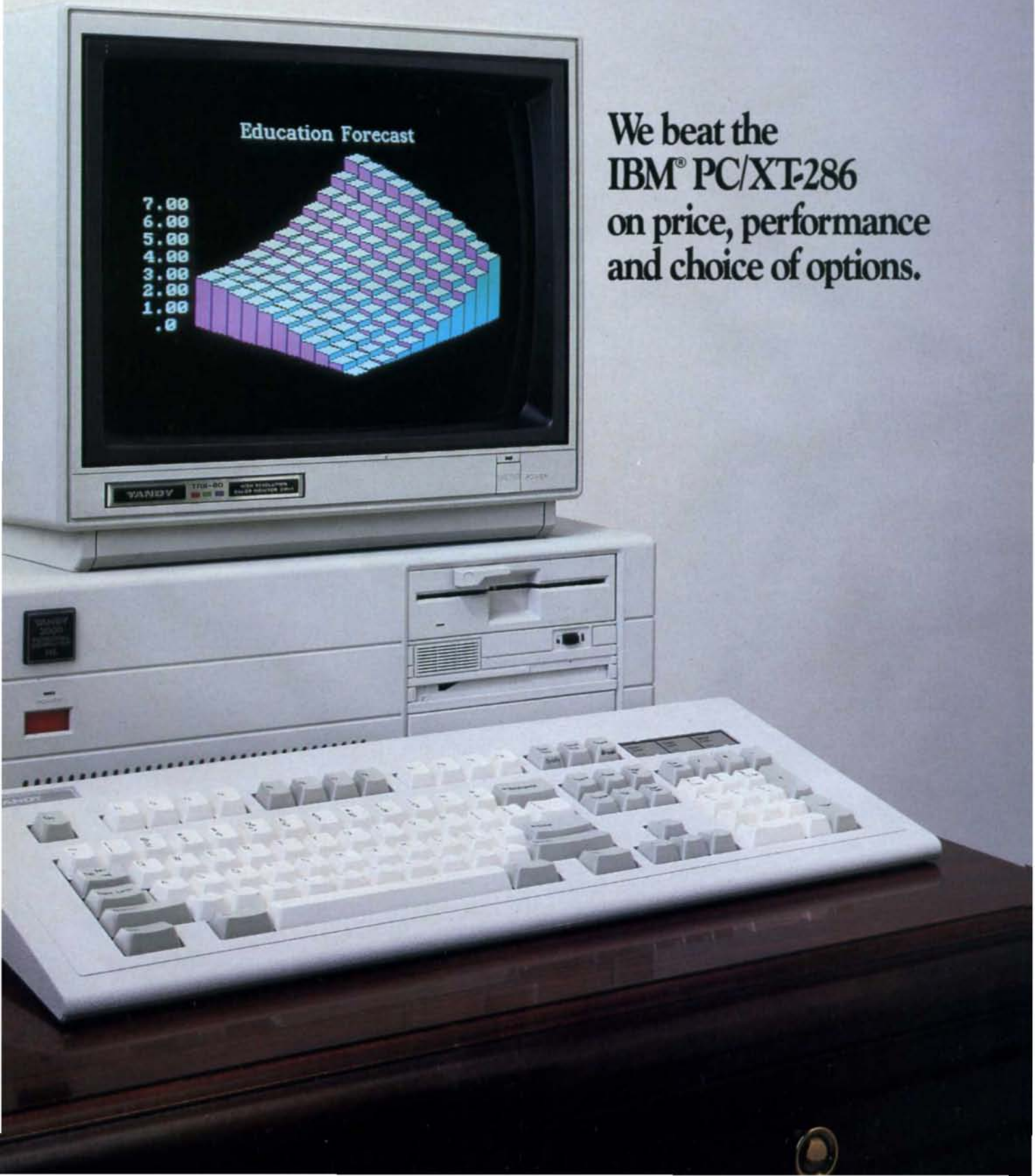

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Color Keeper 2.0

In the December 1986 Reader Forum, Robert L. Smith provided Patch.IO, which sets the screen colors under MS-DOS 2.11.00 after using the CLS command (see "Color Keeper," p. 25). Unfortunately, Tandy no longer supports MS-DOS 2.11.00.

To use this patch under MS-DOS 2.11.22, which Tandy supports, change line 12 in Mr. Smith's patch from A 251 to A 264. Figure 1 shows the changed Debug script for Patch.IO.

Ed Garcia
Youngsville, LA

```
01 E 81 'IO.SYS' 0
02 A
03 MOV AX,4301
04 MOV CX,20
05 MOV DX,81
06 INT 21
07 INT 20
08
09 G
10 N IO.SYS
11 L
12 A 264
13 MOV BH,1F
14
15 W
16 E 81 'IO.SYS' 0
17 A 100
18 MOV AX,4301
19 MOV CX,27
20 MOV DX,81
21 INT 21
22 INT 20
23
24 G
25 Q
```

Fig. 1. Patch.IO.

Print@s to Locates

Program Listing 1, 80-Column Converter, changes all Model 4 Basic Print@ locations to their Locate equivalents for use on the Tandy 1000, and vice versa. It converts from 80-column format to 80-column format only. The program prompts you for the appropriate input.

Alex Roosakos
Millbrae, CA

Program Listing 1. 80-Column Converter.

```
10 'Convert LOCATE to PRINT@ -- by Alex Roosakos, 1986
20 CLS:PRINT "This conversion is for 80-column screens!"
30 PRINT "Convert FROM (L)ocate or FROM (P)rint@ ?";CHR$(95);
40 I$=INKEY$:IF I$="" THEN 40
50 IF I$="L" THEN I=1 ELSE IF I$="P" THEN I=2 ELSE 40
60 PRINT CHR$(8);I$;ON I GOTO 70,90
70 INPUT "Enter values for Locate (Row,Col)";R,C
80 PRINT "Print@ value is";((R-1)*80)+(C-1):END
90 INPUT "Enter value for Print@";P
100 R=INT(P/80)+1
110 PRINT "Locate (Row,Col) values are:"R;",";P-((R-1)*80)+1
```

End

1000 Key Simulation

Tandy failed to include scroll-lock, minus, or plus keys on the Tandy 1000 keypad. But you can use the following keys to simulate them with the following programs:

For Framework II, use the hold key for the scroll lock to shuttle, F11 for the minus key to go up a level, and F12 for the plus key to go down a level.

For Microsoft Word 3.0, use alternate-break for scroll lock and F11 for the minus key to collapse headings.

Use F12 for the plus key to expand headings, the print key for the keypad asterisk (*), shift-F11 for shift-minus to collapse body text, and shift-F12 for shift-plus to expand body text.

Henry C. Yau
Winnipeg, Manitoba

Assembling Multiple Source Files with ALDS

I have a tip for Radio Shack's Assembly Language Development System (ALDS) users creating assembly programs that consist of more than one source file. The ALDS manual says that you must leave the PSECT directives blank to create REL files, which you can bind together later with Allink/CMD to form a single program module. But to get a base loading address other than the default (3000 hexadecimal [hex] on the Model 4, 5200 hex on the Model III), the manual says to use the $=ADDRESS option during the linking operation.

You can, however, tell the linker from within the assembly code where you want the data loaded. On the line after the first (and maybe only) PSECT directive in the first source-code module, enter the line ORG START-3000H (Model 4) or ORG START-5200H (Model III). For example, if you want your program to load at address 7AA5 hex on the Model 4, you could use the code in Fig. 2.

This method works even if the load address is below the default load address. The reason it works is simple: When ALDS creates REL files (PSECTs left blank), the ORG op-code is used differently than it is in absolute-address files (PSECTs not blank). Instead of creating a new absolute-origin address, it creates an offset value that is applied to the base loading address relative to the last PSECT set.

Therefore, in Fig. 2, the ORG offset is set to 7AA5 – 3000 hex, which equals 4AA5 hex. When this value is added to the default base address, 3000 hex on the Model 4, the actual address value becomes 7AA5 hex, the desired loading address.

David Goben
Mansfield Center, CT

```
START   EQU     7AA5H     ;set initial loading address
        PSECT             ;begin code segment
        ORG START-3000H   ;set loading offset value
```

Fig. 2. Sample code to load data at a specific location.

Illustration by Nelle Davis

The Bidirectional Ripple Sort

When sorting a data file, the type of sort routine you use depends on the degree of misordering expected, the quantity of data, and the kind of misordering.

For example, say you have a file that you update regularly—perhaps a membership roster maintained in alphabetical order. Updates consist of additions, deletions, corrections, and reordering.

Added records take the first available slot. If the file is growing, new records are added at its end, badly out of order. Despite placing some records badly, updating leaves the file generally well-ordered.

In this situation, I use a bidirectional ripple sort (Program Listing 2). It is slow and somewhat crude, but appropriate for the job. My version runs on the Models III and 4, and on the Tandy 1000, 1200, and 3000.

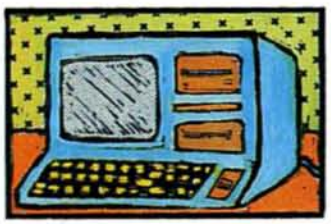
The ripple sort works as follows: Assume that the membership file has n number of records and that you've updated it by adding one record, with the name "Brown," at the end. A forward-only ripple sort needs the better part of n passes to complete the sort. The bidirectional ripple sort places "Brown" correctly on the first reverse pass.

Robert M. Doerr
Rolla, MO

Program Listing 2. Bi-directional ripple sort.

```
99 'Bi-Directional Rippelsort subroutine, R.M. Doerr
100 M = 1:K = NRECORDS -1
110 FOR I = 1 TO NRECORDS 'Sort the NRECORDS records
 of vector TABLE(); L is the JOB DONE indicator
120 L = -1:FOR J = M TO K: IF TABLE$(J) <=TABLE$(J+1
) THEN 130 ELSE L = 0: SWAP TABLE$(J), TABLE$(J+1)
   'Forward
130 NEXT J
140 FOR J = K-1 TO M STEP-1: IF TABLE$(J) <= TABLE$(
J+1) THEN 150 ELSE L = 0:SWAP TABLE$(J), TABLE$(J+ 1
) 'Reverse
150 NEXT J
160 IF L THEN I = NRECORDS ELSE K = K -1:M = M +1
170 NEXT I: RETURN
```

End



Mod 4 Drive Data

When installing double-sided drives in the Model 4, you must use the normal 34-pin connectors (Radio Shack part no. 276-1564, $3.95), not connectors with a pin removed for single-sided drives.

If you plan to install four half-height drives, make sure you get the later-model, low-power Tandon TM-65 drives. The older, high-power TM-50 drives require more power than the Model 4 can deliver, and installing them would possibly result in overheating. You must also redrill the mounting bracket to accommodate the extra drives and trim part of the plastic housing to allow the drive doors to operate. You need a custom made Y-cable to connect the drives to the power supply, as well.

Hal Decker
Avon, CT

Password Bypass

While writing assembly-language programs under TRSDOS 6.x, you might need to bypass password checking. You can do this by executing @FLAGS SVC (101) and setting bit 7 of IY + 13, the network flag bit. The *Model 4 Technical Reference Manual* says that this bit is reserved for system use, but actually SYS2/SYS uses it to see if password checking should be bypassed.

If this bit is set, then the DE register pair is set equal to the HL register pair. This produces a Z state during a subtract operation, causing a success result even if you omitted the password or used the wrong one.

You can eliminate password checking completely by entering at TRSDOS Ready: PATCH SYS2/SYS.LSIDOS (D02,33 = 18:F02,33 = 28) to alter the password-check routine. Entering PATCH SYS0/SYS.LSIDOS (D00,83 = 80: F00,83 = 00) sets the password-check flag within @FLAGS on boot-up.

David Goben
Mansfield Center, CT

Entry Loops

Program Listing 3 shows a somewhat standard Basic keyboard-entry routine for the Model III. It works well for many applications, especially if you put it in a subroutine at the beginning of the program, so that Basic doesn't have to search through too many line numbers to execute the Goto.

But Program Listing 4 is a faster keyboard-entry routine, appropriate for applications such as word processing. The technique involved puts the Inkey$ routine into one or more For. . .Next loops. It also makes little difference to Basic as to where you place this routine in the program.

Listing 4 uses a standard loop followed by a Goto. Program Listing 5 is less conventional: It uses an "infinite" loop. The key to this technique is to always close the loop at the same point in time. You can do this at any time prior to using another loop that uses a different variable. Failure to close the loop causes a For. . .Next error at some unexpected part of the program.

There are two ways you can close a finite or infinite loop prematurely. You can set the loop variable to its ending value and then execute the Next statement. However, I prefer the method used in line 30 of Listing 5—executing a dummy loop. This has the desired effect of removing the loop variable from Basic's stack.

Daniel Baright
Lebanon, MO

Program Listing 3. Common keyboard-entry routine for the Model III.

```
10 A$=INKEY$: IF A$="" THEN 10 ELSE PRINT A$
20 GOTO 10
```

End

Program Listing 4. Model III keyboard-entry routine that puts Inkey$ in a For. . .Next loop.

```
10 FOR N=0 TO 999:A$=INKEY$:IF A$="" THEN 20 ELSE PR
INT A$
20 NEXT
30 GOTO 10 'This is seldom executed.
```

End

Program Listing 5. Model III keyboard-entry routine that uses Inkey$ in an infinite loop.

```
10 FOR N=0 TO 1:STEP 0: A$=INKEY$: IF A$="" THEN NEX
T ELSE PRINT A$
20 IN A$=CHR$(13) THEN 30 ELSE NEXT
30 FOR N=0 TO 0:NEXT
40  ' Program continues here.
```

End

Think It Up

by Hardin Brothers

★★★★

Maxthink runs on the Tandy 1000/1200/3000 and requires two disk drives. Maxthink, 230 Crocker Ave., Piedmont, CA 94610. 415-428-0104. $89.

Maxthink didn't impress me at first. A large piece of foam took up most of the space inside its box. The soft-cover manual has a cartoon drawing on the front, and the blurbs on the package cover seem to be pure hype. Things didn't improve much as I read through the manual, which seemed simplistic and wordy. It devoted too many pages to pointers about writing and thinking, and none of it seemed fresh or exciting.

However, as I started to use Maxthink, my attitude improved. By the time I had worked through the tutorials and read the reference section, I was won over.

As an outline processor, Maxthink is similar to other programs of its type. It lets you define a structure of topics into an outline form, move topics from one level or location in the outline to another, view the outline in a number of ways, and print or save the file in a variety of formats. Maxthink's opening menu lets you copy or move an outline section, use cut-and-paste commands, jump to a specific location in an outline, and insert a new topic or subtopic. No matter where you are in Maxthink, pressing F1 invokes a help screen that lists all key commands presently available. The list is usually quite extensive, partly because Maxthink supports much of the Wordstar control-key command set along with cursor- and function-key commands.

You have a choice of resetting a number of options controlling how you work with an outline and its final printed appearance. You have 14 sets of predefined options, and you can add customized sets at your discretion. Once you define a set of options, you can invoke it by pointing a cursor to its name and pressing the enter key.

Brainstorming

The most intriguing option is Brainstorm, a command subdirectory that distinguishes Maxthink from other outline processors. Maxthink's authors recognized that some people do not think in an organized manner. Using Brainstorm, you can define a number of "bins" and scroll through the current outline entries, tossing each item into one of the bins. If you have a number of ideas, seeing them printed on screen or paper makes structuring seem easier. The Binsort command lets you experiment with this structure, rearranging idea fragments until you have created a coherent outline.

Another Brainstorm command, Fence, works the way most people make notes on paper. Instead of working with the standard tree structure of an outline, you create a flat list of topics and emphasize the most important elements in a kind of linear fashion. This is helpful for preliminary organization of your ideas. Prioritize lets you select topics from any level of an outline and easily sort them by name. For example, you could create a list of things you need to do during the next day or week and, after the list is complete, rearrange them according to their relative importance.

The opposite of prioritizing a list is arranging it in random order. At first, I could see little reason for shuffling a list in this way. Later, however, I saw this as an important feature. It shakes up your mental processes, forcing you to see new relationships between ideas.

Data Base of Sorts

Maxthink is also handy as a small, free-form data base. It can sort all or part of the outline entries at any level, rearranging them in alphabetical or ASCII order. You can perform the sort on any part of each line in ascending or descending order. More interesting still, Maxthink has a reference facility that lets you keep track of all words in an outline. You can use this as part of a search-and-replace command, as a method for deriving a count of unique words in a document, or as a way of tracking free-form data that you have entered into the program.

By itself, Maxthink is not particularly geared for creating long, involved documents. I prefer using a regular word processor for large pieces of text, but Maxthink can save files in a format that almost any word processor will accept. It can link outline entries to specific files on disk and then read those files as you are writing. I use Wordstar extensively on my Tandy 1000 and had no trouble moving between it and Maxthink as I de-

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 Jeff Kronen

veloped long documents. Maxthink kept things organized and never misinterpreted Wordstar control codes.

Creating outlines and lists on the screen is fine, but you also need to print or output those files in a variety of ways. Maxthink lets you set up any number of output formats, move among them at will, and view the resulting text before it goes to a printer or disk file.

Some valuable utilities are included on the Maxthink disk. One of my favorites uses an outline to create a large wall chart. Another utility, Maxtoc, presumably changes a Maxthink outline into a form that a C compiler will accept. However, this utility has no documentation and I could not make it work successfully.

Small Bugs

Maxthink is easy to use but not completely idiot-proof. It can remind you to save a current outline every 1 to 999 minutes, will allow escapes from almost every command, and has an undo command that reverses the most recent delete, insert, or undo. On the other hand, I managed at one point to lock up Maxthink by accident and, after rebooting the computer, found that some of my files were lost.

One feature missing from Maxthink is a large type-ahead buffer. It holds only one type-ahead keystroke at a time while executing a command, although you can define one macro key if you are going to perform a repetitive operation. A tricky way around this problem is to save a log of keystrokes to disk and later repeat those keystrokes when Maxthink reads the file.

Maxthink seems designed for people who are writing short, highly structured documents, rather than for those who want an outline as a guide to a much longer document. I could not find any acceptable way to expand a Maxthink outline into a full document without doing a lot of the writing and editing with a word processor. This, however, is a complaint that I have about other outline processors as well.

Conclusion

Despite these reservations, I like Maxthink very much. I have yet to explore some areas of the program, but understanding the major functions takes little practice. Part of its genius is that it seems so simple on the surface but harbors so much power underneath. It is the kind of outline processing program you can begin using immediately and after repeated use, continue to find new options and commands. It admirably cleans up your writing and organizational skills, even if its manual does have a cartoon on the cover.■

Speed Demon

by David A. Williams

★★★★

286 Express runs on the Tandy 1200 HD. PC Technologies Inc., 704 Airport Blvd., Ann Arbor, MI 48106. 313-996-9690. $695.

Speedpac 286 runs on the Tandy 1200 HD. Victor Technology Inc., 380 El Pueblo Road, Scotts Valley, CA 95066. 408-438-6680. $595.

Racecard-286 runs on the Tandy 1200 HD. Mountain Computer Inc., 360 El Pueblo Road, Scotts Valley, CA 95066. 408-438-6650. $695.

Sooner or later, most computer owners yearn for increased performance. The popularity of the AT and clones such as the Tandy 3000 has fanned the flames of desire in otherwise satisfied users. Accelerator (or turbo) boards use a number of methods to improve performance. Most of them use an 8088 processor running at an increased clock speed, but some use the 80186 or even the 80286. When using the 80286, an accelerator board might contain a full complement of memory chips, because these 16-bit microprocessors are not compatible with a PC's 8-bit memory bus. Consequently, most of these boards are expensive.

Today one class of accelerator board outperforms most older turbo boards and costs considerably less. The 286 Express, designed and built by PC Technologies and marketed by Victor Technologies as Speedpac 286 and by Mountain Computer as Racecard-286, is a member of this class. The three boards are essentially the same. This new board doesn't work with the Model 1000, but it can speed up your 1200 HD.

Here's the Cache

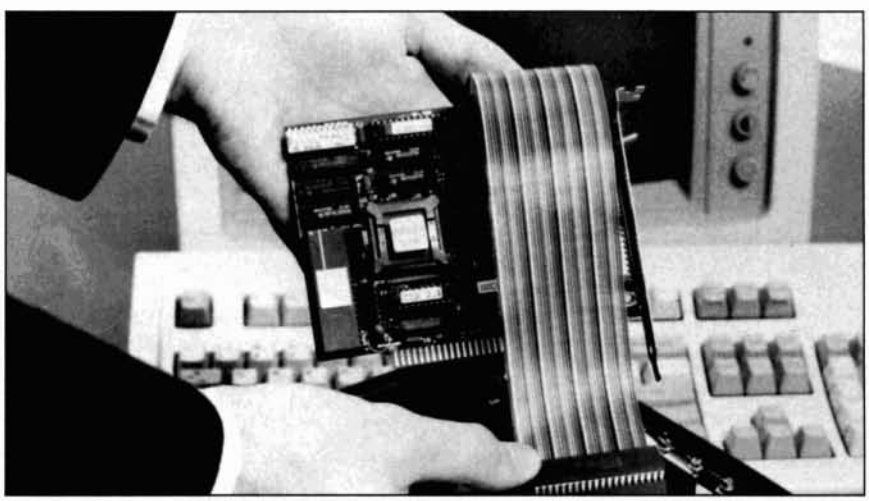
The board occupies one expansion slot and uses an 80286 coupled with an 8K cache memory. Its associated memory-management logic can use the processor's 16-bit memory bus while retaining your computer's normal memory. The cache lets a fast device (the processor) work effectively with your computer's main memory or disk drives, retaining the most recently accessed instructions and data. When the processor needs information, it checks the cache first. The board is compatible with the Intel expanded memory standard and has an extra chip socket for an 80287 math coprocessor.

A good accelerator board ought to run all your existing software without utility programs or switches to change speed modes. You should notice a substantial increase in processing speed to justify the considerable cost, and installation should not require the services of an electronic technician. Based on the unit I evaluated, the 286 Express/Speedpac 286/Racecard-286 passed these tests admirably.

I used the board in my Tandy 1200 HD with software standards like Microsoft Word, Multiplan, R-base 5000, 1-2-3, Reflex, and a variety of utility, telecommunications, and memory-resident programs. Except for the noticeably higher performance, I felt as if I were still running the standard configuration. Some copy-protection schemes might give you trouble when you use a turbo board, and I found one. Dow Jones Market Manager Plus, which uses a non-MS-DOS operating system, would not load. According to PC Technologies, an earlier version of the board was not compatible with EGA-type adapter boards, but this problem has been corrected.

Easy Installation

Installation is only slightly more difficult than hooking up a display adapter or



286 Express is versatile, easy to install, and fast.

memory-expansion board. First you remove the existing 8088 chip (a handy tool is provided to help you do this). Then you set switches or jumpers on the accelerator board according to how much installed memory is in your computer. The speed-up board comes with jumpers set for a computer running 256K of RAM, but the manual is clear on how to change the default setting to accommodate 640K. If you have compatible problems, you can disable locking and the board will run as an 8088. Plug the cable attached to the board into the 8088 socket and install the board in an open expansion slot. The cable is not long and you might have to move other boards to free a slot close to the 8088 socket.

My 1200 HD had one bent pin on the 8088, probably due to an error in the motherboard. If you find any bent pins on your 8088, bend the corresponding pins on the cable plug. You must also remove the 8087 coprocessor if you have one. Should you want to add an 80287 on the accelerator board, place the provided socket plug in the empty 8087 socket.

Life in the Fast Lane

I noticed the increased performance as soon as I turned on the computer. The improvement in scrolling speed and other screen operations is dramatic but difficult to measure. To quantify the board's performance, I ran several benchmarks using Multiplan; processing speeds clocked in at 2.5 to 3 times faster than normal. Every program I tried appeared to run faster than usual, but disk operations were not affected.

The accelerator board's 7.2MHz clock speed is 1.5 times that of a normal PC and 20 percent faster than an AT. The 80286 requires fewer cycles to execute some instructions than the 8088, and the wider memory data bus lets you access 2 bytes from the cache in each memory cycle.

To measure an accelerator board's value, vendors often quote the Norton Utilities performance index—roughly 6.6 compared to 1 for a standard PC. Don't expect to achieve an increase like this all the time, (it won't run Multiplan 6.6 times faster than a PC). My tests indicate that the actual performance index lies somewhere between 6.1 and 6.4, depending on your computer model.

Despite lowering retail prices, accelerator boards are still a heavy investment for those who want PC/AT-like processing speeds. On the other hand, the price of a board is right compared to what a new system would cost. Your best bet is to find a supply house that markets one of these brand names at a nominal discount.■

Shows Promise, But

by Ed Joyce

★★½

Webster's New World Writer runs on the Tandy 1000/1200/3000 (256K) and requires two disk drives. Computer Software Division, Simon & Schuster Inc., 1230 Avenue of the Americas, New York, NY 10020. 212-373-8000. $150.

★★★★

Webster's New World On-Line Thesaurus runs on the Tandy 1000/1200/3000 (256K) and requires two disk drives. Computer Software Division, Simon & Schuster Inc. $69.95.

★★★

Webster's New World Spelling Checker runs on the Tandy 1000/1200/3000 (256K) and requires two disk drives. Computer Software Division, Simon & Schuster Inc. $59.95.

In the fast-paced world of personal computers, you must periodically wonder if you're using the best available technology for the job at hand. I recently posed that question regarding my word processor and decided that, after five years of using Wordstar, I needed to take a fresh look at what the market had to offer. I picked up Webster's New World Writer package, which Simon & Schuster has touted as "the word processor you've been waiting for." This product comes with a 120,000-word thesaurus and 114,000-word spelling checker, either of which you can purchase separately. Packaged together, the trio had the potential to be the ultimate writing system.

First Impressions

Since my expertise with Wordstar has grown to the point that I can compose letters with the screen monitor unplugged, I was apprehensive about retraining my fingers to whatever *modus operandi* New World Writer would require. Apparently, the program's authors contemplated this same problem and solved it in an ingenious manner. Rather than forcing you to pick up a new command structure, New World Writer recognizes popular Wordstar commands as well as its own. In Wordstar, for example, pressing control-F moves the cursor forward one word and control-T deletes a word. Under New World Writer, you accomplish these functions by shift-right-arrow and shift-backspace, respectively, but control-F and control-T have the same effect.

The net result is that New World Writer has a built-in bridge to an existing word-processing system. A Wordstar user can adapt to the new command philosophy at leisure without feeling handicapped at the onset.

Another borrowed Wordstar feature is the delayed display of help screens. When entering commands rapidly, you will seldom see a menu or help screen. On the other hand, when New World Writer senses a perplexed user, or if you appear to pause and think while choosing a command set, it will automatically pop up a window with help information explaining the commands. You can conceivably learn the whole system from the help screens (which you can enable and disable at will) and never refer to the user's guide.

Several Attractions

For calculating the size of a document, New World Writer includes a length command that displays the total number of words and pages. When you end an editing session, New World Writer internally marks the position of the cursor within the document. When you edit the document again, the program prompts you to press alternate-J to jump to where you left off. This slick function takes the place of the comparable Wordstar command, which involves typing "left off here" and then searching for that string at the start of the next edit. Another New World Writer command that will probably see daily action is the date command, which inserts the current month, day, and year into a document at the cursor position.

To allow easy access to foreign-alphabet letters, printer control codes, graphics symbols, and other special characters, New World Writer delivers the ASCII table upon request. You can insert any of the table's 256 characters directly into your document.

Three other New World Writer features stand out. Whoops (or the undo or undelete key as it is variously referred to) reinserts a block of deleted text. Automatic save, which you can toggle on or off, is a type of insurance against power-company faults, automatically saving a copy of your text every 1000 keystrokes. The box-drawing option lets you draw vertical and horizontal lines anywhere on the screen.

The documentation, in addition to explaining the intricacies of the software, strives to improve the writing skills of its audience through five appendices covering punctuation, wordiness, trite expressions, prepositions, and commonly misused words. The manual also provides instruction on preparing book-length manuscripts, drama scripts, poetry, speeches, press releases, business correspondence, proposals, resumes, and form documents. If you are new to word processing, this is valuable material.

Disenchantment

Initially, I was favorably impressed with New World Writer. Given its well-designed menus, robust set of commands, and other amenities, I expected to retire my old word processor. But the honeymoon didn't last long and, as I started probing the fine details, the tide turned.

Discounting the thesaurus and spelling checker, New World Writer commits three intolerable sins. First, it takes WYSIWYG (what you see is what you get) to extremes, offering no way of viewing material on the screen in single-space format while having it print as double-spaced. In Wordstar, this display mode uses the line-height printing command; for example, putting ".lh16" at the top of a document tells Wordstar to print at three lines per inch or double-spaced. Wordstar calculates page breaks accordingly, but the text appears on the screen in condensed form as single-spaced. Thus, you can see 22 lines of information on a 24-line screen. In contrast to this method, New World Writer insists that blank lines appear on screen between displayed text that is to be printed in double-spaced format. Effectively, it cuts the information density to one-half that of a Wordstar screen.

The second flaw lies with background printing, another feature pioneered by Wordstar yet conspicuously absent in New World Writer. Background printing means that one file can print while you edit another one. New World Writer cannot handle two tasks at the same time. Another problem is the lack of a window for viewing a document other than the one you are editing. A few years ago this would not have been a serious omission, but today many systems offer this capability.

On-Line Thesaurus

You can select Webster's New World On-Line Thesaurus from a menu within the word processor. Position the cursor on a word in the text, press alternate-F10, and the thesaurus delves into a list of 120,000 synonyms and phrases, offering substitutes in a pop-up window. Choose the best one and the original word or phrase is replaced in your document. You can even flip through the thesaurus, branching from synonym to synonym, searching for a better way to express your idea.

For example, consider looking up the word "computer." The thesaurus shows seven synonyms: data processor, micro, microcomputer, personal computer, mini, minicomputer, and mainframe. It also lists "machine" as a related word with meanings of "instrument," "movement," "automation," and corresponding synonyms. At this point, you can

select a word by positioning the cursor on it or browse through the thesaurus to reference "compute," "computation," and "computable," among others.

The thesaurus does its job with speed and grace, scanning through its collection of words without distracting delays. After it finds the root word which you are looking for, the program appears to stack the synonyms in memory for quick access. It is organized in dictionary style, rather than as a Roget-type thesaurus. A dictionary-style thesaurus lists only synonyms. A true thesaurus groups words according to related thoughts or concepts, in addition to listing synonyms, and readily shows different parts of speech and antonyms. The New World On-Line Thesaurus is also available as a stand-alone product and is compatible with Wordstar, Wordperfect, Sidekick, and other word processors and text editors.

Spelling Checker

Webster's New World Spelling Checker, like the New World Writer, seems to have been designed for yesterday's audience. The spelling checker, alas, does not work on line but only in batch mode. Suppose you type in a word and are not positive of the correct spelling. With an on-line spelling checker, you press a key and the correct spelling appears on the screen. With New World Spelling Checker's batch-mode system, you must first save your document, exit the word processor, and load the spelling checker to proofread your text file and reveal your misspelled words.

If proofreading is all you need, New World Spelling Checker might be the right way to go. It has a 114,000-word dictionary which is one of the largest available on disk, and is clever enough to detect phonetic misspellings (it recommends "phenomenal" for "fenomenal"), correct transpositions ("ohuse" becomes "house"), and point out contractions ("aren't" for "arent"). It also boasts compatibility with popular word processors.

Conclusion

In concept, at least, Simon & Schuster has dreamed up a large-scale integrated package that should have been the ultimate word processor. In reality, they missed an opportunity to take the lead from Wordstar and other heavyweight text editors. The New World On-Line Thesaurus is impressive but seems less so when flanked by its mediocre sidekicks. Although my Wordstar is eventually destined to be replaced by something more state-of-the-art, I'll have to pass for now on the New World package.■

Moving Forth

by William H. Potter

★★★½

Pro-Hartforth runs on the Model 4/4P/4D (64K) running TRSDOS 6.x and requires two disk drives. Misosys Inc., P.O. Box 239, Sterling, VA 22170, 703-450-4181. $74.95 (plus $3 shipping).

Forth is unlike any of the standard computer languages such as Basic, Pascal, and C. The most important difference is that you don't really write programs in Forth. Instead, you add definitions to the operating system to perform specific tasks. These command extensions can be temporary, to be executed a few times and forgotten, or permanent and included in your version of the language.

A Forth system begins with a basic vocabulary of function words called the kernal. Each word invokes a machine-language subroutine—the building blocks of Forth. The kernal can read and compile Forth source code to add as many new words as you like, provided that you define new words in terms of the current vocabulary. Once you define a new word, you can use it as a Forth function. Pro-Hartforth implements a complete Forth-79 system together with several enhancements. It uses TRSDOS for all disk access and runs on a hard-disk system with no problems. It comes on one floppy without any copy-protection and has a 45-page manual. All the software functions that I tested worked well, but the manual is a bit difficult to follow and has some significant typographical errors.

Forth Fundamentals

The key to understanding Forth code is realizing that variable values are passed along on the stack unless you define a memory location to store them. To add two numbers, for example, you put the numbers on the stack by entering their values and typing the command "+". Their sum will be at the top of the stack, and you can print it with the "." command. To solve a problem in Forth, you build a system by defining as many additional words as you require until you have defined one word that solves the entire problem. With Forth, the bootstrap process underlying most computer usage becomes visible, and structured programming is natural.

Forth provides a standard method of accessing disks by organizing programs and data into screens of 1,024 bytes each. You can call up one or more screens by number to edit or execute, with Forth taking responsibility for finding the specified screen in RAM or on disk. These screens form a kind of virtual memory. When you load a program screen, all word definitions on that screen are compiled (that is, added to the definitions that were already in the vocabulary). Forth is also interactive. You can do a quick check on a code fragment before it is incorporated into a larger piece of software, or you can sit at the keyboard and use your computer as a pocket calculator.

Getting Started

Since Pro-Hartforth comes in a standard TRSDOS file, back up the original disk to generate a working copy. The program uses the TRSDOS I/O drivers to access the disk, screen, keyboard, and printer. Put the TRSDOS system disk in drive zero and Pro-Hartforth in drive 1. Type FORTH at the prompt, and Pro-Hartforth asks you to enter the file name to be accessed. Until you have created some new files, use Forth/CMD. You can execute Forth from the keyboard or inspect, edit, and load screens. If you have only one disk drive, copy the Pro-Hartforth file to a TRSDOS disk with at least 80K of free space. Unfortunately, with one drive you can work with only one Forth file at a time.

The 80K Pro-Hartforth file would have room for 80 screens except that the kernal uses the first 20K. The screens reserved for your source code are screens 20–80, with screens 20–36 loaded automatically during bootup. If you need any of the others, you have to specifically load them. Screen 20 acts as a directory for the rest of the system.

One disk file is active at a time, but you can move around easily to create and change files from within Forth. You can also load source code from a file generated by other software, such as your favorite text editor. You can also run programs that you have downloaded from a bulletin board. The only requirement is that the file be in ASCII and end with a zero or null byte.

Pro-Hartforth Extensions

Standard Forth handles only integers, generally 16 bits long, and 8-bit characters. Most Forth systems provide some extensions to handle other types of data. Pro-Hartforth includes extensions to handle strings, double-length integers, floating-point variables, and arrays. These extensions are in the form of Forth source code, and you can load them from screens found in the Forth/CMD file. Pro-Hartforth also includes extensions that are specific to the Model 4, including provisions for driving a printer, using interrupts, moving the cursor on the screen, generating simple graphics on the screen, and accessing the I/O ports.

Several Forth utilities are provided, including a screen editor, an editor to inspect and change data in RAM or on disk, and a package of debugging aids for inspecting stack contents. One handy feature, decompile, reconstructs the source code for any defined word. Decompile does not completely reconstruct Forth source code, but it's close enough to be useful when you forget a word's definition. If the original definition is in machine language, Decompile shows you the code in hexadecimal. Another utility lets you enter machine-language code within a Forth definition. One of Pro-Hartforth's most valuable features, the native code generator, can create a machine-language version of Forth for use in sections of your programs where speed is essential.

Weak Link

The Pro-Hartforth manual suffers from a lack of examples and cross-referencing. It is organized to help you seek out what a specific command does. Unfortunately, most of the time you also want to know what command (or sequence of commands) performs a desired function. This means a lot of searching for answers that are often not there. I had to reread most of the manual for almost every new kind of file manipulation that I wanted to attempt. Some meaningful printed examples would be helpful.

In addition to being incomplete, the manual contains some unfortunate typographical errors. The characters # and @ have been consistently misprinted or omitted. These characters are vital to many Forth definitions. The @ character, for instance, is the Forth word for fetch, which puts the value of a named variable on the stack. At least the manual's author recommends that you buy one of the standard Forth tutorial books, such as *Starting Forth*, by Leo Brodie. Expect to add the price of a book or two to that of the Pro-Hartforth program.

Conclusion

Pro-Hartforth is a good system and a valuable programming aid once you overcome Forth's peculiarities. It ran without a hitch on my Model 4P using both a floppy- and hard-disk drive. The only time I crashed the system was when I overflowed the stack due to my own carelessness. Those crashes left all the disk files intact, and recovery was easy. You should expect to sweat a little before you master the many utilities and extra features. A Model III version, HartForth, is also available from Misosys, but it does not have as many features or utilities as the Model 4 version.■

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:

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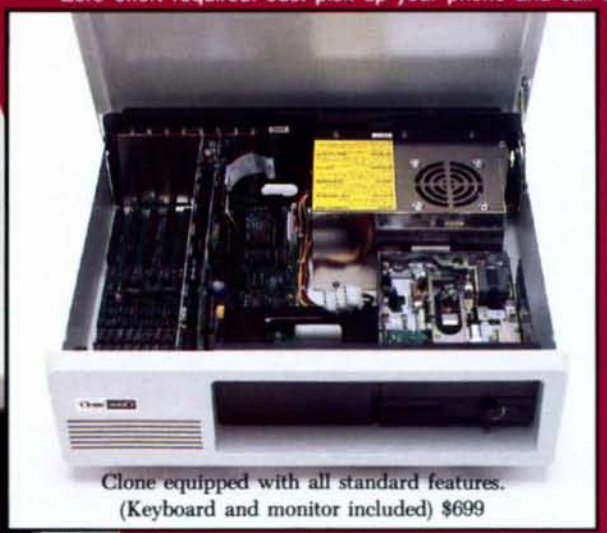

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US VS. THEM

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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Basic Expansion

by John B. Harrell III

★★★★

Enhcomp Basic Compiler 2.5 runs on the Model 4/4P/4D (64K) running TRSDOS 6.2. It is also available for the Model I/III running LDOS 5.14. Misosys Inc., P.O. Box 239, Sterling, VA 22710. 703-450-4181. $125 (plus $3 shipping).

Considering the current emphasis on MS-DOS computers, it is surprising to see a new compiler for the Model 4. The Enhcomp Basic Compiler is an innovative, full-fledged Basic compiler that maintains an air of friendliness similar to the standard Basic interpreter. This type of user interface is quite unique to Model 4 software, making this product a valuable addition to any programmer's library.

The Enhcomp system produces a stand-alone Z80 machine-language program; no other routines are required to support your programs. While Enhcomp bears a strong relationship to Basic, the word from Misosys is that there is no attempt to make a Basic-compatible compiler. Besides, differences among Basic interpreters for the Model I/III/4 would make the chances of compatibility practically nil.

The Enhcomp system contains a compiler (BC), line editor (CED), cross-reference facility (REF), and supervisor program (S). The supervisor program, an interface between BC and CED, provides a mechanism for easy entry into your programs and temporarily saves your source code during the transition from line editor to compiler. After a quick compilation and double-check, it runs your program. It then transfers control to your program after successful compilation. Control returns to the line editor when the newly compiled program has completed execution. You can use BC and CED separately without this interactive "run" feature.

The CED Editor

Your first contact with Enhcomp is the CED editor. It is not like the familiar Basic editor for the Model 4, but the differences are minimal and you quickly adapt. The most striking change is the lack of Basic line numbers for each Enhcomp statement. While you have the option of using line numbers, the editor maintains its own internal reference numbers. In fact, your source code can be devoid of line numbers, as Enhcomp lets you use symbolic labels as the targets of Gotos and Gosubs. Enhcomp's E edit command is similar to the Basic interpreter's capability, with one significant variation: It can apply the editing command to multiple lines. You have a choice of using either the Basic line numbers or CED's internal line numbers for making changes.

The edit function accepts commands for aborting, changing, deleting, hacking, inserting, killing, listing, searching, and inserting at the end of a line, just like the Basic interpreter. More important, you can supply a string on the command line that executes as if you typed it in while editing. For example, the command "e'irem ['15,20" tells CED to insert a remark token at the start of each line between lines 15 and 20. It interprets the open bracket ([) as a carriage return.

The Enhcomp system provides a stand-alone Z80 machine-language program.

The line editor's question-mark (?) command evaluates an expression, resembling the Print command from the Basic interpreter's direct command level. CED can also insert or remove a Basic line number on specified lines, copy or move a block of lines, and search and replace. A good selection of DOS commands lets you access frequently used functions while remaining in the editor.

Like the Basic interpreter, CED stores a program in an internal tokenized format that is nonetheless incompatible with the interpreter. To facilitate transfer of your programs, CED also reads and writes source code in ASCII character format compatible with other language translators. This feature makes CED an easy choice for writing Pascal or C programs, and the large text buffer is a welcome addition.

The Language and Compiler

One of Enhcomp's outstanding features lets you include Z80 assembly language at any point within a source program. This is a full Z80 assembler with access to all the data items within the Enhcomp data space. Although this is a powerful feature, Enhcomp does not support the USR or Call statements as the Microsoft interpreter does.

Enhcomp also implements multiline procedures and functions. Functions are declared using a flexible parameter structure. Unlike other compiler implementations, Enhcomp allows a completely recursive definition and maintains a local list of parameters for each function. Enhcomp also provides a convenient method of defining your commands or procedures. The Command-Endcom construction lets you define any sequence of numeric and string expressions as a simple command with an optional parameter list. These new commands can also employ recursive definitions similar to those used in functions.

Enhcomp gives you features not commonly found in Basic compilers. For instance, you can dynamically dimension arrays at any location within your program. Similarly, you can specify more than one statement that dimensions an array, as long as only one statement is executed. Attempting to do either of these with Microsoft's Basic Compiler (Bascom) immediately gets you a compilation error. Enhcomp includes double-precision math functions. Basic, even on MS-DOS computers, allows only single-precision functions, and you must go to elaborate extremes to formulate additional precision results.

Another welcome Enhcomp feature provides multiple Next statements to exit a For loop. Bascom requires that each For statement terminate with only one Next statement. This is a significant problem, making it nearly impossible to port some Basic programs from the interpreter to Bascom. A significant Enhcomp extension is the multiline implementation of the If. . .Then. . .Else. . .Endif statement. After having spent many hours trying to code the proper logic into the limitation of Basic's line length, I applaud this Enhcomp feature.

Enhcomp extends Basic's string-handling abilities by offering strings up to 32K in length, improved manipulation routines, and garbage collection that works. Basic originally imposed a prohibitive 255-byte limit on string length and had an awful garbage-collection routine that ate up lots of program execution time. The compiler also offers full handling of the break key (used as an all-purpose escape

The Enhcomp Basic Compiler runs under TRSDOS 6.2 or LDOS 5.14.

key or for program control). Although most compilers do not generate code to recognize the break key, Enhcomp uses the BKOn and BKOff statements when checking is performed and provides the On. . .Break. . .Goto command for handling break exceptions.

One weakness of the Model 4 TRSDOS Basic interpreter is the omission of the graphics commands found in Model I/III Basic. Rudimentary as they are, you can put these commands to outstanding use to enhance Model I/III programs. While Bascom does not provide support for any Model 4 graphics, Enhcomp gives you the Set, Reset, and Point graphics commands. In addition, COMPL inverts the bit designated by the screen parameters, Invert reverses all graphics pixels on the screen, Paint fills in any graphics area, and Plot draws a line by specifying the end points. The Draw command provides limited turtle graphics. To provide parameters, you designate a starting point followed by a list of line segments and rotations. Draw then produces the figure on the video screen. The ROT command sets the initial rotation reference for Draw.

Enhcomp should alleviate most of your sorting problems, as it contains an easy mechanism for sorting data arrays. This feature is not in either Bascom or the Basic interpreter. In Enhcomp, arrays must be single-dimensioned, and you can sort on up to 32 keys. The keys determine the order of the sort. You can also associate "tags" with the data to rapidly access your sorted data—the tag array is updated by the sort algorithm to reflect the positional value of associated data items.

Performance

The size of a finished, compiled program is important when gauging Enhcomp's success (see Tables 1–3). When testing Enhcomp against Bascom and the Basic interpreter, I used five benchmark programs. The minimal benchmark contained a simple End statement and is compiled to illustrate the size of the minimum run-time support required. Thousands of ways exist to measure a compiler's performance and I do not claim to provide the most accurate measure. The charts in Tables 1–3 provide a subjective measure of Enhcomp as compared to the Basic interpreter and Bascom. The testing is limited and does not include all aspects of compiler performance.

The Count benchmark tests integer arithmetic and looping controls using an empty For statement to count to 32,000. The Sieve of Eratosthenes prime-number generator (Program Listing 1) involves looping and integer arithmetic, as well as array manipulation. The FPTest program (Program Listing 2) uses the floating-point math support library and tests these functions' efficiency. The last program is a simple test of the graphics Set and Reset commands used to alternatively fill and clear the video screen. As the Basic interpreter and Bascom do not include graphics statements, I wrote a simple assembly interface to provide graphics from within the interpreter, which you can link with any program compiled using Bascom.

Compiled Enhcomp programs are significantly more compact than those created by Bascom (see Table 1), but each system has its trade-offs. For Bascom to execute properly, you need only one copy of its run-time library on the disk containing your compiled programs. On the other hand, each compiled Enhcomp program must link to a separate copy of the Enhcomp run-time support before execution can succeed. With Enhcomp, the five benchmark programs take up roughly 50K, which includes the run-time support; with Bascom, 21.5K belongs to its library and 2K to the compiled Basic programs. If you are using Bascom for personal work, this is certainly in its favor. Unfortunately, Micro-

Program Listing 1. Sieve of Eratosthenes prime-number-generator test.

```
10 PRINT TIME$
20 DEFINT A-Z
30 DIM FLAGS(8190)
40 PRINT "1 Iteration: ";
50 FOR I=1 TO 1
60   COUNT = 0
70   FOR J = 0 TO 8190
80     FLAGS(J) = -1
90   NEXT J
100   FOR J = 0 TO 8190
110     IF NOT FLAGS(J) THEN GOTO 200
120     PRIME = J + J + 3
130 '   PRINT PRIME,
140     K = J+PRIME
150     IF K > 8190 GOTO 190
160       FLAGS(K) = 0
170       K = K+PRIME
180     GOTO 150
190     COUNT = COUNT + 1
200   NEXT J
210 NEXT I
220 PRINT
230 PRINT COUNT;" Primes."
240 PRINT TIME$
```

Program Listing 2. FPTest, floating-point benchmark test.

```
 10 DEFINT I
 20 DEFDBL A, B, C
 30 '
 40 PRINT TIME$
 50 FOR I=1 TO 1000
 60   A = 0.0
 70   B = 1234.0
 80   C = 78.9
 90   A = B * C
100   A = B / C
110 NEXT I
120 PRINT TIME$
```

Program Name	Enhcomp	Bascom
Minimal (End)	8,553	22,084
Count	9,215	21,872
Sieve	10,239	22,114
FPTest	9,315	21,914
Graphics	12,031	22,155

Table 1. Compiled program size in bytes.

Program Name	Enhcomp	Bascom
Minimal (End)	33.5	79.5
Count	40.6	78.3
FPTest	40.3	79.2
Graphics	43.9	81

Table 2. Program compilation times in seconds.

Program Name	Enhcomp	Interpreter	Bascom
Count	33.1	21.6	0.9
Sieve	71.5	155	1.9
FPTest	21	32.6	24.5
Graphics	58.7	86.4	29.15

Table 3. Program Execution Times in Seconds.

Enhcomp's exceptional language enhancements make it a contender.

soft enforces stringent licensing restrictions if you plan to distribute its run-time library in your programs. Also, you must link your program files to a secondary Bascom library package, resulting in programs that are ultimately much larger than Enhcomp's. In comparison to Microsoft, Misosys offers a liberal policy regarding the use of the Enhcomp run-time system in your programs.

When you develop any software project, the time required to make a change and check it out is a big consideration, as is the type of user interface. These are two of the reasons for Turbo Pascal's overwhelming success. Enhcomp is no Turbo Pascal, but the user interface is just as good, and overall compilation times are significantly less than those of Bascom (see Table 2).

Most important of all is the generated code's performance. If the code executes very fast, you can overlook a multitude of sins. Studying the times from Table 3, I'm surprised that Enhcomp is as slow as it is. These execution times are even more surprising when you look at the backgrounds of these compilers. Enhcomp is a Z80 compiler written to work well with TRSDOS/LDOS; Bascom was developed for CP/M and has been ported to run on the Model I/III/4 computers. Due to its CP/M background, Bascom generates only 8080 instructions and does not make full use of the Z80 CPU. A reasonable assumption is that a good Z80 compiler can generate a faster program because the greatly enhanced instruction set is available.

The compilation times for the floating-point arithmetic and graphics routines point to differences that depend largely on library code. The counting loop program, though, is a real shock. Not only is Enhcomp quite a bit slower than Bascom, it is also slower than the interpreter. This same execution flaw appears in the Sieve of Eratosthenes benchmark.

The Sieve program also points out a significant difference between Enhcomp's implementation of the language and industry standard (Microsoft) Basic. When I first ran the Sieve, I got a run-time error about 50 seconds into the program for violating the dimensioned limits of my array (flags). A careful syntax check of the original code in this area resulted in no errors, which is baffling. I repeat the original loop here for your edification:

```
120 PRIME = J + J + 3
130 FOR K = J + PRIME TO 8190 STEP PRIME
140 FLAGS(K) = 0
150 NEXT K
```

Enhcomp calculates the loop values and executes the loop. When the body of the loop has executed, the loop test is performed and the loop repeated if necessary. In other words, the body of the loop always executes at least once. The error occurs in the above code fragment when the initial value of J is large enough that the calculated value of K is greater than 8190. This is different from almost all other Basic implementations, Pascal, Modula-2, and C.

Enhcomp does not provide a While. . . Wend statement block similar to Basic, just a Repeat. . .Until statement that also performs the test at the end of the loop. The code in Program Listing 1 is modified, using an If statement to simulate the functions of the While. . . Wend statement.

Conclusion

Enhcomp's exceptional language enhancements and many other features make it a contender. If you like, you can live with the Microsoft language definitions and use the interpreter to develop your programs, compiling only the finished product. If you do this, however, be prepared to work around the minor Bascom-Enhcomp incompatibilities. Compiled code executes smoothly, although Enhcomp will not set any speed records in this category. Enhcomp's superior user interface makes it an easy-to-use package, and the accompanying documentation is excellent, offering a wealth of detail on the language and its implementation on the TRS-80. Watching Enhcomp work, you almost forget that it's not an interpreter, but a compiler. If you use Basic on your TRS-80, drop everything and buy Enhcomp.■

On-Line Help greatly simplifies the task of creating on-screen help routines.

On-Line Help

★★★

On-Line Help runs on the Tandy 1000/1200/3000 and requires two disk drives. Kudos Software. Available from Opt-Tech Data Processing, P.O. Box 678, Zephyr Cove, NV 89448. 702-588-3737. $149.

I enjoy programming, but creating on-screen help routines is always a chore I tackle after I've written and debugged most of a program. On-Line Help greatly simplifies the task and takes the frustration out of writing pop-up help windows from scratch. If you use one of the many languages that On-Line Help supports, you can create impressive, colorful help screens with a modest amount of effort.

You begin with a text editor and write the contents of each help window to separate files. On-Line Help restricts these files to 21 lines of 76 characters each. To spice up the look of your text, you can include graphics characters if your editor allows it. On-Line Help's HLIB program collects the text files into a single library, working much like the MS-DOS LIB program. You can add to or extract from text files, update parts of the library, or remove text files from the library.

Once you create the library, you can see how a help window will look in your program with Checkout. This utility lets you experiment with the screen placement, text, background, and border color of your help window. I found Checkout somewhat clumsy. It requires that you enter the parameters on a screen that you cannot reuse in subsequent experiments. In other words, if you don't like the way your first screen placement worked, you must go back and type the parameter information again. Each time you return to the first screen, the information you previously entered is gone. You also need to jot down the parameters for each experiment so you will have the correct values to include in your program.

Once you complete the help library and decide how to display each window, you must include the necessary commands in your program. For programs written in compile-and-link languages, the help routine is supplied in an OBJ file to be added to the program at link time. For languages such as interpreted Basic, the help routine is memory-resident, and you must load it before invoking Basic.

Each time your program displays a help window, it calls the help routine and provides it with the name of the help library and file inside that library; the top left screen row and column of the help window; the border, text, and background colors for the window; and two variables that the help routine uses for

Continued on p. 101

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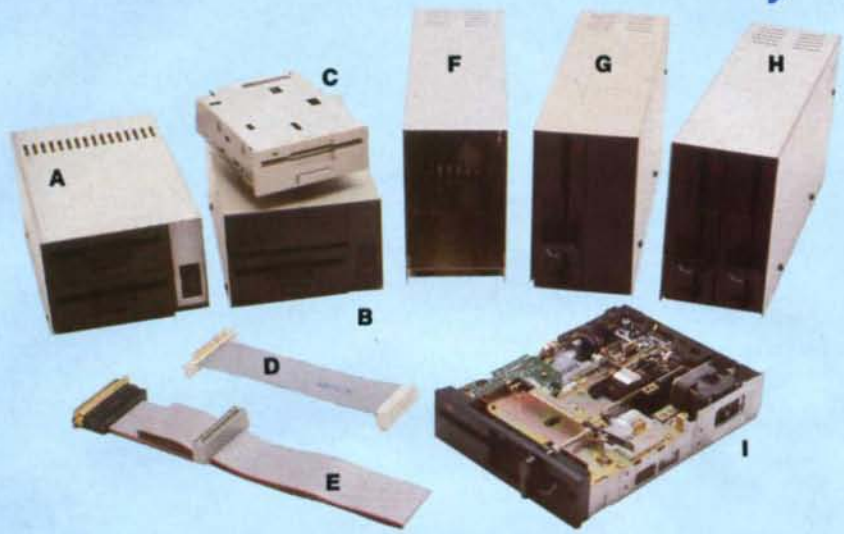

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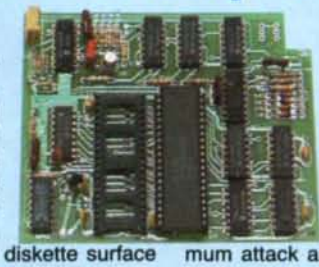

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Reliable double density operation required a better disk drive than Radio Shack was furnishing in addition to better quality components and diskettes. Therefore, no double density for the Model I. We went to work and came up with a design that allowed 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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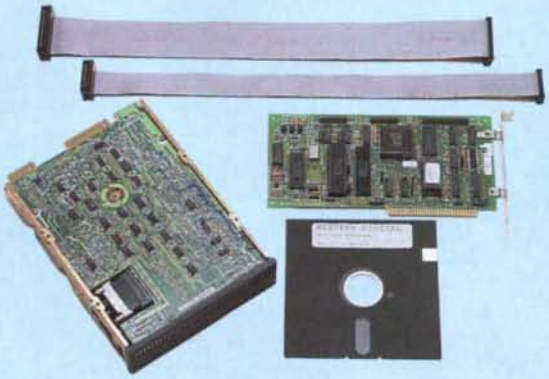

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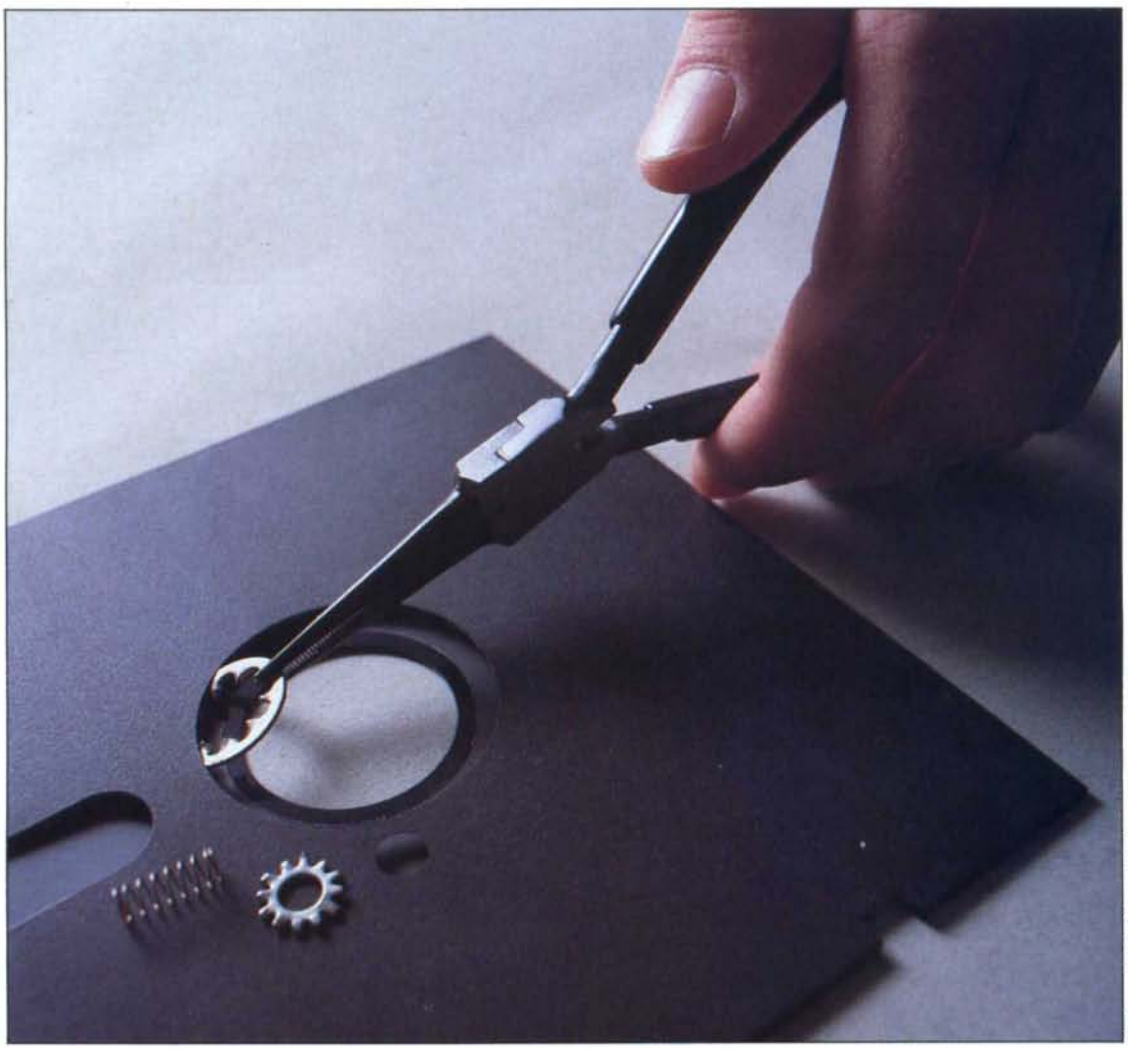


Photography by Edward Judice

by John B. Harrell III

Take a crash course in PC/MS-DOS disk structure and repair.

System Requirements

All MS-DOS systems
MS-DOS
Turbo Pascal 3.0 (optional)

Consider the humble floppy: a flexible, magnetically coated plastic disk that stores computer data. Not an object to strike awe—even fear—in the heart of a computerist. Yet many users who lose data because of a disk crash or an inadvertent deletion think the floppy disk is something mysterious.

The truth is floppy disks are neither inscrutable nor beyond your power. A file loss might be infuriating, but it need not be catastrophic if you understand how disks work. With my Disk Info program, you can begin to explore PC/MS-DOS disk structure. The program, written in Turbo Pascal, analyzes key areas of operating-system disks and displays a concise picture of your disk. Disk Info is primarily an educational tool that demonstrates the algorithms used to access your disk's vital parameters. Later in the article, I'll descibe one method of recovering lost data files using the DOS Debug utility.

The Skeleton

Before you attempt disk magic, you must understand how a disk is arranged. The PC/MS-DOS disk has four basic parts: the boot-record block, the file-allocation table, the root directory, and the data area.

The boot-record block (BRB) occupies a single logical sector on the operating-system disk. In addition to a small machine-language program that begins the DOS loading sequence, BRBs formatted after DOS 1.x contain the total number of disk sectors, the number of sectors per track, and the number of disk heads. You can determine the number of tracks on the disk by dividing this total by the sectors per track and the number of heads.

Table 1 provides a description of the boot-sector parameter block. The offsets are decimal values from the start of the sector; the length is the number of bytes.

You can examine the BRB on a floppy disk using Debug. Put a disk containing Debug in your floppy-disk drive and type:

A:DEBUG

After you see the Debug Ready prompt (-), type:

L 100 0 0 1

and press the enter key. This command (reading from right to left) tells Debug to read one (1) sector beginning with the first sector (0) from drive A (0) and copy the contents into address offset 100 hexadecimal (hex) in the current data segment. You can then display the contents of the sector by typing:

D 100

The sample Debug output in Fig. 1 lists an entire boot sector.

The first 3 bytes of the BRB contain a jump instruction to the remainder of the boot program. If you want to examine the instruction, type:

U 100 L 3

Don't be surprised if Debug lists two instructions—the first is a jump instruction with an address offset to the remainder of the loader code. You can use the offset from this instruction to disassemble the code and examine the rest of the DOS boot loader.

Offset	Length	Parameter description
3	8	System identification
11	2	Number of bytes per logical sector
13	1	Number of logical sectors per cluster
14	2	Number of sectors reserved at the beginning
16	1	Number of FAT copies
17	2	Number of root-directory entries
19	2	Total number of logical sectors
21	1	Format-type identification byte
22	2	Number of sectors for each FAT
24	2	Number of sectors on each track
26	2	Number of disk heads (or sides)
28	2	Number of special reserved sectors

Table 1. Description of the boot-sector parameter block.

```
-L 100 0 0 1
-D 100 L 200
XXXX:0100  EB 2A 90 49 42 4D 20 20-33 2E 30 00 02 02 01 00   k*.IBM  3.0.....
XXXX:0110  02 70 00 D0 02 FD 02 00-09 00 02 00 00 00 00 00   .p.P.}..........
XXXX:0120  14 00 00 00 00 0F 00 00-00 00 00 00 FA 33 C0 8E   ............z3@.
XXXX:0130  D0 BC 00 7C BB 78 00 36-C5 37 1E 56 16 53 8E C0   P<.|;x.6E7.V.S.@
XXXX:0140  BF 21 7C B9 0B 00 FC AC-26 80 3D 00 74 03 26 8A   ?!|9..|,&.=.t.&.
XXXX:0150  05 AA E2 F3 8C C0 8E D8-89 47 02 C7 07 21 7C FB   .*bs.@.X.G.G.!|{
XXXX:0160  CD 13 73 03 E9 C7 00 0E-1F A0 10 7C 98 F7 26 16   M.s.iG... .|.w&.
XXXX:0170  7C 03 06 1C 7C 03 06 0E-7C A3 2C 7C A3 2E 7C B8   |...|...|#,|#.|8
XXXX:0180  20 00 F7 26 11 7C BB 00-02 03 C3 48 F7 F3 01 06    .w&.|;...CHws..
XXXX:0190  2E 7C B8 50 00 8E C0 A1-2C 7C E8 A7 00 33 DB B8   .|8P..@!,|h'.3[8
XXXX:01A0  01 02 E8 B9 00 72 1A 33-FF B9 0B 00 BE D6 7D FC   ..h9.r.3.9..>V}|
XXXX:01B0  F3 A6 75 0D BF 20 00 BE-E1 7D B9 0B 00 F3 A6 74   s&u.? .>a}9..s&t
XXXX:01C0  13 BE 77 7D E8 6F 00 32-E4 CD 16 5E 1F 8F 04 8F   .>w}ho.2dM.^....
XXXX:01D0  44 02 CD 19 26 A1 1C 00-BB 00 02 33 D2 F7 F3 FE   D.M.&!..;..3Rws~
XXXX:01E0  C0 A2 20 7C A1 2E 7C A3-75 7D B8 70 00 8E C0 33   @" |!.|#u}8p..@3
XXXX:01F0  DB A1 2E 7C E8 4D 00 A0-18 7C 2A 06 16 7C FE C0   [!.|hM. .|*..|~@
XXXX:0200  32 E4 50 B4 02 E8 56 00-58 72 23 28 06 20 7C 76   2dP4.hV.Xr#(. |v
XXXX:0210  0C 01 06 2E 7C F7 26 0B-7C 03 D8 EB D4 8A 2E 15   ....|w&.|.XkT...
XXXX:0220  7C 8A 16 1E 7C 8B 1E 75-7D EA 00 00 70 00 BE C0   |...|..u}j..p.>@
XXXX:0230  7D E8 02 00 EB FE AC A8-FF 74 22 B4 0E BB 07 00   }h..k~,(.t"4.;..
XXXX:0240  CD 10 EB F2 33 D2 F7 36-18 7C FE C2 88 16 16 7C   M.kr3Rw6.|~B...|
XXXX:0250  33 D2 F7 36 1A 7C 88 16-1F 7C A3 30 7C C3 8B 16   3Rw6.|...|#0|C..
XXXX:0260  30 7C B1 06 D2 E6 0A 36-16 7C 8B CA 86 E9 8B 16   0|1.Rf.6.|.J.i..
XXXX:0270  1E 7C CD 13 C3 00 00 0D-0A 4E 6F 6E 2D 53 79 73   .|M.C....Non-Sys
XXXX:0280  74 65 6D 20 64 69 73 6B-20 6F 72 20 64 69 73 6B   tem disk or disk
XXXX:0290  20 65 72 72 6F 72 0D 0A-52 65 70 6C 61 63 65 20    error..Replace
XXXX:02A0  61 6E 64 20 73 74 72 69-6B 65 20 61 6E 79 20 6B   and strike any k
XXXX:02B0  65 79 20 77 68 65 6E 20-72 65 61 64 79 0D 0A 00   ey when ready...
XXXX:02C0  0D 0A 44 69 73 6B 20 42-6F 6F 74 20 66 61 69 6C   ..Disk Boot fail
XXXX:02D0  75 72 65 0D 0A 00 49 42-4D 42 49 4F 20 20 43 4F   ure...IBMBIO  CO
XXXX:02E0  4D 49 42 4D 44 4F 53 20-20 43 4F 4D 00 00 00 00   MIBMDOS  COM....
XXXX:02F0  00 00 00 00 00 00 00 00-00 00 00 00 00 00 55 AA   ..............U*
-U 100 L 3
XXXX:0100 EB2A          JMP     012C
XXXX:0102 90            NOP
-U 12C
XXXX:012C FA            CLI
XXXX:012D 33C0          XOR     AX,AX
XXXX:012F 8ED0          MOV     SS,AX
XXXX:0131 BC007C        MOV     SP,7C00
XXXX:0134 BB7800        MOV     BX,0078
XXXX:0137 36            SS:
XXXX:0138 C537          LDS     SI,[BX]
```

Fig. 1. Sample Debug output for the boot sector.

The file-allocation table (FAT) appears after the BRB. DOS allocates files in clusters, which the FAT maps on the disk and declares allocated, free, or damaged. DOS usually maintains two copies of the FAT; the BRB specifies the number and length. Figure 2 is a sample Debug display of a FAT sector.

On most disks, the FAT consists of a group of 12-bit entries representing one of the codes contained in Table 2. DOS uses 12-bit entries so it can store two FAT entries in 3 bytes, thus conserving space. A 12-bit table lets DOS allocate up to 4,086 file clusters. On large fixed disks, DOS 3.0 and later versions have 16-bit tables that can accommodate up to 65,526 clusters. Though a 16-bit table does not offer the space savings of a 12-bit one, its access algorithm is simpler. More on this later.

Figure 3 is a sample list of FAT entries for either a 12-bit or 16-bit table (the formats are identical). The three rightmost hex digits indicate 12-bit entries; 16-bit entries include all four digits. Note that the first two cluster entries are reserved for special functions. The first entry contains the media-identification byte and provides an additional mechanism for determining the format of the disk.

The first file on the disk is File.1. DOS obtains the starting cluster (2) from the file-directory entry (FDE). Note that this FAT entry contains the number of the next FAT entry (3) in the chain. A file chain ends with (F)FFFH, the end-of-cluster indicator.

By following the arrows (2, 3, 4, and 6), you can see that file clusters are not contiguous. Though DOS attempts to put your file in a connected cluster block, it segments files into groups if it can't find a big enough block. It can put parts of a file wherever it finds free clusters. You need to remember this during file recovery.

File.2 also has cluster breaks (5, 8, and 10). Cluster 9 is bad, so the chain skips it. File.3 is an example of a small file. Since it has only one cluster, the FAT entry (7) pointed to by the FDE contains (F)FFF, indicating an immediate end of the cluster chain.

Entry	Function
(0)000	Cluster is available for allocation
(F)FF7	Bad cluster/not part of file
(F)FF8	End of file-cluster chain
(F)FF9	End of file-cluster chain
(F)FFA	End of file-cluster chain
(F)FFB	End of file-cluster chain
(F)FFC	End of file-cluster chain
(F)FFD	End of file-cluster chain
(F)FFE	End of file-cluster chain
(F)FFF	End of file-cluster chain
(x)xxx	Next cluster in the file

Table 2. Special file-allocation table cluster entries.

```
-L 100 0 1 1
-D 100 L 200
XXXX:0100  FD FF FF 03 40 00 05 60-00 07 80 00 09 A0 00 0B   }...@..`.....  ..
XXXX:0110  C0 00 0D E0 00 0F 00 01-11 20 01 13 40 01 15 60   @..`..... ..@..`
XXXX:0120  01 17 80 01 19 F0 FF 1B-C0 01 1D E0 01 1F 00 02   .....p..@..`....
XXXX:0130  21 20 02 23 40 02 25 60-02 27 80 02 29 A0 02 2B   ! .#@.%`.'..) .+
XXXX:0140  C0 02 2D E0 02 2F 00 03-31 20 03 33 40 03 35 60   @.-`./..1 .3@.5`
XXXX:0150  03 37 80 03 39 A0 03 3B-C0 03 3D E0 03 3F 00 04   .7..9 .;@.=`.?..
XXXX:0160  41 20 04 43 40 04 45 60-04 47 80 04 49 A0 04 4B   A .C@.E`.G..I .K
XXXX:0170  C0 04 4D E0 04 4F 00 05-51 20 05 53 40 05 55 60   @.M`.O..Q .S@.U`
XXXX:0180  05 57 80 05 59 A0 05 5B-C0 05 5D E0 05 5F 00 06   .W..Y .[@.]`._..
XXXX:0190  61 20 06 63 40 06 65 60-06 67 80 06 69 A0 06 6B   a .c@.e`.g..i .k
XXXX:01A0  C0 06 6D E0 06 6F 00 07-71 20 07 73 40 07 75 60   @.m`.o..q .s@.u`
XXXX:01B0  07 77 80 07 79 A0 07 7B-C0 07 7D E0 07 7F 00 08   .w..y .{@.}`....
XXXX:01C0  81 20 08 83 40 08 85 60-08 FF 8F 08 89 A0 08 8B   . ..@..`..... ..
XXXX:01D0  C0 08 8D E0 08 8F 00 09-91 20 09 93 40 09 95 60   @..`..... ..@..`
XXXX:01E0  09 97 80 09 99 A0 09 9B-C0 09 9D E0 09 9F 00 0A   ..... ..@..`....
XXXX:01F0  A1 20 0A A3 40 0A A5 60-0A A7 80 0A A9 A0 0A AB   ! .#@.%`.'..) .+
XXXX:0200  C0 0A AD E0 0A AF 00 0B-B1 20 0B B3 40 0B B5 60   @.-`./..1 .3@.5`
XXXX:0210  0B B7 80 0B B9 A0 0B BB-C0 0B BD E0 0B BF 00 0C   .7..9 .;@.=`.?..
XXXX:0220  C1 20 0C C3 40 0C C5 60-0C C7 80 0C C9 A0 0C CB   A .C@.E`.G..I .K
XXXX:0230  C0 0C CD E0 0C CF 00 0D-D1 20 0D D3 40 0D D5 60   @.M`.O..Q .S@.U`
XXXX:0240  0D D7 80 0D D9 A0 0D DB-C0 0D DD E0 0D DF 00 0E   .W..Y .[@.]`._..
XXXX:0250  E1 50 12 E3 40 0E FF 6F-0E E7 80 0E E9 A0 0E EB   aP.c@..o.g..i .k
XXXX:0260  C0 0E ED E0 0E EF 00 0F-F1 20 0F F3 40 0F F5 60   @.m`.o..q .s@.u`
XXXX:0270  0F F7 80 0F F9 A0 0F FB-C0 0F FD E0 0F FF 00 10   .w..y .{@.}`....
XXXX:0280  01 21 10 03 41 10 FF 6F-10 07 81 10 09 A1 10 0B   .!..A..o.....!..
XXXX:0290  C1 10 0D E1 10 0F 01 11-11 21 11 13 41 11 15 61   A..a.....!..A..a
XXXX:02A0  11 17 81 11 19 A1 11 1B-C1 11 1D E1 11 1F 01 12   .....!..A..a....
XXXX:02B0  21 21 12 23 41 12 FF 6F-12 27 F1 FF 00 00 00 00   !!.#A..o.'q.....
XXXX:02C0  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
XXXX:02D0  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
XXXX:02E0  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
XXXX:02F0  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
```

Fig. 2. Sample Debug display of the first FAT sector.

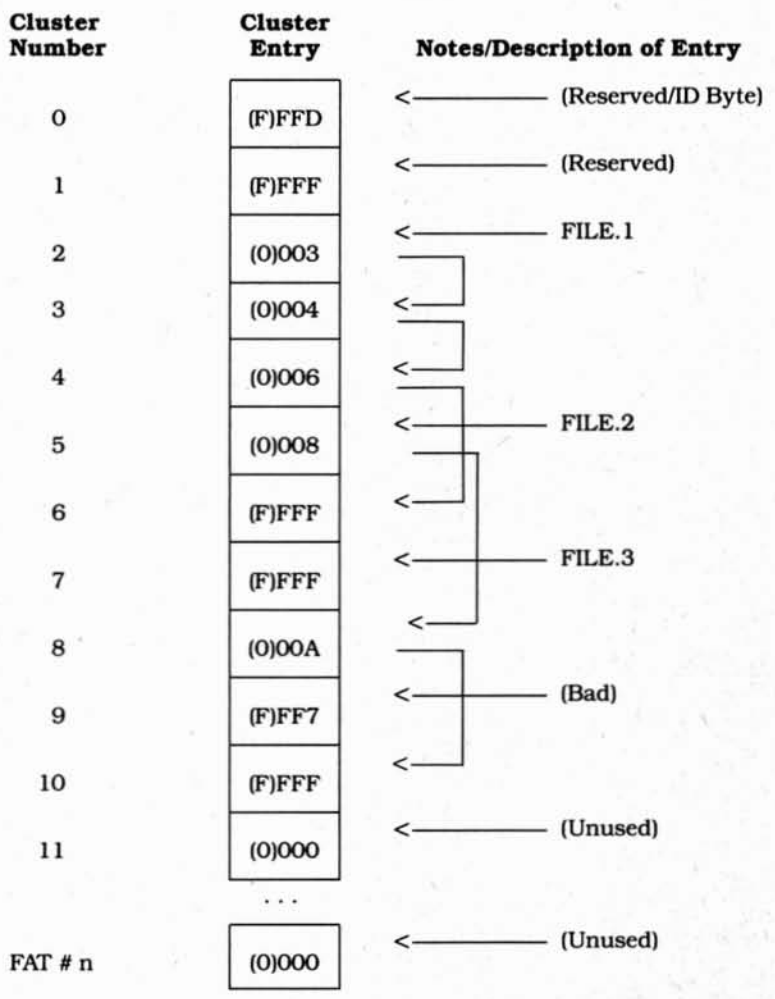


Fig. 3. Sample file-allocation table entries.

The next important part of the disk is the root directory, which holds the entries for subdirectories, files, and the DOS volume label. DOS uses the entries to locate files on the disk. (See Fig. 4 for a sample Debug display of a root-directory sector.) Each FDE is 32 bytes long (see Table 3). Unlike a subdirectory, the root directory is a permanent data structure.

The root directory occupies enough sectors to accommodate the number of entries identified at offset 17 in the BRB. One standard sector (512 bytes) can hold 16 entries. Offset 26 of the FDE contains the starting FAT cluster number. The first field can contain three special characters—00H, E5H, and 2EH—in the first byte. 00H signifies an unused file and lets DOS limit directory searches. E5H signifies a deleted file, which means the entry is free and can be used again. 2EH is the code for a decimal point, which DOS uses to mark the beginning of a subdirectory.

```
-L 100 0 5 1
-D 100 L 200
XXXX:0100  45 64 77 69 6E 45 64 69-74 6F 72 08 00 00 00 00   EdwinEditor.....
XXXX:0110  00 00 00 00 00 00 93 59-C4 0C 00 00 00 00 00 00   .......YD.......
XXXX:0120  54 53 52 53 52 43 20 20-41 52 43 20 00 00 00 00   TSRSRC  ARC ....
XXXX:0130  00 00 00 00 00 00 6C 87-7C 0C 02 00 66 5D 00 00   ......l.|...f]..
XXXX:0140  45 44 57 49 4E 49 42 4D-41 52 43 20 00 00 00 00   EDWINIBMARC ....
XXXX:0150  00 00 00 00 00 00 1C 51-C4 0C 1A 00 47 B3 01 00   .......QD...G3..
XXXX:0160  45 44 57 49 4E 43 4F 4D-41 52 43 20 00 00 00 00   EDWINCOMARC ....
XXXX:0170  00 00 00 00 00 00 A0 4D-4E 0D 87 00 53 75 01 00   ...... MN...Su..
XXXX:0180  43 4D 41 43 53 20 20 20-4D 41 43 20 00 00 00 00   CMACS   MAC ....
XXXX:0190  00 00 00 00 00 00 4D 65-C4 0C E2 00 00 0A 00 00   ......MeD.b.....
XXXX:01A0  50 52 4F 54 45 43 54 20-41 53 4D 20 00 00 00 00   PROTECT ASM ....
XXXX:01B0  00 00 00 00 00 00 54 A6-C8 0C E5 00 0B 7E 00 00   ......T&H.e..~..
XXXX:01C0  41 52 43 20 20 20 20 20-45 58 45 20 00 00 00 00   ARC     EXE ....
XXXX:01D0  00 00 00 00 00 00 8C 85-62 0C 05 01 AD 7E 00 00   ........b....~..
XXXX:01E0  00 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   .vvvvvvvvvvvvvvv
XXXX:01F0  F6 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   vvvvvvvvvvvvvvvv
XXXX:0200  00 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   .vvvvvvvvvvvvvvv
XXXX:0210  F6 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   vvvvvvvvvvvvvvvv
XXXX:0220  00 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   .vvvvvvvvvvvvvvv
XXXX:0230  F6 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   vvvvvvvvvvvvvvvv
XXXX:0240  00 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   .vvvvvvvvvvvvvvv
XXXX:0250  F6 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   vvvvvvvvvvvvvvvv
XXXX:0260  00 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   .vvvvvvvvvvvvvvv
XXXX:0270  F6 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   vvvvvvvvvvvvvvvv
XXXX:0280  00 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   .vvvvvvvvvvvvvvv
XXXX:0290  F6 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   vvvvvvvvvvvvvvvv
XXXX:02A0  00 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   .vvvvvvvvvvvvvvv
XXXX:02B0  F6 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   vvvvvvvvvvvvvvvv
XXXX:02C0  00 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   .vvvvvvvvvvvvvvv
XXXX:02D0  F6 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   vvvvvvvvvvvvvvvv
XXXX:02E0  00 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   .vvvvvvvvvvvvvvv
XXXX:02F0  F6 F6 F6 F6 F6 F6 F6 F6-F6 F6 F6 F6 F6 F6 F6 F6   vvvvvvvvvvvvvvvv
```

Fig. 4. Sample Debug display of the first root-directory sector.

Offset	Length	Type	Field description
0	8	Char.	File name (blank filled)
8	3	Char.	File extension (blank filled)
11	1	Bits	File-attribute field
12	10	Unknown	Reserved for use by MS-DOS
22	2	Binary	Coded-file update/creation time
24	2	Binary	Coded-file update/creation date
26	2	Binary	Starting FAT-cluster number
28	4	Binary	Long (32-bit) file size

Table 3. File-directory entry fields.

```
Boot sector information for disk drive A:
My system identification is: IBM  3.0
My format ID byte says I am: Dual sided, 9 sector/track diskette
        512 bytes per sector.
          2 sectors in each of my clusters.
          1 reserved sectors at beginning.
          2 copies of my File Allocation Table.
        112 directory entries in my root directory.
        720 disk sectors on this disk.
          2 sectors in my FAT.
          9 sectors on my tracks.
          2 read/write disk heads.
          0 special reserved sectors.
         40 tracks on this disk.
This disk has a formatted capacity of:   368640 bytes.
DOS overhead requires:                     6144 bytes.
Unused bytes on the disk:                     0 bytes
User space is    354 clusters or:        362496 bytes.
Current disk usage is:                   301056 bytes.
Bad sectors take up:                          0 bytes.
Bytes remaining on disk                   61440 bytes.
```

Fig. 5. Sample Disk Info display.

The last and most important part of the disk is the data area. This area not only stores your files, it also holds the contents of each subdirectory you create. DOS treats subdirectories as if they are files—the only exception is a file size of zero bytes for all subdirectories, regardless of the number of entries.

Once you understand disk structure, you can venture into the disk to repair and recover files. The first step is to locate the problem, which is where Disk Info can help. Disk Info reads the BRB and the FAT of your target disk and displays information as shown in Fig. 5. The on-screen report is actually a summary of the information in Figs. 1, 2, and 4.

Disk Info reports known clusters and tells you whether they are allocated, bad, or free. It does not check for orphaned clusters (those that are allocated but not part of a file chain). Nor will it report a damaged FAT—one having a circular reference, where the tail points back to the beginning of the chain. To do this, the program must read each FDE in the root and all other directories while following all of the FAT chains. All files would have to be traced before FAT errors could be detected.

To use Disk Info, type in the Program Listing on page 49 and compile it. Type in the file name from DOS to load the program. Those of you interested in Turbo Pascal programming will find a description of the techniques I used in the sidebar, "Inside Disk Info."

File Recovery with Debug

Losing data files generally occurs for one of two reasons: a disk failure or an inadvertent deletion. Disk failures include loss of the disk-format pattern, CRC (cyclical redundancy check) errors, and physical damage to the disk. You can lose the format pattern by placing the disk next to a telephone or magnet. CRC errors occur when the automatic checksum that the disk controller writes for each disk sector fails to produce a match. When this happens, DOS is unable to read the disk.

With disk failures, data recovery is extremely difficult. It can be done with hard work and a detailed knowledge of the disk structure, but the procedure is beyond the scope of this article. Instead, I'll focus on the easiest error to correct: inadvertent file deletion.

DOS doesn't erase your data when it executes a delete command. Rather, it marks the first byte of the FDE with an E5H byte, indicating that the entry is free. Then, beginning with the file-allocation entry pointed to by the directory entry, it marks the entire chain free by storing zeros in each cluster in the chain. Once DOS releases a file's clusters, it can use them to store new data at any time. If you inadvertently delete a file, it's important that

you *don't* write anything!

To recover the file, you must restore the FDE and the file-cluster chain. Commercial programs like The Norton Utilities and PC Tools contain special utilities for this purpose, but they cost money. (For reviews of several popular commercial utilities, see "MS-DOS Disk Utilities: Don't Leave Home Without Them," August 1986, p. 27.) I'll explain how you can do it yourself with Debug.

Table 4 lists the Debug commands you'll find most useful for recovering files. Refer to your DOS manual for a complete Debug command list.

DOS has an interrupt function to read (25H) and write (26H) sectors on the disk by addressing them with a relative address. This address begins with zero for the BRB and extends to one less than the maximum number of sectors available. Figure 5 shows 720 sectors on the disk; therefore, the sector numbers range from zero to 719.

Cluster numbers start with 2 and extend to one more than the maximum number available. For example, the cluster numbers in Fig. 5 are 2–355. Notice that the BRB occupies one sector and each FAT occupies two sectors. This means the directory begins in relative-sector 5 on the disk (see Fig. 4) and extends for seven sectors (112 entries × 32 bytes per entry ÷ 512-byte sector size). The data area (or the first cluster) begins in relative-sector number 12 (1 + 2 + 2 + 7).

The algorithm in Table 5 calculates the starting relative-sector number of the lost file on your disk. As an example, try using the information from Fig. 5 to locate the starting relative-sector number for cluster 200. The data area (beginning in relative-sector 12) follows one sector at the beginning, two sectors for each FAT, and seven sectors for the root directory (112 entries ÷ 16 entries per sector). Using the algorithm, you get 408 as the relative-sector number:

12 sectors + (2 sectors per cluster × [200 – 2]) = 408

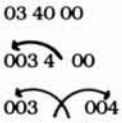
To access the FAT entry for a cluster, you must first determine the size of the FAT entries. Figure 3, for instance, consists of 12-bit entries. To extract the value of a cluster number, multiply the cluster by 1.5 and use the integral part of the result to access the word at that FAT offset.

This gives you the proper three digits of the FAT entry, but you also must determine the location of the unused digit. If the cluster number is odd, keep the three highest digits; if it is even, keep the three lowest digits. In Disk Info, I used the Turbo Pascal Move procedure to retrieve an integer word from the FAT buffer regardless of the alignment.

Here's another way to visually decode the 12-bit FAT entries as you view them on Debug's display (refer to Fig. 2). The first two FAT entries following the identification byte (ID) and reserved entries are:

03 40 00

To decode these 3 bytes into two separate 12-bit entries, perform the hex-digit swaps as follows:



If the disk has more than 4,086 clusters, the FAT must use 16-bit entries. As I mentioned before, the algorithm for accessing FAT values for a 16-bit table is simpler than for a 12-bit table: Just multiply the cluster number by 2 to form an index of the FAT. Then access the word at this FAT offset to determine the FAT value corresponding to the cluster.

Debug Conversions

Debug uses relative-sector addresses formed by using Table 5 to access clusters on the disk. (Don't forget when using Debug to convert results to hex.) First, you must search through a directory to locate deleted FDEs that have an E5H byte as the first character. The remainder of the file name and the extension (offsets 1–10) should help you identify the correct entry.

The beginning cluster number located in byte offsets 26 and 27 tells you where to start looking at the FAT chain. You can also use the cluster to calculate where the file begins on the disk. The byte values are stored in Intel format with the low-order byte first. For example, F8 01 really is 01F8 hex, or 504 decimal.

Examine the file size located in byte offsets 28–31. To determine the number of clusters required to store the entire file, divide the file size by the sector size (in bytes) and the number of sectors per cluster. This tells you how many more clusters you have to find. You will find this is

Command	Explanation
D address or D range	Displays the contents of the specified address or range in hexadecimal. The display has 16 bytes per line with a corresponding display of ASCII characters where appropriate. Omitting both parameters displays 128 bytes, beginning with the last address.
E address [list]	Enters the byte values into memory at the specified address. If you enter the optional list of values, Debug automatically stores them in memory at the specified address. Otherwise, it prompts you for each byte.
L [address [drive sector count]]	Loads a file or part of a disk into memory at the specified address. The command is commonly used to read a file into the Debug work space. The optional parameters let you read any sector of any disk installed at any address.
W [address [drive sector count]]	Writes data being debugged to a disk file. If you omit the second group of parameters, Debug writes data from the specified address or from CS:0100 if no address is specified. The BX and CX registers contain a 32-bit value specifying the number of bytes to write. If you specify the second group of parameters, Debug writes whole sectors, beginning with the starting sector specified and continuing for the specified count.

Table 4. Partial Debug command list.

1. Determine the starting sector of your disk's data area from the BRB as follows:
   a. Number of sectors reserved at the beginning
   b. Number of sectors per FAT × the number of FATs
   c. Number of sectors in the root directory = the number of entries in the root directory × 16 entries per sector (assuming 512 bytes in a logical sector)
2. Add the numbers. This determines the starting logical-sector number for data clusters on the disk.
3. Subtract 2 from the number of the desired cluster.
4. Multiply the result by the number of sectors per cluster as determined from the BRB information.
5. Add the number of sectors determined in step 2. This is the relative logical-sector number for use with Debug or interrupt 25H/26H.

Table 5. Algorithm for finding disk clusters with Debug.

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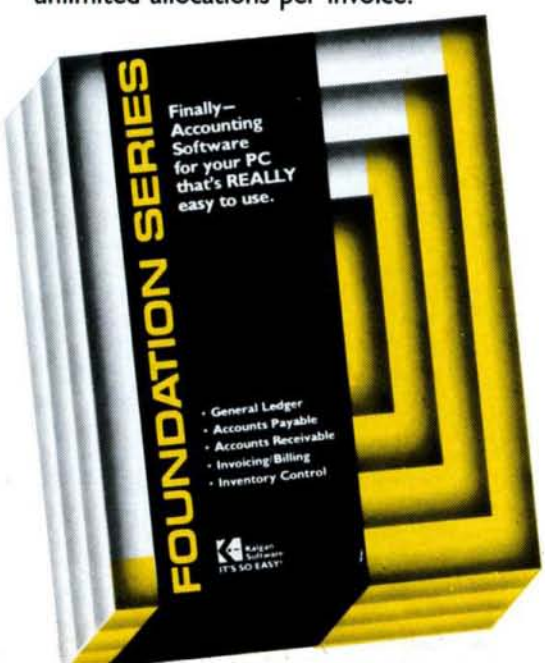

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the most difficult part of the procedure. Don't forget that the file size is in bytes and might be up to 4 bytes long (stored in the Intel format). For example, the 4 bytes 97 86 07 00 represent a file size of 78697 hex, or 493,207 bytes.

If a file has more than one cluster, you must find the next available cluster in the FAT. Look at one or more sectors from succeeding clusters and determine if they belong to the file. As you identify clusters belonging to the file, store the new numbers in the FAT location corresponding to the last cluster recovered. When you reach the end of the chain, store an end-of-file marker (see Table 2) in the current cluster's FAT location.

File recovery depends heavily on visual recognition of the data. The easiest data to recover is a normal text file. Recovery of a binary file image is totally unpredictable under certain circumstances. Because DOS can create a file at any cluster location, you might find clusters that don't belong to your file.

The last step is to change the first directory-entry byte to something other than E5H. Type in the hex codes corresponding to the first letter of the file name. Of course, you must write this directory sector and any modified FAT sectors back to the disk for the changes to take effect. Use the DOS DIR and CHKDSK commands to verify that you've recovered the file.

Debug's ability to read and write to any sector is both an asset and a liability.

Debug's ability to read and write to any sector is both an asset and a liability. Though it gives you a rudimentary tool for performing disk surgery, you can wreck your disk with a few erroneous keystrokes. I strongly advise making a backup copy of the disk before you begin the recovery process. Use the Disk Copy or Compdupe commands to make the copy.

Second Opinions

Using Debug to recover lost files is effective, but certainly not easy. If you can afford one, I suggest investing in a commercial disk utility. The Norton Utilities 3.1 contains three utilities for reclaiming lost files: Quick Unerase (QU), Unremove Directory (UD), and the main Norton Utilities program (NU).

The techniques used by The Norton Utilities are similar to those of other utilities such as PC Tools and Super Utility Plus. Most lack features to repair physical damage to the disk. A freeware utility called Ultra Utilities does provide a mechanism for this type of repair, however. For a copy, send $5 and a stamped, self-addressed mailer to Freesoft Co., P.O. Box 27608, St. Louis, MO 63146.

Some excellent books are available that can help you develop your surgical skills. One is *The MS-DOS Developer's Guide* by John Angermeyer and Kevin Jaeger (Howard W. Sams & Co., The Waite Group). Another is *The Peter Norton Programmer's Guide to the IBM PC* by Peter Norton (Microsoft Press).■

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Related Articles

Martel, Philip, "Repairing a Disk Crash," January 1983, p. 292. A step-by-step description of how to recover Color Computer files after a disk crash.

Payne, Douglas, "That Sinking Feeling," March 1985, p. 38. Learn how to correct disk errors on the Models III and 4.

Williams, David A., "Zap Master," April 1985, p. 62. Read and change Model 4 disk sectors to remove passwords and add assembly-language patches.

Inside Disk Info

If you're used to programming in Basic, the Pascal structures used in Disk Info might seem bewildering at first. Though you don't need to be a Pascal expert to use Disk Info, a little understanding of how the program works can't hurt.

Data structures are declared at the beginning. The first declaration allocates an area for the BRB. The second part of the record statement defines the individual fields. Byte and integer data closely conform to the specification contained in Table 1 of the article.

The FATSector variable is an array with a maximum of 64 disk sectors, which should be sufficient for most investigations. An array of integers, sized to allow access to each word within the 64 sectors, overlays the declaration.

The GetSector procedure uses MS-DOS interrupt 25H to read sectors on the disk. Though relatively easy to use, the DOS interrupt functions tend to corrupt CPU registers. They also leave the contents of the flag register on the top of the stack. Since this confuses Turbo Pascal, I coded the GetSector procedure in machine language using Turbo Pascal's in-line statement. The in-line code saves and restores the registers correctly. I did not provide an error return, but you can add one by inserting another parameter and a few lines of code.

The Card function allows integral word values greater than 32,768 to be interpreted correctly. Turbo Pascal and some other high-level languages don't provide for an integer value of more than 16 bits. For example, 32,767 is 7FFF in hex; 53,201 is CFD1 in hex. Pascal interprets the latter as −12,335, since integers range only from −32,768 to 32,767. Card converts these word values to real numbers in the range of zero to 65,535.

List Info displays the BRB parameters in tabular form, using nested procedures such as Print Format ID to convert and print data where necessary. The "with" statement supplies the record identifier; the remaining statements can use just the field-specification name. ListInfo uses the Card function to ensure that parameters are in the proper range for printing.

CalcInfo uses the BRB information to calculate the size of various areas on the disk. TSize is the total size of the disk in bytes (the formatted disk capacity without accounting for system overhead). SSize is the space DOS requires for the BRB, the FATs, and the root directory. This information is directly available from the BRB.

The next section calculates the data area which is used by your files, the bad-cluster size, and the free space remaining on the disk. As mentioned in the article, DOS uses either a 12-bit or 16-bit format for the FAT entry, depending on the number of clusters. A 12-bit number has values ranging from zero to 4,095.

As shown in Table 2, these 4,096 values have special meaning. This leaves 4,086 clusters for available file storage. If the calculations for your disk show more than 4,086 clusters, DOS must be using a 16-bit format for the FAT entries.

The GetParameters procedure retrieves command-line parameters and initializes the program. Disk Info accepts a single command-line parameter consisting of a valid drive letter. If no parameters are present, Disk Info assumes you want to read the currently logged drive and gets the appropriate information from DOS. Erroneous information causes the program to abort.

—John B. Harrell III

Program Listing. Disk Info.

```
{$C-}                          {Disable Control-C Checking}
{$R+}                          {Enable range checking}

PROGRAM DiskInfo;

TYPE
  Buffer = ARRAY[0..511] OF Byte;
  Str80  = STRING[80];

VAR
  BootSector    : RECORD
                    CASE Byte OF
                      1 : (SecBuff : Buffer);
                      2 : (Jump  : ARRAY[0..2] OF Byte;
                           Name  : ARRAY[0..7] OF Char;
                           BPS   : Integer; {Bytes per sector}
                           SPC   : Byte;    {Sectors per cluster}
                           Nres  : Integer; {Number of reserved sectors}
                           NFAT  : Byte;    {Number of FAT's}
                           NDir  : Integer; {Number of root DIR entries}
                           NSec  : Integer; {Number of sectors on disk}
                           FID   : Byte;    {Format ID byte}
                           SPF   : Integer; {Sectors per FAT}
                           SPT   : Integer; {Sectors per track}
                           NHDS  : Integer; {Number of disk heads}
                           Nspec : Integer  {Number of special reserved sects}
                          )
                    END;
  FATSector     : RECORD
                    CASE Byte OF
                      1 : (SecBuff : ARRAY[1..64] OF Buffer);
                      2 : (Entry   : ARRAY[0..32767] OF Byte)
                    END;
  Disk          : Integer;
  DriveLetter   : Str80;
  Counter       : Integer;


{||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||}
||                                                                              ||
||   GetSector uses MS-DOS interrupt 25H to read the sector of the disk         ||
||   named.  The sector is stored in the bBuffer provided at location           ||
||   SecBuff.                                                                   ||
||                                                                              ||
||   This procedure is coded in machine language using Turbo Pascal's          ||
||   INLINE statement with assembly source commentary provided.  I used         ||
||   this method because of INT 25's penchant for destroying all of the        ||
||   registers but the segment registers and because the function leaves        ||
||   the prior CPU flags on the top of the stack. An error return              ||
||   value is stored in the actual flag register.  You must immediately        ||
||   pop off this value and restore the original task registers before          ||
||   continuing Turbo Pascal.                                                   ||
||                                                                              ||
||   No error handling is provided for this function.  It can easily be         ||
||   added by inserting another parameter and a few additional lines of         ||
||   machine code.                                                              ||
||                                                                              ||
{||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||}

  PROCEDURE GetSector(Disk, Sector : Integer; VAR SecBuff : Buffer);
  BEGIN
    INLINE(
      $06/                    {PUSH    ES            ;Save Registers}
      $50/                    {PUSH    AX}
      $53/                    {PUSH    BX}
      $51/                    {PUSH    CX}
      $52/                    {PUSH    DX}
      $56/                    {PUSH    SI}
      $57/                    {PUSH    DI}
      $55/                    {PUSH    BP}
      $8B/$46/$0A/            {MOV     AX,[BP+10]    ;AL := Disk}
      $C5/$5E/$04/            {LDS     BX,[BP+4]     ;DS := Seg(SecBuff)
                                                     ;BX := Ofs(SecBuff)}
      $B9/$01/$00/            {MOV     CX,1          ;CX := 1;}
      $8B/$56/$08/            {MOV     DX,[BP+8]     ;DX := Sector}
      $CD/$25/                {INT     25H           ;Intr($25, Regs)}
      $9D/                    {POPF            ;INT 25 leaves the flags on stack}
      $5D/                    {POP     BP            ;Restore all registers}
      $5F/                    {POP     DI}
      $5E/                    {POP     SI}
      $5A/                    {POP     DX}
      $59/                    {POP     CX}
      $5B/                    {POP     BX}
      $58/                    {POP     AX}
      $07                     {POP     ES}
      );
  END;


{||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||}
||                                                                              ||
||   Card converts the 16-bit signed integer on the range of -32,768            ||
```

Listing continued p. 106

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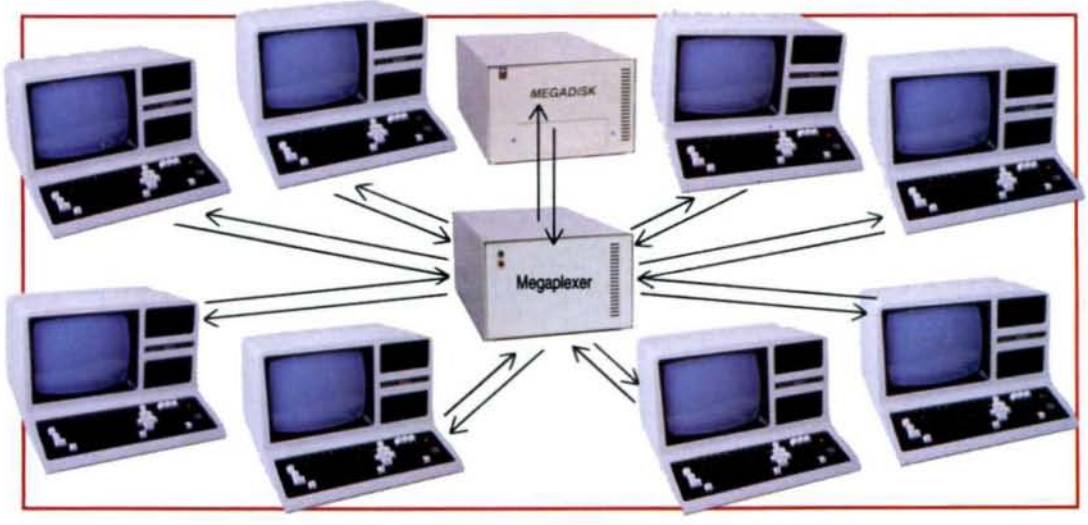

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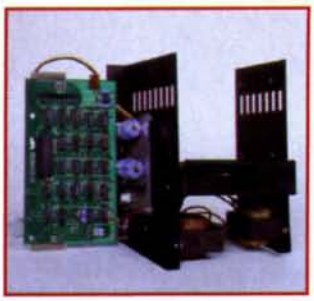

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So, You Want to Buy a House

by John Edward Crew

Take stock of your assets *before* filling out a mortgage application.

LOAD 80

System Requirements

All systems
Basic
Printer optional

Buying a house is probably the biggest investment you'll ever make. Before applying for a mortgage, you should be sure your income can support both the hidden and the obvious costs involved. In addition to the down payment, you must consider closing costs, home insurance, property taxes, and many other financial factors. Banks examine these details closely to determine if you're a good loan risk.

To help first-time home buyers, I wrote House, a Basic program that helps assess your financial situation before you talk to the banker. Though it won't guarantee a roof over your head, it will calculate the size of the mortgage you can afford. The program, as written, runs on the Model 4, but you can convert it easily for other machines. I'll discuss the necessary changes later.

House Tour

To use House on a Model 4, type in the Program Listing 1 and save it as House/BAS. When you run the program, it displays a list of finance- and tax-related questions. (In addition to calculating the size of the mortgage you can afford, the program will estimate your state and federal taxes. More on this later.) Starting with the prompt "Enter your gross monthly salary," type in the requested information.

Figure 1 uses the financial information of a hypothetical mortgage applicant to show how the program calculates a maximum allowable loan. The applicant—Mr. X—is a single man earning $1,000 a month and expecting a 2.5 percent raise. (The program bases its calculations on his salary *after* the raise, just as a bank or mortgage company would. You must show a paycheck stub when applying for the mortgage. At that time you must have received your raise or it won't be counted.) He earns an additional $120 a month working weekends at a fast-food chain and plans to put 3 percent of his total income into an Individual Retirement Account (IRA). An IRA is fully deductible for single filers with less than $25,000 in taxable income. This example remains valid in 1987.

Closing costs on the purchase of a home are typically about 5 percent, so Mr. X enters a 5 for the closing-cost percentage. Although he has no itemized deductions, he did donate $100 to Farm Aid. Because he can deduct 50 percent of charitable contributions, he enters $50 for "non-housing related deductions besides itemized deductions."

Next he enters 2.5 for the maximum

Illustration by Megan Laverty

property-tax rate allowed in his state. (This varies by town, so check the rate in your area.) Since insurance in his area costs $330 for a $100,000 house, he enters 0.33 for the insurance percentage.

The example assumes that Mr. X has only one outstanding loan—a car loan. Most banks limit your total debt ratio (total of all loans—car, house, school, and so forth) to 33 percent and limit housing costs to 28 percent. If you have no other loans, you're allowed 28 percent of your gross income for a mortgage payment. If a car loan equals 5.5 percent of your gross income, the limit for a mortgage payment would be 27.5 percent (33 – 5.5 = 27.5) of your gross income.

After careful shopping, Mr. X found a bank offering a 9.01 percent variable-rate mortgage. Variable-rate mortgages are usually less expensive than fixed-rate mortgages because the banks take less of a risk. After one to three years, a bank can recalculate the interest rate based on prevailing trends. If interest rates rise, the bank can raise your mortgage or add extra interest to the loan amount.

In order to borrow the most money, Mr. X wants a 30-year loan, and he is prepared to make a down payment of $4,000. Most banks require a down payment equal to 10–20 percent of the mortgage value. A few require only 5 percent, and even fewer require no down payment at all. As a rule, the lower the down payment the higher the interest you will pay.

The last information the program requests is the desired accuracy (0.01-100 dollars) in the calculated loan amount. In the example, Mr. X enters 100. The program runs the first time using the estimates of insurance costs, closing costs, and property taxes to calculate a loan amount. It then runs a second time, adding the down payment to the loan amount and recalculating closing costs, insurance, and property tax. The process repeats until the difference in loan amount in two consecutive passes is less than the requested accuracy.

Once the program arrives at an accurate calculation, it automatically sends the final report to your printer. Figure 2 shows the final report for Mr. X. The program calculated a maximum loan amount of $29,936.12 toward the purchase of a $33,936.12 home. Since his $4,000 down payment is 11 percent of the calculated house value, Mr. X should have no trouble qualifying for the loan.

Family Ties

House can also calculate the maximum allowable mortgage for working couples. Figure 3 uses the financial information of Mr. and Mrs. Y, an upwardly mobile couple with one child. Mrs. Y is a lawyer earning $3,000 a month; she anticipates her next raise will be 11.5 percent of her current salary. Mr. Y is an accountant earning $2,450 a month and anticipating a 9.4 percent raise. The couple takes advantage of company 401(K) plans to protect much of their income from taxes. (Under the new tax law you can still put up to $7000 into a 401(K) account.) They earn $2,500 from their investments. (Note that the couple expects to have this income after the purchase of a house. If you use all your savings for a down payment, you obviously won't have investment income.)

On their tax return, the couple will claim $4,000 in itemized deductions for medical expenses, credit-card interest, state sales tax, and work-related education costs. They expect to deduct $2,100 in moving costs. (In 1987, all these deductions will be eliminated or restricted under the new tax law. Only medical expenses in excess of 7.5% of adjusted gross income will remain deductible. Only 65% of nonmortgage interest will be deductible. Sales tax and educational expenses will not be deductible.)

Payments on a car loan and credit-card interest eat up 6 percent of their combined income. To keep their debt ratio to 33 per-

cent, they can use only 27 percent of their gross income for a mortgage. Like Mr. X, they want a 30-year mortgage. (In addition to qualifying them for a larger loan, this gives them more years to deduct the mortgage interest on their tax return.) Unlike Mr. X, however, the couple wants a fixed-rate mortgage so their payments won't increase. (If interest rates fall dramatically, they can always refinance.)

In this example, the program calculated a maximum allowable loan of $173,620.59, which can be put toward the purchase of a $258,620.59 house (see Fig. 4). Based on these estimates, the couple's first-month interest payment would be $1,446.84. Their first-month principal payment would be $76.81.

Taxing Situations

If you already own a home, you can use House to estimate your state and federal taxes. The program uses 1985 federal and Massachusetts tax tables and rules (starting at line 780). To make the program consistent with the new 1987 tax law, you must load House into memory. Then type the replacement lines shown in Listing 2. Delete lines 1020 and 1050.

Residents of states other than Massachusetts will have to change the state-tax computations. To help you make these modifications, I've included a cross-reference list of variables and line numbers (see the Table). An equals sign (=) means that I assigned the variable a value in the line. To change the value, insert the appropriate number in the line.

To estimate your federal tax using the tax table, type in zeros for the percent of income allowed for housing expenses, mortgage interest, term of mortgage, and deductible closing costs (see Fig. 5). (A harmless division-by-zero error will occur in the mortgage calculations. All other calculations will be correct, however, so ignore the message.)

Make sure that you enter your mortgage interest and other itemized deductions after the prompt "Total annual non-housing-related itemized deductions." If you have other deductions (moving expenses, deduction for married couple, and so forth), enter them after the prompt "Total annual non-housing-related deductions besides itemized deductions." Follow the rules for filling out schedule A when totalling these deductions.

The program calculates the Massachusetts state income tax in lines 630–770. House estimates Social Security payments from income. In Massachusetts, Social Security taxes (lines 640–730) are deductible up to a limit of $2,000 per wage earner. The personal deduction for single wage earners is $2,200. For couples, it is $2,200 plus the lesser of two incomes up to a maximum of $4,400. Each additional dependent tacks on $700 to the total of

```
Enter filing status (1) single (2) married filing jointly? 1
Enter total number of dependents (counting you & spouse)? 1
Now enter your financial information

Enter your gross monthly salary? 1000
Enter estimated percentage raise? 2.5
Enter % going to 401(K) or IRA? 3
Enter monthly income besides salary? 120

Now enter federal tax information
% of total house costs going to closing (5% typical)? 5
Total annual nonhousing related itemized deductions? 0
Total annual nonhousing related deductions besides itemized deductions? 50
Estimated property tax rate % (2.5% max. in Mass.)? 2.5
Estimated annual homeowners insurance rate per thousand (in $)? 0.33
Enter % of gross income allowed as housing costs (usually 25-33)? 28
Enter mortgage percentage (9.1 variable, 10 fixed typical)? 9.01
Enter term of mortgage in years? 30
Enter amount of downpayment? 4000
Enter desired accuracy in loan amount (100 or less)? 100
```

Fig. 1. Sample responses of Mr. X.

```
Your gross monthly income       1,025.00
Other monthly income              120.00
Total gross yearly pay         13,740.00
% of your salary to 401(K) or IRA
                                    3.0
Total gross monthly salary-401(K) or IRA
                                  994.25
Total net annual pay           13,371.00
Mortgage calculations----------------------------------------------
Mortgage= 28 % of gross pay       320.60
Annual insurance                  111.26
Annual local property tax         842.88
monthly interest + principal      241.09
Mortgage interest rate              9.01 %
Term (months)                     360
Maximum loan                   29,936.12
Maximum affordable house       33,936.12
1st month's interest              224.77
1st month's principal payment      16.32
1st year's interest             2,687.42
1st year's principal payments     204.11

Estimate Mass. Tax-------------------------------------------------
Social Security deduction         879.45
Total personal deductions       2,200.00
Mass. 5.375% income-deduct     10,291.55
Mass. tax                         553.17

Estimate Federal tax-----------------------------------------------

Local tax=                        842.88
Deductions=mortage interest+state tax+local tax+closing+miscellaneous- 2390 =
                                3,379.23
Personal deduction(s)           1,040.00
Taxable income with no itemized deduct, but with other deductions
                               12,281.00
Tax with no itemized deduct     1,439.78 (10.5% of gross income, 18.0 % bracket)
Taxable income with itemized deduct and other deductions
                                8,901.77
Est. Fed tax with house deduct
                                  878.28 ( 6.4% of gross income, 16.0% bracket)
Tax saving                        561.50 or      46.79 per month
Net monthly cost=mortgage - savings=
                                  273.81
```

Fig. 2. Mr. X's final report.

```
Enter filing status (1) single (2) married filing jointly? 2
Enter total number of dependents (counting you & spouse)? 3
Enter spouse's gross monthly salary? 3000
Enter estimated percentage raise? 11.5
Enter % of salary going to 401(K) or IRA? 8.4
Now enter your financial information

Enter your gross monthly salary? 2450
Enter estimated percentage raise? 9.4
Enter % going to 401(K) or IRA? 12
Enter monthly income besides salary? 2500

Now enter federal tax information
% of total house costs going to closing (5% typical)? 5
Total annual nonhousing related itemized deductions? 4000
Total annual nonhousing related deductions besides itemized deductions? 2100
Estimated property tax rate % (2.5% max. in Mass.)? 2.5
Estimated annual homeowners insurance rate per thousand (in $)? 0.33
Enter % of gross income allowed as housing costs (usually 25-33)? 25
Enter mortgage percentage (9.1 variable, 10 fixed typical)? 10
Enter term of mortgage in years? 30
Enter amount of downpayment? 85000
Enter desired accuracy in loan amount (100 or less)? 100
```

Fig. 3. Samples responses of a married couple with one child.

```
Your gross monthly income       2,680.30
Spouse's gross monthly income   3,345.00
Other monthly income            2,500.00
Total gross yearly pay        102,303.60
% of your salary to 401(K) or IRA
                                   12.0
% of spouse's salary going to 401(K) or IRA
                                    8.4
Total gross monthly salary-401(K) or IRA
                                5,422.68
Total net annual pay           95,072.21
Mortgage calculations----------------------------------------------
Mortgage= 25 % of gross pay     2,131.33
Annual insurance                  850.32
Annual local property tax       6,441.85
monthly interest + principal    1,523.64
Mortgage interest rate             10.00 %
Term (months)                       360
Maximum loan                  173,620.59
Maximum affordable house      258,620.59
1st month's interest            1,446.84
1st month's principal payment      76.81
1st year's interest            17,310.58
1st year's principal payments     965.11

Estimate Mass. Tax-------------------------------------------------
Social Security deduction       4,000.00
Total personal deductions       5,100.00
Mass. 5.375% income-deduct     85,972.21
Mass. tax                       4,621.01

Estimate Federal tax-----------------------------------------------

Local tax=                      6,441.85
Deductions=mortage interest+state tax+local tax+closing+miscellaneous- 3400 =
                               41,857.13
Personal deduction(s)           3,120.00
Taxable income with no itemized deduct, but with other deductions
                               89,852.21
Tax with no itemized deduct    27,319.79 (26.7% of gross income, 45.0 % bracket)
Taxable income with itemized deduct and other deductions
                               47,995.00
Est. Fed tax with house deduct
                               10,295.13 (10.1% of gross income, 38.0% bracket)
Tax saving                     17,024.66 or   1,418.72 per month
Net monthly cost=mortgage - savings=
                                  712.60
```

Fig. 4. House's final report for Mr. and Mrs. Y.

```
Your gross monthly income       1,025.00
Other monthly income              120.00
Total gross yearly pay         13,740.00
% of your salary to 401(K) or IRA
                                    3.0
Total gross monthly salary-401(K) or IRA
                                  994.25
Total net annual pay           13,371.00
Mortgage calculations----------------------------------------------
Mortgage= 0 % of gross pay          0.00
Annual insurance                    0.00
Annual local property tax           0.00
monthly interest + principal        0.00
Mortgage interest rate              0.00 %
Term (months)                       0
Maximum loan                  Division by zero

      0.00
Maximum affordable house            0.00
1st month's interest                0.00
1st month's principal payment       0.00
1st year's interest                 0.00
1st year's principal payments       0.00

Estimate Mass. Tax-------------------------------------------------
Social Security deduction         879.45
Total personal deductions       2,200.00
Mass. 5.375% income-deduct     10,291.55
Mass. tax                         553.17

Estimate Federal tax-----------------------------------------------

Local tax=                          0.00
Deductions=mortage interest+state tax+local tax+closing+miscellaneous- 2390 =
                                    0.00
Personal deduction(s)           1,040.00
Taxable income with no itemized deduct, but with other deductions
                               12,281.00
Tax with no itemized deduct     1,439.78 (10.5% of gross income, 18.0 % bracket)
Taxable income with itemized deduct and other deductions
                               12,281.00
Est. Fed tax with house deduct
                                1,439.78 (10.5% of gross income, 18.0% bracket)
Tax saving                          0.00 or       0.00 per month
Net monthly cost=mortgage - savings=
                                    0.00
```

Fig. 5. Sample tax-report printout.

personal deductions. The standard tax rate in Massachusetts is 5.375 percent (lines 750–760).

Press the enter key when you finish entering tax information. The program makes the necessary calculations and prints the results in the bottom half of the house-buying printout.

If you rent, you can still use the program to estimate taxes. Type in zeros when prompted for the percent of income allowed for housing expenses, mortgage interest, and deductible closing costs. When asked for the total of non-housing-related deductions, enter the amount you would enter on line 24 of schedule A.

In Massachusetts, 50 percent of your rent is deductible up to a maximum of $2,500. House doesn't take that deduction into consideration, so you have to refigure your Massachusetts income with the rental deduction. For example, suppose you pay $5,200 a year in rent. Fifty percent of that is $2,600, but you can only deduct $2,500. To account for this, run the program. After it runs the calculations the first time, type in:

```
MASSINCOME = MASSINCOME - 2500:IF MASS-
INCOME<0
THEN MASSINCOME = 0:GOTO 760
ELSE 760
```

Then press the enter key. The program recalculates your Massachusetts and federal taxes using the Massachusetts rental and all other deductions.

Converting House

You can modify House for other Tandy computers by changing lines 970 and 980 to the following:

```
970 IF REPEAT = -1 THEN END
980 IF ABS(LOAN - LASTLOAN) < ACCURACY
    THEN REPEAT = -1:PRINT
    "**** THE FINAL REPORT ****"
    ELSE REPEAT = REPEAT + 1
```

(To run the program on the Model III, you also need to change the variable names to two letters.) On some computers, you might have to use a different character for exponentiation in lines 520 and 550. The Model 4 and the Tandy 1000 use a caret. (To produce a caret on the Model 4, hold down the clear key and press the semicolon [;]. The Tandy 1000 has a caret key.)

If you're using a Model 4, line 980 automatically copies the screen's output to your printer. On other computers, you'll have to use whatever output redirection the operating system allows. On the Tandy 1000, for instance, you first have to press the hold key to view the report on screen. When you see "The Final Report" heading, press shift-print to send the report to the printer.

Another approach would be to make a copy of House under a different file name (House2/BAS, for example) and change the new copy so it prints the output on

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.**

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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?

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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.**

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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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paper. Delete lines 10–330 from the new copy and replace every Print statement with LPrint. In line 980, chain from the original version to the printing version using the All option:

```
IF ABS(LOAN - LASTLOAN) < ACCURACY
THEN CHAIN "HOUSE2/BAS",,ALL
```

The easiest way to print the report is to replace every Print statement with LPrint. When it runs, House will print all copies of the report, including its preliminary calculations. Be forewarned: The program produces many pages of output. It usually repeats the calculations five to nine times before stopping.■

John Edward Crew is a software engineer at Raytheon Co. Write to him at 16 Strawberry Hill Road, Apt. 14C, Acton, MA 01720.

Table. Variable and line-number cross-reference list.

Type	Line/Name	Variable reference(s)				
Line #	1010	1,060				
	1040	1,060				
	1060	880	900			
	1090	1,090				
	130	90				
	270	280				
	330	990				
	70	70				
	720	690				
	950	930				
DBL	ACCURACY	320	980			
	ADDINCOME	170	360	370	420	
	ADJMONTHPAY	410=	410	420		
	BAS(	10	1,070	1,100		
	CLOSING	200=	810	990=		
	CLOSINGRATE	200	200=	200	200	990
	DEDUCT	810=	810=	810	820	820=
		820	820=	830	900	
	DOWNPAY	310	560	990		
	FEDPERSONDEDUCT		840=	850	860	
	FEDPERSONEXEMPT		180=	840		
	FEDTAX	880	890	920	930	950
		950	960	1,080=	1,100=	
	GROSSYEARPAY	370=	380	450	890	890
			930	930		
	HOUSERATIO	270	280=	280	280	450
		460				
INT	I	600=	890	940	1,070=	1,070
		1,070	1,070	1,080=	1,080=	1,090
		1,090=	1,090	1,100	1,100	1,100
DBL	I	520=	550	550		
	INSURANCE	250=	470	490	960	990=
	INSURANCERATE	250	250=	250	250	
		990				
	LASTLOAN	60=	980	990=		
	LOAN	550=	550	560	570	660=
		600	600	980	990	990
	LOWERLIM	240=	240=	820	820	830
		1,080				
	MASSINCOME	750=	750	750=	750	760
	MASSPERSONDEDUCT		690=	690=	690=	700
		700=	720=	720	730=	730
		740	750			
	MASTAX	760=	770	810		
	MISCDEDUCT	210	810			
	MONTHINTER	570=	580	590	600	600=
		600				
	MONTHPAY	140	150=	150	340	370
		410	640	690	690	
	MORTGAGE	450=	460	490=	490	500
		500=	510	550	590	600
		810	960			
	MORTGAGERATE	290	290=	290	520	530
		570	600			
	OLDFEDTAX	880=	890	950	950	960
	OTHERDEDUCT	220	860			
	PEOPLE	80	720	720	730	730
		840				
	PERCENT(	10	890	940	1,070	1,100
	PRICE	990=	990	990	990	
	PRINC	600=	600	600		
	PROPTAX	230=	480	490	800	810
		960	990=			
	PROPTAXRATE	230	230=	230	230	990
	RAISE	110	110	150	150	
	REPEAT	60=	970=	980=	980=	980

Table continued

Table continued

SAVINGSRATE	160	390	410		
SOCSECRATE	260 =	640	650		
SPOUSEMONTHPAY		100	110 =	110	350
	370	410	650	690	690
SPOUSESAVINGS	120	400	410		
SPOUSESS	650 =	660	660 =	670	
SSDEDUCT	640 =	640	640 =	670 =	670
	680	750			
STATUS	70	70	70	90	240
	350 =	400 =	690 =	720 =	730 =
	1,060 =				
TAXINCOM	860 =	870	900 =	900	910
	1,080	1,090			
		1,100			
TERMS	300	300 =	300	540	550
UPPER(	10	1,070	1,090	1,100	
YEARINTER	600 =	600 =	600	610	810
YEARPAY	420 =	430	750	860	
YEARPRINC	600 =	600 =	600	620	

51 variables
277 variable references
10 target lines of Goto, Gosub, etc.
11 line-number references
Variable type definitions: ABCDEFGHIJKLMNOPQRSTUVWXYZ are double precision

Program Listing 1. House/BAS. See p. 116 for information on using the checksums in Listings 1 and 2.

```
10 DEFDBL A-Z:DIM UPPER(16),BAS(16),PERCENT(16)                    '*  2865
20 CLS:PRINT"1st year Tax and House buying calculations using 19
   85 tax law":PRINT"written by John Edward Crew":PRINT:PRINT      '* 10354
30 PRINT:PRINT"Assume house owned for 12 months in tax year":PRI
   NT"Assume each wage earner has raise for 12 months in tax yea
   r"                                                             '* 10965
40 PRINT"Mass. personal deduction=2200 for singles":PRINT"   for
    couples 3200+lesser of 2 incomes with 4400 max.":PRINT"   Ea
   ch additional dependent adds $700 to the total personal deduc
   tions                                                          '* 16110
50 PRINT"Assume 10% Mass. income is insignificant":PRINT          '*  4656
60 LASTLOAN=0:REPEAT=0                                            '*  1465
70 INPUT"Enter filing status (1) single (2) married filing joint
   ly";STATUS:IF STATUS <>1 AND STATUS <>2 THEN 70                '*  8627
80 INPUT"Enter total number of dependents (counting you & spouse
   )";PEOPLE                                                      '*  6368
90 IF STATUS=1 THEN 130                                           '*  1421
100 INPUT"Enter spouse's gross monthly salary";SPOUSEMONTHPAY     '*  5259
110 INPUT"Enter estimated percentage raise";RAISE:SPOUSEMONTHPAY
   =SPOUSEMONTHPAY*(1+RAISE/100)                                  '*  7333
120 INPUT"Enter % of salary going to 401(K) or IRA";SPOUSESAVING
   S                                                              '*  4901
130 PRINT"Now enter your financial information"                   '*  4209
140 PRINT:INPUT"Enter your gross monthly salary";MONTHPAY:        '*  4935
150 INPUT"Enter estimated percentage raise";RAISE:MONTHPAY=MONTH
   PAY*(1+RAISE/100)                                              '*  6379
160 INPUT"Enter % going to 401(K) or IRA";SAVINGSRATE:REM Percen
   t of your gross monthly pay which goes to 401(K) or IRA    s
   avings plan                                                    '* 10819
170 INPUT"Enter monthly income besides salary";ADDINCOME          '*  4794
180 FEDPERSONEXEMPT=1040:REM Federal personal exemption           '*  4514
190 PRINT:PRINT"Now enter federal tax information"                '*  4330
200 INPUT"% of total house costs going to closing (5% typical)";
   CLOSINGRATE:CLOSINGRATE=CLOSINGRATE/100:CLOSING=108000!*CLOS
   INGRATE:REM 108000 is national median home price               '* 13398
210 INPUT"Total annual nonhousing related itemized deductions";M
   ISCDEDUCT                                                      '*  6528
220 INPUT"Total annual nonhousing related deductions besides ite
   mized deductions";OTHERDEDUCT                                  '*  8488
230 INPUT"Estimated property tax rate % (2.5% max. in Mass.)";PR
   OPTAXRATE:PROPTAXRATE=PROPTAXRATE/100:PROPTAX=PROPTAXRATE*10
   8000!:REM initialize proptax=national median home price*rate   '* 14952
240 IF STATUS=1 THEN LOWERLIM=2390ELSE LOWERLIM=3400:REM lower l
   imit for itemized deductions                                   '*  7214
250 INPUT"Estimated annual homeowners insurance rate per thousan
   d (in $)";INSURANCERATE:INSURANCERATE=INSURANCERATE/100:INSU
   RANCE=INSURANCERATE*108000!                                    '* 11956
260 SOCSECRATE=7.15:REM % of income going to Social security      '*  4841
270 INPUT"Enter % of gross income allowed as housing costs (usua
   lly 25-33)";HOUSERATIO                                         '*  7147
280 HOUSERATIO=HOUSERATIO/100:IF HOUSERATIO>1/3 THEN PRINT"Most
   banks won't let your debt ratio exceed 33% of gross income":
   GOTO 270                                                       '* 10288
290 INPUT"Enter mortgage percentage (9.1 variable, 10 fixed typi
   cal)";MORTGAGERATE:MORTGAGERATE=MORTGAGERATE/100               '*  8859
300 INPUT"Enter term of mortgage in years";TERMS:TERMS=TERMS*12   '*  5091
310 INPUT"Enter amount of downpayment";DOWNPAY                    '*  3938
320 INPUT"Enter desired accuracy in loan amount (100 or less)";A
   CCURACY                                                        '*  5831
330 PRINT:PRINT:PRINT                                             '*  1489
340 PRINT"Your gross monthly income"TAB(30);:PRINT USING"$$$,$$$
   .##";MONTHPAY                                                  '*  5599
350 IF STATUS=2 THEN PRINT"Spouse's gross monthly income"TAB(30)
   ;:PRINT USING"$$$,$$$.##";SPOUSEMONTHPAY                       '*  7578
360 PRINT"Other monthly income"TAB(30);:PRINT USING"$$$,$$$.##";
   ADDINCOME                                                      '*  5114
```

Listing 1 continued on p. 112

by Jack Feldman

The Custom Cable Connection

If equipment interfaces have you perplexed, try making connections the old-fashioned way—build your own cable.

Connecting a serial printer to a computer's serial port is a common problem for computer owners. The difficulty stems from mating two types of equipment that have identical interface connectors. The RS-232C standard specifies male connectors for both the computer's serial port and the serial printer. However, a standard, off-the-shelf modem cable has one male and one female connector, which means you cannot use it to connect the two devices.

In most cases, the solution is to customize a cable that interfaces your computer with your printer. A project like this can intimidate even some experienced users. The job is not as difficult, however, if you know how different types of equipment work and what it takes to make them interact. Later, I'll show you how to make cables which accomplish a variety of equipment pairings, but first you'll need to know the difference between data-terminal equipment (DTE) and data-communications equipment (DCE), as well as the important pin assignments for an RS-232C interface.

The RS-232C Standard

In 1969, the Electronic Industries Association (EIA) published the RS-232C standard, which defined the interface between DTE (exemplified by terminals) and DCE (exemplified by modems). The association has reaffirmed, but not revised, the standard since that date.

At that time computers were not common, and most equipment consisted of terminals or modems. Many companies wanted to print information from a source that did not need a response. The Receive Only Printer (ROP) connected directly to a modem, which required manufacturers to configure the printer as DTE. Even now, when serial printers are dedicated to computers, they are configured as DTE. Microcomputers are also usually configured as DTE.

According to the EIA standard, DTE interfaces should have male connectors and DCE interfaces should have female connectors. Figure 1 shows the standard pin arrangements of male and female connectors (DB-25). If you put them together, pin 1 is properly opposite pin 1, 2 is properly opposite 2, and so on. If you try to put two male or two female connectors together, pin 1 is opposite pin 13, 2 is opposite 12, and so on.

You cannot always tell if equipment is configured as DTE or DCE when you look at its connectors. Lobo Drives International put female connectors on its LX-80 expansion interface for the Model I and on its Max-80 computer. You might assume, then, that the interfaces are DCE, but both connectors have a DIP shunt inside them that you can jumper to make them DTE or DCE.

Another problem is that not all computers and printer interfaces use all a connector's pins. Each connector can have as many as 25 pins. Table 1 gives the RS-232C pin assignments set by the EIA. To successfully interface your equipment, you must know which signals each uses and how they are sent from one to the other. This is called handshaking. I'll demonstrate how handshaking works between a microcomputer (DTE) and a modem (DCE).

Sending the Right Signals

When you turn on a terminal or load communications software into your computer, it puts a plus voltage on pin 20 to signal the DCE that it's ready to go to work. The DCE activates pin 6 to let the

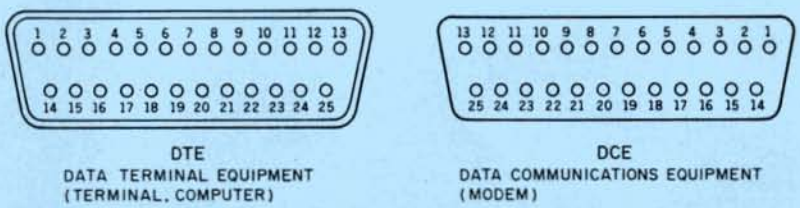

Fig. 1. Pin numbers on male and female connectors.

Pin	Name
1	Protective ground
2	Transmit data
3	Received data
4	Request to send
5	Clear to send
6	Data set ready
7	Signal ground (common return)
8	Received-line signal detector
9	(Reserved for data-set testing)
10	(Reserved for data-set testing)
11	Unassigned
12	Second received-line signal detector
13	Second clear to send
14	Secondary transmit data
15	Transmission-signal element timing (DCE source)
16	Secondary received data
17	Receiver-signal element timing (DCE source)
18	Unassigned
19	Secondary request to send
20	Data terminal ready
21	Signal-quality detector
22	Ring indicator
23	Data-signal rate selector (DTE/DCE source)
24	Transmit-signal element timing (DTE source)
25	Unassigned

Table. Standard pin assignments.

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20 Mega Byte Hard Card

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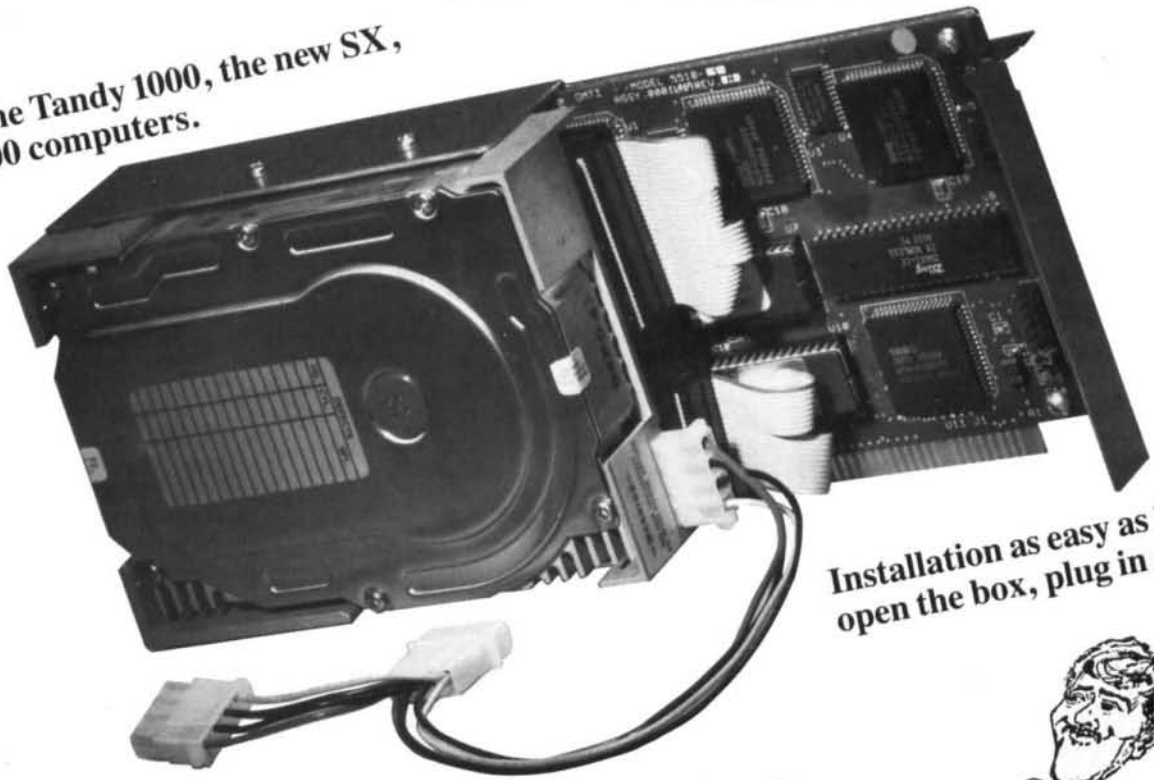

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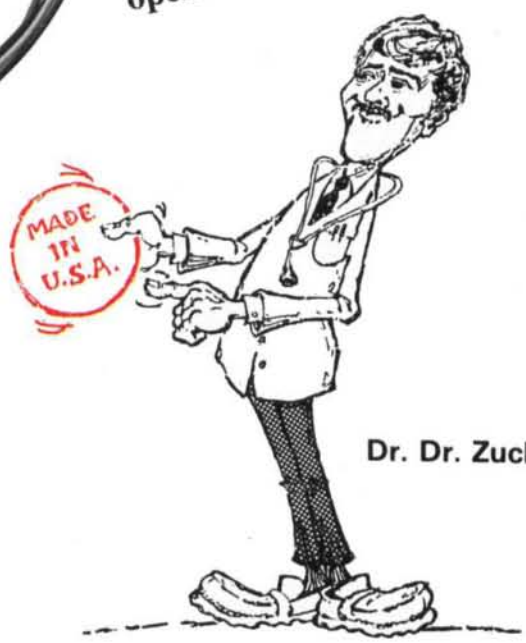
Availability	Now	Soon
Warranty	2 Years	90 Days
Installation	Preformatted for Plug & Play	Need to Format
Reliability	3× More Reliable Than a Seagate	Unknown
Access Time	66 Millisecond	Unknown
Slot Usage	1 Slot	Unknown



Dr. Dr. Zucker

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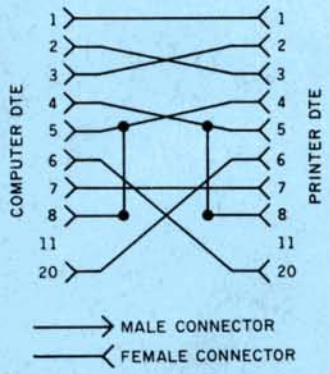

Fig. 2. A simple cable to interface two devices configured as DTE.

computer know it's ready.

Next, one of two things happens. If the computer wants to send data, it puts a +5 voltage on pin 4. If the modem is ready to transmit the data, it responds by putting +5 volts on pin 5. If there is no request (no positive voltage applied to the interface), then the computer applies a −3 to −25 voltage.

A lead must have a positive voltage to signal that the device is making a request for action or signaling that the requested action is allowed. If the two devices are waiting with pins 20 and 6 set to +5 volts to indicate that the data terminal and data set are ready, and someone calls the modem or the other device, then pin 8 goes positive on the modem or DCE to indicate a received line-signal detector, commonly called a carrier-detect signal.

In either event, the computer only needs to indicate that the data terminal is ready to receive data, and the data-communications device only needs to indicate that the data set is ready. If the computer sends a request-to-send signal, the modem must give the clear to send before the computer can transmit data. Also, the modem must send a carrier-detect signal to the terminal before it can pass data to the terminal.

Data is sent or received on pins 2 and 3, transmit data (TD) and received data (RD). Note that the chart lists pin 2 as TD and pin 3 as RD. That is the convention, but it is not correct. If you send data on pin 2, the DEC must receive on pin 2 and send on 3. The EIA standard looks at pins 2 and 3 from the terminal's viewpoint. TD goes to the DCE on pin 2, and RD comes from the DCE on pin 3. You usually deal with DTE, however.

To sum up, the computer is looking for pins 6, 8, and 5 to have voltages in the range of +3 to +25. It also needs to have pin 2 connected to the received data of the other device, and that device's send-data lead must be connected to pin 3 (the computer's received-data lead).

To connect two DTE devices, you only need to be concerned with those leads. The trick is fooling the computer into thinking it is connected to a workable device. That would be easy if everything worked as the EIA standard says it should, but some manufacturers, in trying to make their equipment flexible, don't follow the rules.

Custom Cables

Figure 2 shows a cable solution that does follow the rules for connecting two DTEs. If a computer or printer expects certain responses to certain signals, then all you have to do is furnish that response. Note that these come in pairs: pins 2 and 3, 4 and 5, and 20 and 6. You also need pin 8, and since the DCE turns that pin on, it is not part of a pair. You have to approximate the original handshake by tying the pin to any source of positive voltage. In this case, tie it to pin 5 (clear to send), which the other DTE's request-to-send lead turns off and on.

The computer and printer expect certain responses to signals. They can get these responses from themselves.

Figure 3 offers a solution if your printer or computer does not use pin 4. Just tie pins 5, 6, and 8 together and connect them to the incoming pin 20 of the other device. The cabling technique has many variations, but these two should handle most situations.

In a minimum configuration involving a computer and a printer, you must connect pin 7 to pin 7 to get a reference ground and pin 2 to pin 3 to get a send/receive pair. Anything beyond that is extra. If your computer and printer are software-configured to send x-on and x-off signals, then you must have both send and receive pairs active. As a safety precaution, you should also preserve the connection between pins 1 and 1, which grounds the frame.

Figure 4 shows an example of a cable that uses a minimum number of lines but satisfies all the necessary requirements for handshaking. It is the functional equivalent of a null modem cable. In this case, you don't need to have interaction between devices. You only satisfy the requirements by tying pins that need positive voltages to pins that give those voltages. Instead of getting the signals from the other DTE, the computer and printer get them from themselves.

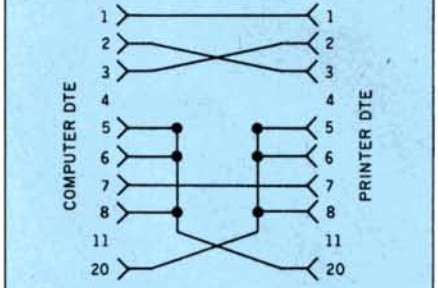

Fig. 3. A cable that does not use a request-to-send signal.

Going by the Book

The Table and figures should help you make your own cables for any situation. Before you start, though, you must know whether your equipment is configured as DTE or DCE, what hardware interaction is required to get the printer or computer to work, and how you can manipulate that interaction, either through custom cabling or other hardware and software options. The best course is to study the documentation, learn how the devices work, and then test your options.

I once had to interface my computer with a Diablo 630 printer and a standalone buffer with a serial input and a serial output. The situation called for two cables, both of which I thought had to be custom made. After reading the buffer manual, however, I realized I had to customize only one cable and could use an existing, off-the-shelf cable for the other.

The buffer's documentation told me that the buffer input is configured as DTE and buffer output as DCE. Technically, the proper handshake is through pin 5 (clear to send), but the buffer options suggested using pin 4 (request to send). This meant I could use a standard cable like the one in Fig. 2 to send data to the buffer. When the buffer fills, it drops the request-to-send signal, which in turn drops the clear-to-send signal to the computer. In effect, the buffer tells the computer to stop sending data until it empties and pin 4 goes positive.

The buffer output is DCE because most serial printers are DTE. Ordinarily, this

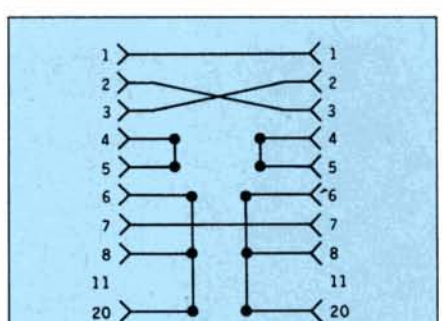

Fig. 4. One form of a null modem cable.

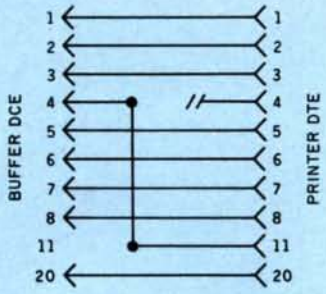

Fig. 5. A cable for the Diablo 630 serial printer and buffer.

lets you connect printers through a standard cable. However, the Diablo 630 does not use standard signals to tell the sending device when its buffer is full; instead, the 630 uses pin 11 to indicate "printer ready." While its 2K buffer is filling, the printer holds pin 11 positive and does not release it until the buffer is almost full. Either pin 20 (data terminal ready) or pin 4 (request to send) going negative stops the stand-alone buffer from sending.

This gave me the idea for the cable in Fig. 5, which puts a request-to-send signal on pin 11. I took a normal cable and clipped the lead to pin 4 in the female connector. Using an extractor, I then removed pin 11 and moved it to the pin 4 position. Without reading the manual, I would not have known I could do this.

New Horizons

Several books about the RS-232C interface discuss what happens on each pin and some of the variations that manufacturers have introduced. Martin D. Seyer's *RS-232 Made Easy: Connecting Computers, Printers, Terminals, and Modems* (Prentice Hall, Englwood Cliffs, N.J., 1984) shows the interface for a number of devices and diagrams the cable to connect them. It also discusses special cables to interface the various devices.

If you need a special cable, The Data Set Cable Co. (722 Danbury Road, Ridgefield, CT 06877) has parts and will customize cables for you. A number of other companies sell kits that let you make your own cables. The Black Box Corp.(P.O. Box 12800, Pittsburgh, PA 15241) has a catalog of test sets, cables, and switches.■

Jack Feldman uses a Model I, 4P, and a Lobo MAX80. He is a Director of CACHE (Chicago Area Computer Hobbyist Exchange), and leader of its MAX80 SIG. Write him c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.

KSM Helper

Expand and edit keystroke-multiply files quickly and easily.

The keystroke multiply filter (KSM/FLT) in LDOS 5.1.x and TRSDOS 6.2 lets you enter up to 26 frequently used phrases and commands by pressing a single letter key while the clear key is depressed. It's a great time-saver with a big drawback: Editing the files that load the KSM data is inconvenient at best.

Not anymore. With the KSM/FLT patch and Basic program that I'll describe, you can combine several KSM sets into a single neat file and edit them easily. In addition, a special directory showing all the modules helps you manage the expanded KSM file. If you use more than one KSM file, you'll especially like this utility.

The Setup

The patches work very simply. A module number is passed to the program via the N parameter. If this number is greater than one, the patch code reads Your/KSM, counting through to the desired module. The patch does not interfere with the use of KSM/FLT on ordinary KSM files. When the N parameter is omitted, the default value is one and the first or only module is taken.

To install the patches, you must prepare pure ASCII files exactly as the listing for the patch or patches that you need. Note that the X-type patch at the end of either file is all one line. You can use the Build library command to type in the file; if you use a word processor, be sure it is capable of pure ASCII output. Install the TRSDOS 6 patch (Fig. 1) with:

PATCH KSM/FLT.FILTER:d JLH6:d

For LDOS 5.1 (Fig. 2), use:

PATCH KSM/FLT.GSLTD:d JLH51:d

Add Strip (Program Listing) adds the helpful alphabetical prompts that KSM/FLT lacks. You can only use it on an existing KSM file. To create one, start at the DOS level and enter the following command:

BUILD file name/KSM

LOAD 80

System Requirements

Model III or 4
LDOS 5.1.x or TRSDOS 6.2
Word processor

This produces a vertical display of letters next to which you would normally type the desired words or characters. Hold the enter key down. When you pass "Z" the file closes and the Build sequence terminates.

Load Basic and Add Strip. Enter the name of your KSM file and choose the Add option. The program adds letter prompts and brackets around the original character sequences and writes a new file having the FIL extension. At this stage you can only look at the file's contents; to edit it, you must use a word-processing program with an option for saving in ASCII. (Remember: The new file name has the FIL extension.)

While editing the file, insert material immediately after the first bracket and take special care not to overwrite the second bracket. The same holds for deleting: Be sure to keep the brackets. When you have the file looking just right, save it back to disk in ASCII, run Add Strip again, and choose the strip option. The program reads from the new file, strips off the editing prompts, and writes the root back to the KSM file.

Since there is no need to keep the FIL file, you can back up the KSM file to a memdisk and perform all the Add Strip operations there. Then write the revised KSM file back to its home disk.

Before installing the KSM filter in LDOS 5.1.x, you must set the driver with the following command:

SET *KI TO KI/DRV

Then use this command to install the filter:

FILTER *KI KSM/FLT file name/KSM

In TRSDOS 6.2, issue the following two

```
.JLH6/FIX a patch to KSM/FLT (TRSDOS 6)
.to select modular data sets
.
.load DE with new parameter table address
.1 bytes at X'242A'
D00,4F=8C
F00,4F=96
.jump to module search at X'2821'
.1 bytes at X'2492'
D00,B7=C3
F00,B7=21
.shorten "Exceed" message to make room for NUMBER parameter
.22 bytes at X'2675
D02,A2="Exceeds available Mem!"
F02,A2="Request exceeds availa"
.parameter table starts at X'268C'
.3 bytes at X'268B'
D02,B8=0D D2 96
F02,B8="ble"
.6 bytes at X'268E'
D02,BB="NUMBER"
F02,BB=" memor"
.3 bytes at X'2694'
D02,C1=00 2A 28
F02,C1=79 0D D2
.module search to be overwritten later by KSM buffer
.34 bytes at X'2821'
X'2821'=3A 94 26 E6 60 C2 61 25 01 01 00 21 21 28 06 1A 0D CA 97 24 3E 03 EF C2
A8 24 FE 0D 20 F6 10 F4 18 EC
```

Fig. 1. Patch to TRSDOS 6.2 KSM/FLT file.

```
.JLH51/FIX a patch to KSM/FLT (LDOS 5.1)
.to select modular data sets
.
.Call 55F9 to correct address error in HL
.4 bytes at X'5253'
D00,5F=CD F9 55 00
.jump to module search at X'55DA'
.1 bytes at X'526A'
D00,76=C3
.prevent loading KSM data if 1 or 2 bytes too long
.1 byte at X'52B2'
D00,BE=59
.parameter table for module number
.8 bytes at X'5452'
D02,66=4E 20 20 20 20 20 DB 55
.38 bytes at X'55DA'
X'55DA'=01 01 00 0C CA 3D 53 0D 21 DA 55 06 1A 0D CA 6F 52 CD 13 00 C2 7E 52 FE
0D 20 F6 10 F4 18 EC FD 66 03 FD 6E 02 C9
```

Fig. 2. Patch to LDOS 5.1 KSM/FLT file.

Program Listing. Add Strip.

```
10 CLEAR 200:DEFINT A-Z                                                 '*  1398
20 CLS:J=0:PRINT"KSM ADD or STRIP":Q$="Q":PRINT                         '*  3119
30 PRINT"To ADD editing prompts, FILNAME/KSM:d must exist. FILNA
   ME/FIL:d":PRINT"will be the output file.":PRINT                      '*  8946
40 PRINT"To STIP prompts, FILNAME/FIL:d must exist and FILNAME/K
   SM:d":PRINT"will be the output.":PRINT                               '*  8139
50 GOSUB 400                                                            '*   697
60 PRINT"Do you wish to <A>dd or <S>trip the editing prompts"           '*  5199
70 G$=INKEY$:IF G$="" THEN 70                                           '*  1662
80 G=ASC(G$) AND 95                                                     '*  1056
90 IF G=83 THEN 210                                                     '*  1065
100 IF G<>65 THEN 60                                                    '*  1121
110 PRINT:PRINT"Adding Editing prompts":PRINT                           '*  3697
120 FI$=F$+"/KSM"+D$:FO$=F$+"/FIL"+D$:GOSUB 360                         '*  2626
130 N=65:L=0                                                            '*   669
140 IF EOF(1) THEN 460                                                  '*  1225
150 LINE INPUT#1,M$:GOSUB 440                                           '*  1777
160 M$=CHR$(N)+"=>{"+M$+"}"                                             '*  1522
170 PRINT#2,M$:PRINT M$                                                 '*  1423
180 G$=INKEY$:IF G$="" THEN 180   REM line may be deleted               '*  3891
190 N=N+1:IF N<91 THEN 140                                              '*  1488
200 GOSUB 450:GOTO 130                                                  '*  1298
210 PRINT:PRINT"Striping Editing prompts":PRINT                         '*  3963
220 FI$=F$+"/FIL"+D$:FO$=F$+"/KSM"+D$                                   '*  2000
230 GOSUB 360                                                           '*   750
240 N=65:L=0                                                            '*   671
250 IF EOF(1) THEN 460                                                  '*  1227
260 LINE INPUT#1,M$                                                     '*  1153
270 IF M$="" THEN 460                                                   '*  1123
280 IF ASC(M$)<32 THEN 460                                              '*  1452
290 PRINT M$:M$=RIGHT$(M$,LEN(M$)-4)                                    '*  2131
300 M$=LEFT$(M$,LEN(M$)-1):GOSUB 440                                    '*  2063
310 PRINT#2,M$                                                          '*   819
320 G$=INKEY$:IF G$="" THEN 320   REM line may be deleted               '*  3883
330 N=N+1:IF N<91 THEN 250                                              '*  1486
340 GOSUB 450:GOTO 240                                                  '*  1305
350 '                                                                   '*   223
360 OPEN"I",1,FI$                                                       '*   948
370 IF Q$="A" THEN 390                                                  '*  1195
380 OPEN"O",2,FO$                                                       '*   963
390 PRINT "Reading from "FI$" and Writing to "FO$:RETURN                '*  4255
400 LINE INPUT"Enter FILNAME:d ";F$:S=INSTR(2,F$,"/"):C=INSTR(2,
    F$,":")                                                             '*  4460
410 IF C=0 THEN PRINT"Must specify DRIVE":GOTO 400                      '*  3537
420 IF S=0 THEN S=C                                                     '*  1127
430 D$=MID$(F$,C,2):F$=LEFT$(F$,S-1):RETURN                             '*  2500
440 L=L+LEN(M$)+1:RETURN                                                '*  1487
450 PRINT L:PRINT:J=J+1:A(J)=L:RETURN                                   '*  2457
460 IF G=65 THEN 480                                                    '*  1123
470 PRINT"Stripped prompts from ";:GOTO 490                             '*  3435
480 PRINT"Added prompts to ";                                           '*  2290
490 PRINT FI$" and output result to "FO$:PRINT                          '*  3559
500 PRINT"Press <ENTER> for Module information"                         '*  3934
510 PRINT:FOR K=1 TO J                                                  '*  1386
520 G$=INKEY$:IF G$="" THEN 520                                         '*  1758
530 IF G$=" " THEN 520                                                  '*  1145
540 PRINT "Module # "K,"Total Length is"A(K)                            '*  3213
550 NEXT:IF G=65 AND N=65 THEN 700 ELSE IF G=65 THEN 660                '*  3314
560 PRINT"Do you wish to add directory records to the /KSM file?
     <Y/N>"                                                             '*  5879
570 G$=INKEY$:IF G$="" THEN 570                                         '*  1768
580 G=ASC(G$) AND 95                                                    '*  1109
590 IF G=78 THEN 660                                                    '*  1131
600 IF G<>89 THEN 570                                                   '*  1186
610 FOR K=1 TO J:K$=STR$(K):K$=RIGHT$(K$,LEN(K$)-1)                     '*  2996
620 PRINT "Enter Dir Record"K"  ";:LINE INPUT M$                        '*  3346
630 IF M$="" THEN 650                                                   '*  1124
640 M$=K$+") "+M$+STR$(A(K)):PRINT#2,M$:PRINT M$                        '*  2738
650 NEXT                                                                '*   506
660 CLOSE:PRINT "Continue? <Y/N>"                                       '*  2385
670 G$=INKEY$:IF G$="" THEN 670                                         '*  1770
680 G=ASC(G$) AND 95                                                    '*  1110
690 IF G=89 THEN 20 ELSE END                                            '*  1652
700 PRINT "If you wish to append another /KSM file, press <A>           '*  4999
710 G$=INKEY$:IF G$="" THEN 710                                         '*  1760
720 G=ASC(G$) AND 95:IF G=13 THEN 710                                   '*  2089
730 IF G<>65 THEN 660 ELSE CLOSE 1                                      '*  2000
740 Q$="A":GOSUB 400:FI$=F$+"/KSM"+D$:GOSUB 360:GOTO 130                '*  3242
```

End

commands to install the filter:

```
SET *KM KSM/FLT file name/KSM
FILTER *KI *KM
```

Interesting Combinations

To combine existing KSM files, use the DOS Append command or Add Strip's Append option.

Suppose you have three KSM files called A, B, and C/KSM on a disk in drive 1 and a RAM disk in drive 2. The following steps yield combined files, COM/FIL and COM/KSM, which add the character count and directory to the end of COM/KSM and let you edit COM/FIL.

First, type in and enter the following:

```
COPY A/KSM:1 TO COM/KSM:2
```

Run Add Strip from Basic, and answer the "Filname:d >" prompt with COM:2 (the extension is unnecessary). At the "<A>dd or <S>trip" prompt, press the A key; the program reads from COM/KSM:2 and writes COM/FIL:2.

Hold down the spacebar to advance through the messages and review the file. Press the enter key for a module count, and answer the "Append" prompt with "A" followed by the next file name, B:1. The message, "Reading from B/KSM:1 and writing to COM/FIL:2" will appear.

COM/FIL now contains two modules, and character counts appear for both. Proceed similarly with C/KSM. Answer the "Continue" prompt by pressing the Y key, and enter COM:2 for "Filname:d." Then strip COM/FIL:2 (press the S key) to yield COM/KSM:2.

Three character-count lines will appear at the end of the Strip option; after each, type in a name to produce a directory (Add Strip adds a line consisting of the module number, name, and character count).

The character count Add Strip creates is important if you want to replace one KSM data set with another. If the second data set is equal in length to or shorter than the first, the KSM installation allows the replacement; otherwise you have to reboot. Add Strip combines the counts with an identifying name in a simple directory.

Use the following DOS command to display the directory neatly at the bottom of the screen:

```
LIST COM/KSM
```

A typical directory might read:

```
1) Basic 207
2) DOS Cmds 189
3) Vendors 503
```

If you installed module 2 (DOS Cmds) first, you couldn't replace it with the 207-character Basic file; you could replace module 3, however, with module 1 or 2.

To install the Vendors KSM file in LDOS 5.1.x, you would type the following:

```
FILTER *KI KSM COM:d (N=3
```

Since the default value of N is 1, typing the following:

```
FILTER *KI KSM COM:d
```

would install the Basic KSM file.

You can try an interesting trick in LDOS 5.1.x to move from the current KSM data set to any other set in COM/KSM. Set the Z key to call the following command:

```
FILTER *KI KSM COM:1(N=
```

From now on, pressing control-Z and the module number moves you to the new module.

To switch back and forth between two KSM files, program the Z key of module 1 with the following:

```
FILTER *KI KSM(N=2;
```

Do the same with the Z key in module 2, except for setting N equal to 1;. If you invoke KSM with the longer member of the two, pressing control-Z switches you to the other set (KSM interprets the semicolon as an embedded enter command).

These file-switching techniques are unavailable in TRSDOS 6.2 because of the complexity of the command structure for invoking KSM. To replace a KSM data set in TRSDOS 6.2, enter the following:

```
RESET *KI
RESET *KM
SET *KM KSM NEW/KSM (N=n)
FILTER *KI *KM
```

■

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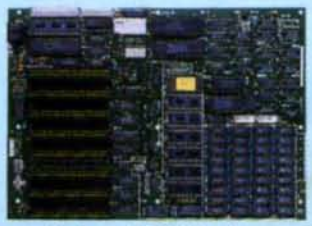

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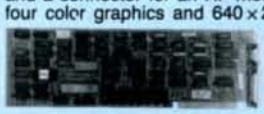

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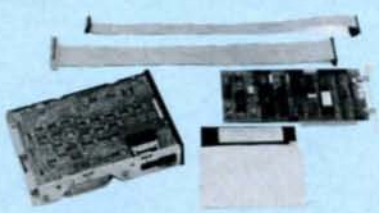

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Deep-Six Your Directories

Rid your disks of unwanted subdirectories with just a few keystrokes.

The Tandy 1000 has several handy features, including the ability to manipulate files stored in subdirectories. I usually store a back-up copy of my working files in a subdirectory until I finish writing a section of code. After I've debugged the section, I copy the source files to the original root directory. This saves some disk swapping, and I don't end up with two duplicate disks.

A roadblock appears, however, when I finish writing and want to clean the disk. I can use MS-DOS's RMDIR (remove directory) command to delete a subdirectory entry from the root directory, but RMDIR won't delete a subdirectory that contains files. I first have to purge the directory with the Delete or Erase command.

My program, Delete Directory, lets you delete a subdirectory with files in it. Type the Program Listing into your editor/assembler and link it so that you have an executable file. If you have a subdirectory to delete, type DELDIR at the command prompt and press the enter key.

The utility prompts you for the name of the subdirectory you want removed. You can enter a subdirectory name with or without a drive specification. The program reads the subdirectory files, displays each file name it finds, and asks if you want to continue. Typing an N aborts the program and returns you to the MS-DOS command prompt. Typing a Y instructs the program to proceed with the deletion.

Reading Labels

The utility includes several assembly-language routines. First, a function call at the Begin label finds the current default drive and places the selected drive number (zero to 4) in the AL register. It then makes a set of comparisons to determine the drive number and stores the corresponding drive letter in the path-name buffer (Path1).

Function 09H of INT 21H displays the subdirectory-name prompt and holds it until the program finds a string ($) delimiter. The input buffer specifies a name of no more than eight characters. The program stores the number of bytes you enter at NAMD + 1 and converts the name to an ASCIIZ string.

Another function call at the BeginA label changes the current path to that of the subdirectory, enabling the program to search for file names stored there. If the program can't find the subdirectory, it displays an error message and returns to MS-DOS.

If the subdirectory exists, the program branches to the Show1 label to search for the first occurrence of a file name. By specifying a file-control block (FCB) filled with question marks, the function call returns the first file name it finds.

The program displays the file name via the INT 10H function. It then uses the find-next-occurrence call at the Show3 label to search the rest of the subdirectory. When finished, it asks if you want to continue and uses the INT 16H function to check the response.

The deletion begins at the label Begin2, which again uses the directory-searching routines to load the FCB buffer with a file name. When the program has deleted all the files, it branches to the Done label and displays the message "All files have been deleted." The final portion of the program uses function call 3AH of INT 21H to remove the subdirectory entry from the root directory.■

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

System Requirements

Tandy 1000
MS-DOS
Editor/assembler

Program Listing. Delete Directory.

```
stacksg segment para stack 'stack'
        db      256 dup(0)
stacksg ends
datasg  segment para 'data'
namd    db      8               ;maxm # bytes allowed
        db      ?               ;actual # bytes entered
        db      9 dup(0)        ;sub-directory filespec
buffer  db      128 dup(0)      ;buffer for filenames found in sub-dir
fcb     db      0,'???????????' ;buffer for file to delete
        db      25 dup(0)       ;rest of it is here
path1   db      'a:..',0
err1    db      0dh,0ah,'No such Sub-Directory found by that name!',07,'$'
msg1    db      0dh,0ah,'Enter the name of the SUB-DIRECTORY to delete> ','$'
msg2    db      0dh,0ah,'All files have been deleted','$'
msg3    db      0dh,0ah,'This sub-directory contains the following files:','$'
msg4    db      0dh,0ah,0dh,0ah
        db      'Do you wish to proceed with the deletion process (Y/N) ?','$'
datasg  ends
codesg  segment para 'code'
start   proc    far             ;set
        push    ds              ;up
        sub     ax,ax           ;return
        push    ax              ;to
        mov     ax,datasg       ;dos
        mov     ds,ax           ;for data
        mov     es,ax           ;for extra segment
        assume  cs:codesg,ds:datasg,es:datasg,ss:stacksg
begin:  mov     ah,19h          ;get current drive default
        int     21h             ;call dos
        cmp     al,00h          ;drive A?
        je      driva           ;go if so
        cmp     al,01h          ;drive B?
        je      drivb           ;go if so
        cmp     al,02h          ;drive C?
        je      drivc           ;go if so
        cmp     al,03h          ;drive D?
        je      drivd           ;go if so
        jmp     error           ;else no such drive
driva:  mov     al,'a'          ;show its drive A
        jmp     dirp            ;and continue
drivb:  mov     al,'b'          ;show its drive B
        jmp     dirp            ;and continue
drivc:  mov     al,'c'          ;show its drive C
        jmp     dirp            ;and continue
drivd:  mov     al,'d'          ;show it drive D
dirp:   mov     bx,offset path1 ;point to root directory
        mov     [bx],al         ;store the code for later
        lea     dx,msg1         ;prompt for sub-directory name now
        mov     ah,09h          ;display function
```

Listing continued

Listing continued

```
          int     21h             ;call dos
          mov     dx,offset namd  ;point to input buffer
          mov     ah,0ah          ;line input function
          int     21h             ;get sub-dir name from user
          mov     bl,namd+1       ;now make it an
          mov     bh,0            ;ASCIIZ string
          mov     [namd+bx+2],0   ;for it
          cmp     bx,00h          ;was a name entered?
          jne     begina          ;continue if so
          jmp     dos             ;else exit the program
begina:   mov     dx,offset namd+2;point to sub-directory to go to
          mov     ah,3bh          ;change current directory
          int     21h             ;call dos
          jnc     show            ;go if everything is ok
          jmp     error           ;else error occurred
show:     lea     dx,msg3         ;contains files messages
          mov     ah,09h          ;display function
          int     21h             ;call dos
show1:    mov     dx,offset buffer;point to buffer
          mov     ah,1ah          ;set as DTA area
          int     21h             ;call dos
          mov     dx,offset fcb   ;look for first occurence
          mov     ah,11h          ;search function
          int     21h             ;call dos
          or      al,al           ;did we find one?
          jnz     show6           ;abort to dos if not
          mov     al,0dh          ;else display a c/r
          mov     ah,0eh          ;display function
          int     10h             ;call bios
          mov     al,0ah          ;get a linefeed too
          int     10h             ;call bios
show4:    mov     bx,offset buffer;point to filespec
          inc     bx              ;move up 1 place first
          mov     cx,11           ;this many bytes
show2:    mov     al,[bx]         ;get the byte there
          mov     ah,0eh          ;display function
          int     10h             ;call bios
          inc     bx              ;point to next
          loop    show2           ;til filespec shown
          mov     al,0dh          ;get a c/r
          mov     ah,0eh          ;display function
          int     10h             ;call bios
          mov     al,0ah          ;get a linefeed
          int     10h             ;call bios
show3:    mov     dx,offset buffer;point to buffer
          mov     ah,1ah          ;set as DTA area
          int     21h             ;call dos
          mov     dx,offset fcb   ;search next filespec
          mov     ah,12h          ;search function
          int     21h             ;call dos
          or      al,al           ;did we find one?
          jnz     show5           ;go continue if not
          jmp     show4           ;else display this filespec too
show6:    jmp     dos             ;no files at all found!
show5:    lea     dx,msg4         ;proceed with deletion?
          mov     ah,09h          ;display function
          int     21h             ;call dos
inkey:    mov     ah,00h          ;wait for a keypress
          int     16h             ;call bios
          and     al,5fh          ;make it uppercase
          cmp     al,'Y'          ;yes we want to do it
          je      dodel           ;go if so
          cmp     al,'N'          ;no abort the program
          je      nodel           ;go if so
          jmp     inkey           ;back if not valid
dodel:    jmp     begin2          ;and continue deleting
nodel:    jmp     dos             ;exit to dos then
begin2:   mov     dx,offset buffer;point to buffer
          mov     ah,1ah          ;set as DTA area
          int     21h             ;call dos
          mov     dx,offset fcb   ;search for first occurence of a file
          mov     ah,11h          ;search function
          int     21h             ;call dos
          or      al,al           ;was a filename found?
          jnz     done            ;go if none found
delit:    mov     dx,offset fcb   ;point to filename to delete
          mov     ah,13h          ;delete function
          int     21h             ;call dos
nextfl:   mov     dx,offset buffer;point to buffer
          mov     ah,1ah          ;set as DTA area
          int     21h             ;call dos
          mov     dx,offset fcb   ;search for next directory file
          mov     ah,12h          ;search function
          int     21h             ;call dos
          or      al,al           ;was a filename found?
          jnz     done            ;exit if no more found in dir
          jmp     delit           ;else delete this file
done:     lea     dx,msg2         ;all files have been deleted
          mov     ah,09h          ;display function
          int     21h             ;call dos
          lea     dx,path1        ;go back to root directory now
          mov     ah,3bh          ;change directory function
          int     21h             ;call dos
          mov     dx,offset namd+2;sub-directory to delete from root
          mov     ah,3ah          ;remove a directory entry function
          int     21h             ;call dos
          jnc     dos             ;go if successful
error:    lea     dx,err1         ;error message - no such sub-dir
          mov     ah,09h          ;display function
          int     21h             ;call dos
dos:      mov     ah,4ch          ;terminate program
          int     21h             ;now
start     endp
codesg    ends
          end     start                                        End
```

Easy Interpolation

Researchers analyzing scientific data can use this program to visualize the relationship of variables.

Finding the relationship between two variables is the first aim of much scientific research. Expressing this relationship by means of a mathematical equation and then constructing a data curve is the next logical step. But even scientists who are proficient at math sometimes have difficulty determining which function will best interpolate points on a curve. To help solve this problem, I wrote Interpolate.

Interpolate asks you to enter pairs of data points (X,Y). It then computes seven types of equations—random, linear, exponential, logarithmic, sigmoid, quadratic, and normal—and determines which one best interpolates the data on a graph. Scientists analyzing the data can then use the computed formula to plot the values of Y when only the values of X are known.

Plotting a Course

Interpolate is written in Model 4 Disk Basic and runs without alteration on the Models 4, 4D, and 4P. It will also run on the Models I and III and on the Tandy 1000, 1200, and 3000 with minor modifications. I've listed all changes at the end of the article.

Type in the Basic code shown in the Program Listing and save it as Interpol/BAS. Then run it. The program asks you to enter data points (X,Y) one pair at a time. Y refers to the variable whose values you will later want to ascertain based on the values of X. Enter the data by typing the numbers at the prompts and pressing the enter key.

Be sure to enter the variables in the correct order. If you are a fast typist and have a slow machine, you might want to slow down to be sure of properly typing in the data. If you make a mistake while entering a data point, you can correct it by backspacing. If you discover a mistake after you've pressed the enter key, press C and then the enter key to make the correction.

LOAD 80

System Requirements

Model 4
(Models I/III and Tandy 1000/1200/3000 with changes)
Basic

Function type	Equation	Biological variables
Random	$Y = A$	Any condition in which Y is not dependent on X.
Linear	$Y = A + BX$	Conduction velocity in myelinated nerve fibers as a function of diameter. Oxygen consumption as a function of oxygen concentration (at low concentration levels) in vertebrates.
Exponential	$Y = A \times B^X$	Enzyme activity as a function of temperature. Metabolism as a function of ambient temperature in ectotherms.
Logarithmic	$Y = A \times X^B$	Metabolic rate as a function of body mass in vertebrates. Heart rate as a function of body mass in mammals.
Sigmoid	$Y = A + B \times \tanh \frac{X - M}{M/4}$	Oxygen-hemoglobin dissociation curve. Survival to heat stress as a function of acclimation.
Quadratic	$Y = A + BX + CX^2$	Work performed by a muscle as a function of force requirement. Firing rate of thermoreceptors as a function of temperature.
Normal	$Y = A \times e^{\frac{-(X-M)^2}{2V}}$	Distribution of IQ scores, body weight, height, and so forth in a human population.

Note: M = mean V = variance e = 2.71828

$$\tanh x = \frac{e^x - e^{-x}}{e^x + e^{-x}}$$

Table 1. The seven equations computed by Interpolate with examples of biological variables.

To tell the computer that you've finished entering data, press E and then the enter key. Scroll-protected instructions for correcting mistakes and ending data entry appear at the top of the screen.

Table 1 lists the seven equations computed by the program and examples of biological variables. Interpolate uses a different process to compute each equation type. The random function implies independence between the variables X and Y; it serves as a control procedure only. The linear and quadratic interpolations are computed according to the principle of least-squares.

The logarithmic (also called "power function") and exponential interpolations are also computed according to the principle of least-squares, after linearization through logarithmic transformation. If X or Y is a negative or null value, the program skips these two functions, since logarithms of negative values do not exist. The sigmoid and normal interpolations are computed with empirical formulas based on the hyperbolic tangent and the normal probability curve, respectively.

After calculating all equations, the program uses the values of the independent variable (values on the X axis) to estimate sets of values for the dependent variable (values on the Y axis). It then compares the estimated Y values with the actual ones by performing a chi-square (χ^2) test.

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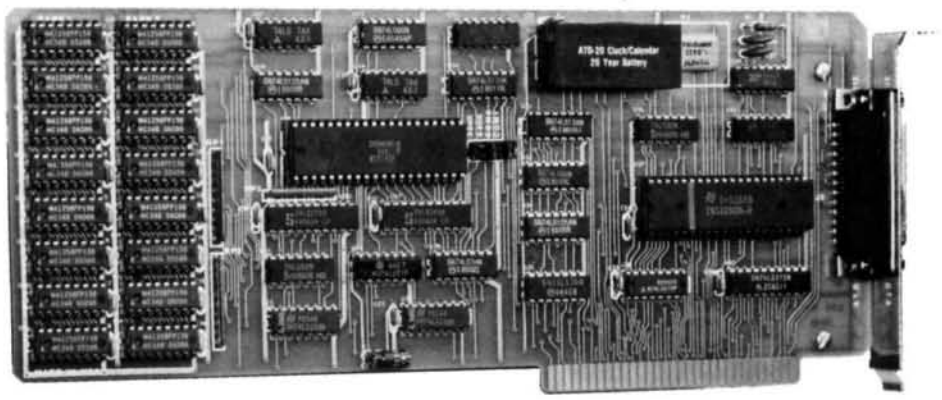

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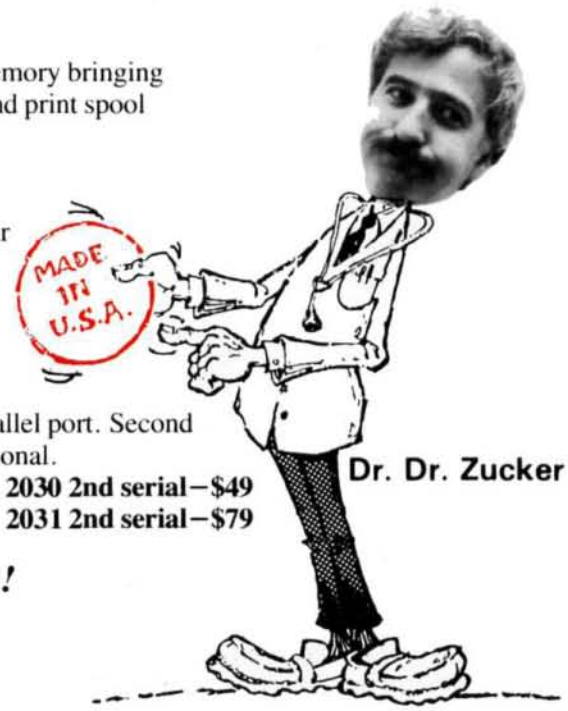

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A chi-square test tells how well actual data points adhere to, or resemble, estimated data points and vice versa. A strict mathematician would not recommend this application of the chi-square test. For the purposes of this program, however, the test is effective and provides results with a level of accuracy appropriate for most work in the biological sciences.

When it completes the chi-square test, Interpolate selects the equation that generates new data adhering most closely to the actual data. It displays the name and equation for each of the seven functions on screen and prints the one that best fits the data at the bottom of the list.

A Fit Example

For a better understanding of what I mean by fitting the data, examine Table 2, which gives quality ratings (on a scale from zero to 10) of programs on a hypothetical cable TV station over a 10-month period. If you run Interpolate using the data, you'll find that the ratings are an exponential function of time (see Figure). You could estimate the quality of entertainment in the 12th month by substituting 12 for X in the equation: $3 \times 1.1^{12} = 9.4$.

If you use an exponential equation to find the quality of entertainment in the 10th month (3×1.1^{10}), you'll obtain a result of 7.8, which adheres to the real data. Any of the other equations will describe the real data less accurately. The linear equation, for example, will indicate a rating of 7.5 in the 10th month. The best fit is not necessarily a good fit. As a rule, the more data points you provide, the more precise the interpolation will be.

In addition to its applications in the life sciences, Interpolate can also be used in such fields as business and the social sciences. A stock analyst, for example, can use it to predict trends on Wall Street.

The Sum of Its Parts

Interpolate comprises five sections of code. For the sake of clarity, I've declared all variables and functions at the beginning (lines 60–190). Some of these declarations are not necessary; if you want, you can omit lines 150–180. The dimension (DIM) statement in line 140 determines the maximum number of data pairs the program will accept (currently, 50 pairs). You can increase this number if your system provides you with enough RAM (the printed version of Interpolate requires less than 5K for program lines and less than 1K for variable storage).

The second part of the program is the data-entry section (lines 200–390), which is followed by a calculations section (lines 400–480). The fourth part (lines 490–1000) calculates the coefficients for each equation. The last section (lines 1010–1320) contains subroutines and Data statements.

You can easily modify Interpolate to run on most Tandy computers. To install it on the Models I and III, make the following changes.

Month	Grade
1	3.3
2	3.6
3	4.0
4	4.4
5	4.8
6	5.3
7	5.8
8	6.4
9	7.1
10	7.8

Table 2. Quality ratings of programs on a hypothetical cable TV channel.

- Substitute an open bracket ([) or up arrow (↑) for the caret (^) in lines 120, 440, 450, 460, 700, 790, 830, 850, 890, 910, 1070, 1090, 1100, 1110, and 1130.
- Delete lines 1160 and 1280–1310.
- Change line 50 to read:

```
50 CLEAR 1000
```

- Change line 210 (Model III only) to read:

```
210 POKE 16916,4
```

- Delete lines 210 and 510 (Model I only).
- Change line 510 (Model III only) to read:

```
510 POKE 16916,0
```

- Change line 980 to read:

```
980 PRINT ">> BEST FIT: ";Z;" <<"
```

Tandy MS-DOS Changes

Since Model 4 Disk Basic is almost identical to IBM Basic, the program is compatible with the Tandy 1000, 1200, and 3000. To preserve the program's scroll-protection feature, however, you should make the following modifications.

- Delete lines 210 and 1280–1310.
- Insert line 265 as follows:

```
265 VIEW PRINT 5 TO 24
```

- Change line 510 to read:

```
510 VIEW PRINT
```

■

You can write to Roberto Refinetti at the Instituto de Psicologia, Universidade de Sao Paulo, 05508 Sao Paulo, SP, Brazil.

```
RANDOM
Y = 5.25

LINEAR
Y = 2.52667 + .495151*X

QUADRATIC
Y = 3.07667 + .220149*X + .0250002*X^2

SIGMOID
Y = 5.25  + 2.25 * TANH((X - 5.5)/1.375)

NORMAL
Y = 7.8*EXP(-(X- 5.5)^2/6.5222)

EXPONENTIAL
Y = 2.98904 * 1.10032^X

LOGARITHMIC
Y = 2.86923 * X^ .375191

>> BEST FIT: EXPONENTIAL <<    PRESS <ENTER> TO RUN AGAIN...
```

Figure. When you run Interpolate, you find that ratings are an exponential function of time.

Program Listing. Interpol/BAS. (See p. 116 for information on using the checksums in this listing.)

```
10 '************************************************************ '*   97
20 '                      I N T E R P O L                       '*   98
30 '                  BY R. REFINETTI, 1986                     '*   99
40 '************************************************************ '*  100
50 CLEAR                                                        '*  492
60 'VARIABLE DECLARATIONS .:..................................... '*  102
70 DEFSNG A-F : DEFSNG O-Y                                      '* 1592
80 DEFINT G-N                                                   '*  804
90 DEFSTR Z                                                     '*  715
100 DEF FN FT(A)=(EXP(A)-EXP(-A))/(EXP(A)+EXP(-A))              '* 2876
110 DEF FN FL(A)=LOG(A)*.434295                                 '* 1725
120 DEF FN FV(A,B,C)=(A-B^2/N)/(N-2)/SQR(N)                     '* 2461
130 DIM CH(7) : DIM B(3,4)                                      '* 1371
140 DIM DA(2,150)                                               '*  889
150 DIM N,X1,X2,X3,X4                                           '* 1240
160 DIM Y1,YX,XY,AM,VA                                          '* 1394
170 DIM YM,A,X,Y,R,S                                            '* 1227
180 DIM G,H,I,J,K,L,M : DIM Z,ZA                                '* 1878
190 R=10000 : S=-10000                                          '* 1122
200 'DATA ENTRY ................................................ '*  146
210 GOSUB 1280 : X%=4 : CALL SCROLL(X%)                         '* 2265
220 CLS                                                         '*  406
230 PRINT "* * * * * * * * *  INTERPOLATIONS  * * * * * * * * *" '* 3157
240 PRINT "*        ENTER X AND Y VALUES AT THE PROMPTS        *" '* 3640
250 PRINT "* TO CORRECT: <C> <ENTER>      TO END: <E> <ENTER> *" '* 3787
260 PRINT "* * * * * * * * * * * * **** * * * * * * * * * * * *" '* 2625
270 N=N+1                                                       '*  494
280 PRINT N; : LINE INPUT " X: ";Z                              '* 2061
```

Listing continued

Listing continued

```
290 IF Z=CHR$(67) OR Z=CHR$(99) THEN N=N-1 : GOTO 330                    '*  3083
300 IF Z=CHR$(69) OR Z=CHR$(101) THEN 500                                '*  2330
310 IF RIGHT$(Z,1)>"9" THEN 280                                          '*  1745
320 DA(1,N)=VAL(Z) : IF DA(1,N)<=0 THEN L=1                              '*  2429
330 PRINT N; : LINE INPUT " Y: ";Z                                       '*  2058
340 IF Z=CHR$(67) OR Z=CHR$(99) THEN 280                                 '*  2305
350 IF RIGHT$(Z,1)>"9" THEN 330                                          '*  1745
360 DA(2,N)=VAL(Z) : IF DA(2,N)<=0 THEN M=1                              '*  2436
370 IF DA(2,N)<R THEN R=DA(2,N)                                          '*  1785
380 IF DA(2,N)>S THEN S=DA(2,N)                                          '*  1790
390 PRINT : GOTO 270                                                     '*  1205
400 'BASIC CALCULATIONS ..........................................       '*   148
410 X1=0:X2=0:X3=0:X4=0:Y1=0:XY=0:YX=0:FOR I=1 TO N                       '*  3147
420 IF G=6 OR G=7 THEN Y=FNPL(DA(2,I)) ELSE Y=DA(2,I)                    '*  3120
430 IF G=7 THEN X=FNPL(DA(1,I)) ELSE X=DA(1,I)                           '*  2706
440 X1=X1+X : X2=X2+X^2 : X3=X3+X^3                                      '*  2121
450 X4=X4+X^4 : Y1=Y1+Y : XY=XY+X*Y                                      '*  2193
460 YX=YX+X^2*Y : NEXT I                                                 '*  1553
470 AM=X1/N : YM=Y1/N : VA=FNPV(X2,X1,N)                                 '*  2424
480 RETURN                                                               '*   668
490 'DETERMINATION OF COEFFICIENTS ..............................        '*   157
500 N=N-1                                                                '*   492
510 X%=0 : CALL SCROLL(X%)                                               '*  1523
520 CLS                                                                  '*   409
530 G=1 : REM                                          RANDOM            '*  2508
540 GOSUB 410 : GOSUB 1030                                               '*  1484
550 PRINT "Y =";YM                                                       '*  1090
560 G=2 : H=2 : REM                                    LINEAR            '*  2619
570 B(1,1)=N : B(1,2)=X1 : B(1,3)=Y1                                     '*  1838
580 B(2,1)=X1 : B(2,2)=X2 : B(2,3)=XY                                    '*  1941
590 GOSUB 1210 : IF G<>2 THEN RETURN                                     '*  2189
600 GOSUB 1030                                                           '*   794
610 ZA="Y ="+STR$(B(1,3))+" "  : IF B(2,3)>=0 THEN ZA=ZA+"+"              '*  3176
620 ZA=ZA+STR$(B(2,3))+"*X" : PRINT ZA                                   '*  2203
630 G=3 : H=3 : REM                                    QUADRATIC         '*  2846
640 B(1,1)=N  : B(1,2)=X1 : B(1,3)=X2 : B(1,4)=Y1                        '*  2481
650 B(2,1)=X1 : B(2,2)=X2 : B(2,3)=X3 : B(2,4)=XY                        '*  2554
660 B(3,1)=X2 : B(3,2)=X3 : B(3,3)=X4 : B(3,4)=YX                        '*  2562
670 GOSUB 1210 : GOSUB 1030                                              '*  1535
680 ZA="Y ="+STR$(B(1,4))+" " : IF B(2,4)>=0 THEN ZA=ZA+"+"              '*  3153
690 ZA=ZA+STR$(B(2,4))+"*X " : IF B(3,4)>=0 THEN ZA=ZA+"+"               '*  3191
700 ZA=ZA+STR$(B(3,4))+"*X^2" : PRINT ZA                                 '*  2348
710 G=4 : REM                                          SIGMOID           '*  2586
720 GOSUB 1030                                                           '*   797
730 ZA="Y ="+STR$(YM)+" " : IF (S-R)/2 >= 0 THEN ZA=ZA+" +"              '*  3214
740 ZA=ZA+STR$((S-R)/2)+" * TANH((X -"+STR$(AM)                          '*  2667
750 ZA=ZA+")/"+MID$(STR$(AM/4),2)+")" : PRINT ZA                         '*  2695
760 G=5 : REM                                          NORMAL            '*  2525
770 GOSUB 1030                                                           '*   802
780 ZA="Y ="+STR$(S)+"*EXP(-(X-"+STR$(AM)                                '*  2348
790 ZA=ZA+")^2/"+MID$(STR$(2*VA),2)+")" : PRINT ZA                       '*  2845
800 G=6 : H=2 : REM                                    EXPONENTIAL       '*  2920
810 IF M=1 THEN CH(6)=5E+20 :CH(7)=5E+20 : GOTO 930                      '*  2824
820 GOSUB 410 : GOSUB 570                                                '*  1445
830 B(1,3)=10^B(1,3) : B(2,3)=10^B(2,3)                                  '*  1979
840 GOSUB 1030                                                           '*   800
850 ZA="Y ="+STR$(B(1,3))+" *"+STR$(B(2,3))+"^X"                         '*  2534
860 PRINT ZA                                                             '*   774
870 G=7 : H=2 : REM                                    LOGARITHMIC       '*  2908
880 IF M=1 OR L=1 THEN CH(7)=5E+20 : GOTO 930                            '*  2554
890 GOSUB 410 : GOSUB 570 : B(1,3)=10^B(1,3)                             '*  2408
900 GOSUB 1030                                                           '*   797
910 ZA="Y ="+STR$(B(1,3))+" * X^"+STR$(B(2,3))                           '*  2452
920 PRINT ZA : PRINT                                                     '*  1290
930 A=10000 : REM                                      BEST FIT          '*  2682
940 FOR I=1 TO 7                                                         '*   917
950 IF CH(I)<A THEN A=CH(I) : G=I                                        '*  1896
960 NEXT I : RESTORE                                                     '*  1285
970 FOR I=1 TO G : READ Z : NEXT I                                       '*  2010
980 PRINT ">> BEST FIT: ";Z;" <<    PRESS <ENTER> TO RUN AGAIN";         '*  3901
990 LINE INPUT Z                                                         '*  1044
1000 CLS : GOTO 50                                                       '*  1019
1010 'SUBROUTINES ..............................................         '*   194
1020 REM CHI-SQUARE                                                      '*  1209
1030 FOR I=1 TO N : Y=DA(2,I)                                            '*  1632
1040 ON G GOTO 1050,1060,1070,1080,1090,1100,1110                        '*  2519
1050 X=YM : GOTO 1120                                                    '*  1208
1060 X=B(1,3)+B(2,3)*DA(1,I) : GOTO 1120                                 '*  2091
1070 X=B(1,4)+B(2,4)*DA(1,I)+B(3,4)*DA(1,I)^2 : GOTO 1120                '*  2997
1080 A=(DA(1,I)-AM)/(AM/4) : X=YM+FNFT(A)*((S-R)/2) : GOTO 1120          '*  3478
1090 X=S*EXP(-(DA(1,I)-AM)^2/(2*VA)) : GOTO 1120                         '*  2697
1100 X=B(1,3)*B(2,3)^DA(1,I) : GOTO 1120                                 '*  2137
1110 X=B(1,3)*DA(1,I)^B(2,3)                                             '*  1475
1120 IF X>1E+10 OR CH(G)>1E+10 THEN 1140                                 '*  2212
1130 IF X<>0 THEN CH(G)=CH(G)+ABS((Y-X)^2/X)                             '*  2592
1140 NEXT I : RESTORE                                                    '*  1324
1150 FOR I=1 TO G : READ Z : NEXT I                                      '*  2049
1160 IF G>1 THEN PRINT                                                   '*  1353
1170 PRINT Z : RETURN                                                    '*  1354
1180 REM DATA STATEMENTS                                                 '*  1584
1190 DATA RANDOM,LINEAR,QUADRATIC,SIGMOID                                '*  2767
1200 DATA NORMAL,EXPONENTIAL,LOGARITHMIC                                 '*  2744
1210 REM SOLVE SIMULTANEOUS EQUATIONS                                    '*  2579
1220 FOR J=1 TO H : IF B(J,J)<>0 THEN A=1/B(J,J) ELSE A=0                '*  3244
1230 FOR K=1 TO H+1 : B(J,K)=A*B(J,K) : NEXT K                           '*  2587
1240 FOR I=1 TO H : IF I=J THEN 1270                                     '*  2050
1250 A=-B(I,J) : FOR K=1 TO H+1                                          '*  1702
1260 B(I,K)=B(I,K)+A*B(J,K) : NEXT K                                     '*  2010
1270 NEXT I : NEXT J : RETURN                                            '*  1807
1280 'SUBROUTINE SCROLL PROTECT                                          '*   203
1290 DIM NT(4) : SCROLL=VARPTR(NT(1))                                    '*  2279
1300 NT(1)=3902 : NT(2)=1798 : NT(3)=-4274                               '*  2211
1310 NT(4)=201 : RETURN                                                  '*  1334
1320 '************************************************************      '*   198
```

End

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Routine Plays

Adding these subroutines to your data-base program will save time and memory.

You've just input a large data file, which contains the names of over 1,000 cities under one field category. As you prepare to print out the file, you have the nagging suspicion that you misspelled "Seattle." To find the mistake, you have no choice but to go back and examine every entry of that city's name.

Sound familiar? Correcting input errors is a common and universally disliked chore among computer operators. To remove this curse, I've written Tally and Sweep, two routines that find and replace errors in data files. Both routines are easy to enter and use. Type in the Basic code in Program Listings 1 and 2 and save the routines under the file names Tally/BAS and Sweep/BAS, respectively.

Sweeping Reforms

Run Tally whenever you want to check a data file for errors. You will have to change the file name in line 100 for every new data file that you want to check. Similarly, change the Field statement in line 110 so that it corresponds to the Field statement of your file. Then specify which of these fields you want to search by changing the CI$ variable in line 150.

When called from Basic, Tally searches the disks in your system's drives for the file name you specified. When it locates the file, the routine searches through the specified field, tabulates entries with the same spelling, and displays them.

Say, for example, you search an address field containing city names for a possible misspelling of "Seattle." If the file contains 10 entries, five of which are "Seattle," three of which are "Spokane," two of which are "Olympia," and one of which is "Seattle," Tally will display the following:

Seattle	5
Spokane	2
Olympia	2
Seatle	1

Program Listing 1. Tally/BAS. See p. 116 for information on using the checksums in Listings 1–3.

```
10 OPEN "D",1,"FILESPEC"                                          '*  1395
20 FIELD 1,20 AS NA$,20 AS AD$,20 AS CI$,2 AS ST$,5 AS ZI$ .       '*  3170
30 FOR K=1 TO LOF(1)                                              '*  1161
40 GET 1,K                                                        '*   556
50 FOR K9=1 TO 2000                                               '*  1059
60 IF G$(K9)=CI$ THEN G(K9)=G(K9)+1:K9=2000:GOTO 80               '*  2906
70 IF G$(K9)="" THEN G$(K9)=CI$:G(K9)=1:K9=2000:GOTO 80           '*  3087
80 NEXT                                                           '*   455
90 NEXT:CLOSE                                                     '*   888
100 FOR K9=1 TO 2000                                              '*  1103
110 IF G(K9)=0 THEN K9=2000:GOTO 130                              '*  2051
120 PRINT G$(K9);G(K9)                                            '*  1271
130 NEXT                                                          '*   499
```

End

Program Listing 2. Sweep/BAS.

```
10 LINE INPUT "Wrong spelling ";WR$                               '*  2672
20 LINE INPUT "Correct spelling ";CR$                             '*  2850
30 OPEN "D",1,"FILESPEC"                                          '*  1397
40 FIELD 1,20 AS NA$,20 AS AD$,20 AS CI$,2 AS ST$,5 AS ZI$        '*  3172
50 FOR K=1 TO LOF(1)                                              '*  1163
60 GET 1,K                                                        '*   558
70 IF LEFT$(CI$,LEN(WR$))=LEFT$(WR$,LEN(WR$)) THEN GOSUB 90       '*  3578
80 NEXT:CLOSE:END                                                 '*  1160
90 A$=NA$:B$=AD$:C$=CR$:D$=ST$:E$=ZI$                             '*  2124
100 LSET NA$=A$:LSET AD$=B$:LSET CI$=C$                           '*  2338
110 LSET ST$=D$:LSET ZI$=E$                                       '*  1657
120 PUT 1,K                                                       '*   628
130 RETURN                                                        '*   660
```

End

Program Listing 3. Lookup/BAS.

```
10 OPEN "D",1,"MAIN/DAT",33                                       '*  1511
20 FIELD 1,30 AS PT$,3 AS S$                                      '*  1548
30 OPEN "D",2,"SUPPLIER/DAT",60                                   '*  1849
40 FIELD 2,20 AS SP$,30 AS AD$,10 AS CI$                          '*  2176
50 F=LOF(1):X=LOF(2):DIM SA$(X)                                   '*  1843
60 FOR K=1 TO X                                                   '*   897
70 GET 2,K:SA$(K)=SP$                                             '*  1218
80 NEXT K                                                         '*   562
90 F=F+1:INPUT "NAME OF PART: ";P$                                '*  2866
100 IF P$="END" OR P$="end" THEN CLOSE:END                        '*  2607
110 INPUT "Number of Supplier: ";SU$                              '*  2777
120 IF SU$="?" THEN GOSUB 190:GOTO 110                            '*  2236
130 N=VAL(SU$)                                                    '*   831
140 IF N>X THEN PRINT "Not a valid number":GOTO 110               '*  3672
150 PRINT "     ";SA$(N)                                          '*  1209
160 LPRINT P$,SA$(N)                                              '*  1191
170 LSET PT$=P$:LSET S$=SU$:PUT 1,F                               '*  2193
180 GOTO 90                                                       '*   635
190 FOR K=1 TO X:PRINT SA$(K):NEXT K:RETURN                       '*  2798
```

End

To replace "Seatle" with the correct spelling, call Sweep. As with Tally, you must be sure that the file name in line 30 and the Field statement in line 40 match those of your data file. Also change the CI$ variable in line 70 and the variables in lines 110 and 120.

When you run Sweep, the routine prompts you for the incorrect spelling. Type in the spelling exactly as it appeared in Tally and press the enter key. The routine then asks you for the correct spelling. After you type it in and press enter, Sweep goes through the file and replaces all incorrect spellings with the correct one. If you misspelled the names of two cities (or whatever your field entries happen to be), repeat the process.

Coded Messages

I have another short routine that is useful for saving typing time and disk space with data files that include many entries of long company or product names. Sup-

LOAD 80

System Requirements

All systems
Disk Basic

Replace supplier names in your data file with numbers or letters of the alphabet.

pose, for instance, you have an inventory file that contains the names of products, the names of suppliers, and other information. A typical file might list 500 products and 20 suppliers.

Entering the full names of the 20 suppliers requires about 20 bytes per entry and a good deal of extra typing. With my Lookup routine, however, you can reduce this to about 1 byte. The trick is to have a file (Supplier/DAT) containing the full supplier names. Read this file into the SA$( ) array. Replace supplier names in specified fields of your data file with numbers or letters of the alphabet. The routine acts as a translator, matching names to code letters or numbers, and prints the full name either to the screen or to the printer.

Like Tally and Sweep, Lookup is simple to use. To install it, add the code in Program Listing 3 to your Basic program. Make sure the file name, record length, and fields match your existing files. As written, lines 10–40 open and field two data files: Loyd/DAT (the main data file) and Supplier/DAT. Line 50 retrieves the number of records in the files and dimensions the SA$( ) array, which will contain the suppliers' names.

Lines 60–80 read the names from Supplier/DAT into the SA$( ) array. Instead of the Supplier/DAT file, you could identify the suppliers' names within the program as the array variables, or you could put them in Data statements to be read into the array.

If your file contains 26 or fewer names and you intend to use an alphabetic code, change line 120 to:

```
N = (ASC(SU$) - 64)
```

Lines 120 and 190 provide a method for displaying the supplier names and codes on screen during data input.■

Loyd Bulmur is the president of Primero Consultants Inc. You can write to him at Box 670, Postal Station K, Toronto, Ontario M4P 2H1.

DEBUG

Art of Programming Correction

Curtis E. Stevens of Walnutport, PA, pointed out an error in Program Listing 1 of my November 1986 The Art of Programming column (Checks and Balances, p. 86). As it stands, if you type in two or more letters and then press the left arrow key, the subroutine erases the last byte in the typed string and inserts a space in the next-to-last byte in A$. Also, according to Mr. Stevens, "if, after typing a string of n letters, you press the left arrow key n times, the typed string is erased and the program bombs out with the error notice 'Illegal function call in 2050.'"

To fix the bug, change line 2050 to the following:

```
2050 IF B$ = CHR$(8) THEN MID$(A$,
     I,1) = " ":I = I - 1: IF I >= 0 THEN
     PRINT B$;" ";:GOTO 2010:ELSE
     I = 1:GOTO 2020
```

I had tested the routine and found the error in the normal course of writing the article, but I apparently became distracted and failed to insert the correction.

Bruce Tonkin
Round Lake, IL

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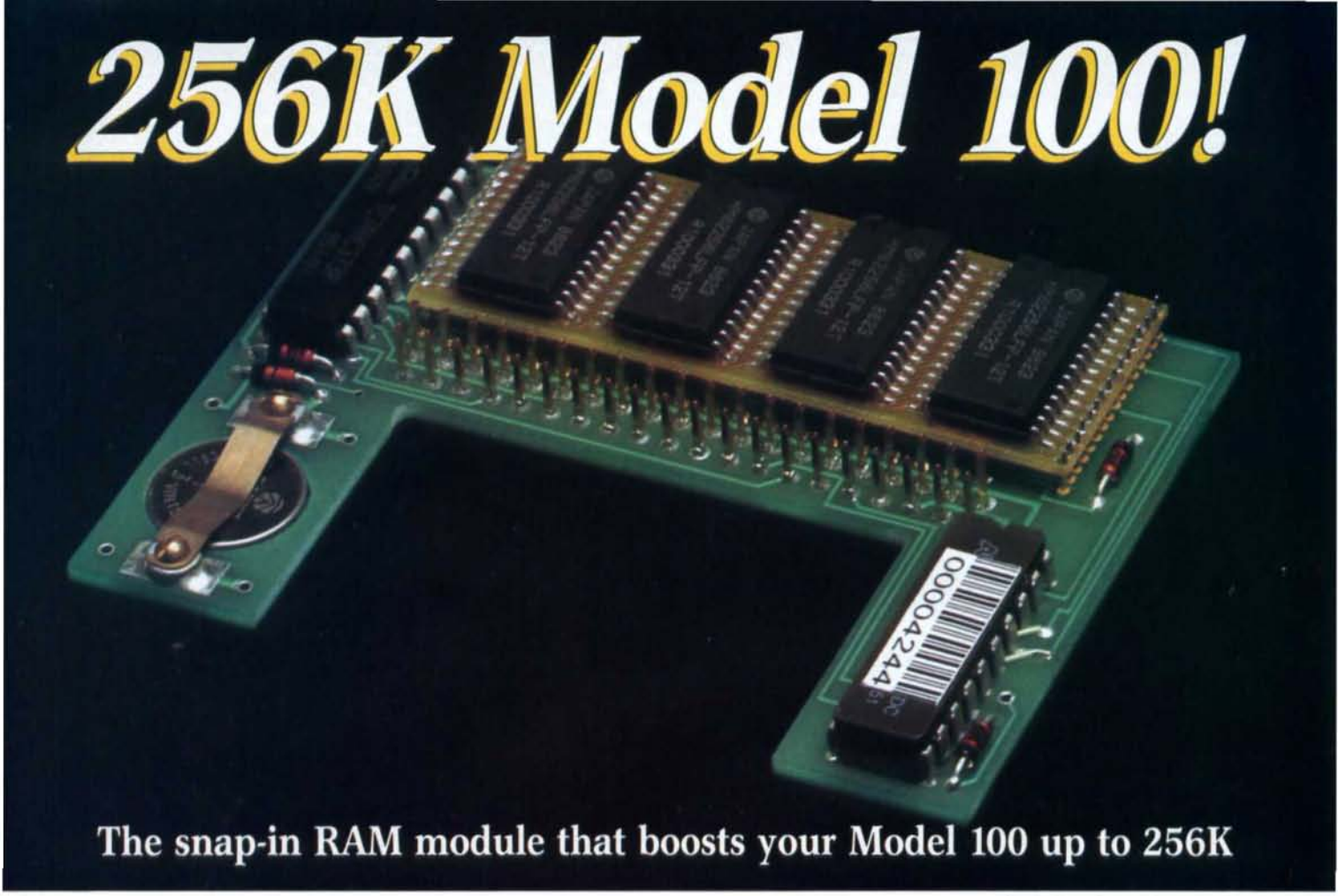

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Timely Tomes, Fond Farewells

Among my greatest pleasures is discovering a good book on a favored topic. Lately I've been reading two MS-DOS thrillers from Microsoft Press—Ray Duncan's *Advanced MS-DOS* and Van Wolverton's *Supercharging MS-DOS*. Duncan's book is subtitled "The Microsoft Guide for Assembly Language and C Programmers." If you program in 8086/8 assembly, you probably need this book; it's become my most used assembly reference.

Wolverton's book claims to be "The Microsoft Guide to High Performance Computing for the Experienced PC User." That's quite a boast, but the book comes close enough for my money. If you think you know every DOS trick and batch-file technique invented, you might find some pleasant surprises here.

Advanced DOS

Advanced MS-DOS ($22.95) provides solid information on programming under MS-DOS—not the tricks, but the fundamentals you should have before trespassing beyond orthodox DOS. The first section (269 pp.) provides all the details you need to manipulate files; control character devices; and write your own interrupt handlers, filter programs, and device drivers. The remainder of the book comprises the best reference I've seen on the DOS and BIOS function interrupts and one of the few on the Lotus/Intel/Microsoft expanded memory specification (EMS 3.2).

After starting with a concise history of MS-DOS through all its versions, Duncan gives a detailed description of the booting process and how DOS is loaded. You'll find this information helpful later when he discusses DOS's memory-management scheme and use of the Exec function. The next several chapters serve to bring not-so-experienced programmers up to speed. Short but effective, these chapters describe the basics of writing COM and EXE programs (and the differences between them), and use of the programming tools: a run-through on using an editor, assembler or compiler (both Microsoft's), linker, and debugger to create a small program.

Complete programs (in assembly and C) illustrate most chapters, along with many short code snippets. I find examining other people's code one of the best ways to learn programming, and Duncan's programs are models for emulation.

The chapters on file input/output (I/O) favor the easier-to-use, Unix-like file-handle functions that arrived with DOS version 2. The handle functions treat devices uniformly so that I/O redirection and piping through filter programs become routine. Duncan does not neglect the older CP/M-like file-control block (FCB) methods of file I/O, however. He gives full details on using DOS's FCB functions, which are still needed to manipulate subdirectory and volume names.

Although *Advanced MS-DOS* promotes programs that are device independent, it also covers hardware-dependent I/O methods where appropriate. For example, Duncan often uses file-handle functions to send text to the display (the standard output device) as if it were a file. It's easy to do and allows redirection of video output. However, he also presents the faster methods of video display—using DOS and BIOS functions and writing directly to video memory.

In addition to serving as examples, some of the sample programs are useful. In the filters chapter, Duncan provides full listings for assembly and C versions of a filter program that converts nonstandard text files into pure ASCII. A file-dump program (also in assembly and C) displays file sectors in hexadecimal (hex) and ASCII. The sample device-driver is just a shell you can build on for your own uses, but that's enough.

The last 182 pages of *Advanced MS-DOS* (three appendixes) devote themselves to complete documentation of the DOS, BIOS, and EMS function interrupts. All the official details are first summarized, then laid out in full, organized detail specific to DOS version (1, 2, or 3).

Duncan makes additional suggestions for use, warns of any quirks, and provides cross-references to related functions. A small code fragment shows function usage. As with the rest of the book, attractive layout and clear writing make it easy to find what you need to know. Where else can you find complete documentation of MS-DOS functions for all three versions?

To the Limit

Supercharging MS-DOS ($18.95) gives you the tools and training to push MS-DOS commands and batch files to the edge of their utility. Wolverton doesn't attempt to cover all MS-DOS commands; he assumes the reader is already comfortable with DOS.

Most of the topics covered serve as building blocks for a single major end. In the final chapter the tricks and techniques developed singly in each chapter join to form a sophisticated menu system based on batch files, the ANSI.SYS extended

Illustration by Paul Fisch

screen and keyboard driver, and several small machine-language programs (created with Debug) that add new powers to your batch-file vocabulary.

Although it assumes experience with MS-DOS, the book is easy to swallow. Wolverton covers each topic with clear explanations and many examples. Each batch file, for instance, is detailed line by line. And although the book works toward the final menu system, the techniques provided are generally useful.

I found unexpected tricks, insights, and suggestions sprinkled generously throughout. Wolverton also wrote several chapters that have nothing to do with the final menu batch program. Sections with tricks for using a VDisk (the MS-DOS version 3 RAM disk) or for controlling an Epson-compatible printer are examples.

The book's techniques depend heavily on ANSI.SYS driver for graphics displays, which some people find annoying because this driver slows down video display. There's no other easy way to gain adequate display control from batch files, however. With ANSI.SYS installed in your Config.SYS file, you can move the cursor around, clear all or part of the screen, and change colors. You can also assign new values, even words or phrases, to any key.

Other topics covered include using Debug, accessing ANSI.SYS with the prompt command, setting environment variables, and improving the Print command. Although most chapters include batch files, there are several chapters devoted solely to batch-file techniques. Wolverton develops a batch file that calls itself and another that redefines the numeric keypad (through ANSI.SYS) to display the fancy framing characters in the IBM extended character set.

The query program he shows you how to create with Debug is the best (and shortest) I've seen. When put in a batch file, this program waits for keyboard input, then returns the ASCII or extended ASCII value of the pressed key as an error code. Your batch file can then use the If Error Level statement to determine what key was pressed. (It doesn't tell you if the returned ASCII code is extended or not.)

Because Error Level only tells you if the returned error code is at or above a certain value, it takes two tests to pinpoint a specific return code. Wolverton manages this with only one batch-file line by using the neat trick of stringing two If statements together. The query program returns the code 59 (extended) when the F1 function key is pressed, for instance. The batch file line:

```
IF ERRORLEVEL 59 IF NOT ERRORLEVEL 60 GOTO FUNCTION1
```

tests for the F1 key.

Supercharging MS-DOS ends with a series of reference appendixes that cover all ANSI.SYS escape sequences for screen and keyboard control, Epson printer commands, ASCII codes and the IBM extended character set (one table), and a hex-to-decimal conversion table. It also includes of small glossary of technical terms used in the book.

Latest Word

Some topics take on a life of their own. A reader sends in a noteworthy piece of information, and I put it in my column. Others read it and realize through their experiences that there's more to it, so they drop me notes. I have several such items for you, plus other tidbits.

Steve Robinson (Santa Maria, CA) found that adjusting the contrast and brightness knobs on his CM-2 monitor didn't give him the true brown he was looking for (see my October 1986 column, p. 134). In search of perfect brown, he opened up his monitor and noticed a small trimpot on the circuit board (just below the picture tube) labeled "brown adjust."

Risking shock from hazardous high voltage, Steve ran Jim Christ's screen-color test pattern (also from my October column) while tuning the potentiometer with a plastic alignment tool. He achieved the elusive true brown. I don't recommend that you try this, but if you can't get brown by tuning the brightness and contrast knobs on the front of your monitor, at least you know someone can fix it for you by tuning something inside.

Jack Powell (Yorba Linda, CA) discovered that not only does control-X insert the previous line of Basic code onto the screen as I reported several months ago, but that control-Y inserts the next line of code. The cursor must be somewhere on a program line when you press control-Y. The next line of program code then inserts itself after the marked line, and the cursor moves to the start of that line, ready to edit.

Any program lines at or below the point of insertion are scrolled down the screen. Jack notes that some GW-Basics that come with MS-DOS 3.x lack these undocumented editing features—the Tandy 3000's, for instance. However, the GW-Basic 3.20 supplied with the 1000 SX does all.

And there's more. Mike Riley (Grass Valley, CA) not only found the control-Y function, but added a new one: control-T. This key combo alters the function-key display on the 25th line. In 80-column display mode, you only see the functions assigned to keys F1 to F10. Pressing control-T displays the F11 and F12 key assignments; pressing it again turns off function-key display altogether. Additional control-T presses recycle you through the same sequence. In 40-column mode, you see only five function-key assignments at a time, so there's one more step in the sequence.

Batch Memory

Many people use batch files to run applications kept in separate subdirectories with their associated data files. Entering just the batch-file name switches to the application subdirectory, runs the application, and switches back to the root directory.

To save even more typing, I wrote Write.BAT, a batch file that does all of the above plus remembers the last data file you were working on:

```
ECHO OFF
C:
CD \WORDPROC
IF "%1" = = "" GOTO NOPARM
SET WRITEDOC = %1 :NOPARM
WRITE %WRITEDOC%
CD \
CLS
```

This technique works only with applications that let you specify the data file with which you want to work on the command line. The data-file name is stored as a variable in the MS-DOS environment space (along with Comspec and any path name set with Path).

Line 4 of Write.BAT checks to see if you typed a file name after WRITE. If you did, the Set command stores the parameter (%1) in the environment space. If you didn't, the batch file supplies the application (a word processor named Write) with the environment variable (WRITEDOC) for a file name. Be sure to denote any variable you use as a parameter in a batch file with the percent symbol (%).

Last Words

Next month I join the staff of our new MS-DOS magazine *PC Resource*. I will miss the pleasures of writing a monthly column. I am happy, however, that authorship of *80 Micro*'s MS-DOS column passes to someone as experienced and knowledgeable as John Harrell, an experienced programmer and system manager in the Navy, and an associate editor of *80 Micro*. John has already favored this magazine with several columns, including his Tandy 2000 column, and if you haven't noticed, he contributes many reviews and articles to our pages. ■

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.*

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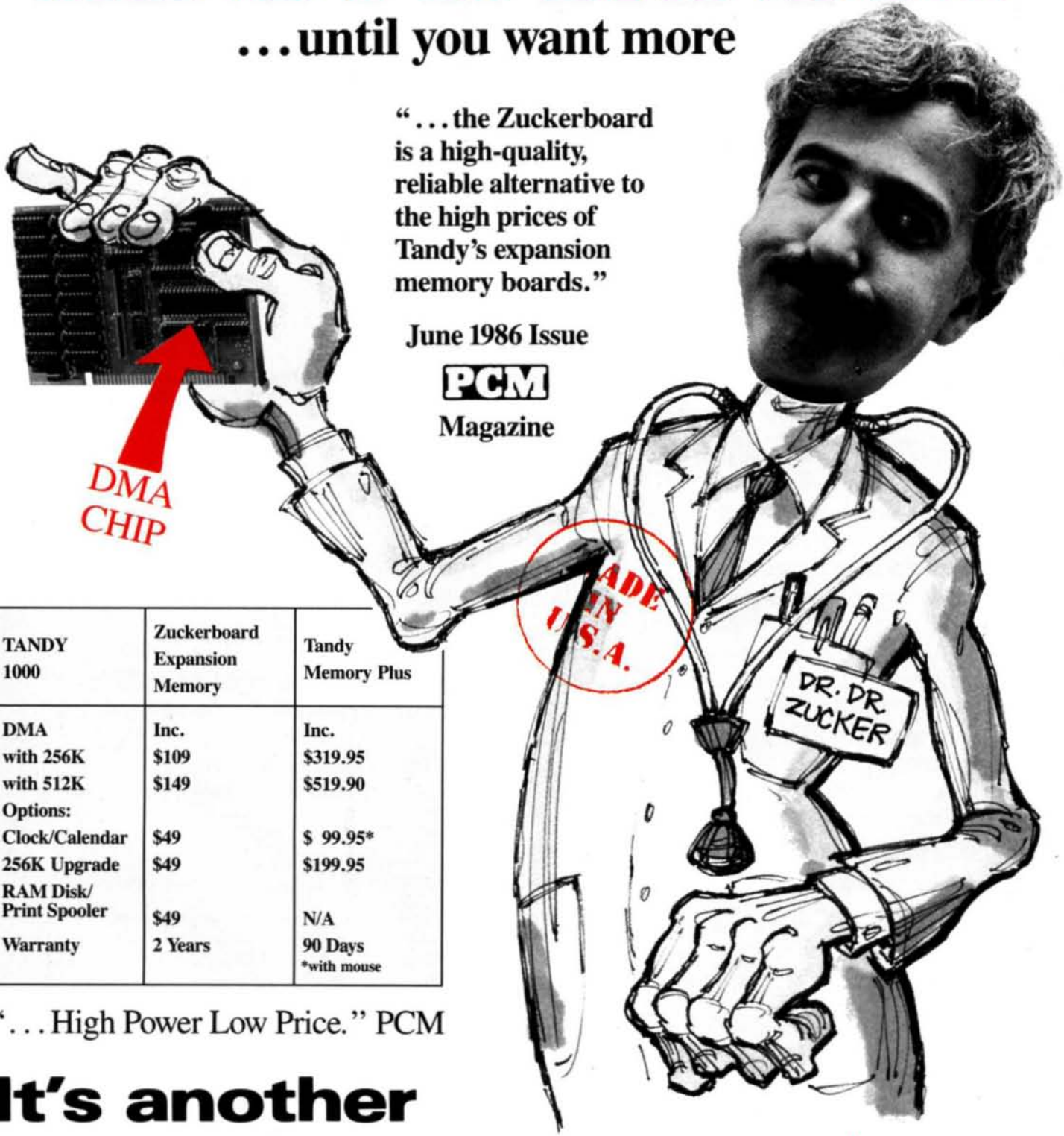

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2017	_____	599	_____
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Beating the Odds with Basic

State lotteries are poor bets. In most states, players can expect to get back only 20 to 40 cents for each dollar they invest. This is bad business, both for players and lottery organizers. Since the introduction of state-sponsored lotteries, the illegal numbers racket has grown stronger, largely because it offers better odds—usually in the neighborhood of 750-1 on a three-digit number. If you gamble, a 75-percent return is pretty enticing.

A small Basic program would allow states to beat those odds without cutting into expected revenues. The programming technique is the same one used in computer simulations.

Setting Odds

Imagine you are the organizer of a lottery with about 100 players. To win, players must pick the correct single-digit number. You can simulate the game's outcome with the following program:

```
5  Randomize 'MS-DOS
6  Random 'Model 4
10 DIM A%(9)
20 FOR I = 1 TO 100:X = RND:
   Y = INT(10*X):A%(Y) = A%(Y) + 1:NEXT I
30 FOR I = 0 TO 9:PRINT I:A%(I):NEXT I
```

When run, the program prints the 10 digits from zero to nine and the number of times each is picked. To determine the winning number, you scan the list and select the one generated least often.

With 100 players, you'd expect each digit to be picked an average of 10 times—and that is what happens. However, an average of 10 times isn't *exactly* 10 times. If you run the program 1,000 times, the least-popular number turns up an average of 5.423 times, the most-popular number 15.102 times.

Suppose, as the lottery organizer, you pay $10 for each winning $1 bet. Under that policy, the lottery would pay $54.23 and take in $100, making a profit of $46.77. If only 25 people play, the least-popular number would be picked .447 times and the most-popular number 5.205 times. You'd pay out $4.47 and take in $25, making a gross profit of $20.53 for a profit margin of over 82 percent. A dishonest lottery operator could restrict the pool to nine people and guarantee that no one would win.

If 500 people play, the least-popular number would be picked 39.466 times and the most-popular number 61.316 times. You'd make a profit of just over 21 percent—not bad, especially since most players consider a 10-1 payoff completely fair. The pattern, however, is clear: The more people play, the smaller the profit margin. If fewer than 1,000 people play, the profit margin is 100 percent. If millions play, the margin is closer to zero—but you'll still make a profit.

As indicated, one way to maximize profits is to restrict the number of players. This can be done by using color-coded tickets or by issuing tickets on a daily or even hourly basis. An even easier way is to increase the number of digits in the lottery number. A four-digit number could pay off at 10,000-1; five digits at 100,000-1; and six digits, at 1,000,000-1. Most state lotteries use six-digit numbers, attract large numbers of players, and advertise payoffs worth millions of dollars.

Lucky Numbers

Unfortunately, these profit-projection methods are flawed: They assume that lottery players always pick numbers randomly. Suppose the number 3 wins a simple, single-digit lottery one week. Will it be more or less popular the next week? Lottery operators say that winning numbers from the previous week are usually picked by more people in the next game.

Many players have lucky numbers that they play every week. Interestingly, the effect of these non-random choices is to increase the operator's profits. The more people who repeatedly play their favorite numbers, the fewer there are who will randomly pick the winning number.

If the program that determines the winning number always picked the smallest number in the case of ties, the lottery would have a noticeable bias toward small winning numbers. That would encourage more people to play the smaller numbers, further increasing non-random choices and making even bigger profits for the operator. Also, some winning tickets are never turned in—they get lost or are misread. This also increases operator profits.

The publicizing of winning lottery numbers transforms what appears to be a simple game of chance into a game of skill. By analyzing previous winners, players can deduce which numbers cannot win in future weeks. Betting an equal amount on all the remaining numbers would guarantee a steady, if unspectacular, profit.

Adding Interest

Lottery organizers make money in another way, which you can also simulate

Illustration by Hal Mayforth

in Basic. Suppose you're lucky enough to win the state's $1,000,000 grand prize. Usually, organizers spread large payoffs over a number of years. You might receive $50,000 a year for the next 20 years, but that's not the same as $1,000,000 paid today. The reason has to do with something called present value.

To take things to ridiculous extremes, suppose I ran a lottery with a $1,000,000 payoff. The catch: Payments would be $1 a year for a million years. I could put $20 in the bank and, at 5-percent interest, make enough each year to pay the winner. The $20 would remain on deposit, accumulating interest for the next year's payment. At the end of a million years, the $20 could be withdrawn. In effect, the cost of the $1,000,000 payoff would be $20.

A Basic program can illustrate the same concept. Assume you agreed to pay someone $50,000 in 20 years (payment to be made at the beginning of the 21st year). The following program calculates how much money you would need to set aside right now (assuming you put the money in the bank, where it earns 5-percent interest):

```
10 amount = 1:rate = .05
20 for i = 1 to 20:amount =
   amount*(1 + rate):next i
30 print"Total, plus interest, is";
   amount;"after 20 years."
```

The total, plus interest, is about 2.653295. The present value is $50,000 divided by 2.653295, or $18,844.49.

Check for Inaccuracies

Aside from illustrating present value, this program teaches some important lessons about Basic. Look again at the program; see anything wrong?

The program contains a couple of problems that could produce inaccuracies. For one thing, it defaults variables to single precision. In most cases, being accurate to just over six significant digits is enough. However, when you are dealing with calculations within a loop (as in line 20), these errors can rapidly escalate to unacceptable levels.

Suppose, for example, the interest rate is compounded monthly over 20 years. The loop in line 20 would then execute 240 times. An insignificant error in the first result would be magnified 239 times, instead of just 19.

For more accurate results, I could declare variables to be double precision by adding the line:

```
DEFDBL A, R
```

The program has another flaw: Constants don't carry type indicators. That means the setup in line 10 also could introduce inaccuracies. When I set the rate equal to .05, Basic uses the single-precision approximation for .05 and stores that number as the rate value. If I made the rate a double-precision variable (rate = .05#), I'd be assured of generating more accurate results.

The Print Using command can force Basic to round the answers to two decimal places.

Other constants should be set the same way. If I made both changes to the program (using double-precision variables and type indicators), my answer for the problem described above would be 2.653297705144419.

These errors might seem unimportant. Over 20 years, they amount to a difference of only 2 cents in the computed present value of $50,000. But suppose the period is 240 months and that the 5-percent interest rate is compounded monthly instead of yearly. The program might look like this:

```
10 amount = 1:rate = .05/12
20 for i = 1 to 240:amount = amount*
   (1 + rate):next i
30 print"Total, plus interest, is";amount;
   "after 20 years."
```

The answer, with variables left as single precision, is 2.712672. If variables are double precision, the answer is 2.712640285482007. The first answer gives a result of $18,432.01; the second, $18,432.226. Instead of 2 cents, the difference has grown to a little more than 21 cents. Twelve times as many iterations increased the error by about the same factor. Calculations involving exponentiation, trigonometric functions, and so forth, introduce even more errors. Interpreted single precision Basic is slightly different numerically from compiled single precision Basic, and TRS-DOS Basic.

Round Numbers

Let's examine another common error that has to do with how Basic stores numbers. Suppose you've written the following one-line program to total the checks in your checkbook:

```
10 INPUT"Check amount (0 to exit):";X:
   T = T + X:PRINT"Total = ";T:
   IF X < >0 THEN 10
```

After you type in a few numbers, the computer starts printing totals like 64.32999, even if you've specified that all variables are supposed to be double precision. Why can't the computer print 64.33 instead?

The answer is that the computer can't accurately store certain numbers as floating point. If you entered .05, the computer stores that number as a series of powers of 2. It would look something like this:

```
0.00001100110011001100110...
```

The computer must allocate a fixed amount of space for the number, which means it will truncate the result after a fixed number of binary digits. No matter what precision you specify, the number stored in the computer is not precisely equal to .05, although it might be very close to it.

The first few times you enter such numbers, Basic rounds them when it prints the answer on screen. Everything appears correct at first, but inaccuracies build as you begin to add more numbers. Eventually, Basic can't round the result correctly when converting the answer to a decimal number. At that point, you start seeing numbers slightly less than the correct answer. The more numbers you add, the further off your final answer is.

The problem has a simple solution: Use the Print Using command to print the total, which can force Basic to round the answers to two decimal places. This works, provided you don't add so many numbers (or use numbers so large) that the inaccuracy begins to affect the cents. If you'll be adding many numbers, or if you'll be using numbers larger than 9999.99, I suggest using double-precision numbers and the Print Using command.

The ultimate solution, of course, would be if Basic used a different method to store numbers. One method does exist: It's called binary-coded decimal (BDC). BCD math reduces the risk of error when you're adding dollars and cents, but it's far slower than floating-point math and uses more space to store the same number of digits. I'd rather have a slightly incorrect answer in 10 seconds (and round off the answer myself) than wait 30 seconds for an absolutely correct one. Evidently, Microsoft felt the same way. ■

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

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Yes, Virginia, There Is Model 100 PD Software

The Model 100/102 laptop computer has shown surprising strength in both the home and business markets—enough for a small software industry to evolve for this little gem of a computer. A vast amount of Public Domain (PD) software is available for the 100, but the distribution of this software is practically nil except through the data-base networks such as Compuserve and Club 100 (more on this later). These networks require either a fee for access and download time or long-distance telephone calling. Some PD programs are specific to the Model 200, but most Model 100 Basic programs run on the 200, as well.

Compuserve's Model 100 Special Interest Group (SIG) has several PD data libraries from which you can download programs and discussion on popular topics. Among these files are bar-code programs and files, hardware-oriented utilities, file-transfer programs, programming utilities, print formatters, text utilities, listers, cross-referencers, line renumbering utilities, checksum utilities, and RAM-oriented utilities to save you from a cold-start crash.

Also on line are reference texts on many topics including rechargeable batteries, different storage devices, programming techniques, engineering programs (surveying, statistics, scaling), financial and accounting information, spreadsheets and templates, loan amortization, stocks, general math, time management, screen dumps, and passwords and encryption.

The first file you should get if you plan to use Compuserve is 1200BD.PGM (Compuserve) or 1200BD.DO (*80 Micro* BBS). This file explains the technical aspects of using a 1,200-baud modem with your 100 and what the faster rate saves you in both time and Compuserve charges. It includes a Basic utility that lets you configure an external 1,200-baud modem for Compuserve access with a Model 100 or 200. The file also directs you to other related utilities on Compuserve.

Club 100 is an on-line Model 100 club in the San Francisco area dedicated to supporting 100/102/200 users with access to PD software and other useful information. Club 100 is not just a BBS, but rather a full-fledged, applications-oriented support group. Members who do not telecompute get access to PD software through distribution disks that the club offers. Club 100 offers a four-level membership-dues structure, the lowest level being free and a "must get" item for all 100/102/200 users.

For further information, call the BBS at 415-939-1246 (300/1,200 baud, 8-bit words, no parity, 1 stop bit). You may also contact Richard Hanson, club secretary, by voice at 415-932-8856 or write Hanson-McBride Services/Club 100, P.O. Box 23438, Pleasant Hill, CA 94523.

Another San Francisco-area-based club for Model 100 users, the Danville Tigers Club, works closely with Club 100. These two groups freely share information and PD programs. Membership in the Danville Tigers is free also. You can get information about the Danville Tigers Club by writing Bill Templeton, c/o Danville Tigers, 78 Larkstone Court, Danville, CA 94526.

Traveling Software, in conjunction with the Danville Tigers Club, offers a disk that contains 16 of the Danville Tiger's PD programs, representing a good selection of programs for the beginning user. These programs include graphics games, music programs, and a mini Visicalc-type spreadsheet. Contact Traveling Software at 800-343-8080 for the disk. The price is $9.95 to cover distribution. The Danville Tigers offer other PD disks as well.

Club 100 and the Danville Tigers Club are not-for-profit organizations dedicated to the advancement of computing with the 100 and similar laptop computers. Traveling Software is a commercial venture, but its PD disk is available as a public service.

The Virginia Connection

Two northern Virginia BBSes offer a smattering of PD programs for the 100. First, the National Capital Tandy Computer Users Group (NCTCUG) is developing a Model 100 PD library. Having a fair-sized group of Model 100 users with a lot of interest in PD software, the club is cataloging 300–400 programs, some of them written by club members.

NCTCUG has a limited number of Model 100 programs available for downloading on its BBS to club members. It will also distribute PD programs once an acceptable system is in place. Though the downloads from the BBS are only available to members, the BBS is free for message traffic to anyone with Model 100 and other computer questions; answers are given freely. The NCTCUG BBS system operator (sysop), Gary Smith, invites all interested to call the BBS. The BBS number is 703-836-0384 (300/1,200 baud, 8-bit words, no parity, 1 stop bit).

For the month of March, NCTCUG will establish a special section on its BBS where you can call and download selected Model 100 files and programs (ASCII only for this section). The programs will probably be rotated on an announced schedule. Instructions will be

Illustration by Claudia Tantillo

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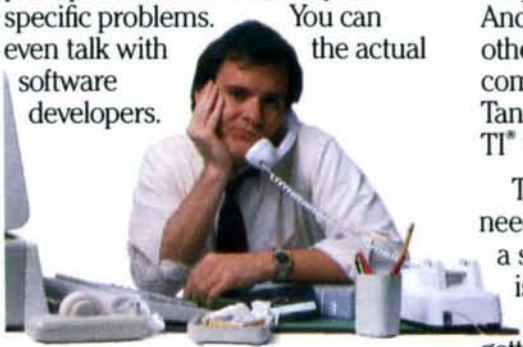

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For further information about NCTCUG and its support including PD programs for the I/III/4, 100, and MS-DOS, send $1 to NCTCUG Inc., P.O. Box 2826, Fairfax, VA 22031, and the club will send you an issue of its newsletter plus other information. If you specify your interests, NCTCUG might be able to send you an issue that applies to those topics. You'll get the information, but no newsletter, if you don't send $1.

Also in the Washington area, the Handy Tandy BBS at 703-532-5317 (300/1,200 baud, 8-bit words, no parity, 1 stop bit) covers the 100 as well as the Models I/III/4, Color Computer, and MS-DOS. Though it doesn't have an extensive selection, this BBS has some good programs available for downloading and an active message base on Model 100 questions and answers.

If your home-town BBS or club has a good set of PD software for the 100 that it would like to share with the *80 Micro* readers, let me know by a letter and I'll report on it in a future column.

PD Favorites For the Model 100

My list of some PD favorites for the 100 follows. The most useful Model 100 PD programs tend to involve text processing, spreadsheet calculations, disk access, disk cataloging, data bases, or memory-management utilities.

In celebration of this being my first Public Works column authorship, I offer a PD program called Scripy.CO (no connection with Radio Shack's Scripsit word processors), which I wrote. It is a low-memory-overhead, low-frills text processor. Many in the Washington, DC, area have used this program for the last two years.

Scripy is a machine-language program that sends formatted printer output using Model 100 files created by the 100/102's text mode. Though Scripy is a minimal-function text processor, it offers some powerful options. One of its most useful features is the ability to send much needed carriage returns to the printer. Scripy does not do right-justification, nor does it number pages. Scripy takes only 320 bytes of user memory. I wrote it to conserve precious memory for other programs that you might want to keep in your 100.

You can use Scripy with practically any parallel printer. A 12K documentation explains how to imbed control codes within text to access special printer functions. This file includes the Scripy program and a default configuration program. You can easily extract these programs from the text to create Scripy.CO and CFIG.BA. Full instructions are given.

In celebration of my first Public Works column, I offer Scripy.CO.

Just download Scripy.DO from the *80 Micro* BBS and you will have it all.

Spread.BA is a Basic spreadsheet program with a long history. It was first called Minivc.BA and was written by Terry Dettmann for the now-defunct *Basic Computing* magazine. It has been rewritten and modified several times by others and has made its way into the public domain.

The version of Minivc that I like is not the latest version (you'll need Minivc.BA and Minivc.DO), but for my purposes it offers enough functions. I prefer this Basic PD spreadsheet commercial machine-language versions. Machine-language programs for the 100, unless they are on a ROM chip, need twice as much memory as their size to run. They have a storing location and a running location, and space must be allocated for both. Mort.DO is a loan-amortization template for Minivc; and Mortdo.DO gives instructions for setting up the template to meet your needs. I believe that Compuserve has the latest version of Spread.BA if you prefer it.

Disk Goodies

Disk access with the Tandy Portable Disk Drive is the name of the game these days. John Heilman's DSKMGR.CO and related utilities are available through Compuserve only, according to its documentation file. Another version of DSKMGR is available from the author on *Pico* magazine's BBS at 603-525-4438 (300/1,200 baud, 8-bit words, no parity, 1 stop bit). Since the *Pico* BBS was down due to technical problems, I have not verified the official status of this program with regard to its PD distribution.

DSKMGR provides a menu-driven access to the Tandy Portable Disk Drive. It reminds me of the commercial program TS-DOS from Traveling Software. Its functions include a menu of available programs on the disk or in RAM and load, save, save all, erase disk files, kill RAM files, and format commands. This program is much easier to use than Floppy.CO, which Tandy supplies with its drive.

DBNEW.BA is a good PD data-base program by Bob Ripley. It sorts by any column either numerically or alphabetically. It searchs for up to 10 items on any column or columns. Operators of "or," "and," "less than," "greater than," and "not" are allowable. You can send the results of this search to cassette, printer, disk, liquid-crystal display (LCD), CRT, or RS-232.

DBNEW prints data in columns, on address labels, postcards, or any-size paper (with return address). It also can print a single variable on a line. Four-function math is allowed with a single operator between columns. DBNEW also totals columns and prints the results in an additional column.

You can select additional printing options such as single field per line, skipping lines between records, printing of only selected fields, multiple copies, and batch sorting and printing. You can create from one to 16 data fields with DBNEW. The only problem with DBNEW is the size of its documentation file: approximately 17K. DBNEW and this file do not both fit in your 100 at the same time.

More Utilities

Rick Perry's Change.BA is a must if you plan to download or upload files between computers over the telephone. Change is a Model 100 utility program that incorporates menu-driven directory access and manipulation, conversion of binary CO files into ASCII-hexadecimal (hex) DO files, and vice versa. You can upload and download these ASCII-coded files easily using the 100. If a BBS has stored machine-language files in the ASCII-hex format compatible with Change, then a simple conversion using Change is all you need to install those programs. It also converts Lucid Calcsheet files with the CA extension to CO and ASCII-hex DO files.

I've written other utilities that I'm now offering for further distribution in the PD market. Again, these programs have been around awhile in the Washington, DC, area.

Length.CO is a 200-byte, machine-language, memory-management program. Length quickly gives you a screen display with the name and length of each file as well as the amount of memory tied up in the Basic and Paste buffers, the setting of your Himem pointer, the number of Max-files you have allocated, and the number of bytes free. To conserve screen space so all this information can fit, Length does not display file-name extensions. Hidden file names are also not displayed.

You do not need Change to download Length from the *80 Micro* BBS. A Basic program called Length.BA creates Length.CO and saves it. You can then kill

Length.BA after saving a copy for archival purposes.

I wrote SaveM.BA and LoadM.BA for program-development purposes. When I write a machine-language program, I use a Model III or 4 editor/assembler. Since Z80 code is an extension of the 100's 8080, I can just program in Z80 with codes that are compatible. After saving the file, I use Orcterm/CMD, a PD program for the Model III, to convert the compiled file to a straight ASCII-hex file and send it to the 100.

LoadM.BA reads the file on the 100, creates the machine-language program, and saves it as a CO file. If all goes right, my program runs as is on the 100. SaveM.BA does just the opposite. It creates an ASCII-hex file for uploading to another computer for storage. A SaveM-created file also includes a file name, which LoadM can read, and a checksum to make sure the upload/download was proper. The file SAVNLD.DO combines both of these programs along with instructions in much the same way that Scripy.DO does.

All PD software discussed in the Public Works column is available for downloading from the *80 Micro* BBS, unless otherwise noted, at 603-924-6985 (300/1,200 baud, 8-bit words, no parity, 1 stop bit). For the convenience of *80 Micro* readers, I'll also make available a 3½-inch Model 100 disk containing as many PD programs as will fit on the disk. Specify which programs you want so I can include those on the disk.

For those who have III/4 or MS-DOS computers (and also Model I LDOS) and the know-how, software, and null-modem cable to transfer ASCII programs to their 100s, I can also provide a 5¼-inch disk with these programs on it. If I don't get too many requests, I'll even make a cassette for you. Be prepared for me to turn you down on this if I get inundated, so please send a self-addressed, stamped envelope for tape requests.

Send $5 for any disk or tape to my home address given below and specify your format. Please include a gummed return-mailing label if possible.

Next month's column will talk about PD software distributors, covering most TRS-80 and MS-DOS microcomputers. I'll also include more information on Club 100.■

Photo by Richard Quindry

Thomas Quindry has written for 80 Micro since 1980. Write Tom at 6237 Windward Drive, Burke, VA 22015. Enclose a stamped, self-addressed envelope for a reply.

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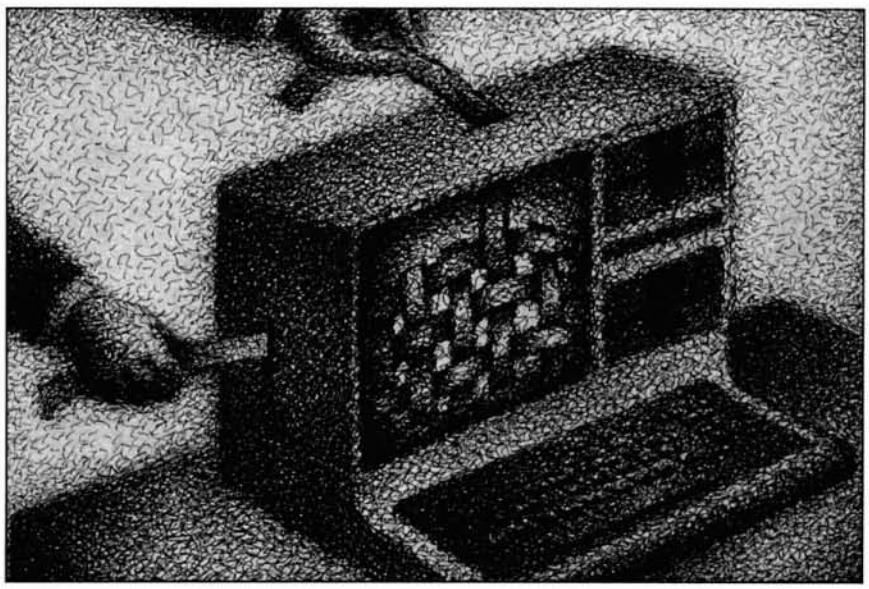

Illustration by Dave Ridley

Because the Model I and Model III video displays were memory mapped, programs could create fast or animated displays by using a number of video tricks. Many Basic programs used Peeks and Pokes to write directly to the video screen; assembly-language programs wrote directly to video memory.

The Model 4 video display isn't memory mapped, so these programming techniques at first seem impossible. When a program sends a request to Model 4 TRSDOS to write to video memory, the operating system must move the stack to low memory, bank-switch the video display into high memory, write to video memory, and then bank-switch the display out to restore the high-memory area. The process is fast, giving programs an extra 2K of available memory, but it makes direct video access nearly impossible.

There are at least two ways to gain almost instant access to the Model 4's video display. The first and most dangerous is to send the necessary bits out port 84 hexadecimal (hex) to pull the video display into normal, addressable memory. Unfortunately, any operating-system access of video memory or the keyboard type-ahead buffer ends up switching the video display back out of main memory. Furthermore, calls to high-memory drivers and filters are made to video memory, and the computer will almost certainly lock up.

A much safer technique employs the @VDCTL supervisor call (SVC). Four subfunctions of this SVC let a program send either a full 1,920-byte buffer or a single 80-byte line to the video display, or obtain a copy of the current video display in either a full buffer or a single line. Used judiciously, the @VDCTL SVC can duplicate most of the Peeks and Pokes of older programs while following the normal rules of Model 4 programming.

LOAD 80

System Requirements

Model 4/4P/4D
64K RAM
Basic

I recently decided to convert some Model I Basic subroutines for a Model 4 program I was writing. The results, which are demonstrated in Program Listings 1 and 2, were well worth the effort and let me create screen effects I've never seen in Model 4 programs. Although the listings merely demonstrate simple techniques, they give you the tools you need to spice up screen displays in your own programs.

Finding a Buffer

The major difficulty in using the buffer functions of @VDCTL from Basic is finding a suitable 1,920-byte screen buffer (80 columns by 24 lines). You can try putting the buffer in an integer array, as I first did, but the array variables tend to move around in Basic. Every time a new simple (nonarray or scalar) variable is used, Basic moves the arrays up in memory to make room. You either have to define simple variables at the beginning of the program or spend considerable processing time ascertaining the integer-array buffer's address each time the program accesses it.

Protected high memory is another possible location for the buffer, but the @VDCTL SVC only performs buffer-to-screen transfers if the buffer resides below 0EC01 hex. I found that moving the High$ variable that low to protect a buffer left too little room for a complex Basic program and proved unworkable.

The solution lies in manipulating Basic's pointers to four of the tables it keeps in memory. The tables contain the program listing in tokenized form, simple variables, array variables, and dynamic string space; each is referenced by a pointer. It should be possible to manipulate the pointers to include a fifth memory area for the screen buffer that could go above Basic itself and below the first Basic table, which is the program listing. One program could create the buffer and a second program could be loaded into memory to locate the video buffer by looking at Basic's pointers. There's a catch, however, that makes changing the pointers risky and difficult. I'll tell you about it later.

To examine and experiment with Basic's pointers, enter the following commands from TRSDOS Ready:

```
DEBUG (E)
BASIC.BASIC
```

The first command loads the extended debugger into high memory and protects it there. The second command calls Basic along with its password, letting Debug take control. As Basic loads, the Debug screen appears before Basic initializes itself. Press "G" and enter to see Basic's copyright message. Now, whenever you press the break key, Debug takes over control from Basic and you can search through memory. To return

to Basic, press "G" and the enter key again. Be careful not to change any register values while in Debug.

Once you've entered Basic and reentered Debug, type S followed by D7100. You'll see a 256-byte memory page that includes Basic's table of pointers to various memory areas. If you experiment by running short Basic programs that define simple and array variables and strings, you will soon discover which addresses point to which tables (see The Next Step, May 1986, p. 88, for a more detailed discussion of how Basic stores variables).

Resetting the pointers 1,920 bytes higher in memory and leaving a screen buffer below the Basic tables should be simple, but it isn't. As soon as Basic executes a New or Load command, all the pointers are reset to their original values and the buffer is destroyed. I soon realized that another value elsewhere in Basic sets the pointers.

In Model 4 Basic versions 01.01.00 and 01.01.01 (supplied with TRSDOS 6.2, 6.2.1, and Logical Systems Inc.'s new LS-DOS 6.3), the value is stored at memory location 6E9E hex. If you increase the 2-byte value in that location and execute a New or Load command, Basic resets its pointers higher in memory and leaves a protected memory buffer that your programs can use for any purpose.

A program can create a screen buffer, tuck machine-language programs into protected memory, or use the memory to pass data from one program to another. Other programs can find the buffer by examining the value at 6E9E hex and subtracting a fixed offset to locate the beginning of the protected area (you have to choose the offset and then code it into the programs that will use the buffer).

Armed with this knowledge and able to establish a low-memory buffer, you should find this month's demonstration programs easy to understand.

The Moment of Creation

Setup (Listing 1) is meant to be run at the beginning of each Basic session. It begins by finding the current value at 6E9E hex and adding an offset large enough to make room for a short machine-language routine and a full screen buffer (line 60). The machine-language subroutine that the program stores in the beginning of the protected area receives an address and a function number from Basic and calls the @VDCTL SVC.

Listing 1 also fills the last 3 bytes of the buffer with zeros. Basic expects there to be 3 zero bytes immediately preceding a program in memory. If the ze-

Program Listing 1. Setup.

```
10 '   Setup Routine (SETUP/BAS) for Fast Video Displays                '*   97
20 '   This program must be run exactly ONCE before                     '*   98
30 '   running the Video Demonstration Program                          '*   99
40 '                                                                    '*  171
100 BASE% = PEEK(&H6E9E) + VAL("&h"+ HEX$(PEEK(&H6E9F) * 256))         '* 3398
110 NEW.BASE% = BASE% + 10 + 1920 + 3                                   '* 1896
120 POKE &H6E9E, NEW.BASE% AND 255                                      '* 1980
130 POKE &H6E9F, ((NEW.BASE% AND -256)\256) AND 255                     '* 2870
140 FOR I% = 0 TO 9                                                     '* 1011
150    READ BYTE$                                                       '*  938
160    POKE BASE% + I%, VAL("&h" + BYTE$)                               '* 2196
170 NEXT I%                                                             '*  645
180 FOR I% = NEW.BASE%-3 TO NEW.BASE%                                   '* 2206
190   POKE I%,0                                                         '*  787
200 NEXT I%                                                             '*  639
210 RUN "DEMO/BAS"                                                      '* 1078
220 '                                                                   '*  219
500 DATA 1A:        '  LD   A,(DE)      ;Get @VDCTL sub-function       '*  667
510 DATA 47:        '  LD   B,A         ;Put sub-function into B       '*  661
520 DATA 7E:        '  LD   A,(HL)      ;Get LSB of buffer addr.       '*  679
530 DATA 23:        '  INC  HL          ;Point to MSB of address       '*  657
540 DATA 66:        '  LD   H,(HL)      ;Get MSB of buffer addr.       '*  665
550 DATA 6F:        '  LD   L,A         ;HL==> video buffer            '*  682
560 DATA 3E,0F:     '  LD   A,15        ;@VDCTL SVC number             '*  841
570 DATA EF:        '  RST  28H         ;Call @VDCTL                   '*  699
580 DATA C9:        '  RET              ;Return to Basic               '*  685
```

End

Program Listing 2. Demo.

```
10 'This is the demonstration program: DEMO/BAS                         '*   97
20 '   You must run SETUP/BAS before this program                       '*   98
30 '                                                                    '*  170
95 '      Set up the video array                                        '*  110
100 DIM VIDEO$(24)                                                      '* 1021
110 BUFFER% = PEEK(&H6E9E) + VAL("&h" + HEX$(PEEK(&H6E9F)*256))
    - 1923                                                              '* 3842
120 ADDR% = BUFFER%                                                     '* 1103
130 FOR LIN% = 1 TO 24                                                  '* 1210
140   POKE VARPTR(VIDEO$(LIN%)),80                                      '* 2044
150   POKE VARPTR(VIDEO$(LIN%))+1, ADDR% AND 255                        '* 2816
160   POKE VARPTR(VIDEO$(LIN%))+2,((ADDR% AND -256)\256) AND 255        '* 3674
165   LSET VIDEO$(LIN%) = " "                                           '* 1577
170   ADDR% = ADDR% + 80                                                '* 1224
180 NEXT LIN%                                                           '*  800
190 CALL.ADDR% = BUFFER% - 10                                           '* 1646
200 '      Set up arrays and strings for demonstration                  '*  146
210 DIM A$(30), E$(24)                                                  '* 1074
220 FOR LOOP% = 1 TO 30                                                 '* 1294
230   A$(LOOP%) = STRING$(LOOP%,"-") + "LINE" + STR$(LOOP%)             '* 3294
240   A$(LOOP%) = A$(LOOP%) + STRING$(80 - LEN(A$(LOOP%)),"-")          '* 3339
250 NEXT LOOP%                                                          '*  885
260 FOR LOOP% = 1 TO 21                                                 '* 1298
270   C1$ = C1$ + CHR$(191) + "   "                                     '* 1549
280   C2$ = C2$ + CHR$(140) + "   "                                     '* 1546
290 NEXT LOOP%                                                          '*  889
300 CLR$ = ""                                                           '*  633
310 C.NRML$ = STRING$(27,32) + "Press any key to continue"              '* 4186
320 FOR LOOP% = 1 TO LEN(C.NRML$)                                       '* 1962
330   CH$ = MID$(C.NRML$,LOOP%,1)                                       '* 1831
340   IF CH$ = " "  THEN C.INV$ = C.INV$ + CH$ ELSE C.INV$ = C.I
    NV$ + CHR$(ASC(CH$) + 128)                                          '* 4836
350 NEXT LOOP%                                                          '*  886
360 PRINT CHR$(15);                    'Turn off cursor                 '* 1113
980 '                                                                   '*  232
990 '      Running borders                                              '*  162
1000 CLS                                                                '*  451
1005 WHILE INKEY$<>"": WEND            'Empty type-ahead buffer         '* 1641
1010 LSET VIDEO$(12) = C.NRML$                                          '* 1748
1020 FUNC% = 5                                                          '*  742
1030 FOR LOOP% = 1 TO 4                                                 '* 1295
1040   LSET VIDEO$(1) = MID$(C1$,LOOP%)                                 '* 2185
1050   LSET VIDEO$(24)= MID$(C1$,LOOP%)                                 '* 2207
1060   LSET VIDEO$(2) = MID$(C2$,5-LOOP%)                               '* 2287
1070   LSET VIDEO$(23)= MID$(C2$,5-LOOP%)                               '* 2307
1080   CALL CALL.ADDR% (BUFFER%,FUNC%)                                  '* 2236
1090 NEXT LOOP%                                                         '*  936
1100 IF INKEY$ = "" THEN GOTO 1030                                      '* 1922
1990 '    Scroll a line down the screen                                 '*  211
2000 CLS                                                                '*  452
2010 FUNC% = 6: CALL CALL.ADDR% (BUFFER%,FUNC%): FUNC% = 5              '* 3377
2020 FOR LOOP% = 1 TO 6                                                 '* 1297
2030   FOR NEW.LINE% = 1 TO 24                                          '* 1672
2040     OLD.LINE% = NEW.LINE% -1: IF OLD.LINE% = 0 THEN OLD.LIN
     E% = 24                                                            '* 4060
2050     LSET VIDEO$(OLD.LINE%) = CLR$                                  '* 2183
2060     LSET VIDEO$(NEW.LINE%) = A$(LOOP%)                             '* 2467
2070     CALL CALL.ADDR% (BUFFER%,FUNC%)                                '* 2300
2080     FOR PAUSE% = 0 TO (6-LOOP%) * 20: NEXT PAUSE%                  '* 3039
2090   NEXT NEW.LINE%                                                   '* 1263
2100 NEXT LOOP%                                                         '*  929
2980 '                                                                  '*  282
2990 '    Scroll a line up the screen                                   '*  212
3000 CLS                                                                '*  453
```

Listing 2 continued

Listing 2 continued

```
3010 FUNC% = 6: CALL CALL.ADDR% (BUFFER%,FUNC%): FUNC% = 5              '*  3378
3020 FOR LOOP% = 1 TO 6                                                '*  1298
3030   FOR NEW.LINE% = 24 TO 1 STEP -1                                 '*  2147
3040     OLD.LINE% = NEW.LINE% + 1: IF OLD.LINE% = 25 THEN OLD.L
     INE% = 1                                                          '*  4093
3050     LSET VIDEO$(OLD.LINE%) = CLR$                                 '*  2184
3060     LSET VIDEO$(NEW.LINE%) = A$(LOOP% + 6)                        '*  2629
3070     CALL CALL.ADDR% (BUFFER%,FUNC%)                               '*  2301
3080     FOR PAUSE% = 0 TO (LOOP%-1) * 20: NEXT PAUSE%                 '*  3035
3090   NEXT NEW.LINE%                                                  '*  1264
3100 NEXT LOOP%                                                        '*   930
3980 '                                                                 '*   283
3990 '    Scroll 30 lines of text down the screen                      '*   213
4000 CLS                                                               '*   454
4010 FUNC% = 6: CALL CALL.ADDR% (BUFFER%,FUNC%): FUNC% = 5             '*  3379
4020 FOR LOOP% = 1 TO 30                                               '*  1344
4030   IF LOOP% <= 24 THEN SCREEN% = LOOP% ELSE SCREEN% = 24           '*  3509
4040   FOR LINES% = 1 TO SCREEN%                                       '*  1861
4050     LSET VIDEO$(LINES%) = A$(30 - LOOP% + LINES%)                 '*  3002
4060   NEXT LINES%                                                     '*  1065
4070   CALL CALL.ADDR% (BUFFER%,FUNC%)                                 '*  2238
4080 NEXT LOOP%                                                        '*   938
4090 FOR LOOP% = 1 TO 24                                               '*  1354
4100   FOR LINES% = 23 TO LOOP% STEP -1                                '*  2250
4110     LSET VIDEO$(LINES%+1) = VIDEO$(LINES%)                        '*  2735
4120   NEXT LINES%                                                     '*  1062
4130   LSET VIDEO$(LOOP%) = CLR$                                       '*  1869
4140   CALL CALL.ADDR% (BUFFER%,FUNC%)                                 '*  2236
4150 NEXT LOOP%                                                        '*   936
4980 '                                                                 '*   284
4990 '    Scroll a line left and right                                 '*   214
5000 CLS                                                               '*   455
5010 FUNC% = 6: CALL CALL.ADDR% (BUFFER%,FUNC%): FUNC% = 5             '*  3380
5020 FOR LINES% = 1 TO 4                                               '*  1363
5030   FOR START% = 1 TO 79                                            '*  1507
5040     RSET VIDEO$(12) = LEFT$(A$(LINES%),START%)                    '*  2920
5050     LSET VIDEO$(13) = MID$(A$(LINES%+4),81-START%)                '*  3080
5060     CALL CALL.ADDR% (BUFFER%, FUNC%)                              '*  2334
5070   NEXT START%                                                     '*  1086
5080   FOR START% = 1 TO 80                                            '*  1504
5090     LSET VIDEO$(12) = MID$(A$(LINES%),START%)                     '*  2838
5100     RSET VIDEO$(13) = LEFT$(A$(LINES%+4),80 - START%)             '*  3226
5110     CALL CALL.ADDR% (BUFFER%,FUNC%)                               '*  2298
5120   NEXT START%                                                     '*  1082
5130 NEXT LINES%                                                       '*  1000
5980 '                                                                 '*   285
5990 '      Blinking prompt                                            '*   215
6000 CLS                                                               '*   456
6010 FUNC% = 6: CALL CALL.ADDR% (BUFFER%,FUNC%): FUNC% = 5             '*  3381
6020 PRINT CHR$(16);CHR$(17);     'enable inverse video                '*  1662
6030   LSET VIDEO$(10) = C.NRML$                                       '*  1817
6040   LSET VIDEO$(15) = C.INV$                                        '*  1747
6050   CALL CALL.ADDR% (BUFFER%,FUNC%)                                 '*  2238
6060 IF INKEY$ <> "" THEN GOTO 6100                                    '*  1996
6070 FOR PAUSE% = 1 TO 50: NEXT PAUSE%                                 '*  2281
6080   LSET VIDEO$(10) = C.INV$                                        '*  1746
6090   LSET VIDEO$(15) = C.NRML$                                       '*  1828
6100   CALL CALL.ADDR% (BUFFER%,FUNC%)                                 '*  2234
6110 FOR PAUSE% = 1 TO 50: NEXT PAUSE%                                 '*  2276
6120 IF INKEY$ = "" THEN GOTO 6030                                     '*  1934
6130 CLS                                                               '*   460
6140 FUNC% = 6: CALL CALL.ADDR% (BUFFER%,FUNC%): FUNC% = 5             '*  3385
6150 PRINT CHR$(14);                                                   '*  1163
6160 END                                                               '*   452
```

End

ros are not present. Basic often reports syntax errors where none exist and apparently destroys both the program and data in memory.

Listing 1 ends by running a second program, Demo (Listing 2). The Run command, like New and Load, forces Basic to reset its table pointers based on the value at 6E9E hex. Since that value has been changed, a protected buffer area is now ready for programs to use. The buffer won't disappear until control returns to TRSDOS.

The Payoff

Listing 2 assumes Listing 1 has already created a 1,933-byte buffer in memory. It has no way to check that assumption because the address originally stored at 6E9E varies for different versions of Basic and changes when you add a Basic enhancement package. If you write programs only for yourself and always use the same version of Basic, you can include checks in both programs that determine if the buffer has been created.

Listing 2 begins by using the current value at 6E9E to find the beginning of the buffer. Then it points 24 strings of 80 characters each at the buffer. The latter process deserves explaining.

If you use the VARPTR statement to find the location of a numeric variable, Basic returns the address of the variable's value. However, when you use VARPTR with a string variable, Basic returns the address of a 3-byte data structure called a "string descriptor." The first byte of the string descriptor contains the length of the string; the next 2 bytes contain the address of the first character of the string.

By changing the values in the string descriptor, you essentially create a new string in memory at a location that you determine. The new string can be anywhere: in the string storage area, in a file buffer, or, as in Listing 2, in the memory buffer that Listing 1 created. On the Model I or III (or the Model 4 in Model III mode), you can point a string directly at video memory—a powerful technique for creating certain kinds of graphics displays. (See *Encyclopedia for the TRS-80*, Wayne Green Inc., volume 9, pp. 79–89, for examples.)

The loop between lines 130 and 180 of Listing 2 points 24 strings to the memory buffer and sets the length of each at 80 characters. The strings continue to point to that area unless they are used on the left side of an assignment (or Let) statement. Throughout the remainder of Listing 2, these 24 strings in the Video$ ( ) array represent the 24 lines on the Model 4 screen.

What makes these strings valuable are Basic's LSet and RSet commands. Unlike the Let command or simple assignment, these commands don't change a string's descriptor. When Basic executes LSET A$ = B$ it copies B$ into the present location of A$. If the two strings are the same length, A$ contains an exact copy of B$. If they are different lengths, LSet either adds spaces or truncates B$ to fit into the current length of A$. RSet works in exactly the same manner, but it adds spaces at the beginning of B$, if necessary, to make it fit into the current A$ string.

LSet and RSet are normally used to place data in random-access file buffers. RSet is also useful for displaying information right-justified in a table, something that Print Using is incapable of doing. Together, LSet and RSet also allow Listing 2 to perform some video trickery.

Lines 200–360 create additional strings for use in the video demonstrations. The A$ array contains 30 strings of dashes and the phrase "Line nn" (nn is the number of each line). C1$ and C2$ each contain graphics blocks and spaces. CLR$ is a null string that, along with LSet, clears a video line. Finally, C.NRML$ contains a prompt string; C.INV$ holds the same string, but the high bit of each alphabetic character is set.

At the end of Listing 2's initialization section (line 360), the Print CHR$(15) command turns off the cursor so that a blinking line won't get in the way of the video screens in the demonstration.

Illustrating the Point

Each section of the demonstration works in essentially the same way. Characters are placed in the memory buffer with LSet and RSet, and the buffer is

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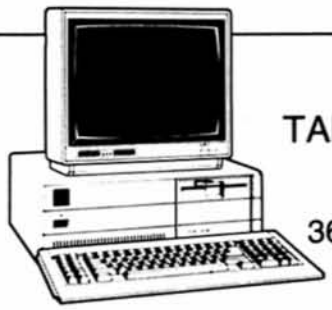

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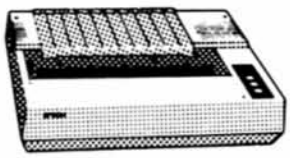

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copied to the screen with a call to function 5 of the @VDCTL SVC. The quickest way to clear the memory buffer is to clear the screen (CLS) and use function 6 of @VDCTL.

The first demonstration (lines 1000–1100) puts a moving border at the top and bottom of the screen. It does this by copying different portions of C1$ and C2$ into the buffer during each iteration of the loop and then copying the buffer to the screen. At the end of the loop, the program checks whether the user has pressed a key; if not, the entire process starts over.

The second and third routines (lines 2000–3100) show how a single line is scrolled up and down the screen. At full speed, the line moves too quickly to be seen clearly, so I've built a variable-speed pause into each routine. The technique is simple: During each iteration of the inner loops, one line is blanked out and a string is copied into the next video line before @VDCTL is invoked.

The fourth routine (lines 4000–4150) is a little more complicated because it scrolls an entire display down the screen. Once again, lines are copied into set positions in the video memory between each call to @VDCTL. This routine also shows how technique slows down appreciably when all 24 video lines have to be scrolled.

The fifth routine demonstrates horizontal scrolls and shows how LSet and RSet pad the target strings with spaces. While one line scrolls to the right, the one below it scrolls left. The effect is reminiscent of two arrows passing in midair.

The final demonstration (lines 6000–6120) shows how you can make a prompt blink in Basic. If you remove the timing loops in lines 6070 and 6110, the blinking is so fast that the lines become blurry. You will probably want to adjust the timing values to fit your sense of what's legible and pleasing.

Think of the Possibilities

Besides using the buffer to prepare a screen display, you can use it to capture the current contents of the screen. You could write a program that lets the user type anything anywhere on the screen, then capture the contents and save them in a disk file by pressing a specific key. With a little work, you could make a useful "video notebook" or index-card program.

If you like having a screen buffer, try creating a version of Basic that always boots up with the buffer in place, making a setup program like Listing 1 unnecessary. The exact way to do this depends on which Basic version you use, but I can give some general guidelines.

Start by making a new copy of Basic; you can use a command like COPY BASIC/CMD.BASIC TO VBASIC/CMD from TRSDOS Ready. You need not make a new copy of the Basic/OVL (overlay) file, since both the old and new versions of Basic can use the same low-memory overlay.

The goal is to permanently change the value at 6E9E hex in your new version of Basic. Normally, you could just look at the present value with Debug, add an offset for the desired buffer size, and add a patch to VBasic/CMD. Things aren't that simple. The value at 6E9E hex isn't put there when Basic loads; rather, it is set by part of Basic's initialization routine.

Use Debug to find the current value stored at 6E9E hex, and search VBasic/CMD either in memory or on disk for the commands that placed the value there. I found Misosys Inc.'s LS-FED II disk editor to be ideal for this task and simply asked it to search the entire VBasic program on disk for the correct value. Finally, you can either change the value directly with a disk editor or have the Patch command do it for you.

Putting the machine-language routine in memory at the beginning of the buffer is more problematic. My best advice is to poke it there at the beginning of each program that uses the buffer area. Basic fiddles around with so much memory during its initialization that it isn't safe to assume you can write a patch that will load the routine for you.

A final warning: Always test patches like these—and programs that use them—with the disk-drive doors open. Then you can reboot if anything goes wrong. If you have a hard disk with a write-protect switch, turn on the switch before running your program. If your hard disk doesn't have a protect switch, at least use the System command from TRSDOS to write-protect it before you enter VBasic.

It is amazing how a simple bug can cause a runaway program that tries to write to a disk drive. But with a few precautions, you can write any program you wish, and know that the worst that can happen is your computer will freeze and you'll have to reboot—with all your disk files still in one piece.■

Write Hardin Brothers at 280 N. Campus Ave., Upland, CA 91786. Enclose a stamped, self-addressed envelope for a reply. You can also contact Hardin on Compuserve's WESIG (PCS-117).

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return values. During this time, the help routine returns an error value code that tells the running program whether the window is correctly displayed.

On-Line Help works well, but the process of calling the routine to display a window seems unnecessarily complex. I would prefer that Checkout store the screen location and colors for each window in the window library. I can see little reason for the calling program to supply those values every time it wants to display a window.

I was confused by the manual at first. It does not have an index, and its examples are too brief and often include the phrase, "Study the sample program on the distribution diskette carefully." More noticeable are the restrictions of On-Line Help's user license. You are free to use On-Line Help to enhance your own programs, but you may not distribute those programs to others without negotiating a licensing agreement with Kudos Software. Similar on-line help programs do not require a secondary license.

You can use On-Line Help with several versions of interpreted and compiled Basic (except Quickbasic), several versions of C, four versions of Cobol, Microsoft and Turbo Pascal, Microsoft Fortran, and programs written in assembly language. It is an interesting and potentially useful programming utility, but beware of its limitations before you buy.

—Hardin Brothers

Printrix

★★★

Printrix 2.0 runs on the Tandy 1000/1200/3000 (256K) and requires two disk drives and a printer. Data Transforms Inc., 616 Washington St., Denver, CO 80203. 303-832-1501. $120.

At first glance, Printrix pitches an irresistable lure to those who want professional-looking printouts of text files. The manual's title page proclaims that "the power of the printed word is now in the hands of the common man," which is a sharp trumpet call for what is essentially a fancy printer-enhancement program.

Printrix transforms a word-processor text file into a typeset document complete with logos, icons, and other decorative graphics. You can use it to jazz up files created with Microsoft Word, Wordstar, Wordperfect, Lotus's 1-2-3, PFS:Write, and other popular programs. Printrix also merges text with graphics, incorporating designs that you have saved in Basic or created with Data Transform's sister program, Fontrix. If you do not use one of the supported word processors, Printrix also accepts any ASCII text file.

Printrix comes with preformatted page layouts that you can customize and save or use as is. Several typefaces are available, including Helvetica, Times, Old English, and Greek. Through a series of menu prompts, you choose which fonts to use and store them as part of the layout format. The format file automatically processes your document and engages the printer with a single keystroke. A layout format can read and save any configuration of Printrix-supplied fonts, but a modified font cannot be saved unless you create a subdirectory from DOS to hold it.

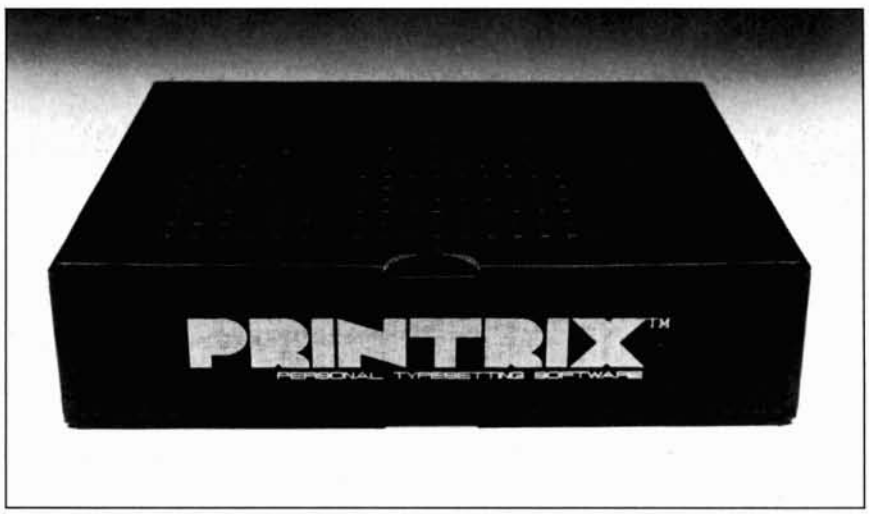
Printrix transforms a word-processor text file into a typeset document.

If you are printing a standard ASCII text file, Printrix is amazingly fast. It bogs down, however, if your word-processor file incorporates embedded commands for underlining, boldface, italics, superscripting, and other cosmetic goodies. Printrix ignores these commands, so you must insert format codes that it can read. For instance, if you are using Wordstar or PFS:Write, you have to delete all dot commands and tab sets and replace them with their Printrix equivalents; you must alter 1-2-3 files to accommodate Printrix, as well. The manual contains translation charts for each supported word processor, but adding the special codes can be a tedious job. The Printrix format commands allow for font changes, color printing, character magnification and rotation, 1- or 2-bits-per-pixel modes, negative imaging, and a host of other complex options. If you're unfamiliar with these concepts, Printrix quickly becomes intimidating.

For times when you don't want to wait for a printout, Printrix has an automated mode. From DOS, enter a scripted command argument or call up a batch file that loads the program, selects a layout file and fonts, locates a word-processor file, and starts printing. In the meantime, you can take a coffee break. Initially, you will probably have to experiment with the automated mode; its command sequences are somewhat cryptic and one false move hangs up the computer.

Although the final printout looks fine when you use an IBM PC, you hit a snag on the Tandy 1000. Most of the Printrix output contains added line feeds that can turn a one-paragraph memo into a two-page fiasco. Before running Printrix on the 1000, make sure your printer's DIP switches are set properly, with line feeds turned off. The Printrix manual contains an appendix covering supported printers and their corresponding DIP switch positions, but this information is not completely reliable. Even if you tell a printer to turn off line feeds, Line 14 on Tandy's parallel interface cable will probably override your printer's DIP switch settings. One possible solution is to carefully place a small piece of tape over Line 14 on the printer connector and return the connector to the port slot. You could cut the line physically, but I don't recommend that you amputate. This output problem occurs most frequently in Epson printers and Epson clones such as the Gemini line.

Aside from its faulty printer fact sheet, the Printrix manual is crisply written and comes with a handy reference card. If you're a beginner who wants to typeset a simple text file with no frills, the opening



Data Transforms' Printrix: A sophisticated printer-enhancement program.

chapters provide helpful tutorials to get you up and running in short order. At this level, answering the menu prompts should give you acceptable results first time out. For advanced users, the simple menu system seems cumbersome and inefficient, and it does not always provide the kind of precise detail you would expect from a commercial typesetter.

If the well-written documentation and simple menu-oriented commands make you think that Printrix is an easy solution to your typesetting needs, look again. This sophisticated program is a challenge unless you have some graphics design or typesetting experience. If you own a Tandy 1000, be prepared to spend some time getting Printrix to work properly with your printer.

—Jeffrey Frentzen

Q-DOS

★★★★

Q-DOS version 1.21 runs on the Tandy 1000/1200/3000 (256K); a hard drive is recommended. Gazelle Systems, 42 N. University Ave., Suite 10, Provo, UT 84601. 801-377-1288 or 800-233-0383. $29.95 (plus $2 shipping and handling).

Until you see this nifty program sort a 5-megabyte directory holding 300 files in under five seconds, you're not a believer. Q-DOS handles like a dream. You can execute nearly every command by pressing a single key, and if you're not sure what to do, just press F1 for on-line help.

Q-DOS stands for Quick-DOS, and it is lightning fast. This memory-resident program lets you view, move, copy, delete, and sort your files. A hard drive is recommended because rapid movement between directories and files is this program's forte; if you have a floppy-based system, Q-DOS will be of comparatively little value.

If you are searching for a file in a hard-drive subdirectory, Q-DOS finds the file, wherever it is located, in less than three seconds. Next, select the view option and the file is printed on screen. You can scroll through it and look at it in ASCII or hexadecimal. Press and enter "D" at the main menu; a directory appears instantly. Move the cursor to the subdirectory of your choice, open it, and highlight the COM file to start a program. You can tag files for deletion, rename, check file attributes, copy, move, and sort files in a directory. The status key gives you information not normally available: date and time, files selected for display, start-up drive, the sort order (ascending or descending), the drives available, special key status, and memory status. If you're interested in speeding up access to your hard-drive files, Q-DOS doesn't waste a millisecond.

Q-DOS is lacking in some regards. When you use the view function, a simple line editor would be a welcome addition. Gazelle Systems is planning an upgraded version that will include a text editor. Upgrades will be available to registered users for $15. While the manual has several typographical errors, they shouldn't cause much confusion. It has a comprehensive error-message appendix, as well as a lesson on how to organize hard-disk drives.

For those who want a file-handling package that is more of a jaguar than a gazelle, I recommend Q-DOS without reservation. It's easy to become spoiled using Q-DOS, and now I always keep it running in the background.

—Jeffrey Parker

Business Analyst ROM

★★

Business Analyst ROM runs on the Tandy 100/102. Portable Computer Support Group, 11035 Harry Hines Blvd., Dallas, TX 75229. 214-351-0564. $99.95.

Business Analyst, a program on a ROM chip for Models 100 and 102, is designed to aid the businessperson with financial analysis and what-if calculations. It plugs into the ROM socket on the bottom of the computer and accesses 10 internal registers for computations. No mathematical knowledge is required to perform numerous functions, including break-even and risk analysis, compound-interest variables, annuities, net present value, future value, and internal and modified internal rate of return. After keying in known values, you solve for the unknown values by pressing a function key that selects the type of analysis you desire.

On one side of the Business Analyst screen is a list, called the dynamic tape, that can include up to 120 entries with eight values shown at a time. Visually similar to an adding-machine tape, this feature can scroll through all values you have typed in, as well as non-numeric note entries you might have included. The program provides a full-function scientific calculator for entering values. You can save these values and the resulting calculations to RAM or cassette, or print them out. You can send an amortization table to a parallel printer, but you cannot save it as a file or print it using a serial printer. When sending data to a printer, Business Analyst ROM makes no provision for sending the carriage-return/line-feed combination needed by so many printers, especially those configured for MS-DOS computers.

If you want to enter your data on the dynamic tape, the manual suggests that you use the Model 100 or 102's pseudo-numeric keypad function by pressing the number-lock key. Other functions require that you press the caps-lock key as well. If you choose to add text notes to each entry and are using the numeric keypad, you must raise the number-lock key, press the left-arrow key, write your note, and press number-lock again to enter new values. If you want your notes in lowercase, you must also raise the caps-lock key. This keystroke confusion is typical of Business Analyst ROM program and causes operation to be cumbersome.

I never got a feeling of security with this program. When you use the analysis functions, the registers have to be set up just right in order to get a correct answer. Depending on which registers are filled or cleared, you could end up with unexpected calculation errors and not be aware that something has gone awry. Business Analyst ROM automatically changes the HIMEM pointer to reserve high memory, but when you exit the program, this pointer is not restored to its previous value. In addition to this nuisance, Business Analyst ROM cannot work with other memory-resident programs that save data directly to a portable disk drive.

I was also disappointed in the manual, which teaches by example but never summarizes all the program's capabilities in one place. The manual's last four pages finally introduce the majority of keystroke functions, following an overlong tutorial section. Six stick-on labels are included which correspond with keys that perform mathematical functions. This might sound convenient, but the manual does not give you a diagram or written description to refer to these keys in case you opt not to use the stickers.

The manual does not give instructions for removing the Business Analyst entry from the menu should you remove the ROM. By trial and error, I found that a command from Basic, Call 63012,0,1, removes the directory entry. I cannot guarantee that this is the proper way to delete it, though, since the manual skirts the subject.

The Portable Computer Support Group has a reputation for providing high-quality software, but I'm not overjoyed with the Business Analyst ROM. The program is designed to fill an obvious niche for those who use Tandy's portable computers, but it might well alienate its intended audience by being poorly documented and so difficult to use.

—Thomas L. Quindry

Circle 186 on Reader Service card.

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Circle 86 on Reader Service card.

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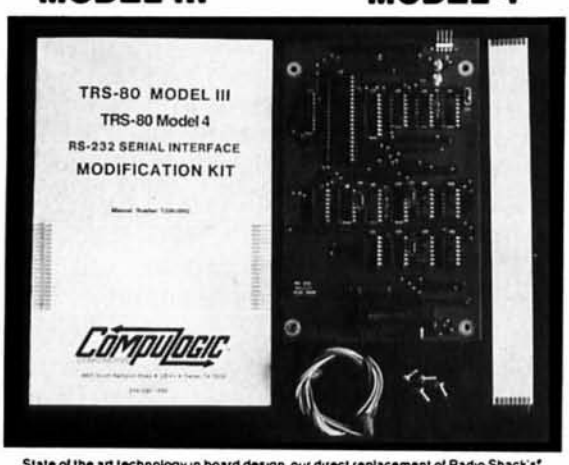

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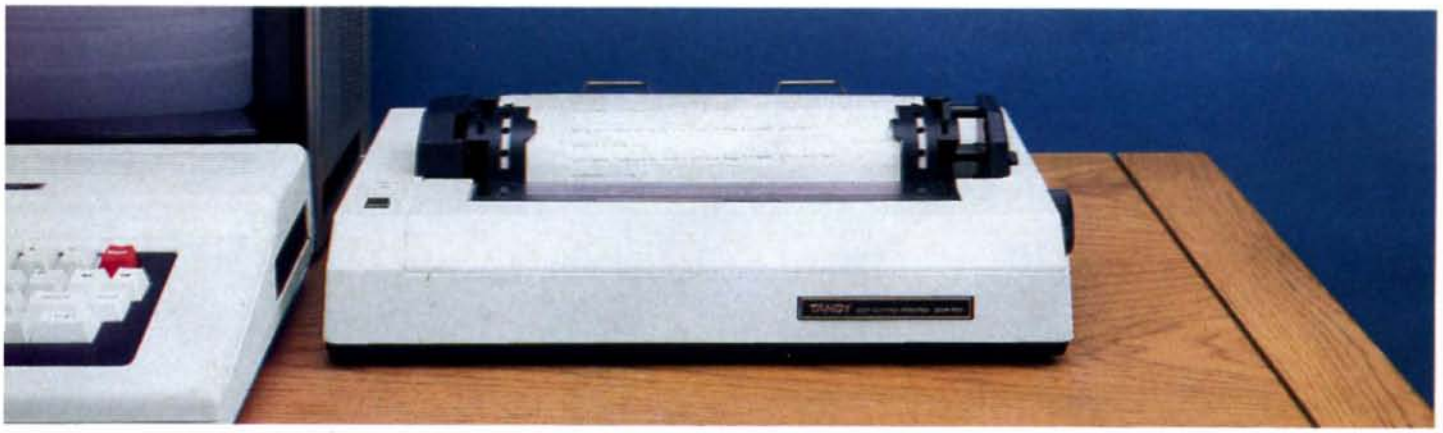

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The DMP 105 (26-1276, $199.95) is the low-cost solution for data-processing and general-purpose use. The DMP 105 features a bidirectional head that prints 80 characters per line at 43 lines per minute (10 cpi). Elongated and condensed modes are also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

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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.

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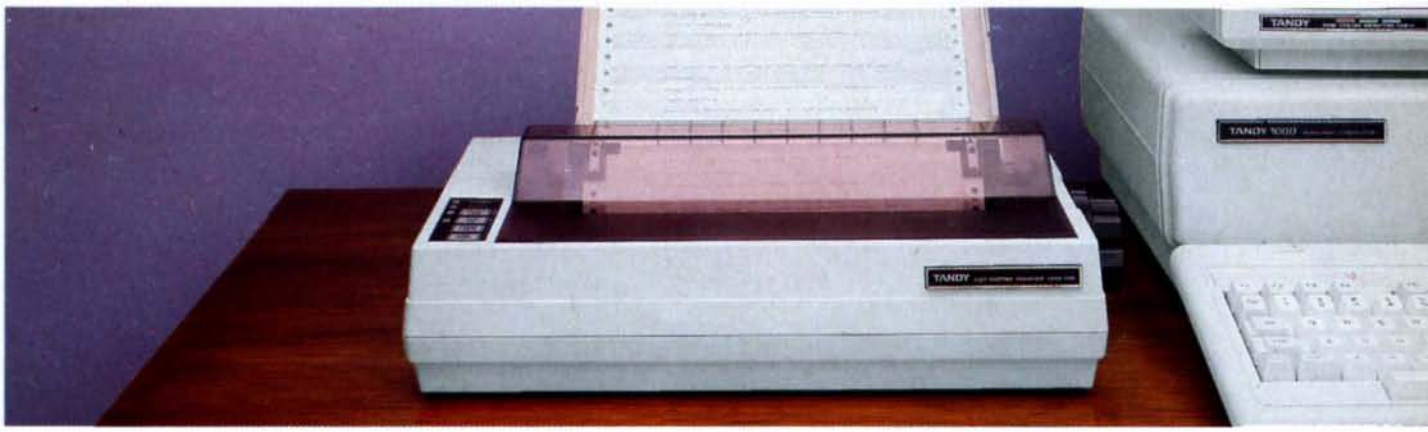

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Circle 75 on Reader Service card.

Listing continued

```
||   to 32,767 into a cardinal integer value on the range of 0 to 65,535.  ||
||   Card converts the input number to a real value on return.             ||
||                                                                         ||
|||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||}

  FUNCTION Card(N : Integer) : Real;
  BEGIN
    IF N >= 0
      THEN Card := N
      ELSE Card := 65536.0 + N;
  END;


{|||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
||                                                                         ||
||   ListInfo processes the information located in the Boot Record         ||
||   Block and lists the information out to the display.                   ||
||                                                                         ||
|||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||}

  PROCEDURE ListInfo;
  VAR
    I : Integer;

    PROCEDURE PrintFormatID(FormatByte : Byte);

      FUNCTION CheckValid(FBBTE " Byte) : Boolean;
      BEGIN
        {*
        **  Check for a valid format identification byte according to the
        **  values specified for the IBM-PC and computers that maintain a
        **  close compatible relationship.  Different OEM's may use this
        **  byte to reflect a special formatting requirement such as the
        **  Tandy 2000:  the floppy disk is formatted similar to the IBM
        **  clones but using 80 tracks and the hard disk has no special
        **  reserved partitioning sector.
        *}
        IF FBBTE IN [$FF, $FE, $FD, $FC, $F9, $F8]
        THEN CheckValid := True
        ELSE CheckValid := False;
      END;

      PROCEDURE WriteFormatByte(FBBTE " BBTE);
      BEGIN
        CASE FByte OF
          $FF : Write('Dual sided, 8 sectors/track diskette');
          $FE : Write('Single sided, 8 sectors/track diskette');
          $FD : Write('Dual sided, 9 sector/track diskette');
          $FC : Write('Single sided, 9 sector/track diskette');
          $F9 : Write('Dual sided, 15 sector/track diskette');
          $F8 : Write('Fixed disk');
        END                     {Case of FBBTE}
      END;

      PROCEDURE WriteHex(number : Byte);
      CONST
        HexChars : ARRAY[0..15] OF Char = '0123456789ABCDEF';
      VAR
        I : Integer;
      BEGIN                     { WriteHex }
        Write(HexChars[(number SHR 4) AND $0F]);
        Write(HexChars[(number AND $0F)]);
      END;                      { WriteHex }


    BEGIN                       { PrintFormatID }
      IF CheckValid(FormatByte)
      THEN WriteFormatBBTE(FormatByte)
      ELSE BEGIN
        IF CheckValid(FATSector.Entry[0])
        THEN
          BEGIN
            WriteFormatBBTE(FATSector.Entry[0]);
            WriteLn;
            WriteLn('as determined from the File Allocation Table.  The boot');
            Write  ('sector ID byte is non-standard.');
          END
        ELSE
          BEGIN
            WriteLn('(unknown)');
            WriteLn('I cannot recognize the disk format from either');
            WriteLn('the Boot Sector or File Allocation Table ID bytes.');
            Write  ('Boot Sector byte = ');
            WriteHex(FormatByte);
            Write  ('   FAT ID byte = ');
            WriteHex(FATSector.Entry[0]);
          END
      END
    END;                        { PrintFormatID }

  BEGIN                         { ListInfo }
    Write('My system identification is: ');
    FOR I := 0 TO 7 DO
      Write(BootSector.Name[I]);
    WriteLn;
    WITH BootSector DO BEGIN
      Write('My format ID byte says I am: ');
      PrintFormatID(FID);
      WriteLn;
      LowVideo;
      WriteLn(Card(BPS  ):12:0, ' bytes per sector.');
      WriteLn(Card(SPC  ):12:0, ' sectors in each of my clusters.');
      WriteLn(Card(Nres ):12:0, ' reserved sectors at beginning.');
      WriteLn(Card(NFAT ):12:0, ' copies of my File Allocation Table.');
      WriteLn(Card(NDir ):12:0, ' directory entries in my root directory.');
      WriteLn(Card(NSec ):12:0, ' disk sectors on this disk.');
      WriteLn(Card(SPF  ):12:0, ' sectors in my FAT.');
      WriteLn(Card(SPT  ):12:0, ' sectors on my tracks.');
      WriteLn(Card(NHDS ):12:0, ' read/write disk heads.');
      WriteLn(Card(Nspec):12:0, ' special reserved sectors.');
      WriteLn((Card(NSec) / SPT / NHDS):12:0,' tracks on this disk.');
    END
  END;                          { ListInfo }


{|||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
||                                                                         ||
||   CalcInfo uses the information extracted from the Boot Record Block    ||
||   and the additional information from scanning the File Allocation      ||
||   Table to calculate and print additional information about the disk    ||
||   media in question.  Note that this procedure handles the 12-bit FAT   ||
||   allocation scheme (DOS 2.0 and small fixed disks) and the newer 16-   ||
||   bit FAT allocation used on large disks with the more recent           ||
||   versions of DOS.                                                      ||
||                                                                         ||
|||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||}

  PROCEDURE CalcInfo;
  VAR
    TSize    : Real;            { Total number of bytes on the disk }
    SSize    : Real;            { Size of the required system sectors }
    Usize    : Real;            { Size of the remaining user space }
    FileSize : Real;            { Size of the FAT area allocated to files }
    BadSize  : Real;            { Size of the bad cluster block }
    Clusters : Integer;         { Number of clusters on the disk }
    Next     : Integer;         { Next cluster number for inspection }
    Index    : Integer;         { Index into the FAT }
    FValue   : Integer;         { Value of the FAT at the calculated location }
  BEGIN                         { CalcInfo }
```

Listing continued

Circle 114 on Reader Service card.

Circle 46 on Reader Service card.

Listing continued

```
{*
**   Calculate additional information pertaining to the selected disk
**   media from the Boot Record Block previously accessed.
*}
    WITH BootSector DO BEGIN
      TSize := Card(NSec) * BPS;
      WriteLn('This disk has a formatted capacity of:', TSize:9:0, ' bytes.');
      SSize := (Nres + NFAT * SPF) * Card(BPS) + (NDir * 32.0);
      WriteLn('DOS overhead requires:                ', SSize:9:0, ' bytes.');
      Clusters := Trunc((TSize - SSize) / BPS / SPC);
      Usize := Card(Clusters) * BPS * SPC;
      WriteLn('Unused bytes on the disk:             ',
              (TSize - SSize - Usize):9:0, ' bytes');
      Write('User space is ', Clusters:6, ' clusters or:      ');
      WriteLn(Usize:9:0, ' bytes.');
    END;
{*
**   Now, access the FAT and inspect each element for type.  Calculate
**   the allocated size, bad cluster size, and remaining free space from
**   the FAT.
*}
    BadSize := 0.0;
    FileSize := 0.0;
    Next := 2;
{*
**   The number of clusters determines the size of each FAT element on a
**   DOS disk.  If there are more than 4,086 clusters then the FAT must
**   be constructed using 16 bits (0 through 4,095 ($FFF) can fit in 12
**   bits -- 0 means the cluster is free and DOS reserves 9 12 bit
**   markers for its own use).
*}
    IF Clusters <= 4086
      THEN                        { Use 12 bit FAT Entry size }
        WHILE (Next < (Clusters + 2)) DO BEGIN
          Index := (Next * 3) SHR 1;
          Move(FATSector.Entry[Index], FValue, 2);
          IF Odd(Next)
          THEN FValue := (FValue SHR 4) AND $0FFF
          ELSE FValue := FValue AND $0FFF;
          IF FValue = $FF7
          THEN BadSize := BadSize + 1
          ELSE
            IF FValue <> 0
            THEN FileSize := FileSize + 1;
          Next := Succ(Next);
        END                         {While}
      ELSE                        { Use 16 bit FAT entry size }
        WHILE (Next < (Clusters + 2)) DO BEGIN
          Index := Next SHL 1;
          Move(FATSector.Entry[Index], FValue, 2);
          IF FValue = $FFF7
          THEN BadSize := BadSize + 1
          ELSE
            IF FValue <> 0
            THEN FileSize := FileSize + 1;
          Next := Succ(Next);
        END;                        {While}
    WITH BootSector DO BEGIN
      BadSize := BadSize * SPC * BPS;
      FileSize := FileSize * SPC * BPS;
    END;
    WriteLn('Current disk usage is:                ', FileSize:9:0, ' bytes.');
    WriteLn('Bad sectors take up:                  ', BadSize:9:0, ' bytes.');
    WriteLn('Bytes remaining on disk               ',
             (Usize - FileSize - BadSize):9:0, ' bytes.');
  END;                            { CalcInfo }

{||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
||                                                                        ||
||   GetParameters search the command line for a single                   ||
||   character representing the disk drive to be displayed.  If the       ||
||   parameter is valid, sets the variable DriveLetter to the command     ||
||   line string and Disk to the numerical value for that disk drive.     ||
||   If no command line parameter is present, the default disk drive is   ||
||   substituted.                                                         ||
||                                                                        ||
||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||}

  PROCEDURE GetParameters;

    FUNCTION CurrentDrive : BBTE#
    VAR
      Reg : RECORD
              CASE Byte OF
                1:(AX, BX, CX, DX, BP, SI, DI, DS, ES, FLAGS : Integer);
                2:(AL, AH, BL, BH, CL, CH, DL, DH : Byte);
            END;
    BEGIN                         { CurrentDrive }
      Reg.AH := $19;
      MsDos(Reg);
      CurrentDrive := Reg.AL;
    END;                          { CurrentDrive }

  BEGIN                           { GetParameters }
    IF ParamCount = 0             { no parameters exist -- default drive }
      THEN
        BEGIN
          Disk := CurrentDrive;
          DriveLetter[0] := Chr(1);
          DriveLetter[1] := Chr(Disk + Ord('A'));
          Exit;
        END;
    IF ParamCount <> 1
    THEN BEGIN
      WriteLn('DiskInfo: parameter error - only drive letter required!');
      Halt(1);
    END;
    DriveLetter := ParamStr(1);
    IF Length(DriveLetter) <> 1
    THEN BEGIN
      WriteLn('DiskInfo: parameter error -- more than one character!');
      Halt(1);
    END;
    DriveLetter[1] := UpCase(DriveLetter[1]);
    IF NOT(DriveLetter[1] IN ['A'..'Z'])
    THEN BEGIN
      WriteLn('DiskInfo: parameter error -- not a valid drive letter!');
      Halt(1);
    END;
    Disk := Ord(DriveLetter[1]) - Ord('A');
  END;                            { GetParameters }


{==========================================================================
==========================================================================}

BEGIN                             { DiskInfo }
  GetParameters;
  GetSector(Disk, 0, BootSector.SecBuff);
  FOR Counter := 1 TO BootSector.SPF DO
    GetSector(Disk, Counter, FATSector.SecBuff[Counter]);
  ClrScr;
  WriteLn('Boot sector information for disk drive ', DriveLetter[1], ':');
  ListInfo;
  CalcInfo;
END.                              { DiskInfo }
```

End

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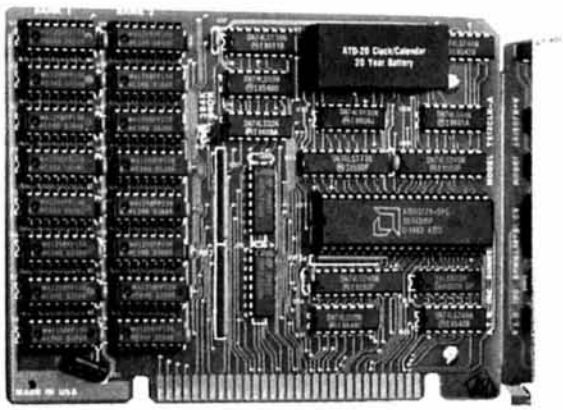

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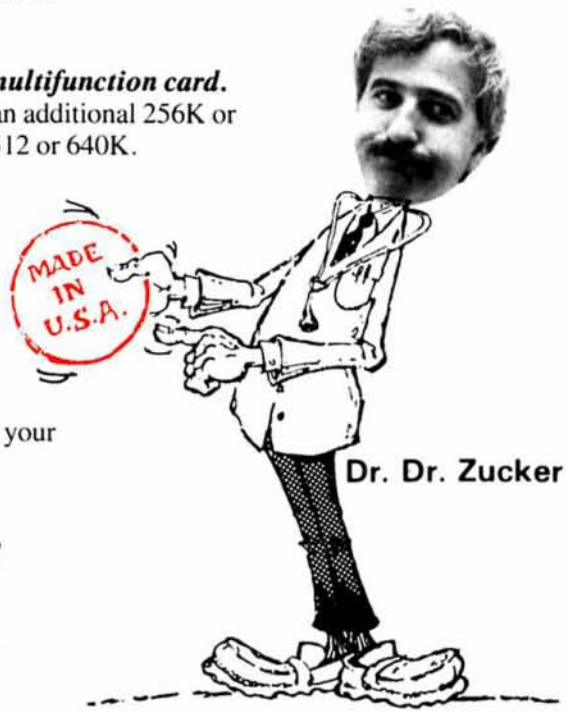

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Listing 1 Continued

```
370 GROSSYEARPAY=(SPOUSEMONTHPAY+MONTHPAY+ADDINCOME)*12                '*  3863
380 PRINT"Total gross yearly pay"TAB(30);:PRINT USING"$$$,$$$.$$
    ";GROSSYEARPAY                                                    '*  5579
390 PRINT"% of your salary to 401(K) or IRA"TAB(30);:PRINT USING
    "     $$.$";SAVINGSRATE                                           '*  5827
400 IF STATUS=2 THEN PRINT"% of spouse's salary going to 401(K)
    or IRA"TAB(30);:PRINT USING"     $$.$";SPOUSESAVINGS              '*  8061
410 ADJMONTHPAY=(1-SAVINGSRATE/100)*MONTHPAY+ (1-SPOUSESAVINGS/1
    00)*SPOUSEMONTHPAY:PRINT"Total gross monthly salary-401(K) o
    r IRA"TAB(30);:PRINT USING"$$$,$$$.$$";ADJMONTHPAY               '* 12192
420 YEARPAY=(ADJMONTHPAY+ADDINCOME)*12                               '*  2522
430 PRINT"Total net annual pay"TAB(30);:PRINT USING"$$$,$$$.$$";
    YEARPAY                                                          '*  4923
440 PRINT"Mortgage calculations----------------------------------
    --------------"                                                  '*  4900
450 MORTGAGE=HOUSERATIO*GROSSYEARPAY/12                              '*  2740
460 PRINT"Mortgage="HOUSERATIO*100"% of gross pay"TAB(30);:PRINT
     USING"$$$,$$$.$$";MORTGAGE                                      '*  6220
470 PRINT"Annual insurance"TAB(30);:PRINT USING"$$$,$$$.$$";INSU
    RANCE                                                            '*  4767
480 PRINT"Annual local property tax"TAB(30);:PRINT USING"$$$,$$$
    .$$";PROPTAX                                                     '*  5499
490 MORTGAGE=MORTGAGE-(PROPTAX+INSURANCE)/12                         '*  2999
500 IF MORTGAGE<0 THEN MORTGAGE=0:PRINT"You probably can't affor
    d a house"                                                       '*  5727
510 PRINT"monthly interest + principal"TAB(30);:PRINT USING"$$$,
    $$$.$$";MORTGAGE                                                 '*  5831
520 I=MORTGAGERATE/12: REM Most banks use this formula because i
    t is simple and makes you pay more money for interest.           '* 10272
530 PRINT"Mortgage interest rate"TAB(30);:PRINT USING"     $$.$$
    %";MORTGAGERATE*100                                              '*  5799
540 PRINT"Term (months)"TAB(30):PRINT USING"  $,$$$";TERMS           '*  3878
550 PRINT"Maximum loan"TAB(30);:LOAN=MORTGAGE/I*(1-1/(1+I)^TERMS
    ):PRINT USING"$$$,$$$.$$";LOAN                                   '*  6152
560 PRINT"Maximum affordable house";TAB(30);:PRINT USING"$$$,$$$
    .$$";DOWNPAY+LOAN                                                '*  5802
570 MONTHINTER=LOAN*MORTGAGERATE/12                                  '*  2409
580 PRINT"1st month's interest"TAB(30);:PRINT USING"$$$,$$$.$$";
    MONTHINTER                                                       '*  5184
590 PRINT"1st month's principal payment";TAB(30);:PRINT USING"$$
    $,$$$.$$";MORTGAGE-MONTHINTER                                    '*  6769
600 YEARINTER=0:YEARPRINC=0:FOR I%=1 TO 12:PRINC=MORTGAGE-MONTHI
    NTER:YEARPRINC=YEARPRINC+PRINC:LOAN=LOAN-PRINC:MONTHINTER=LO
    AN*MORTGAGERATE/12:YEARINTER=YEARINTER+MONTHINTER:NEXT           '* 12647
610 PRINT"1st year's interest"TAB(30);:PRINT USING"$$$,$$$.$$";Y
    EARINTER                                                         '*  4976
620 PRINT"1st year's principal payments"TAB(30);:PRINT USING"$$$
    ,$$$.$$";YEARPRINC                                               '*  5968
630 PRINT:PRINT"Estimate Mass. Tax-------------------------------
    ----------------------"                                          '*  5043
640 SSDEDUCT=SOCSECRATE/100*MONTHPAY*12:IF SSDEDUCT>2000 THEN SS
    DEDUCT=2000                                                      '*  4926
650 SPOUSESS=12*SPOUSEMONTHPAY*SOCSECRATE/100                        '*  3119
660 IF SPOUSESS>2000 THEN SPOUSESS=2000                              '*  2531
670 SSDEDUCT=SSDEDUCT+SPOUSESS                                       '*  2152
680 PRINT"Social Security deduction"TAB(30);:PRINT USING"$$$,$$$
    .$$";SSDEDUCT                                                    '*  5572
690 IF STATUS=1 THEN MASSPERSONDEDUCT=2200:GOTO 720 ELSE IF SPOU
    SEMONTHPAY<MONTHPAY THEN MASSPERSONDEDUCT=3200+SPOUSEMONTHPA
    Y*12ELSE MASSPERSONDEDUCT=3200+MONTHPAY*12                       '* 11430
700 IF MASSPERSONDEDUCT>4400 THEN MASSPERSONDEDUCT=4400              '*  3688
710 REM Now add deductions for other dependents                      '*  4222
720 IF STATUS=1 AND PEOPLE>1 THEN MASSPERSONDEDUCT=(PEOPLE-1)*70
    0+MASSPERSONDEDUCT                                               '*  5525
730 IF STATUS=2 AND PEOPLE>2 THEN MASSPERSONDEDUCT=(PEOPLE-2)*70
    0+MASSPERSONDEDUCT                                               '*  5529
740 PRINT"Total personal deductions"TAB(30);:PRINT USING"$$$,$$$
    .$$";MASSPERSONDEDUCT                                            '*  6222
750 MASSINCOME=YEARPAY-SSDEDUCT-MASSPERSONDEDUCT:IF MASSINCOME<0
     THEN MASSINCOME=0ELSE PRINT"Mass. 5.375% income-deduct"TAB(
    30);:PRINT USING"$$$,$$$.$$";MASSINCOME                          '* 11270
760 MASSTAX=.05375*MASSINCOME                                        '*  1894
770 PRINT"Mass. tax"TAB(30);:PRINT USING"$$$,$$$.$$";MASSTAX        '*  3843
780 PRINT:PRINT"Estimate Federal tax-----------------------------
    ----------------------"                                          '*  5277
790 PRINT                                                            '*   589
800 PRINT"Local tax="TAB(30);:PRINT USING"$$$,$$$.$$";PROPTAX       '*  3952
810 DEDUCT=MASSTAX:IF MORTGAGE>0 THEN DEDUCT=DEDUCT+PROPTAX+YEAR
    INTER+CLOSING+MISCDEDUCT                                         '*  6172
820 IF DEDUCT>LOWERLIM THEN DEDUCT=DEDUCT-LOWERLIM ELSE DEDUCT=0     '*  4368
830 PRINT"Deductions=mortage interest+state tax+local tax+closin
    g+miscellaneous-"LOWERLIM"="TAB(30);:PRINT USING"$$$,$$$.$$"
    ;DEDUCT                                                          '* 10595
840 FEDPERSONDEDUCT=FEDPERSONEXEMPT*PEOPLE                           '*  3008
850 PRINT"Personal deduction(s)"TAB(30);:PRINT USING"$$$,$$$.$$"
    ;FEDPERSONDEDUCT                                                 '*  5624
860 TAXINCOME=YEARPAY-FEDPERSONDEDUCT-OTHERDEDUCT                    '*  3506
870 PRINT"Taxable income with no itemized deduct, but with other
     deductions"TAB(30);:PRINT USING"$$$,$$$.$$";TAXINCOME           '*  9388
880 GOSUB 1060:OLDFEDTAX=FEDTAX                                      '*  2037
890 PRINT"Tax with no itemized deduct"TAB(30);:PRINT USING"$$$,$
    $$.$$";OLDFEDTAX;:IF GROSSYEARPAY>0 THEN PRINT USING" ($$.$"
    ;FEDTAX/GROSSYEARPAY*100;:PRINT"% of gross income,";:PRINT U
    SING" $$.$ ";PERCENT(I%);:PRINT"% bracket)"                      '* 15816
900 TAXINCOME=TAXINCOME-DEDUCT:GOSUB 1060                            '*  2765
910 PRINT"Taxable income with itemized deduct and other deductio
    ns"TAB(30);:PRINT USING"$$$,$$$.$$";TAXINCOME                    '*  8586
920 PRINT"Est. Fed tax with house deduct"TAB(30);:PRINT USING"$$
    $,$$$.$$";FEDTAX;                                                '*  5718
930 IF GROSSYEARPAY<0 THEN 950ELSE PRINT USING" ($$.$";FEDTAX/GR
    OSSYEARPAY*100;:PRINT"% of gross income, ";                      '*  7302
940 PRINT USING"$$.$";PERCENT(I%);:PRINT"% bracket)"                 '*  3430
950 PRINT"Tax saving"TAB(30);:PRINT USING"$$$,$$$.$$ or $$$,$$$.
    $$ per month";OLDFEDTAX-FEDTAX,(OLDFEDTAX-FEDTAX)/12             '*  7647
960 PRINT"Net monthly cost=mortgage - savings="TAB(30);:PRINT US
    ING"$$$,$$$.$$";MORTGAGE-(OLDFEDTAX-FEDTAX)/12+(INSURANCE+PR
    OPTAX)/12                                                        '*  9488
970 IF REPEAT=-1 THEN SYSTEM"RESET *DO":END                          '*  2772
980 IF ABS(LOAN-LASTLOAN)<ACCURACY THEN REPEAT=-1:SYSTEM"LINK *D
    O *PR"ELSE REPEAT=REPEAT+1                                       '*  5980
990 PRICE=DOWNPAY+LOAN:INSURANCE=INSURANCERATE*PRICE:CLOSING=CLO
    SINGRATE*PRICE:PROPTAX=PROPTAXRATE*PRICE:LASTLOAN=LOAN:GOTO
    330                                                              '*  9115
1000 REM Estimate federal tax using Schedule X for single taxpay
     ers                                                             '*  6038
1010 DATA 2390,0,0, 3540,0,11, 4580,126.5,12, 6760,251.3,14, 885
     0,556.50,15, 11240,870,16, 13430,1252.4,18, 15610,1646.6,20
     , 18940,2082.6,23,24460,2848.5,26, 29970,4283.7,30, 35490,5
     936.7,34, 43190,7813.5,38,57550,10739.5,42,85130,16770.70,4
     8                                                               '* 11917
1020 DATA 1E38,30009.1,50                                            '*  1302
1030 REM next data is for married taxpayers filing jointly           '*  5259
1040 DATA 3540,0,0, 5720,0,11, 7910,239.8,12, 12390,502.6,14, 16
     650,1129.8,16, 21020,1811.4,18, 25600,2598,22, 31120,3605.6
     ,25, 36630,4985.6,28, 47670,6528.4,33, 62450,10171.6,38, 89
     090,15788,42, 113860,26976.8,45, 169020,38123.3,49, 1E38,65
     151.7,50                                                        '* 12246
1050 DATA 1E38,65151.7,50                                            '*  1317
1060 IF STATUS=1 THEN RESTORE 1010ELSE RESTORE 1040                  '*  3247
1070 FOR I%=1 TO 16:READ UPPER(I%),BAS(I%),PERCENT(I%):NEXT          '*  3596
1080 IF TAXINCOME<=LOWERLIM THEN FEDTAX=0:I%=0:RETURN ELSE I%=1      '*  4144
1090 IF TAXINCOME>UPPER(I%) THEN I%=I%+1:GOTO 1090                   '*  3083
1100 FEDTAX=BAS(I%)+PERCENT(I%)/100*(TAXINCOME-UPPER(I%-1))          '*  3620
1110 RETURN                                                          '*   707
```

End

Program Listing 2. Replacement lines for 1987 tax law.

```
20 CLS:PRINT"1st year Tax and House buying calculations using 19
   87 tax law":PRINT"written by John Edward Crew":PRINT:PRINT        '* 10356
180 FEDPERSONEXEMPT=1900:REM 1987 Federal personal exemption         '*  4768
240 IF STATUS=1 THEN LOWERLIM=3000 ELSE LOWERLIM=5000:REM Lowerl
    imit for standard deduction                                      '*  7044
860 TAXINCOME=YEARPAY-FEDPERSONDEDUCT-OTHERDEDUCT-LOWERLIM:REM s
    tarting in 1987 you deduct the standard deduction (LOWERLIM)
     from your income when figuring taxable income. This is need
    ed because the tax tables no longer account for it               '* 20139
1000 REM 1987 Schedule X (single taxpayers)                          '*  3447
1010 DATA 0,0,0, 1800,0,11, 16800,198,15, 27000,2448,28, 54000,5
     304,35, 1E38,14754,38.5                                         '*  4272
1030 REM 1987 Schedule Y (married taxpayers filing jointly)          '*  5023
1040 DATA 0,0,0, 3000,0,11, 28000,330,15, 45000,4080,28, 90000,8
     840,35, 1E38,24590,38.5                                         '*  4253
1070 FOR I%=1 TO 6:READ UPPER(I%),BAS(I%),PERCENT(I%):NEXT           '*  3547
1090 IF TAXINCOME>=UPPER(I%) THEN I%=I%+1:GOTO 1090                  '*  3144
1100 FEDTAX=BAS(I%-1)+PERCENT(I%-1)/100*(TAXINCOME-UPPER(I%-1))      '*  3808
```

End

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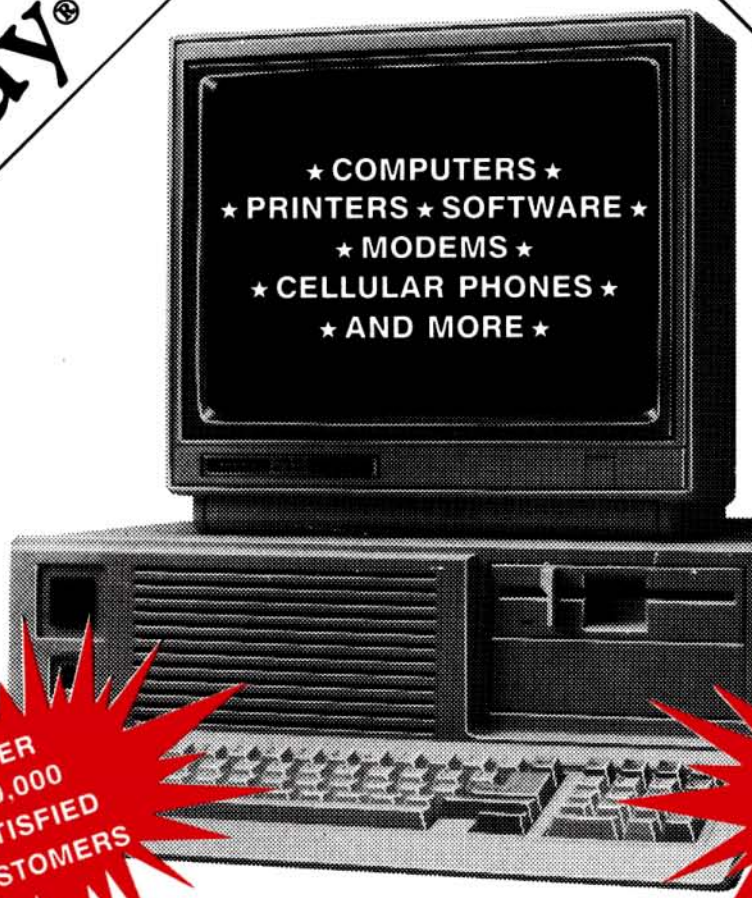

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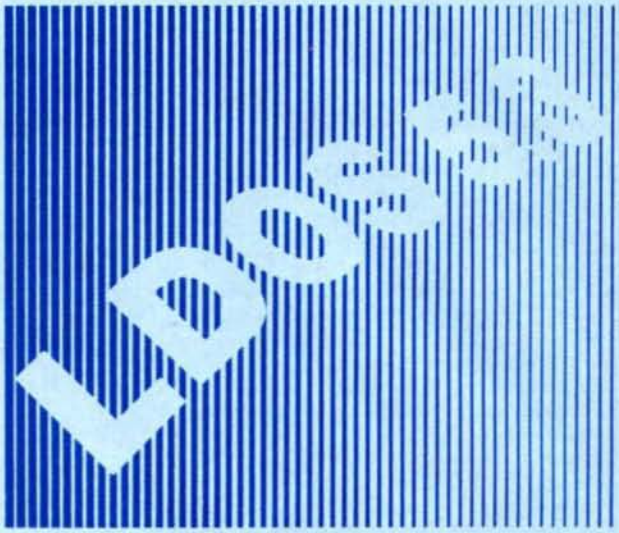

The LDOS 5.3 upgrade kit is now available to take your Model III or 4 (in 3 mode) to the year 2000. LDOS 5.3 provides complete media compatibility with LS-DOS 6.3, the newest Model 4 DOS released by Logical Systems, Inc. With LDOS 5.3, you can add 12 years to the life of your software. Just look at these 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.
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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.

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How to Use *80 Micro* Program Listings

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. With our Checksum program, you can use these values to test the accuracy of your typing after you copy the listings from the magazine.

To check your typing, follow these steps:

- Type in the program *exactly* as listed, omitting the indentations where program lines continue to a second or third magazine line, the '* characters, and checksum values. Checksum ignores all comments marked with an apostrophe, so type them in or leave them out, as you wish.
- Save the program in ASCII format with the command SAVE"filespec",A.
- Load and run Checksum (see the Program Listing). It gives you the option of sending the line numbers and checksum values to the printer or 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.
- Compare the displayed line numbers and checksum values with the checksums shown in the listing. The program asks you if you want to reload the original program. Enter Y for yes. Finally, find and correct errors in lines having checksum values that don't match.

—Beverly Woodbury
Technical Editor

Program Listing. Checksum.

```
10 'CHECKSUM/BAS by Beve Woodbury  --  8/7/86                    '*    97
20 ' Enhancements by Henry Herrdegen, Arthur Walker, Al Arena    '*    98
30 CLEAR 1000:CLS:PRINT@140,"VERIFY CHECKSUMS ON PROGRAM"        '*  3715
40 ON ERROR GOTO 410                                             '*  1241
50 PRINT:PRINT:INPUT "Enter name of File to verify";F$           '*  4280
60 PRINT:PRINT:PRINT "List Checksums to:"                        '*  3236
70 PRINT TAB(20) "<P>rinter":PRINT TAB(20) "<S>creen"            '*  3631
80 PRINT:PRINT:PRINT TAB(30);"? ";                               '*  2151
90 K$=INKEY$                                                     '*   729
100 IF K$="P" OR K$="p" OR K$="S" OR K$="s" THEN 110 ELSE 90     '*  3356
110 PRINT K$:IF K$="P" OR K$="p" THEN LP=1                       '*  2481
120 OPEN "I",1,F$                                                '*   901
130 IF EOF(1) THEN CLOSE:GOTO 370                                '*  2001
140 LINE INPUT#1,L$:L=VAL(LEFT$(L$,6))                           '*  2278
150 IF Z=2 AND L=0 THEN 130 ELSE Z=2                             '*  2095
160 A=VARPTR(L$):GOSUB 300:Q=PEEK(A)                             '*  2241
170 LS=PEEK(A+1):MS=PEEK(A+2):A=MS*256+LS:GOSUB 300              '*  3112
180 IF INSTR(L$,"'") THEN GOSUB 310                              '*   990
190 IF RIGHT$(L$,1)=" " THEN IQ=Q:GOSUB 330                      '*  2513
200 FOR K=1 TO Q:P=PEEK(A):CS=CS+P:A=A+1:NEXT K                  '*  2939
210 IF CS=0 THEN 130                                             '*  1128
220 IF CS<100000! THEN D$="-"                                    '*  1532
230 IF CS<10000 THEN D$="- "                                     '*  1484
240 IF CS<1000 THEN D$="-  "                                     '*  1469
250 IF CS<100 THEN D$="-   "                                     '*  1454
260 IF LP=1 THEN LPRINT "Line";L;D$;CS,:CS=0:GOTO 130            '*  3376
270 PRINT "Line";L;D$;CS:CS=0:X=X+1                              '*  2285
280 IF X=14 THEN X=0:PRINT TAB(30) "Press <ENTER> to continue."
    ELSE 130                                                     '*  4933
290 K$=INKEY$:IF K$<>CHR$(13) THEN 290 ELSE 130                  '*  2714
300 IF A>32767 THEN A=(65536!-A)*-1:RETURN:ELSE RETURN           '*  3269
310 I=INSTR(L$,"'"):IQ=I-1                                       '*   944
320 IF LEN(L$)=INSTR(L$,"'") THEN RETURN                         '*  1463
330 FOR I=IQ TO 1 STEP -1                                        '*  1483
340 C=ASC(MID$(L$,I,1))                                          '*  1264
350 IF C<33 THEN NEXT I                                          '*  1379
360 RL$=LEFT$(L$,I):Q=LEN(RL$):RETURN                            '*  2321
370 PRINT:PRINT"CHECKSUM/BAS now in Memory"                      '*  3246
380 PRINT "Do you want to reload the PROGRAM that you are workin
    g on? (Y/N)                                                  '*  6161
390 Q$=INKEY$:IF Q$="Y" OR Q$="y" THEN CLS:LOAD F$               '*  3023
400 IF Q$="N" OR Q$="n" THEN END ELSE GOTO 390                   '*  2704
410 PRINT "File not found...Please try again.":PRINT:RESUME 50   '*  4827
```

End

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3. ☐ At work
4. ☐ At school
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4 9 14 19 24	154 159 164 169 174	304 309 314 319 324	454 459 464 469 474
5 10 15 20 25	155 160 165 170 175	305 310 315 320 325	455 460 465 470 475
26 31 36 41 46	176 181 186 191 196	326 331 336 341 346	476 481 486 491 496
27 32 37 42 47	177 182 187 192 197	327 332 337 342 347	477 482 487 492 497
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29 34 39 44 49	179 184 189 194 199	329 334 339 344 349	479 484 489 494 499
30 35 40 45 50	180 185 190 195 200	330 335 340 345 350	480 485 490 495 500
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52 57 62 67 72	202 207 212 217 222	352 357 362 367 372	502 507 512 517 522
53 58 63 68 73	203 208 213 218 223	353 358 363 368 373	503 508 513 518 523
54 59 64 69 74	204 209 214 219 224	354 359 364 369 374	504 509 514 519 524
55 60 65 70 75	205 210 215 220 225	355 360 365 370 375	505 510 515 520 525
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102 107 112 117 122	252 257 262 267 272	402 407 412 417 422	552 557 562 567 572
103 108 113 118 123	253 258 263 268 273	403 408 413 418 423	553 558 563 568 573
104 109 114 119 124	254 259 264 269 274	404 409 414 419 424	554 559 564 569 574
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The Torrington Co. has released the cordless Manager Mouse designed for use with the IBM PC and compatible computers. The cordless mouse uses two small wheels that eliminate the need for a ball. A suspension system provides positive traction on a variety of surfaces and at any angle without a special tablet.

The mouse is fully effective up to 8 feet from a computer, and it operates up to 10 hours on a single charge. If you forget to recharge the mouse, you can plug it in and use it with a conventional cord. It charges itself during use. It enters a power-saver mode when it is not in use for more than 60 seconds and restarts automatically when use resumes. The cordless Manager Mouse retails for $229, and includes a receiver/charger with a power pack, driver disk, user's manual, 25- to 9-pin adapter for the IBM AT, and one-year warranty. Contact The Torrington Co., 59 Field St., Torrington, CT 06790, 203-482-9511.

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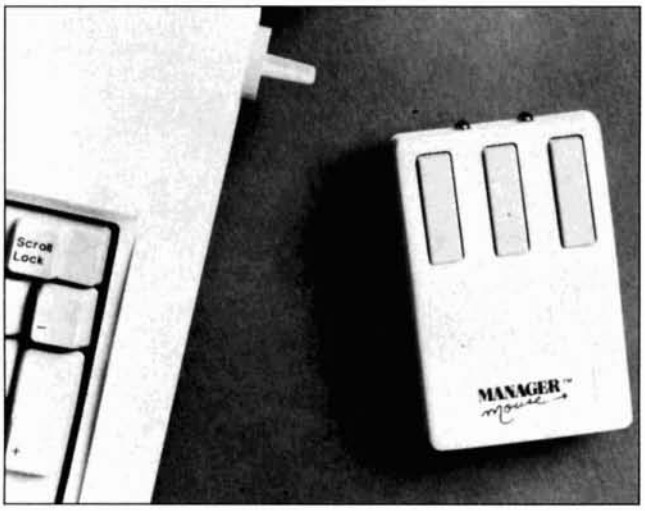


The Manager Mouse from The Torrington Co. provides cordless convenience to PC users.

Pascal-2 for PCs

Oregon Software has developed an MS-DOS version of its Pascal-2 compiler. The compiler features a large-memory model and 32-bit integer support. It is the only MS-DOS version of Pascal certified at the highest level of the international standards, therefore ensuring portability.

The compiler also includes a debugger, error walkback, Intel CEL87 mathematics library, assembler interface, execution profiler, and utility to interface to the programmable Brief text editor.

Pascal-2 is integrated with MS-DOS and all languages that follow the calling sequences for Microsoft's Pascal, Fortran, or C. Pascal-2 provides access to many DOS system services and devices, such as command-line arguments, environment variables, current date and time, and DOS interrupts.

The product is available at a special introductory price of $350. Contact Oregon Software, 6915 SW Macadam Ave., Portland, OR 97219, 800-367-2202.

Circle 571 on Reader Service card.

Stay in Memory

Microhelp has released Stay-Res, a Basic programmer's utility that makes compiled Basic programs memory-resident so you can pop them up with the press of a key or a simple Poke statement. Whenever you pop up a memory-resident program, the screen is automatically saved. It reappears automatically when the Basic program releases control of the system.

With Stay-Res, you can have more than one of your Basic programs running at the same time. Make one or more of them memory-resident, and other programs can invoke your resident program most any time. Because a programmer calls his memory-resident software with a Poke from another program, you can implement a multitasking system for background printing, RAM-disk file backup, and so on.

If your computer has Lotus/Intel/Microsoft expanded memory or you use a RAM disk for swapping, each of your Stay-Res assisted programs needs only 7K of DOS memory using the optional Expanded Memory/RAM-disk module. The balance of the program is swapped in and out of DOS memory as needed.

Stay-Res comes with a DOS shell facility and is not copy-protected. It requires an IBM PC/XT/AT or compatible running DOS 2.0 or above and a Basic compiler. Supported compilers include Microsoft Quickbasic 1 or 2, IBM Compiler version 1 or 2, and Microsoft Basic Compiler version 5.86. The Expanded Memory/RAM-disk module requires DOS 3.0 or later to work.

Stay-Res retails for $95 plus shipping and handling; the RAM-disk module sells for $50. Contact Microhelp Inc., 2220 Carlyle Drive, Marietta, GA 30062, 404-973-9272.

Circle 557 on Reader Service card.

Cheap LAN

BC Associates has developed Simplenet, a low-cost local area network (LAN) designed for small to midsize companies. Simplenet operates at 110,000 bits per second (bps), upgradable to 4 million bps. It offers one of the longest cables available—up to approximately ¾ mile—with no loss of speed.

Fully software compatible with the IBM PC network, Simplenet is supported by MS-DOS 3.1 and 3.2. Users can port from Simplenet to any other PC-compatible network system. It doesn't use any expansion slots, as it easily plugs into an asynchronous communications port.

A Simplenet base connects four IBM PC or compatible computers for $695. You can add up to four more users for $99 each and can expand the basic system to include a maximum of 32 users. Contact BC Associates, 13073 Springdale St. #134, Westminister, CA 92683, 714-526-5151.

Circle 554 on Reader Service card.

Keys to Spelling

PC Type Right is an electronic dictionary that checks spelling as you type text. Its 100,000-word dictionary doesn't use any RAM, disk space, or expansion slots. It is a hardware accessory that reads input directly from your keyboard and reports any spelling errors with a beep tone. The computer keyboard plugs into PC Type Right, which in turn plugs into the computer's keyboard socket.

In addition to the supplied dictionary, you can add up to 1,200 other words. PC Type Right also aids you when you access bulletin boards and on-line information services by intercepting errors before they are transmitted.

PC Type Right works on any IBM PC/XT/AT and compatibles with detachable keyboards and reportedly runs with any software. It costs

$199.95. Contact Xerox Corp., P.O. Box 1600, Stamford, CT 06904, 203-329-8711.

Circle 562 on Reader Service card.

Hard Protection

Intersecting Concepts has released Backup Master, a hard-disk back-up utility for the IBM PC and compatibles. In order to use Backup Master, you need at least 320K RAM. The program protects hard-disk data while backing it up to floppies, other hard disks, or cartridge hard disks (Bernoulli). It can back up a 10-megabyte (MB) hard disk to floppies in less than eight minutes.

Backup Master also features directory-tree and files display and preview-files capabilities. It can call MS-DOS functions not normally associated with programs of this type. Pop-up directories and context-sensitive, on-line help are a keystroke away. Other features are multiple include and exclude directory/filespec capability, archive flag handling, restore options, back-up history reporting, and full-screen color support.

Backup Master is not copy-protected and costs $69.95. Contact Intersecting Concepts, 4573 Heatherglen Court, Moorpark, CA 93021, 805-529-5073.

Circle 555 on Reader Service card.

Big Bytes

Micro Mainframe announced the EMS-5150, an expanded-memory board for the Tandy 1000/1200/3000. It features up to 2MB of RAM supporting the Lotus/Intel/Microsoft expanded-memory specification (EMS) version 3.2. The board comes with 256K of RAM and has sockets for adding up to 2MB.

Included with the board are expanded-memory software, RAM-test utilities, a RAM-disk program, and a print spooler. You can configure the RAM disk to any size, and all DOS commands work with this virtual disk.

Although the board is designed for use with Tandy models, it will also work in any IBM PC/XT or compatible. You can use multiple boards with the EMS-5150, giving your computer up to 8MB of expanded memory. The board costs $239.95 and is available from Micro Mainframe, 322 E. Bidwell, Folsom, CA 95630, 916-985-7501.

Circle 558 on Reader Service card.

Financial Statement

Navstar has announced Perfin, a new 1-2-3 and Symphony template that produces a personal financial statement in a form acceptable to banks and other lending institutions.

Perfin keeps detailed information on all aspects of your personal finances. You can update assets, liabilities, and sources of income in 30 different schedules at any time. Each schedule can hold as many items as your computer's memory permits. Perfin uses a menu system identical to that of 1-2-3.

Perfin costs $29.95. Contact Navstar, P.O. Box 1763, Rockville, MD 20850, 800-835-2246 ext. 230 (orders only) or 301-340-0698 in Maryland.

Circle 559 on Reader Service card.

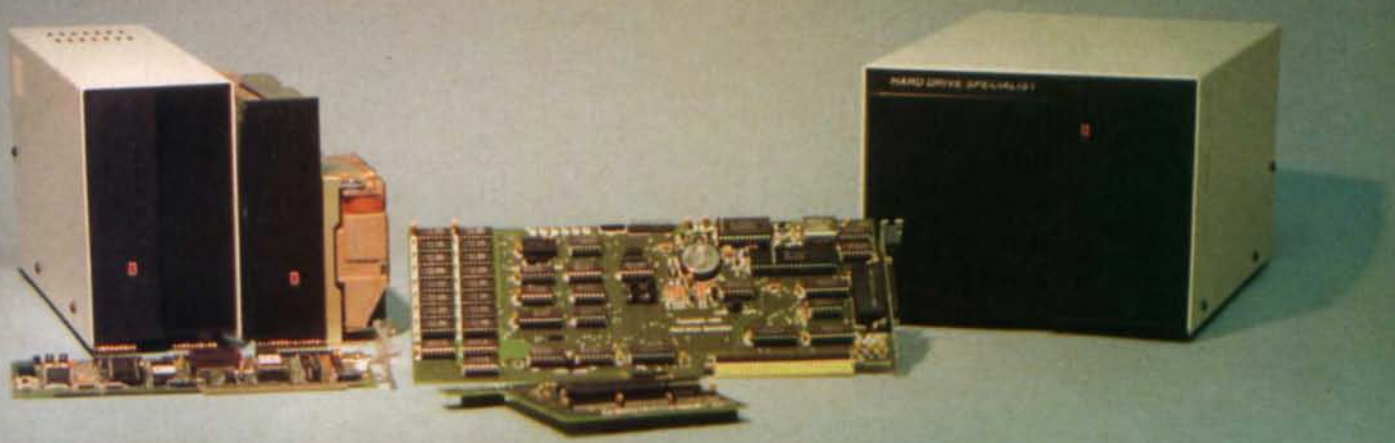
Small Wonder

ATI Technologies has announced a half-size enhanced graphics adapter (EGA) board that lets you display EGA software on any IBM-compatible color monitor. You can upgrade to the new enhanced graphics standard without purchasing an EGA monitor.

The EGA Wonder also lets EGA users display existing CGA (color graphics adapter) software on their EGA monitors, with high-resolution 8-by-14 text and double-scanned CGA graphics. Its automatic mode-switching feature lets you jump be-

Circle 455 on Reader Service card.

The Best Money Can Buy . . .



Model 1000 Multifunction Boards

New!

4 Megabyte Memory PLUS Card

For the Tandy 1000, 1000A, 1000SX, AND THE TANDY 1200. Expands memory beyond the 640K, limited by DOS, to use the Intel/Lotus/Microsoft expanded memory format. Includes a printer spooler, memory disk, and Plus port. PLUS expansion cards (RS232C, Clock, ETC) can be plugged into a special connector, saving a slot for other applications.

4 Megabyte Plus Card (OK) . . . . . **$199.**

TanPak™

For the Tandy 1000 and 1000A. Seven of the most needed functions/features have been combined into one package using only one expansion slot. Features include memory up to 512K, RS232, Serial Port, Clock-Calendar, DMA, Printer Spooler, Memory disk, and a PLUS expansion port that can use most PLUS cards.

TanPak OK . . . . . **$179.**

TanPak™ Secondary

If you already have a Model 1000 memory card and do not wish to replace it the TanPak secondary is for you. It retains all the Features of the TanPak except for the DMA. For the 1000, 1000A.

TanPak™ Secondary OK . . . . . **$139.**

TanPak™ SX

Made for the New Tandy 1000 SX, it contains all the features of the TanPak™ except the Memory and DMA features.

TanPak™ SX . . . . . **$129.**

TANDY 1000 and 1000 EX

RS232C Serial– Clock/Calender
Piggy/Back Card by Hard Drive Specialist

Now available for the TanPak, the Tandy Memory Expansion PLUS Card, the HDS Memory Expansion Plus Card, and other boards that configure their expansion port with side A (component side) routing conductors to the top side of the 62 conductor dual row header.

RS232C Serial Port features a standard female RS232C female just like the Tandy boards, or specify the male version. The port can be set up as COM 1 or COM 2.

Clock/Calender port features a perpetual clock for automatic time/date input into your programs as well as power up routine. The clock has an interchangeable port selector that allows the use of another clock on line.

RS232C-Serial PLUS Card . . . . . **$ 59.**
Clock/Calendar PLUS Card . . . . . **$ 59.**
RS232C-Serial, Clock/Calendar PLUS Card . . $129.

Memory Plus Expansion Board

For the 1000, 1000A. Includes sockets for 512K, DMA, and a PLUS expansion port.

Memory PLUS Expansion Card, OK . . . . . **$99.**

Tandy 1000, 1000A, 1000SX Hard Drives

Shop and compare. Hard Drive Specialist has been building hard drive systems for years and have sold thousands of subsystems to satisfied Radio Shack/Tandy customers. Our drives all use buffered seek logic and plated media to result in almost one-fourth the average access found on our competitor's drives. Internal drive systems include an interface card and a half-height hard drive that replaces the top disk drive in both size and power consumption. External units include an interface card, case, power supply, and hard drive unit. All units require a memory board with DMA compatible with the Tandy 1000.

20 Meg Internal . . . . . **$479.** **External** . . . . . **$629.**
30 Meg Internal . . . . . **$679.** **External** . . . . . **$829.**
20 Meg Hard Card . . . . **$499.** **30 Meg Hard Card** . . . . **$699.**
42 Meg Internal . . . . . **$1195.** **42 Meg External** . . . . **$1345.**
60 Meg Internal . . . . . **$1395.** **60 Meg External** . . . . **$1545.**

All Internal Hard Drives with the exception of the Hard Cards mount where the second disk drive usually mounts.

Tandy 3000, 3000 HL Hard Drives

Hard Drives with Controllers that meet or beat the Tandy products at a fraction of the cost.

20 Meg Internal . . . . . **$ 849.** **External** . . . . . **$999.**
42 Meg Internal . . . . . **$1449.** **External** . . . . . **$1599.**

Model 1,3,4 Hard Drives

20 Meg . . . . . **$845.** **20+20 Meg** . . . . . **$1245.**
40 Meg . . . . . **$1395.** **40+40 Meg** . . . . . **$2295.**

Model 1 add $50

Model 3/4 RS232C Card . . . . . **$69.**
Model 3/4 Floppy Disk Controller Card . . . . . **$99.**
Color Computer Floppy Disk Controller Card . . . . . **$99.**

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Use our WATS line to place your order via Visa, MasterCard, or Wire Transfer. Or mail your payment directly to us. Any non-certified funds will be held until proper clearance is made. COD orders are accepted as well as purchase orders from government agencies. Most items are shipped off the shelf with the exception of hard drive products that are custom built. UPS ground is our standard means of shipping unless otherwise specified. Shipping costs are available upon request.

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BUT YOU HAVE TO READ THE LIST OF TITLES BELOW

Hi. We work with and love computers and software. We are here to see that we give you the best products at reasonable prices. On any given day you may say to y'self, gee I wish I had this; or would it not be nice to have that...ok, look below and see if there really isn't something you would like...if we should be carrying a product that you know about that is absolutely tops, please let us know. If you have a problem with an order call me, Gus Zeller, and I will do my best for you. Thanks.

STAR MICRONICS PRINTERS

SD 10 DOT MATRIX	**$298.00**
LV 1210 DOT MATRIX NC 120 cps draft	**$167.00**
NB 15 (24 PIN) DOT MATIX wc 300 cps 24 wire	**$851.00**
WC-SR15 WIDE CARRIAGE DOT MATRIX 200 cps draft NLQ 16K	**$492.32**
NX 10 DOT MATRIX 120 cps 30 cps NLQ 5K	**$201.88**
SD 15 WC 160 cps draft NLQ mode 16K-buffer	**$398.20**

THOMPSON MONITORS

CM 36382 14" RGB	**$269.50**
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CM 36512 14" RGB VIDEO COMPOSITE	**$195.24**
VM 3107IG 12" GREEN MONOCHROME TTL	**$117.60**
VM 31021A 12" AMBER MONOCHROME	**$119.75**
CM 31311 12" 690 x 240 .31 pitch RGBI Color	**$298.00**

The following is a list of TRS-80 Software.
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.

Deadline	Mod 1	32K
Mystery Fun House	Mod 1 & 3	16K
Flight Path	Tape	Mod 027-0017
Battleground	Tape	Mod 1 & 3 16K Level 2
Beginner's Russian	Tape	Mod 3 16K Level 2
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
Domes of Kilgar	Tape	Mod 1 & 3 16K
Business Analysis	Tape	Mod 1 & 3 Level 2 16K
Business Analysis	Disk	Mod 1 & 3 32K
Ghost Town	Tape	Mod 1 & 3 16K
Mystery House Fun	Tape	Mod 1 & 3 16K
Galactic Empire	Tape	Mod 1 & 3
Dragonquest	Tape	Mod 1 & 3
Dragonquest	Disk	Mod 1 & 3
Key Commander	Tape	Mod 1 & 3 16-48K
Temple of the Sun	Disk	Mod 1 & 3
Temple of the Sun	Tape	Mod 1 & 3
Ball Turret Gunner	Tape	Mod 1 & 3 Level 2 16K
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 (Fileloc;CDisk;Password)	Disk	Level 2 16K
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
Energy Audit	Disk	32K
The Count (Adventure)	Tape	Mod 1 & 3 16K
Basic Programming Assistant	Tape	Level 2 16-32-48K
Starcross		Mod 3 32K
Suspended	Disk	Mod 1 32K
Music Teacher	Disk	Mod 1 & 3 32K
Textedit	Disk	Mod 1 & 3 32K
Encyclopedia for TRS-80 Volumes 1-10		$4.50 ea.
Kitchen Sink	Disk	Mod 1 & 3

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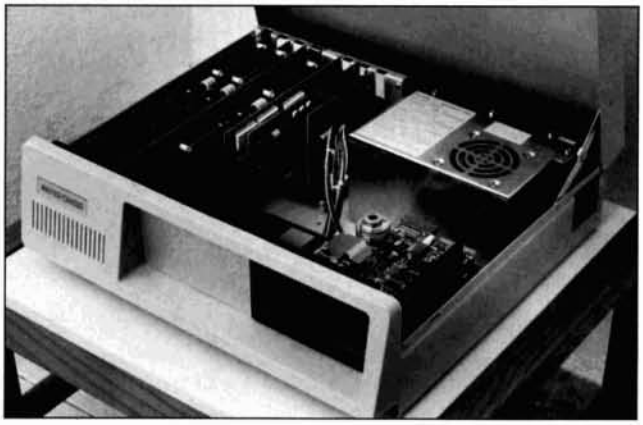
tween CGA, EGA, MDA, and Hercules monochrome modes. It is also compatible with the Hercules Graphics Card.

The board performs smooth scrolling, pixel panning, and windowing through a 1MB pixel memory. It uses CMOS VLSI gate-array technology. EGA Wonder comes with a two-year warranty and sells for $399. Contact ATI Technologies Inc., 450 Esna Park Drive, Markham, Ontario L3H 1H5, Canada, 416-477-8804.

Circle 553 on Reader Service card.

Expanding the 1000

The Master/Chassis, developed for the Tandy 1000 by AFC, lets you plug in eight IBM-size boards and add one to four half-height drives to your existing system. The chassis is large enough to sit underneath your Model 1000 and comes with a 135-watt power supply, a chassis driver card that fits into the 1000, a receiver card in the chassis, and shielded cable.



Master/Chassis lets you plug in eight IBM-size boards and add one to four half-height drives.

The Master/Chassis has built-in multiprocessor and coprocessor capabilities, so you can have more than one CPU speed-up board running with your 1000. The eight slots on the Master/Chassis motherboard are on 1-inch centers. This design lets you move a hard drive or boards that have 1000-type brackets over to the chassis.

The Master/Chassis costs $675, plus $15 for shipping and handling. Contact AFC, 6383 Rose Lane, Carpinteria, CA 93013, 800-543-2233 or 805-684-5464 in California.

Circle 552 on Reader Service card.

Master of the Lamp

File Genie is a utility that dissects and analyzes word-processor and data-base files, letting you operate on structured data files without destroying the structure.

Using a built-in file-utility creator called Genie Language, you can write scripts for converting Wordstar files to Wordperfect files (and back again) and automatically embed codes for phototypesetting. File Genie also includes a utility to diagnose data-base file structures, highlighting possible structure damage and helping to correct hidden errors in data-base files.

With View Genie, you can look at the contents of any file, including embedded control codes, and display corresponding ASCII characters. You can print these files for analysis without the printer reacting to the control codes. Other features include a search-and-replace function that you can write into Genie Language utilities, and a file splitter.

File Genie retails for $69.95

from Team Austin Inc., 6809 Convoy Court, San Diego, CA 92111, 800-822-0852 or 619-278-5353 in California.
Circle 560 on Reader Service card.

Armchair Quarterback

GFL Championship Football is a simulation of gridiron action that, unlike other games of this sort, puts the armchair player down on the field for a ground-level, in-the-helmet perspective.

Scrolling screen animation gives you the feeling of actually moving up and down the field while engaging in any of 34 offensive plays, 12 defensive alignments, kick-offs, field goals, and punts. A player can select the team's playing style, then compete against a friend or any of the 27 computer-controlled GFL opponents. Realistic sound effects let you hear the quarterback counting at the line of scrimmage and the pounding of cleats.

GFL Championship Football runs on the Tandy 1000 and IBM PC and compatibles. It costs $39.95. Contact Activision/Gamestar, 2350 Bayshore Parkway, Mountain View, CA 94043, 415-960-0410.
Circle 551 on Reader Service card.

Looking for Work?

The Super Search System and Financial Analysis Program is a software package designed for those who are looking for a new job or career change. Its menu-driven features include call reports for each job prospect, address book, activity log, expense-report file, follow-up report generator, and mail-merge file for use with a word processor.

In addition, the program provides financial reports on cash flow, disbursements, net worth, and income over a 12-month period. An optional module, Super Search Word Processing Files, comes with 61 documents, including sample resumes and query letters. These samples are available in Wordstar 3.3 or ASCII formats.

Based on the book *Super Job Search* by Peter K. Studner, the Super Search System and Financial Analysis Program costs $59.95; Word Processing Files sells for $24.95. Contact Jamenair Ltd., P.O. Box 241957 PR, Los Angeles, CA 90024-9757, 213-470-6688.
Circle 556 on Reader Service card.

Intelligent C

Computer Innovations has introduced C86 Plus, a C compiler that uses artificial-intelligence techniques to produce highly optimized C source code.

C86 Plus features ANSI C library functions such as register variables for identifying critical data items, structure assignment for efficient manipulation of complex data items, function prototypes for accurate compile-time checking and efficient code generation, long double 80-bit floating point for precise floating-point numbers and trigonometric functions, and enumerator data types for named enumeration of data types.

Additional features include an extensive library of over 300 functions, 8086/186/286/386 code-generation options, and mixed model support (near and far type modifiers). Supplied C source code lets programmers customize library routines.

C86 Plus runs on the IBM PC/XT/AT and compatibles using MS-DOS 2.0 or above. A hard-disk drive and 512K of memory are required. It costs $497. Contact Computer Innovations Inc., 980 Shrewsbury Ave., Tinton Falls, NJ 07724, 201-542-5920.
Circle 568 on Reader Service card.

Dbase on Video

Software training for Dbase III Plus has been announced by Learn PC Video Systems.

Circle 444 on Reader Service card.

Tandy 1000 Memory Card

another high quality product from Southwestern Digital

Why spend a bundle on a Tandy board? Our Board is only

$135.

Features:

- 512K of Memory
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- Expansion Port
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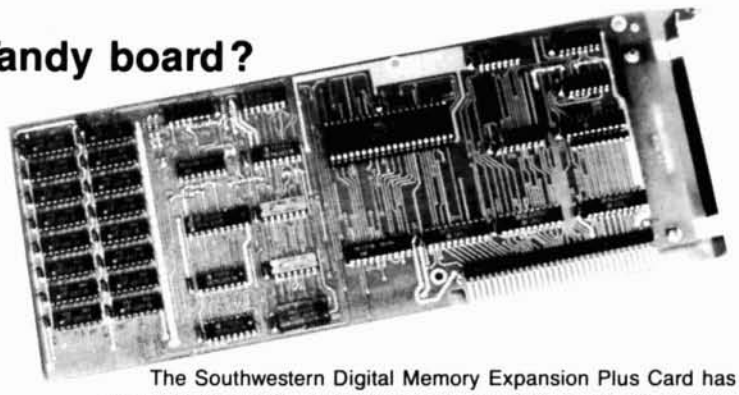


The Southwestern Digital Memory Expansion Plus Card has all the features of the Radio Shack Board but the price; you save almost $400. Features include 512K installed, burned in, and tested to give you a total of 640K, a DMA circut that is fully tested for hard drive operation, and an expansion port 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.

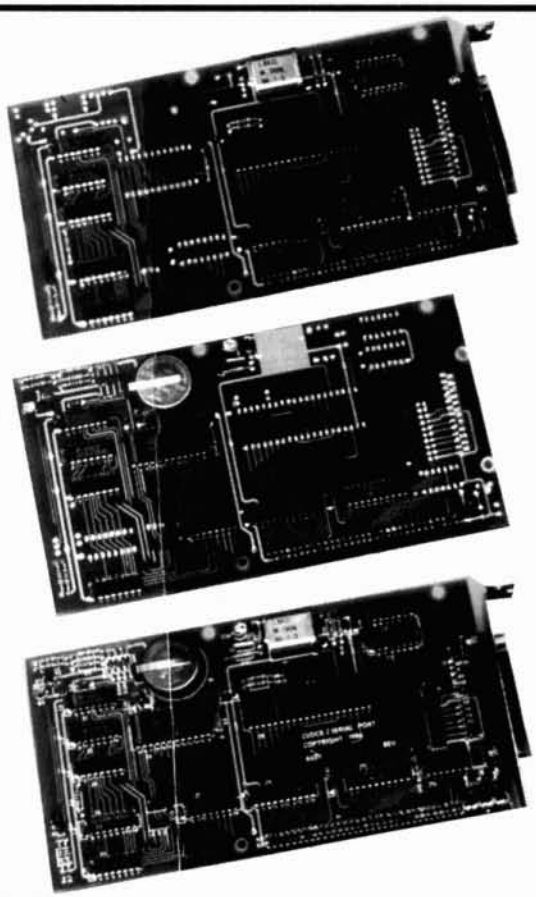
Clock/Calendar PLUS Option Board

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.

Save on the Combination
512K, RS232C-Serial Port, and Clock ..... $245.
(Includes RAM DISK and PRINTER SPOOLER)



NEW!

20 Megabyte Tandy 1000 HARD DRIVE ..... $550.
(for use with 1 or 2 Disk Drives)

Tandy 1000 Computer System

Tandy 1000 with 640K, RS232 Serial Port, Clock/Calender, and a 20 Meg Hard Drive ..... $1450.

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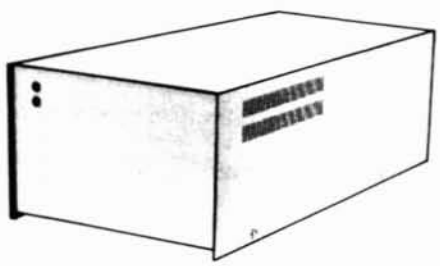
20 MEG HD SYSTEM	799.95



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20 MEG Kit	429.95

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Panasonic 1091	239.95
Panasonic 1092	359.95
Epson LX 80	Call
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Dbase III Plus: Beginning and Intermediate Skills is a two-volume set consisting of two videotapes, two guidebooks, a floppy disk, and a helper plate. You can use the program as a self-study course, with a teacher in a classroom setting, or to train entire departments.

Participants first watch a procedure demonstrated on videotape and then use the disk and guidebook to complete the same procedure on a computer. The same company offers similar training packages for Lotus's 1-2-3.

Dbase III Plus: Beginning and Intermediate Skills is available in VHS or Beta format for $695 or 3/4-inch U-Matic videotape for $795. Additional guidebooks and demonstration disks are available for $20 per set. For more information contact Learn PC Video Systems, 1525 Glenwood Ave., Minneapolis, MN 55405, 800-532-7672 or 612-377-2222 in Minnesota.

Circle 570 on Reader Service card.

TRS-80

AI for Tandy

Pittman Associates has announced E-1, an artificial-intelligence programming package that runs on the Model I/III/4/4P and Tandy 1000. E-1 is a data base that mimics a human information specialist. It learns and recalls information via standard English statements, and no previous programming experience is required to learn the system.

You can enter, validate, recall, dump, or delete information in seconds. E-1 manipulates symbols rather than numbers and can handle information concerning components, capabilities, similarities, features, examples, and properties. Responses might require it to deduce logical consequences from facts in its memory. It can learn synonyms, so you don't have to word an inquiry in a form identical to the entered data. The system automatically detects logical inconsistencies and duplicate information.

E-1 uses 370K of floppy-disk space for files and programs and comes with a detailed reference manual that includes examples and scenarios. The package costs $149.95, plus $2 shipping and handling. For more information contact Pittman Associates, 7837 Greenback Lane, Suite 272, Citrus Heights, CA 95610, 916-966-7769.

Circle 563 on Reader Service card.

File Transfer

Softrends has released a new version of Xport, a utility for transferring files on disk between TRS-80 and PC-compatible computers. As many as 40 files containing more than 204K can be transported on a single disk.

You can move files between any combination of Model I (double-density), Model III, Model 4 (Model III mode), and MS-DOS computers equipped with at least one 40-track, double-density disk drive. All DOS versions are supported. You can automate complex or repetitive transfers using chain or batch files. Other features include a help facility, automated conversion of standard DOS text files, and comprehensive error and file detection.

Xport costs $39 and is available from Softrends, 26111 Brush Ave., Euclid, OH 44132, 216-289-2002.

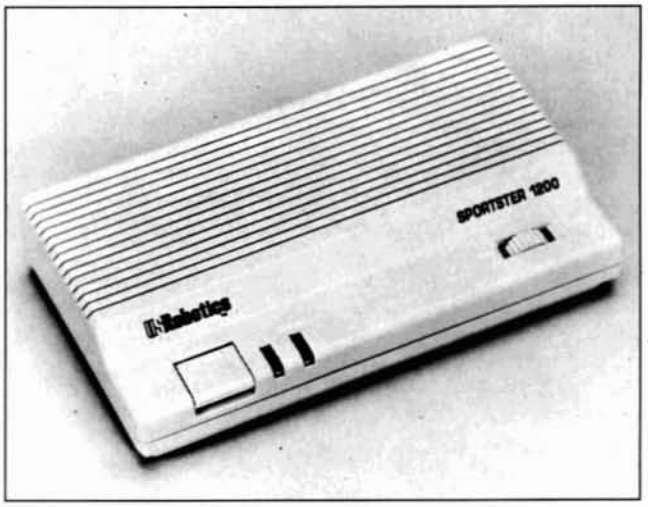
Circle 564 on Reader Service card.

ETC.

On Call

USRobotics has introduced two modems, the Courier 2400e ($699) and the Sportster 1200 ($149). The 2400e incorporates the features of the company's Courier 2400 modem while providing error-free communications through level 3 of the Microcom networking protocol (MNP). It supports autodial, autoanswer, and asynchronous communications at speeds up to 2,400 baud.

Another feature of the Courier 2400e is non-volatile



USRobotics' Sportster 1200: A full-featured modem for $149.

random-access memory (NRAM), which saves user-defined modem settings from session to session even if you turn the modem off and on. Other features include call-duration reporting, call-progress detection, modem-status summary, repeat command, quote mode, help-screen summaries of the modem command set and S registers, a printed operations summary on the bottom panel, externally accessible programming switches, and a nine-function front panel with LED indicators.

The Sportster 1200 is a full-featured, entry-level modem for users who don't require 2,400 baud. The stand-alone device features autodial, autoanswer, and operational speeds from 300 to 1,200 baud. It is designed for use on dial-up, voice-grade phone lines, so you can connect the Sportster 1200 with any personal computer or data terminal equipped with an RS-232C serial interface.

The modem reports the status of calls in progress with on-screen messages. Two LED indicators monitor data-test mode and carrier-detect/received-data status. A thumbwheel switch provides graduated control of an on-board speaker for audio phone-line monitoring.

USRobotics provides free parts and service coverage for its modems under a two-year warranty. Original purchasers can buy a two-year warranty extension for $15.

Contact USRobotics Inc., 8100 N. McCormick Blvd., Skokie, IL 60076, 800-342-5877 or 312-982-5001 in Illinois.

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Acronym Treasury

Computer and Telecommunications Acronyms is a comprehensive source for understanding and deciphering terms such as PSTN, ASCII, LAN, and Nynex.

This dictionary contains 25,000 acronyms taken from computer and telecommunications terminology, including data-processing terms, names of associations and periodicals, and information-retrieval services. Each entry includes the acronym, its definition, and additional information such as subject category, geographic location, and citation of source.

Edited by Julie E. Towell and Helen E. Sheppard, this book sells for $60. Contact Gale Research Co., Book Tower, Detroit, MI 48226, 313-961-2242.

Circle 569 on Reader Service card.

Long Line Of Printers

ALPS America has announced six new dot-matrix printer models. These printers can produce graphics and letter-quality text and are available in 18- and 24-pin configurations.

The P2424C ($1,395) is a 24-pin machine that prints

The new ALPS printers offer color as a no-cost feature.

360 characters per second (cps) in draft mode, 180 cps in correspondence mode, and 120 cps in letter-quality mode. The P2418C ($1,295) is an 18-pin machine that prints 250 cps in draft mode and 125 cps in letter-quality mode. They come with standard push-and-pull tractor feeders and a 4K buffer socketed for expansion to 256K.

The ALQ324 ($995) is a 24-pin machine that prints 240 cps in draft mode, 120 cps in correspondence mode, and 80 cps in letter-quality mode. The ALQ318 ($895) is an 18-pin machine that prints 200 cps in draft mode and 100 cps in letter-quality mode. These models come with a wide carriage and a 7K buffer with an optional 64K buffer.

The ALQ224 ($695) is a 24-pin machine that prints 240 cps in draft mode, 120 cps in correspondence mode, and 80 cps in letter-quality mode. The ALQ218 ($595) is an 18-pin machine that prints 200 cps in draft mode and 100 cps in letter-quality mode. These models include a 10-inch carriage and a 7K buffer with an optional 64K buffer.

Contact ALPS America, 3553 N. First St., San Jose, CA 95134, 408-946-6000.

Circle 565 on Reader Service card.

New Products Index

MS-DOS

TRS-80

Etc.

New Products listings are based on information supplied in manufacturers' press releases. 80 Micro has not tested or reviewed these products and cannot guarantee any claims.

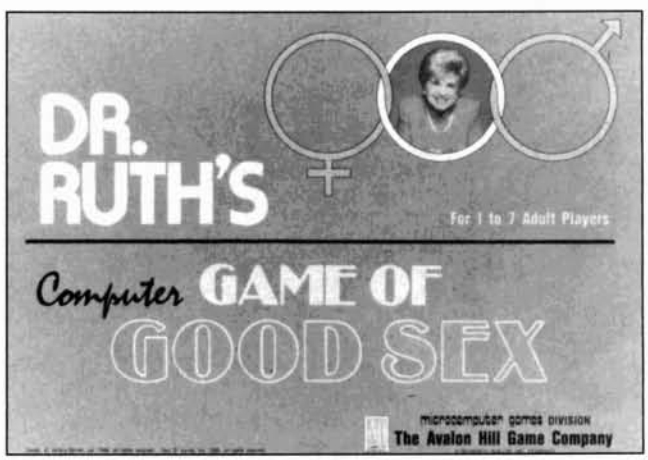
DIFFERENT TRACK

Computer Sex Clinic

After years of dispensing advice about sexuality on television and radio, Dr. Ruth Westheimer brings her candor and common sense to the computer field. Dr. Ruth's Computer Game of Good Sex lets one to seven players answer questions about love, relationships, and (of course) good sex. Successful answers score points and let a player advance to the bonus round called The Sex Clinic. There, a player hears an actual case history as told to Dr. Ruth and must choose the correct answer from four possible responses.

Dr. Ruth's Computer Game of Good Sex contains over 800 questions and features a variable time clock (for handicapping better players) and a high-score table. The game runs on the IBM PC and compatibles and costs $29.95. Contact Avalon Hill Game Co., 4517 Harford Road, Baltimore, MD 21214, 301-254-5300.

Circle 566 on Reader Service card.



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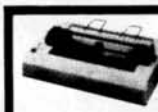
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Site license packages available for classroom instructons. It cost $49.97 plus $2.50 shipping (add 6.5% tax if from California). Thirty day money back guarantee. Pay by check, PO, VISA or MasterCard. May also be ordered under the name "Learning Templates". Lotus version also runs on VP-planner, The *Twin* and most "work-a-likes". Versions available for Excel, VIP Professional and SuperCalc4. Call (415) 952-2375 or write Solar Systems Software, 8105 Shelter Creek, San Bruno,CA 94066. Please Specify your spreadsheet and computer.

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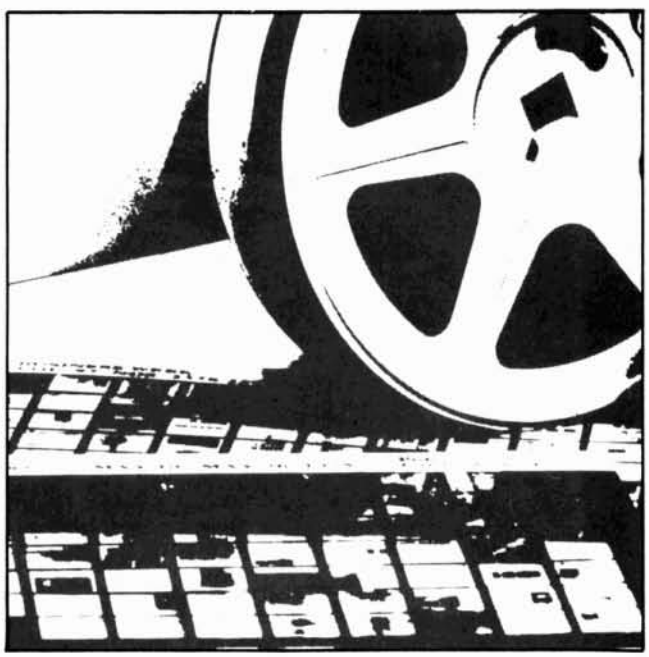

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Sorting Out the Winners

Separating great sort routines from the good was difficult, bordering on impossible, and it gave our usually intrepid judges fits. Though there isn't room to print all the good stuff, there are *80 Micro* bumper stickers and praise for the runners-up.

Dan Davis (Rome, NY) sent the fastest routine. His hybrid Shell/quick sort ordered our test list of 100 words in 11 seconds, 500 in a minute. The shortest came from Cy Shinkawa (Honolulu, HI), whose bubble variation was also the slowest. Steve Woicik's (Turlock, CA) was most flexible: a one-line Shell sort that, with preparation, could handle partial sorts, secondary keys and tag-along lists. Amy Freihofer's (Latham, NY) entry printed as it sorted, giving us something to watch. Randall Craig (Mukwonago, WI) set up his to sort on input.

The listings below show subroutines beginning at line 1000, as we required. They assume a list of words (strings) stored in an array, A$. The first item on the list is A$(1), the last A$(S%).

Dorothy Wolfe (Wynnewood, PA) sent us "a simple-minded solution." Not really. Dorothy used a basic algorithm shorn of wasted steps and non-functional embellishments. As a result the routine (Program Listing 1) is clear and concise. Easy to do, it's a good choice for sorting short lists where its slowness is not apparent: 24 seconds for 100 words, 7 minutes for 500. Of course, the Swap command, which moves pointers instead of data and is not available in early Tandy Basics, helps to speed things up.

John Bailey (Syracuse, NY) didn't have Swap in Model III Basic, so he simulated it by peeking and poking VARPTRs. (See Listing 2) Using a transfer variable (E%) to move integers is quicker than moving strings in the same way, but the real benefit comes from being able to use a minimum of string space and avoiding a lot of "garbage collection."

Francis LeBaron (Greenfield, NH) was one of a few to send us an indexed sort. His brief routine (Listing 3) uses the A% array to index the list in the A$ array without actually moving the string data. Now that Swap is available in many Basics to do the same thing, the most useful application of this technique is to sort large, multidimensional lists in disk files. Francis's program runs as written under any Basic.

Bravo to Fritz Schweitzer Jr. We wanted to sort words, and Fritz was the only one who did a dictionary sort (Listing 4) that weights upper- and lowercase letters equally. Neither briefest nor fastest, his Model III routine does the whole job.

Program Listing 1. Dorothy Wolfe's Simple Solution (4 and 1000).

```
1000 FOR J%=1 TO S%-1:FOR T%=J%+1 TO S%:IF A$(T%)<A$(J%) THEN SWAP A$(J%),A$(T%)
1010 NEXT T%: NEXT J%: RETURN
```

End

Program Listing 2. John Bailey's Model III Pointer Swap.

```
1000 FORD%=S%TO1STEP0:D%=FIX(D%/2)-(D%<2):FORM%=0TOD%-1:T%=S%-D%:FORE%=0TO0:FORK%=
M%TOT%STEPD%:J%=K%+D%:IFA$(K%)>A$(J%)THENT%=VARPTR(A$(K%)):J%=VARPTR(A$(J%)):FORT%
=T%TOT%+2:E%=PEEK(T%):POKET%,PEEK(J%):POKEJ%,E%:J%=J%+1:NEXT:T%=K%-D%:E%=(M%<K%)
1010 NEXT K%,E%,M%,D%:RETURN
```

End

Program Listing 3. Francis LeBaron's Indexed Sort (any Basic).

```
1000 A$(0)="":FOR N%=1 TO S%:A%(N%)=N%:NEXT:FOR N%=1 TO S%:IF A$(A%(N%))<A$(A%(N%-
1)) THEN T%=A%(N%):A%(N%)=A%(N%-1):A%(N%-1)=T%:N%=N%-2
1010 NEXT:RETURN
```

End

Program Listing 4. Fritz Schweitzer Jr.'s Dictionary Sort (I/III).

```
1000 T=S%:DEFFNS(N,X)=ASC(MID$(A$(N),X,1))AND95:FORW=1TO1:T=T-1:FORN=1TOT:B$=A$(N)
:C$=A$(N+1):L=LEN(B$):M=LEN(C$):R=(L=<M)*-L+(M<L)*-M:FORX=1TOR:P=FNS(N,X):Q=FNS(N+
1,X):Y=P=Q:IFYANDX<RTHENNEXTELSEIFP>QORX=RANDL>MANDYTHENA$(N)=C$:A$(N+1)=B$:W=0
1010 NEXTN,W:RETURN
```

End

The Same Difference

She stepped off the scale and her smile was brilliant.

"I've lost five pounds!" she bragged.

"How much is that in dollars and cents?" I wondered.

"Seven-forty at today's prices," she calculated. Then she laughed. "Frusen Glädjé?"

I nodded. "Why not?"

Pounds to dollars or pounds to kilograms, converting among various systems of this or that is a common necessity. Faced with something that needs to be noted, human beings, it seems, have never been satisfied with one way of noting it.

A few months ago your Fine Lines programs turned dates into days of the week. We might have extended that idea and converted our Gregorian dates to any number of calendars of historical or local significance. Of more practical value to some may be the relationship of Rocky Mountain Time to Wall Street time to the time at the London Gold Exchange.

What ever happened to metric conversion? That wave of the future put kilometers on a few roadsigns and most speedometers.

Talking about weights and measures opens a can of worms—which might hold a bushel, ton, or gross of the critters. An ounce is fluid, troy, avoirdupois, or apothecary. Statute miles or nautical? How much heat in a cord of wood? How many berries to the quart?

Now that you have a few ideas, do your best, most important, most interesting conversions for us. Change one system of notation for another (and another still, if you can). Use up to two full lines of Basic. We'd like you to be accurate but, as always, cleverness, wit and whimsy mean the most to us. In turn, we'll convert the best of your entries into *80 Micro* T-shirts and bumper stickers.

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 March 15, 1987. This doesn't give everyone the same amount of time. We apologize to our overseas readers especially.
3. This month's winners will appear in the June 1987 issue.
4. Employees of CW Communications are not eligible.
5. Send your entry to: *80 Micro*, Fine Lines, 80 Elm St., Peterborough, NH 03458. We will not be able to return entries.
6. Specify your T-shirt size. Bumper size not required.■

Contact Harry Bee at P.O. Box 567, Cornish, ME 04020.

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GREAT FOR ADVANCED USERS

Yes, Dac-Easy Base is easy to use, and it is also very powerful. An unlimited number of records with up to 60 fields per record, ability to access up to three files at a time, date arithmetic capability, formula fields for calculations within files, dynamic abbreviations, and keyboard macros are just a few of the powerful features available at your fingertips. Dac-Easy Base can read and convert dBASE II files and can run DBASE II programs.

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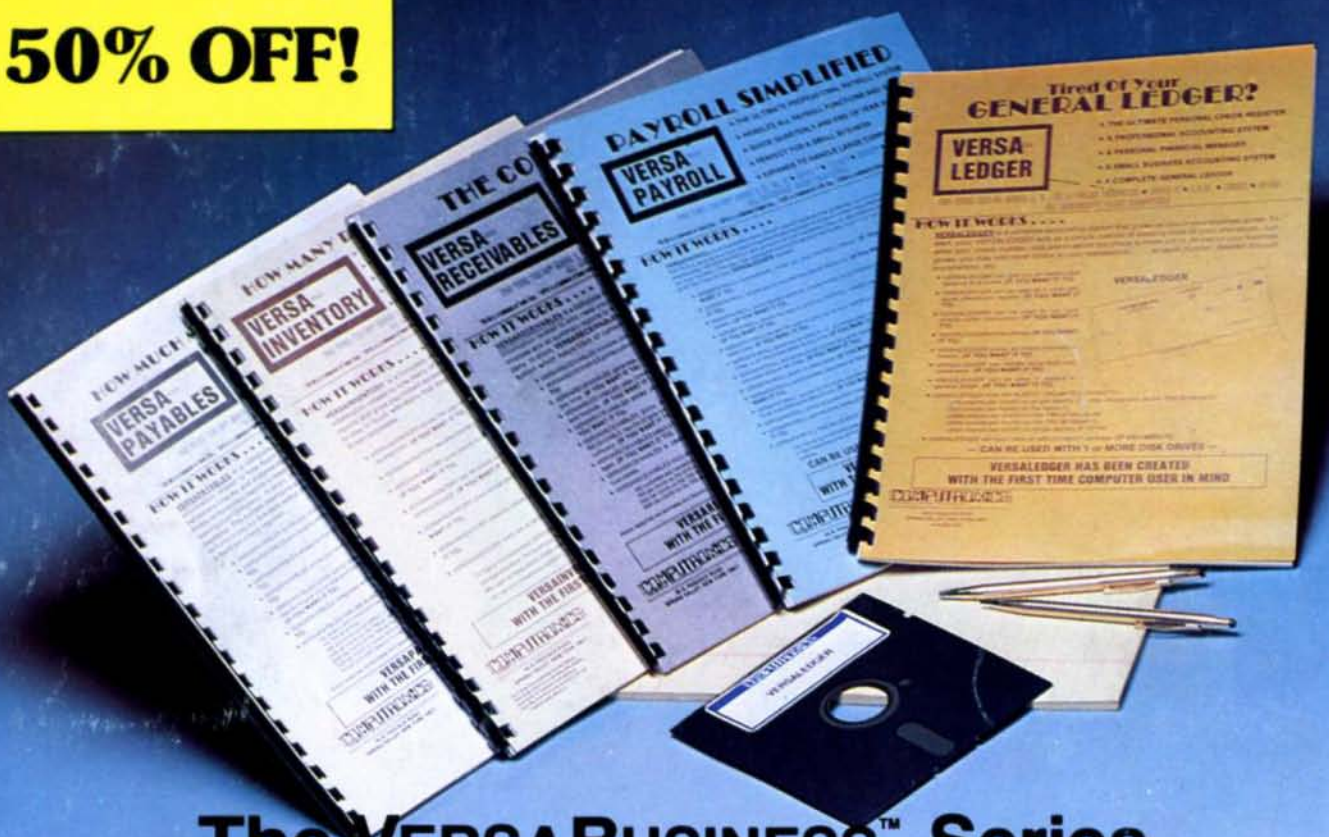

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