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Most small system users think all microcomputers are created equal. And they're right. If you want performance, convenience, styling, high technology and reliability (and who doesn't?) your micro usually has a price tag that looks more like a mini. It seems big performance always means big bucks. But not so with the SuperBrain!

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ROCOMPUTING

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North Star

102 Computer/Video Disk Combo That Really Works! P. Anderson, E. Carr PET

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Computer Games Wear Thin

By Wayne Green

When Will The Industry Grow Up?

The Arcade Misunderstanding

Arcade games are a lot of fun. Even the early pong games were a ball. I remember spending hours slipping quarters into an Atari tank war game in Atlantic City during the first computer show there. But somehow the fun of the pong games didn't seem to carry over into playing them on my home television. Something got lost in the translation. The novelty and excitement of even the advanced color pong, with a half dozen different (but similar) games, only lasted a week or so.

Early computer hobbyists, remembering the fun of arcade games and having played Star Trek on a big computer, spent hundreds of dollars and hundreds of hours building a computer so they could play...only to become bored within a few days. Other hobbyists spent their time and money building a system to play the Game of Life, a real thriller—for an hour or two.

Apparently not aware of this syndrome, several firms have spent millions of dollars to bring computerized games to the public. The Mattel ads on television attempt to illustrate how much more wonderful their stick men playing baseball are than the Atari stick men. After the debacle with pong and super pong, I wonder how many people are going to shell out from a few hundred to a thousand dollars to play games. Is it really worth several hundred dollars to play computer hangman?

Games are still selling well for most systems, though even the best of the adventure games seem to wear thin after a few hours. Simulations seem to hold one's interest better than plain games, so I suspect that these will be improved and eventually replace most of today's games.

I don't have the fun playing against the computer (as in Star Trek) that I do

against people. I enjoy winning against people and get no particular thrill out of winning or losing to a computer. It isn't the same...any more than playing the tank game on my Atari at home is as much fun as shooting 'em up in an arcade—even at a quarter for a few minutes.

I'm much more interested and enthusiastic about computer applications. I enjoy seeing the sales curves of the various publications we put out, and like to keep track of the couple hundred projects which are moving along. I enjoy using the computer where it is doing work for me, but it gets switched off when it comes to games. Besides, how do I know that it *really* is choosing random numbers when it plays against me? Damned thing probably cheats. I don't trust 'em.

I get the same feeling in Vegas when I come up against a computerized onearmed bandit. With the old mechanical ones you could sort of forget that they, too, were programmed to screw you. With the computer bandits I don't ever forget that the screwing is inevitable.

The rage for those handheld computerized games is dying down. We'll get a better idea of where that is going when we see the Christmas sales reports. The manufacturers were griping last Christmas that the fad for these miniature games was fading.

Where will this leave Mattel, Bally, APF, Atari and the other computer firms which went for the game approach? Perhaps my own experience is not in the mainstream and there really *are* millions to be made selling expensive game computers as a continuing business. I would suggest that the firms in this part of the industry keep their sales research departments up to strength, watching for changes and keeping options open.

If *I* were on the board of directors of one of these firms I'd be pushing for business and educational applications just in case the system turned out not to be able to re-

place cards as an adult game. Me? I'll take a good game of Cribbage or Pitch anytime.

Show Births and Deaths

Was it only five years ago that we saw the first microcomputer show in the country? It seems like ages. It was in Atlantic City, then, as now, a tacky, rundown place to go. But everyone went, with chartered flights for hobbyists coming in from San Francisco. That was in August 1976...and it was there, incidentally, where *Microcomputing* was first announced. We had a booth at the show and sold over a thousand subscriptions.

Most of the firms which exhibited there are now long gone. They were, for the most part, run by hobbyists and succumbed to either too much or too little success. Apple, which had a table right across from our subscription booth, is still around. It was the first public showing of the Apple I, and Steve Jobs picked up about 20 orders from dealers...and was on his way.

The chap who put on the show tried it again the next year at Atlantic City, but it didn't do as well. Then he moved it to Philadelphia for three years, where it ran down even more. He didn't bother this year.

Most of the early computer shows have faded away as the interest moved from eager hobbyists to more sophisticated business and educational buyers. Now the shows are almost all local in nature, with a small group of computer stores and software firms exhibiting. The recent ones in Chicago and Washington were about typical...running perhaps 50–60 booths and pulling a fair crowd on Saturday.

Frantic show promoters have recruited all sorts of weird firms to flesh out their shows. We see condominium sales from Florida, encyclopedia sales, eyeglass



cleaner chemicals, telephones, intercoms, office copiers, car gadgets, and so on . . . with the computer stores intermixed. We also see fewer and fewer of the larger firms bothering to exhibit at these shows. They've found that other forms of promotion are far more efficient in selling the product. Indeed, unless you have an extraordinary amount of profit in your product—and it is relatively low in price —shows can lose for you. Local dealers are often able to pick up customers, so they find shows pay off.

To you, the show goer, this means that you are not likely to see much more than you would visiting your local dealer, yet you'll be out around \$5 for the entry fee. Of course, if you are anxious to buy an encyclopedia at retail price, you're all set. I've found very few real bargains at shows in the last year or so. With booths costing around \$600 to \$1000 each, plus the cost of the exhibit and the people to man the booth, you can understand why bargains are not likely. They have to sell a bundle of stuff just to break even.

The word seems to have gotten around that shows can make the promoter rich, hence the proliferation of shows. A recent one in New York, run by a new show entrepreneur, was a disaster. Just about every major city has a show scheduled for this fall and next spring. It will be interesting to see if this settles in . . . or dies out.

Clive Alive!

One of the more interesting cultural micro events in recent times was the visit of Clive Sinclair to Boston, where he did a show and tell of his ZX-81 system.

At \$100 for the kit and \$150 for the assembled model, people have been buying the ZX-81 just for the hell of it. After all, outside of a lunch in New York, ten lunches in Peterborough or a hundred

One of the more interesting cultural micro events in recent times was the visit of Clive Sinclair to Boston.

lunches at home, what can you get for \$100 any more? So people have been buying these computers...mostly for fun. Some say they're for their kids.

This new micro-micro is selling like fish and chips in England. Clive said that he'd sold 30,000 of them there in August and 40,000 in September. They're being made by the Timex people for him, so he doesn't even have to cope with a factory and strikes.

The finished model has accounted for 85 percent of their sales in the U.K., so not many buyers are getting the experience of putting the kit together. Presumably they want to use it for something rather than learn about its construction.

Schools have been big purchasers, with over 2900 schools in the U.K. buying them so far...that's over half of the secondary schools in the country. Well, it is an economical way for a school to advertise that it has a microcomputer for the kids so they will become computer literate.

Clive showed a prototype of a printer which is in the works. It will type at about 50 characters per second, he says, and cost under \$100. It will print out the complete screen for you or list your data.

In the U.S. they are selling by mail only. The ads have already hit—two-pagespread color ads almost everywhere! They're looking to sell about 20,000 a month in the U.S. I don't think they will have any problem with that goal. *Microcomputing* is interested in articles and programs on the ZX-81.... Let's get busy with this one.

Women and the Future

As the invasion of offices by microcomputers continues to expand, what have been considered women's jobs in the past will be hardest hit. Computerized data input will eliminate the need for rows of women doing data input typing. As word processors and electronic mail grow, the typing pool will dry up and even the secretary's responsibilities will diminish, leaving the women in that role either out of work or else needing retraining for some other position.

Will women cope with this by entering business in much the same way that men do, either by starting with a relatively menial job and working upward, or by getting a business education and starting in the middle? Perhaps we will be seeing more women in sales, marketing, advertising, PR, collections and other jobs which will be of increasing importance as computers take over the boring, repetitive work.

Just because people will not have to spend their lives doing boring work is no reason for them to drop out of work entirely.

Investing

Why should the banks be the only ones to get the gravy? Every now and then an investment opportunity comes up where someone could make the same interest as the banks are getting. It seems like a shame to have the banks making all the money. If you've got some extra money which you'd prefer to have working for you, drop a note to me and I'll pass it along to where it might do some good.



8 Microcomputing, January 1982





PET-POURRI

Good News For Old PETs

By Robert W. Baker

Execom's 80-Column Adapter

80-Column Adapter

Execom Corp. of Racine, WI, has announced an 80-column adapter upgrade for older 40-column PET/CBM systems. It can only be added on 2000, 3000 or 4000 series models that do not have the CRT display controller chip used in the newer systems. The upgrade consists of one two-inch-square logic board for both the 40- and 80-column screen editor ROMs, a 4×5 inch logic board that replaces the original screen RAMs and a separate 80-column reference ROM that can be located in any of the normal expansion sockets.

The circuit board and the ROM combination allows you to switch between the original 40-column display and a new 80-column display. The display selection can be made from the keyboard or through program control with two simple POKE commands. All utility software, like Toolkit, DOS Support (Wedge), Extra-Mon, etc., is compatible in both modes of operation.

Price of the modification is \$275 plus installation. The actual installation involves cutting circuit traces on the main PET/CBM logic board, soldering additional wires to the circuit board and installing four new sockets. The installation should only be done by your local dealer or a qualified technician.

Execom Corp. will be offering the installation for \$75 (plus shipping), but you must remove your main logic board and return it to Execom Corp. Factory modifications must be prearranged before you can ship the board to them. Also, be aware that this installation may void Commodore's 90-day warranties on new systems. All Execom boards will have a one-year warranty.

Unfortunately, I haven't had the opportunity to see this installed in a system as

· · · · · · · · · · · · · · · · · · ·
120 REM UTILITY PROGRAM FOR PRINTING
130 REM FORMATTED OUTPUT DISK FILES
140 REM CREHTED BY WURD PRU 3.
160 REM BY: ROBERT BAKER
170 REM 15 WINDSOR DRIVE, ATCO, NJ
180 REM 190 DEM ***********************
200 :
210 INPUT "TFILENAME"; F\$
230 IF LEFT\$(F\$,2) <> "0:" AND LEFT\$(F\$,2) <> "1:" THEN F\$="0:"+F\$
240 OPEN 15,8,15
250 OPEN 8,8,8,8,F\$+",S,R"
270 PRINT: IF EN=0 THEN 300
280 IF EN=62 THEN PRINT"#FILE NOT FOUND": GOTO 370
300 PRINT"OK, READING FILE"
310 OPEN 7,4,7: PRINT#7: CLOSE 7 : REM PUT PRINTER IN UPPER/LOWER CASE MODE
320 OPEN 4,4
340 IF ASC(C\$)=13 THEN PRINT#4,MID\$(S\$,2): S\$="": GOTO 360
350 S\$=S\$+C\$
360 IF SS=0 THEN 330 370 CLOSE 4: CLOSE 8: CLOSE 15
READY.
Listing 1. Utility program for printing formatted output disk files created by Word
Pro 3.

yet, so I can only pass on what information I have. For more information, see your local dealer or write Execom Corp., 1901 Polaris Ave., Racine, WI 53404.

Formatted Disk Files From Word Pro

I recently came across a Word Pro 3 feature that is hinted at in the manual but not fully explained. For those of you who are currently using Word Pro 3, there is a way to save the formatted output on disk in a sequential data file. There is another option to the output (Control-0) command that is not documented anywhere in the manual. The only options covered are the C for continuous output, G for global and X for multiple copies. The manual does explain how the formatted output will be written on the disk, but not how to generate the disk file.

All you have to do is enter a D option to the normal output command. Word Pro 3 will ask for a drive number and file name, and then write the formatted output to the specified file on disk. The file created will be a sequential data file that you can then use for input to other programs or utilities. Each formatted line is stored on disk as a single data record with a leading quote character. The normal carriage return is used to terminate the line. If multiple blank lines are generated using the LN or FP commands within Word Pro, then multiple carriage return characters will appear at the end of the last printed line.

I've included a program that will read and print the formatted data files created by Word Pro (see Listing 1). This program will handle all page formatting and line spacing correctly but it does not support expanded printing. Any expanded print output will be printed in reverse

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(normal size) on a Commodore printer. This may or may not cause problems.

When you run the program it simply asks for the filename of the file to be printed. A default drive number of zero is automatically assigned. You can indicate a specific drive number by preceding the filename by the drive number and a separating colon. You must, however, enclose the entire string within quotes when specifying the drive number. The program checks that the file exists and then proceeds to start printing each line from the data file. There is a short delay between printing each line, because a GET# command is used to read and check each character of the line. This allows checking for the multiple carriage returns that may exist at the end of any line.

If you think about the possibilities, this Word Pro feature is really valuable. You could create a software package with complete documentation, all formatted by Word Pro, but the user wouldn't need Word Pro to print his own manuals from disk. Actually, this is better than getting printed manuals since you can print as many copies as you want, as often as you want and you don't have to worry about losing your only copy.

Once you've gotten the formatted documentation onto disk as a sequential data file, you can easily copy it onto cassette tape. I've included a copy of my utility program for copying data files from disk to tape (see Listing 2). If you remember back in the Feb. 1981 column, I presented a program for copying tape data files onto disk. Well, this is the other program I mentioned in that column for copying data files back onto disk. It will work for any data file, not just the Word Pro formatted output files.

Once you've gotten the formatted output files on tape, you have to make a few changes to the first printing utility to read the data from tape instead of disk. I've included a copy of the print utility for printing from tape files (see Listing 3). Now you can get first-class formatted documentation without a disk or Word Pro, as long as you have a printer. Actually, you could modify the printing program to just display the information and you wouldn't even need a printer.

If you are writing a program that interfaces with Word Pro files, it may be easier to read these formatted output files instead of Word Pro source (input) files. Word Pro's source files use a special character encoding and have numerous commands within the text. Also, the source files are actually program files instead of sequential data files. The formatted output files have all the format commands removed and only contain the actual data. Everything is in the correct format and the data is now true ASCII coding. This should make the formatted output files easier to deal with.

This Word Pro output option opens a number of applications that many people

Now you can get first-class formatted documentation without a disk or Word Pro.

may not have been aware of before. It might be interesting to see what we can do with it.

Jump Vectors

I thought it might be useful to list the jump vectors located at the top of memory in the VIC-20. The corresponding operating-system subroutines can be called by user-written machine-language programs or even from BASIC. I've included a brief description of the operation of each routine and the registers used. Many of these routines are the same as those used in PET/CBM machines, but the addresses may be slightly different. As such, this information should be of general interest. Note that addresses are shown in hexadecimal.

SFF8A—*Restore Old I/O Vectors.* Restores default vector values for system subrou-

tines and interrupts.

SFF8D—*Read/Set Vectored I/O.* If carry is set, the current contents of the RAM vectors are placed in a list pointed at by the X and Y registers. If carry is clear, the user list pointed at by the X and Y registers is transferred to the system RAM vectors.

SFF90—Control Operating System Messages. Bits 6 and ,7 of the accumulator enable the printing of control and error messages, respectively. If the bit is set then the messages will appear. SFF93—Transmit Secondary Command. Transmits the value in the accumulator as a secondary IEEE address. This routine can only be called after commanding an IEEE to listen.

\$FF96—Send Secondary After Talk. Transmits the value in the accumulator as a secondary IEEE address. This routine can only be called after commanding an IEEE device to TALK.

SFF99—*Read/Set Top of Memory.* If carry is set, the top of RAM memory pointer is returned in the X and Y registers. If carry is clear, the contents of the X and Y registers are transferred to the top of memory pointer.

SFF9C—*Read/Set Bottom of Memory.* Same as the previous command except for the bottom of memory pointer.

\$FF9F—*Scan Keyboard*. Same routine as called by the interrupt handler to scan

```
100 REM *****************************
 110 REM
          DISK-TO-TAPE DATA FILE COPY
 120 REM
 130 REM
 140 REM
              BY: ROBERT BAKER
 150 REM 15 WINDSOR DRIVE, ATCO, NJ
 160 REM
 170 REM *************************
 180
 190 PRINT"JINSERT BLANK TAPE IN TAPE#1"
 200 PRINT"& DEPRESS ANY KEY WHEN READY"
 210 GET R$: IF R$="" THEN 210
 220 PRINT"OK": PRINT
 230 OPEN 15,8,15
 240 INPUT"DISK FILE NAME";FL$
 250 PRINT"DRIVE# 0 OR 1: ";
260 GET D$: IF D$ <> "0" AND D$ <> "1" THEN 260
270 PRINT D$
280 OPEN 2,8,2,D$+":"+FL$+",S,R"
290 INPUT#15, EN, EM$: IF EN<>0 THEN 360
 300 PRINT"OK": OPEN 1,1,1,FL$
 310 PRINT: PRINT"COPYING DATA....."
 320 GET#2,C$: S=ST
 330 INPUT#15, EN, EM$: IF EN<>0 THEN 360
 340 PRINT#1,C$;: IF S=0 THEN 320
 350 PRINT: PRINT"DONE COPY": GOT0370
 360 PRINT: PRINT" #DISK ERROR": PRINT EN, EM$
 370 CLOSE 1:CLOSE 2:CLOSE 15
READY.
```

Listing 2. Disk-to-tape data file copy.

the keyboard. If a key is down, its ASCII value is placed in the keyboard queue. SFFA2—Set Timeout on IEEE. A 0 in bit 7 of the accumulator enables timeouts, while a 1 disables timeouts on the IEEE bus. Timeouts are normally used to avoid hanging in a handshake sequence between devices on the bus.

\$FFA5—Input Byte from IEEE Bus. Handshakes a byte from the IEEE bus and returns the data in the accumulator. It is assumed that the device has been told to TALK.

\$FFA8—Output Byte to IEEE Bus. One byte of data is taken from the accumulator to handshake as data on the IEEE bus. A device must be listening or status will reflect a timeout. One character is always buffered by this routine. When the Unlisten subroutine is called, the buffered character is sent followed by the UNLISTEN command.

\$FFAB—Command IEEE Bus to Untalk. \$FFAE—Command IEEE Bus to Unlisten.

\$FFB1—Command IEEE Device to Listen. The device number from the accumulator is ORed with bits to convert this device number to a listen address and then transmits the data as a command on the IEEE bus.

\$FFB4—*Command IEEE Device to Talk.* The device number from the accumulator is ORed with bits to convert this device number to a talk address, and it then transmits the data as a command on the IEEE bus.

SFFB7—*Read I/O Status Word*. Returns the current I/O status in the accumulator. Values are the same as listed for ST in the Commodore manuals.

\$FFBA—Set Logical, First, Second Address. The accumulator contains the

logical file number used by the system to access data stored in a table by the open file subroutine. The X register contains the device number, while the Y register contains the command. The command is sent as a secondary address on the IEEE bus following the device number during an attention sequence. If no secondary address is to be sent, set Y to \$FF.

\$FFBD—Set File Name Information. Load the accumulator with the length of the file name, 0 if opening a file without a file name. The X and Y registers then contain the address of the actual character string corresponding to the file name. \$FFCO—Open Logical File. Previous two subroutines must be called first (\$FFBA & \$FFBD).

\$FFC3—*Close Logical File*. Accumulator contains the logical file number of the file to be closed.

SFFC6—*Open Channel for Input.* Opens a channel for input after being opened by the Open subroutine. This subroutine must be executed before attempting to read data from any device except the keyboard. This call may be omitted for keyboard input with no logical file number association.

\$FFC9—Open Channel for Output. Opens a channel for output after being opened by the Open subroutine. This subroutine must be executed before attempting to write data to any device except the display. This call may be omitted for output to the display with no logical file number association.

SFFCC—*Close Input and Output Channel.* Closes all open channels and restores the default channels, input device 0 and output device 3.

\$FFCF—Input Character from Channel. Returns a character of data from the open

Note that addresses are shown in hexadecimal.

or default channel. The data is returned in the accumulator and the channel remains open after the call. For keyboard input, the cursor is turned on and continues to blink until carriage return is typed. Characters on the line are returned one by one by calls to this routine. SFFD2—Output Character to Channel. Sends a character of data to the open or default channel. The data is taken from the accumulator and may be transmitted to multiple devices on the IEEE bus.

SFFD5—Load RAM from Device. Performs a load from a device if the accumulator is 0, a verify if a 1. The X and Y registers contain the starting address for the load if a secondary address of 3 is used. Otherwise, the block will load into memory starting at where the header has specified. On return the X and Y registers indicate the highest RAM address loaded. SFFD8—Save RAM to Device. Saves memory to a logical device from the bottom of memory pointer to the address pointed to by the X and Y registers.

SFFDB—Set Real-Time Clock. The accumulator and the X and Y registers are loaded into the three-byte system clock. SFFDE—Read Real-Time Clock. Returns the current three-byte system clock value in the accumulator and the X and Y registers.

\$FFE1—*Check Stop Key.* Sets the Z flag if the stop key is pressed while the routine is called, and all other flags are maintained. If the stop key is not pressed, the accumulator will indicate the last row of the keyboard scan. This can be used to check for other key closures.

SFFE4—Get Character from Keyboard Queue. Removes one character from the keyboard queue and returns as ASCII value in the accumulator. A 0 is returned if the queue is empty.

\$FFE7—*Close All Files.* The pointers into the open file table are reset, closing all files. All I/O channels are also reset.

SFFEA—Increment Real-Time Clock. This routine is normally called every 1/60th of a second to update the system clock. If may be necessary to call this routine from a user's program if it processes its own interrupts.

SFFED—*Return X,Y Organization of Screen.* Returns the organization of the screen with columns in X register and lines in Y register.

SFFFO—*Read/Set X,Y Cursor Position*. If carry is set, the current cursor position is returned in the X and Y registers. If carry is clear, the cursor is moved to the position indicated by the X and Y registers. SFFF3—*Return Base Address of I/O*. Returns the address of the page containing I/O in the X and Y registers.□

110 REM 120 REM UTILITY PROGRAM FOR PRINTING 130 REM FORMATTED OUTPUT DISK FILES CREATED BY WORD PRO 3 140 REM THAT ARE COPIED TO TAPE 150 REM 160 REM BY: ROBERT BAKER 170 REM 15 WINDSOR DRIVE, ATCO, NJ 180 REM 190 REM 210 220 PRINT"MINSERT TAPE & DEPRESS ANY KEY WHEN READY" 230 GET C\$: IF C\$="" THEN 230 240 OPEN 1,1 250 PRINT: PRINT"READING FILE ... " 260 OPEN 7,4,7: PRINT#7: CLOSE 7 270 OPEN 4,4 280 GET#1,C\$: SS=ST 290 IF ASC(C\$)=13 THEN PRINT#4,MID\$(S\$,2): S\$="": GOTO 310 300 S\$=S\$+C\$ 310 IF SS=0 THEN 280 320 CLOSE 1: CLOSE 4 READY.

Listing 3. Utility program for printing formatted output disk files created by Word Pro 3 that are copied to tape. LOWEST_PRICE - BEST QUALITY

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has introduced the Genesys Computer. It features a constant voltage transformer. It comes in several configurations: 12-slot, 22-slot, 5" to 8" floppy to Winchester. It's new, so give us a call.

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DIAL-UP DIRECTORY

Midnight Messenger

By Frank J. Derfler, Jr.

Unattended Transmission From Microcom

This edition of Dial-Up Directory marks the second anniversary of the column. Microcomputer-based data communications systems have evolved in a pretty straight line over those two years, but now we are starting to see some branching in the evolutionary tree. This month we'll look at a slightly different kind of electronic mail package, the first commercial adaption of an old idea.

Micro-Courier by Microcom

Micro-Courier is truly an electronic mail package. It provides the Apple II microcomputer with the ability to "wake up" in the middle of the night, dial a phone number, establish contact with another Micro-Courier-equipped Apple II and transfer messages.

In the June 1980 issue of *Kilobaud Microcomputing*, I described a program with similar capabilities called PAN. PAN is still available and costs about \$12 on cassette. PAN has never really been commercially marketed. It exists as a project of the Personal Computer Network (PCNET) in Menlo Park, CA. Micro-Courier sells for \$250 per copy (you need a separate copy at each end) and it is being heavily marketed.

This idea of unattended message transfer is as old as electronic communications. Before World War II, amateur radio operators developed radioTeletype systems using autostart tones. In response to a clock mechanism, a mechanical teleprinter would key up a radio transmitter, broadcast tones to wake up the teleprinter at the other end and transmit a prepunched message tape.

This kind of message transfer fits well into my concept of electronic communications systems that can break down the Time Tyranny of Telecommunications. Unattended message transfer lets people break away from the need to monitor a telephone or terminal to get a message. Several software firms are developing packages with slightly different unattended transfer capabilities, but Micro-Courier is the first one to be marketed on

a commercial basis.

Microcom has a very businesslike approach to their product. They are appealing to the corporate Apple rather than the Apple at home. Technically, the Micro-Courier package is a series of programs on an Apple II disk in DOS 3.3 format. The programs are in assembly language, and Microcom cautions that the disk is uncopyable. They also caution that attempts to copy the disk may result in its destruction. (A real mission impossible?) If you should set your coffee cup on the disk within 90 days of purchase, they will replace it for free. If the disk falls on the floor and you roll your chair over it on the 91st day, it costs you \$35 to replace.

The program selection is done through a series of menus which gradually lead you to the operating level. The program asks the user some questions the first time it is run so it knows where to look for the modem, clock and printer cards. It is easy to step down and up the menus to select the function you want. As you step through the menus, the selections you have made are displayed at the top of the screen (rather like a self-documenting game of adventure).

The manual stresses that all you have to do if you get into a problem is hit escape and you'll return to the next higher menu. This works—most of the time.

The program works well doing what it is advertised to do: dropping off messages in the middle of the night when the rates are low. It will do this only with another Micro-Courier-equipped Apple II. Each system should have an Apple II + or Apple II with Applesoft in ROM. 48K of RAM, a disk system with DOS 3.3 and a Hayes Microcomputer Products Micromodem II. A clock card and two disks are really needed for practical operation. The Micro-Courier disk is nearly full and a separate data disk is needed.

In a typical application, the user creates a message with the Micro-Courier text editor or any editor that will create DOS 3.3 files. Messages can be up to 4000 characters in length. A separate address file tells the system when and where to send specifically named messages. The "where" direction is given as a name or other easily-remembered term.

A separate mailbox ID file matches names to telephone numbers. It is possible to create distribution lists in which many phone numbers are collected under one ID. At the assigned time, the Apple II dials the number and transmits the specified message. It transmits one file per call. The program is not smart enough to ask if the called station has any mail coming back. The program will repeat unsuccessful attempts to deliver a message, and logs of outgoing and incoming messages are maintained.

Micro-Courier does have an interactive terminal mode, but this mode is quite difficult to use. The terminal mode has 22 lines available for the display of received data. The screen displays modem and file status in five lines at the top, and three lines of special commands you need to know are displayed at the bottom.

Unfortunately, the incoming data overwrites the first line of commands on the bottom of the screen and the rest of the information loses meaning.

This is particularly tricky because in this program ESCAPE does not work. You could pound the escape key all day and not get to a higher menu. It also doesn't help that when two Micro-Courier-equipped Apples are in the terminal mode, neither one echoes the other. That means you can't see what you are typing, unless you both work your way back up through two menus and select the full duplex mode. You are much better off dumping the Micro-Courier software and just using the Micromodem II ROM program if you simply want to operate in the terminal mode without exchanging files.

Micro-Courier has been heavily advertised and its slick packaging matches its advertising. The manual contains 164 pages of text with a very good index and a small glossary. It contains illustrations of the keyboard and screen displays. The

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The Prentice P212C is a microprocessorcontrolled modem capable of 300- or 1200-bits-per-second operation. The first button on the right selects high- or low-speed operation. The other buttons select various test modes. Extensive diagnostics are built into this wellengineered device.

discussion in the manual is done at the most elementary level. In fact, the entire packaging concept of the program, from the multiple menus through to the language of the manual, is aimed at the novice user.

That's acceptable, but experienced users can get pretty exasperated with rigid menu structures and the need to wade through lines of explanation to find a specific command. In Microcom's defense, they did provide a stick-on guide to the commands used in the editor program, but a separate instruction card summarizing all the commands would be valuable.

I believe that if Microcom is going to be successful in the corporate market, they have some work to do. One disk I received for evaluation had a bad sector and would not load the editor. The other package had an instruction manual with many of the pages uncut. But primarily, I feel the program needs some way of performing a quality-control check on the messages it transmits. Not all long-distance phone lines are created equal, and it is often worse to transmit garble than never to have transmitted at all.

Significantly, microcomputer programs exist which perform very nice line testing and transmission validation. The ST-80 software series written by Lance Micklus has a line-testing and character echo-check feature. Many programs like Crosstalk provide a protocol file transfer which ensures accurate transmission. Micro-Courier has none of these features. It is an expensive program with limited applications.

Dow Jones

The mailbag has reminded me that I



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have never mentioned the Dow-Jones Information Service (DJIS), which is available to microcomputer data communications users. This service has a higher hourly rate than either The Source or CompuServe, but if you are a serious stock investor it provides lots of useful information. DJIS provides information on over 6000 stocks and securities listed on the New York, American, Midwest and Pacific stock exchanges and the over-thecounter market. If you live in a part of the country without a good newspaper, or if you like to follow "penny stocks" or overthe-counter stocks, this feature could be handy. All listings are delayed 15 minutes, but for 99.99 percent of us that represents real-time information.

DJIS has an involved pricing structure that depends on both the time of day and the kind of service used. During nonprime hours, using the price quote function can cost 15 cents per *minute*. Use of the historical Media General information file costs \$1 per minute during any time period. (Obviously, you don't want to browse too long.) The non-prime hours change with the time zones. The Pacific time zone is only non-prime from 8 PM until midnight. The Eastern time zone gets the low rates from 8 PM to 3 AM.

I find the historical information the most valuable feature of the DJIS. You can get good information on price-earnings ratios, price performance vs market performance and many other features. In addition, news stories and financial information are available from the *Wall Street Journal* and *Barron's*. Most people would find it more economical to get the general news from the financial journals and just use the DJIS for research on specific issues. The news stories do have a subject search capability and can present a summary of the article.

Anyone interested in the Dow-Jones Information Service should note that Radio Shack is offering one hour of DJIS time in their CompuServe membership packages. You get a binder with system information, membership on Compu-Serve and an hour of user time on both CompuServe and DJIS for \$19.95 (order catalog no. 260–2224).

You don't have to use a TRS-80 computer to take advantage of this package; any computer or terminal with communications capability can be used.

Videotex software packages for the TRS-80 Model I, Model II, Model III and Color Computer are available for \$29.95 at Radio Shack. These packages also include one hour on CompuServe and DJIS. The cassette-based Vidtex programs (the program name is slightly different from the package name) are easy to use and nicely integrated into the CompuServe and DJIS formats. They all allow interfacing with a printer to provide hard copy of the received information, but of course they don't let you create data files. You'll need a more advanced terminal program to save the received data in files.

The Dow-Jones Information Service isn't for everyone but those who can use it will find it invaluable. The Radio Shack CompuServe membership package gives many folks the opportunity to try the DJIS at a reasonable price.

The Prentice P212C

You can lease a 212A 1200 bits per second modem from your local telephone company. It will cost you about \$40 a month plus an installation charge of \$80 or more. This installation usually includes an improved line from your location to the telephone office and a telephone instrument with a modem/voice switching arrangement.

Alternatively, you can buy your own 212A modem. You might do this if you are in a business and want to depreciate the equipment, or if you simply want to avoid the monthly payments. Let's take a look at the state of the art in 212 modems. I want to introduce you to one of the most sophisticated 212A modems, the Prentice P212C.

The P212C is a microprocessor-controlled device which will operate at 300 bits per second as a Bell 103 standard device and at 1200 bits per second using the 212 standard. It connects to the computer or terminal through a standard RS- 232C cable. It will auto-answer and adjust itself to the speed of the calling party.

This is a commercial-quality device built in a heavy metal cabinet with a husky power supply. It has a commercial retail price of about \$800. The P212C will do many nice things for its user. It features five different types of loopback circuitry including separate local tests of the analog and digital sections of the modem and tests which show the quality of the telephone circuit with the cooperation of the modem at the other end.

A 212 standard modem can be used over average telephone lines, but you get more reliable operation if you ensure that the signal levels transmitted and received by the modem fall within certain limits. Signals with levels too high or too low can easily cause errors in the fourlevel phase-shifted keying scheme used by 212 modems.

Proper installation requires a padding resistor in the telephone coupler or connecting cable to fine tune the audio level with the telephone office. Prentice can provide various cables to connect the P212C to the telephone system. A "permissive" cable lets you plug the modem directly into any standard voice jack. But the use of a standard jack is the easiest (and cheapest) method of installation. It will usually work, but the error rate depends upon the conditions between your telephone and the central office.

Marketing Advice

Prentice has obviously targeted the commercial market with this high-quality device, but with a few changes they could open the small computer market too. A plastic cabinet and elimination of the fancy test features would be the first step. I would reassign the five buttons on the front as on/off, 300/1200 bits per second, orig/ans, half/full duplex and in/out.

If they could sell the consumer model P212XX at \$400 they would have a big place in the market. In the meantime, if you want to put some zip in your data communications, the Prentice P212C provides a well-engineered and reliable way to do it. Contact the Prentice Corporation, 266 Caspian Drive, Sunnyvale, CA 94086.

Your Help

This column would be much harder to write without the tidbits and tantrums I receive from readers. If you want to help make the third year of Dial-Up Directory even better than the first two, your news and views are needed. Send paper mail to PO Box 691, Herndon, VA 22070. Include a stamped envelope for replies. Send electronic mail to TCB967 on The Source, 70003,455 on CompuServe, or the AMRAD CBBS, 703-734-1387.□

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RADIO SHACK DAISY WHEEL II	1 pk	24.95 3pk	8.25	(8.25 ea)	250	Mylar Multistrike	C-789	*UNDER \$20 ADD \$5 HANDLING
RADIO SHACK LPIII, LPV	one, pk	13.95/cart	8.95/Reload rib. only	(8.95 ea)	500" x 45'	Nylon Incl Instr	R-T3	TADDOX DETAIL ODICE VADIEC
RADIO SHACK LPIL LPIV	3/pk	18.95/3 pk	11.95/3 pk	(3.98 ea)	563" x 45'	Nylon Jet Blk	C-700	APPROX. RETAIL. PRICE VARIES.
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COMPUTER BLACKBOARD

By Walter Koetke

Poor Marks For Software

Hardware Is A Terrible Thing To Waste

The entrance of microcomputers into the country's classrooms has grown from a trickle to a roar. Will we soon see a flood? Is the microcomputer a soon-to-beforgotten technological fad? Is it an ideal instructional tool? I'll discuss these and other questions as this column assesses the microcomputer's impact on instruction and then projects that impact into the near future.

What's Happening Right Now?

As in so many application areas, the gap between the potential and the reality of microcomputer software is enormous. This gap reminds me of the story about the German poet who was asked where he would choose to live if he knew the world was about to end. After very little deliberation, he responded that he would live only in England. Many were surprised by his rapid, decisive response. When his decision was questioned, he responded that England was a perfect choice because England has always been 100 years behind the rest of the world.

While the analogy is not perfect, the state of today's software does indeed trail the potential of today's hardware by many years. This is not news to those in the computer industry, but it is both news and a huge disappointment to educators who've only read of the computer's potential before finding a microcomputer in their classroom.

Colleges and universities are not yet in a position to help educators with their current and short-term needs for assistance. While there are certainly a few exceptions to such a general statement, the number of colleges able to offer teachers no more than FORTRAN, COBOL, assembly-language programming, or something equally inappropriate is distressing. The number of wellpublicized but rarely open or accessible microcomputer laboratories and well-

Walter Koetke, Putnam/Northern Westchester BOCES, Yorktown Heights, NY 10598.



funded software evaluation centers that just can't manage to produce evaluations is also distressing.

Perhaps such situations are unavoidable aberrations of rapidly changing technologies and honest intentions that badly underestimate the magnitude of the task at hand. Although the situation will eventually evolve into a more acceptable state, it is unfortunate that the vast majority of colleges and universities have been unable to respond to a readily definable, nationwide need.

Educators have become increasingly receptive to the idea of using microcomputers for instruction. The lack of support materials coupled with the ideas already discussed has often resulted in frustration. However, many educators have also become more sophisticated in their evaluation of microcomputer software and hardware. While they readily admit their knowledge is inadequate, there is movement in the right direction.

Part of this movement is the result of the evolving technology. Now that several microcomputers popularly used for instruction have been replaced by newer, only somewhat compatible models, educators find themselves in a position of defending earlier purchases of what is now being incorrectly called "outmoded" equipment. For those who properly prepared for their initial purchase, this defense is trivial. For those who were not so well prepared, the defense has necessitated an overdue crash course in computer literacy.

Educators are beginning to realize the disadvantages of basing their local programs on a single brand of microcomputer. The advantages of a single-brand commitment are far outweighed by the disadvantages. For example, my choice for the ten best pieces of instructional microcomputer software involves four different microcomputers. Having only one brand available is a major restriction. Microcomputers are big business, and vendor stability cannot be assumed. Many sales and a few good products are not a guarantee that there will be a tomorrow. Explaining to a school board that the company who sold you all the microcomputers is out of business and the machines can no longer be serviced is not an enviable position, yet I suspect that is where many responsible for onebrand commitments will find themselves. For these and other reasons, educators seem to be broadening the base on which they're developing instructional programs.

IBM and Education

A look at today's role of microcomputers in instruction would be incomplete without acknowledging that industry continues to call many shots for education. Although clever advertising agencies would have us think otherwise, improving instruction is foremost in almost no one's mind as new products are conceived and developed. This is actually quite reasonable, just unfortunate. When you compare the size and available cash in the marketplaces, small business, education and home educators always finish last. When the cost of dealing with the marketplaces is also considered, the spectators have lost interest and gone home before educators finish the race.

Some months ago I had the opportunity to hear a discussion of research regarding reading comprehension. I liked many aspects of this presentation, including the fact that a microcomputer was only one of several tools being developed for the classroom teacher who must teach reading comprehension. An experienced, thoughtful researcher from IBM's Watson Research Laboratories. New York, made the point that research indicates two essential features for instructional microcomputers are voice output and touch-sensitive screens. The importance of color was unclear, since the research presented did not indicate that color would or would not significantly enhance instruction.

Shortly after this presentation, IBM announced its new Personal Computer, a machine with a very impressive list of features, including excellent color, but without voice output and a touch-sensitive screen. IBM has produced an excellent product, but the education marketplace was not high on its list of development priorities. The Personal Computer does not provide those features which IBM's own research considers essential for instruction.

Next time you hear someone moan that education should make as effective use of microcomputers as does small business, remember that the small businessman can select hardware and software packages designed with the needs of small business in mind, while educators are often faced with the task of selecting the best of what was designed for someone else.

As a final general observation, the instructional use of microcomputers seems to be moving away from the "local hero" doing his or her thing to a more structured system-wide approach. This follows quite naturally as administrators become uncomfortable with a proliferation of hardware without someone providing coordination and direction for its use. The same phenomenon is happening at the state level. With at least one state reporting that 95 percent of its public schools provide computing facilities, there are several states attempting to form minimum standards, create computer literacy objectives, set microcomputer standards and offer other evidence that they're on top of things.

It's significant that 12–18 months ago you could survey microcomputer use by calling a school district's central office for information. That is not often the case at present. Now 'such a survey would require a call to each building. Whatever the reason, I believe the growth of local "computer coordinators" should assist other educators as they too begin to use the computer to support instruction.

Let's focus on the evolution of microcomputer hardware as it pertains to instruction. As already mentioned,

IBM has entered the marketplace with a well-designed personal computer system. It has done so in a manner that illustrates the rapid change of the industry. The new IBM Personal Computer is its first "integrated" system, which means IBM has put its name on products produced by others. The IBM Personal Computer will be offered with software developed by others and marketed through Sears and other nontraditional outlets. The point is that the rapidly changing technology has put an industry leader in a position of catching up. I suspect it will do just that, since the IBM Personal Computer seems to have all the good features of the competition plus several terrific extras, an excellent service plan and a name that won't do any harm.

The IBM Personal Computer will have little direct impact in the education marketplace. Too many schools still purchase the least expensive machine and then later worry about software and other forms of support. The chances of large numbers of schools adopting one of the most expensive machines is extremely remote.

On the other hand, I suggest that IBM's

Educators are often faced with selecting the best of what was designed for someone else.

Personal Computer will have a significant indirect impact on instructional microcomputers. As IBM establishes itself in the business market, it will do so partly by expanding that market, but also at the expense of current entries in that market. Should IBM seriously affect the market share of Tandy, Apple or Commodore, that impact is bound to be reflected in the educational marketplace. The next 12 months should be very interesting.

Why BASIC?

There are well-known and respected educators, including Seymour Papert, who contend that BASIC is not just a poor choice, but an impossible choice for many children. We don't use BASIC as the result of any research on learning or instruction. We use BASIC because that's what the computer industry chose to provide.

Logo is now available for the Texas Instruments 99/4A personal computer (versions for the Apple and Atari are expected to be released soon). If you're concerned with computer use in grades K through 3, you can do no better than Logo. If you don't have a TI computer already—an extremely likely possibility—then here's your opportunity to demonstrate some of the merits of having more than one brand of microcomputer.

Try the following on your micro or even minicomputer.

10 FOR C = 1 TO 100 STEP .1 20 PRINT I 30 NEXT I

I've run this on a great many computers of all sizes, and the TI 99/4A is only one of two computers that properly execute the program. There are several other standard examples of annoying round-off error that can be executed without error on the TI 99/4A. The ability to avoid such errors is a strong plus when dealing with younger children.

Another piece of hardware that seems to be slow getting off the ground is the Radio Shack Color Computer. With a 16K memory and Extended BASIC, this is a very nice instructional machine that hasn't found its way into many classrooms. That might be attributed to the huge lack of instructional software. As of this writing, even Radio Shack was offering only three packages that might be considered useful for instruction. A significant step for this computer is the availability of a disk drive. A complete system with disk costs about \$1500. This configuration has nearly all the ingredients for becoming a winner in the education market. I suspect, however, that this will not be the case.

Two of the reasons for my suspicion are the Atari 400 and 800 coupled with Atari's somewhat recent decision to actively pursue the educational marketplace. While other vendors are certainly interested in the educational marketplace, Atari is the only major hardware vendor that has targeted school and home applications as a primary rather than secondary objective.

That Atari is serious in this commitment is evidenced by their recently being awarded the MECC (Minnesota Educational Computing Consortium) microcomputer contract for the next three years. This contract was awarded to Apple for the preceding three years, and that contract and ramifications of it went a long way toward establishing Apple's niche in the education market. As the MECC contract includes the translation of nearly 100 programs to the Atari, this newcomer will have a very sound software base of interest to many schools.

An assessment of today's educational hardware would be incomplete without mentioning the Apple II and TRS-80 Model III/Model I. Certainly these machines are the dominant factors in today's educational market, and there is some excellent software available for each of them. Dollar for dollar, the diskbased Model III is hard to beat for a general-purpose application at home or school. Should Radio Shack lower the price of the disk and/or disk controller for the Model III, they may well continue their dominance in the market.

Where does all this hardware leave the teacher? Are there some clear, unchallengeable choices of hardware? You must carefully evaluate how your application would be best implemented on the personal computers discussed. Just be sure that if your application includes the use of prepackaged software, then use that software once or twice before buying the hardware. Most dealers are more than happy to accommodate a reasonable request such as this if your decision to purchase hardware really does ride on the outcome.

As schools consider additional hardware purchases, I suggest they carefully consider the experience of others. Bargains are not always what they seem. For example, in which marketplace do you find cassette-based systems? The answer is in the hobbyist and school market. Business has never taken a cassettebased system seriously.

As educators have become familiar with the advantages and disadvantages of various microcomputers and peripherals, they've realized that the disadvantage of initial cost of a disk may well be offset by the many user advantages. Cassette-based systems really aren't appropriate for other than beginning programming classes. There are certainly some successful applications in other circum-

Cassette-based systems really aren't appropriate for other than beginning programming classes.

stances, but I suggest such success is achieved in spite of, rather than with help of, the hardware. You can't help but notice that as the market is becoming saturated with cassette-based systems, at least two major manufacturers have announced notably lower-priced disk systems.

Educators should reconsider any decision to purchase other than disk-based microcomputers for instruction. If you've just a small amount of money, add a disk to your present cassette system. The only exception would be the TRS-80 Model I. That is best left alone, since the newer disk systems are vastly improved on the Model III as well as on other brands.

The rapid proliferation of microcomputer hardware in schools continues at a rate that parallels or exceeds the proliferation in other areas. Whether this proliferation is good or bad may be debatable, but its existence is fact. There is a statistic somewhere that says 80 percent of the scientists that ever lived in the world were alive in 1960. In a similar manner, I believe more computers were sold during 1981 than were sold in all previous years. There is every reason to believe that this same outrageous rate of growth will continue. The impact on education will certainly be even 'arger, but the nature of that impact has yet to be well defined.

Next month I'll continue to explore the current state and near future of instructional microcomputing, with the emphasis on software and advice regarding future planning.□

MICRO QUIZ

What Does This Program Do?

If the following program is executed with LS = "you," what will be the final value of P? (An underscore represents a blank.)

SS = "ask_not_what_your_country_ can_do_for_you,_"

S\$ = S\$ + "ask_what_you_can_do_ for_your_country"

P=0

for J = 1 to (len(SS)-len(LS))

if mid\$(S\$,J,len(L\$)) = L\$ then P = J next J

(answer on page 153)



DUAL THERMOMETER COMPLETE with OFTWARE board timer. Display temperature, maximum, minimum and Up to 7 boards with 14 probes in one Apple*. ● -55°C to 125°C range, difference. Sound alarm for over/ 0.4° accuracy over most of under temperature.Store data on disk or Requires 48K Apple* with Applesoft* and disk. printer automatically.
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C-Itoh Comet	425.00



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MICRO-SCOPE

Compiled by Eric Maloney

Old MacDonald Had a Micro

And He's Using It To Call Up Videotext Services

Harvesting Data

Farmers, agriculturists and extension agents in the U.S. and Canada are making use of several specialized videotext services now on-line.

These services can provide a wide range of information, from current mar-



ket statistics to encyclopedic data on crop pests. They include the Kentucky Cooperative Extension Service's Green Thumb project, Instant Update from Professional Farmers of America in Cedar Rapids, IA, Elanco's Agrivision, Project Grassroots in Manitoba and SCAMP in New Hampshire and New York.

While they vary in size and scope, all use videotext technology, transmitting data via telephone line to a terminal or microcomputer.

The most popular type of videotext service so far is based on the Green Thumb project at the University of Kentucky. For that pilot test, Radio Shack developed a keypad which eventually evolved into the Radio Shack Videotex terminal. The project now also uses a TRS-80 Model II to collect and transmit data. The system has been adapted for use by Instant Update and Agrivision.

The initial phase of the Green Thumb project ran from March 1980 to December 1981. In January the Kentucky Extension Service moved into phase two, which was to establish Green Thumb as a permanent service. At first, some 200 farmers in two counties were able to access the service. In phase two, the service has been opened to the entire state.

Users can retrieve information in 17 categories, which include weather, market news, county news, pest management, agriculture economics, animal sciences, entomology, forestry, horticulture, plant sciences and veterinary medicine. The market and weather information is updated automatically; other categories are updated weekly or monthly.

The system consists of a TRS-80 Model II and an eight-line multiplexer. The service is free, except for phone charges. Eventually, different parts of the state will have their own store-and-forward units, thus allowing farmers in each area to access the service with a local call.

While the Cooperative Extension Service provided the keypads for the pilot, farmers will now have to buy their own terminals or microcomputers. John Ragland, assistant to the director, says that software is available for the TRS-80s, the Apple and the TI 99/4.

Ragland expects that about one-third of the initial users will stay with the system, with perhaps a total of 200 users by next July. That number could multiply two or three times by mid-1983.

Instant Update

Instant Update is modeled closely after the Green Thumb project, and is the first commercial pay-as-you-go farmers' videotext service. It serves largely the Midwestern farm states, although it has subscribers in nearly all 50 states.

The core of Instant Update is an electronic newsletter that provides such ephemeral information as market news, commodity prices, marketing tips and the weather. Its features include:

• current future prices for grains, livestock, cotton and gold;

• a cash market scan that tracks the difference between cash and futures at key points for major crops;

• price chart trends;

• Washington Watch, for news from Pro Farmers' Washington bureau;

• a commodity-by-commodity summary of Pro Farmers' marketing plan;

• current recommendations on market tactics;

• local, national and world weather.

Instant Update currently has some 600 subscribers. "We consider that to be pretty good, even though it's not what we'd hoped for," says Marketing Manager Stewart Cross. Subscribers pay \$95 per month, plus toll charges. Cross says the average subscriber calls twice a day and spends about 30 a month on phone calls.

Instant Update subscribers originally were able to access the service only with a Radio Shack terminal. Pro Farmer has since developed software for the Apple, and is working on software for the TRS-80s.

Similar to Instant Update—in fact, Pro Farmer provides the editorial material is Agrivision. Agrivision is provided by Elanco as a service to buyers of its herbicide treflan. Farmers who buy at least 250 gallons a year receive a terminal similar to the one used by Instant Update. The information, while similar to Instant Update's, is geared toward soy bean and cotton farmers in the South. So far, some 2000 units have been installed.

Except for phone charges, the service is free. Elanco provides the database partly to support its image as a "leader in innovation," says Roger Benson, manager of managerial services.

"Hopefully we'll gain a certain amount of market loyalty," he says.

Canada's Telidon system made its agricultural debut in mid-1981 with Project Grassroots in Manitoba. Growing out of the Project Ida field trial in South Headingley, near Winnipeg, Project Grassroots is a joint undertaking of InfoMart and the Manitoba Telephone System.

The project started off with 25 terminals in such public places as the offices of grain elevator operators, crop insurance agents and agricultural agents. It has since expanded to include 25 farm homes and 25–30 commercial subscribers, and InfoMart Branch Manager Bruno Leps hopes for 500 more terminals by early 1982 and 1500 more during the year after that.

Project Grassroots includes some 3500 pages of agricultural information. Included are the Winnipeg Commodity Exchange; the World Weatherwatch; information on home economics and farm safety; Current Focus, a service to provide regular updates on the market outlook for grain, livestock, dairy and poultry producers; the Herald Grain Newsletter, on grain industry activities for the week; statistical reports from the Canadian Grain Commission on the supply and movement of Canadian grain; and information on livestock markets.

To access Project Grassroots, the user needs a Telidon keypad, developed by Norpak, and the Telidon terminal from InfoMart. The user pays \$47 a month for the terminal on a two-year lease, and pays five cents a minute for telephone charges. Leps says that the average user spends ten to 20 minutes a day on the system, with monthly charges coming to about \$80.

One of the outstanding characteristics of Project Grassroots is its graphics displays. Grassroots pages often include colorful illustrations, charts and maps. The SCAMP system differs from the others in that it is currently geared primarily toward extension agents, agriculturists and foresters. It provides pest and crop management information, which is routed through the state extension agencies to the farmers.

The New Hampshire SCAMP program has some 60 users, most of whom are extension agents, University of New Hampshire personnel and foresters. But, says UNH Extension entomologist James S. Bowman, the long-range plans are to include individual farmers.

"There's no reason why a farmer couldn't hook up to the system if he had a coupler and terminal," he says.

The two most important features of SCAMP are its electronics bulletin board system and its library. The bulletin board includes field reports from SCAMP users on current pest problems and recommendations on how to deal with them. The library includes the life histories of a variety of crop pests, and information on their control.

Bowman is pleased so far with the system's development.

"The mechanics are good, and the software is fine," he says. "We just have to get people to use it more. The younger extension agents are embracing it, but some of the older agents are a little hesitant."

Market Strategies

To whom are these systems geared, and what is the potential market?

So far, the commercial services are appealing to owners of larger farms. The av-

erage Instant Update subscriber, for instance, runs a 700–800 acre farm, substantially above the national average of 430 acres, and spends about \$125 a month on the service. Elanco subscribers receive the service free, but the 250 gallons of treflan they buy costs over \$6000 and is enough to treat 1000 acres. Bruno Leps says that Project Grassroots, too, is geared toward the larger farmer.

"This is not to say that there's not a market for others," he adds. "But we're going to have to bring the price down first."

The cost, however, is not the major factor, says Green Thumb's John Ragland. The costs for a terminal are within the reach of even the small farmer. "But you have to have some size before you start trading grain and livestock," he says, noting that marketing information is the most-used service of Green Thumb.

"It doesn't have to be the case that we're used only by larger farms," he continues. "If we get a bulletin board system, if we're imaginative and aggressive, we could come up with a service of value to small farmers, too."

Nevertheless, it is true that many small farmers are currently struggling for survival. According to figures from the U.S. Department of Agriculture, 102,000 farms have shut down in the U.S. since 1975, though the average size has increased from 420 to 430 acres. Many small farmers might not be willing to pay for a service like Instant Update, when they can get much of the same information in periodicals, on the radio and through the local extension agent.



A page from Project Grassroots, an agricultural videotext service in Manitoba, Canada.

A recent survey by *Successful Farming* magazine of its readership shows that 31 percent of those questioned are not interested in a videotext service. Some 41 percent said they are somewhat interested. Only 27 percent said they are interested or very interested. While this figure translates into some 650,000 potential subscribers—more than enough to make services like Instant Update commercially viable—it indicates that the majority of farmers will continue as they have for a while longer.

Bringing down the costs of videotext services will no doubt help. As Ragland points out:

"Farmers have traditionally had technology and information provided in fairly good quality and quantity for low cost, through extension agencies and the federal government. It's a fact that leads me to believe that we should look at alternative means of providing the information without charging the farmer a user's fee."

Several ways of doing this present themselves. Some companies could go the route of Elanco, offering videotext services as premiums to customers. Another possibility is sponsorship of databases by commercial businesses, an option Green Thumb is considering.

"For example, it might be a local county bank," Ragland says. "They may support a service in exchange for a page of information on their interest rates or services. It may be that there might have to be advertising, or at least recognition of sponsorship."

=>VEGETABLE
HOW MANY DAYS TO REPORT?
=>7

08/ 12/ 81 FROM: NEWSLETTER TO: FIELD

FROM 8/11/81 INSECT NOTES

VEGETABLES (Bowman, Eaton)

Cole Crops: Cabbage looper MOTH CATCHES IN PHEROMONE TRAPS ARE STILL ZERO ON DOVER POINT BUT ARE INCREASING TO ABOUT ONE PER DAY IN STRATHAM. STILL NO APPARENT BUILD UP OF LARVAE. SCOUTING HAS DEMONSTRATED AS HIGH AS 56% OF THE PLANTS WITH AT LEAST ONE WORM WHICH IS PREDOMINANTLY THE Imported cabbage worm. AN UNEXPECTED ATTACK BY Japanese beetles ON COLE CROPS OCCURRED ON DOVER POINT THIS WEEK.

Potatoes: Colorado Potato beetle HAS BEEN SLOW BUILDING UP IN COMMERCIAL PLANTINGS SO FAR. PYDRIN HAS ELIMINATED MOST OF THE PROBLEM BUT WE HAVE NOTICED A SLOW BUILD UP IN UNTREATED AREAS ALSO. THIS IS PROBABLY DUE TO THE EXCELLENT GROWING CONDITIONS THIS YEAR. NO PROBLEMS WITH aphids or potato leafhopper SO FAR.

Sweet corm: SINCE OUR INITIAL CATCHES OF corn earworm and fall armyworm MOTHS REPORTED LAST WEEK, WE HAVE FOUND NO MORE OF EITHER SPECIES. A COUPLE OF EARWORMS WERE TRAPPED AT THE SUBURBAN EXPERIMENT STATION (WALTHAM, MASS.) THIS WEEKEND. GROWERS WITH LIGHT TRAPS MUST BE SURE THAT THE TRAPS ARE KEPT CLOSE TO FRESH SILKING CORN, IF EARWORM CATCHES ARE TO BE RELIABLE. European corn borer CATCHES ARE STILL HIGH. WE STILL RECOMMEND ABOUT A 6-DAY SCHEDULE FOR SILKING CORN, BUT THAT CAN CHANGE IF earworm or fall armyworm COUNTS INCREASE.

END

From the electronic bulletin board of the University of New Hampshire's SCAMP system.

We should look at alternative means of providing the information without charging the farmer a user's fee.

Finally, extension agencies might act as clearinghouses for farmers in their area, as is the case with SCAMP. Farmers would call their local agent with questions, and the agent would access the information from the host computer.

Until the costs decline and services become accessible to a broader range of farmers, videotext services will be scrambling to convince their potential market that they have a valuable product.

"Videotext is limited by how good the information is," Roger Benson of Elanco says. "As long as it's expensive to access the information, it has to be worth the customer's while."

-Eric Maloney

More on Woman Computerists

Microcomputing and the Association of Women in Computing have received a number of queries concerning an article on that organization (see "Women, Unite!" on p. 28 of the October issue). Following is a list of chartered or provisional AWC chapters:

Washington, DC area Linda Zenker 4905 Americana Drive, #111 Annandale, VA 22003 232-797-5338

Twin Cities Bonnie Swierzbin PO Box 14605 University Station Minneapolis, MN 55414 612-482-1657

Greater Boston Marcia J. Weston, vice-president 81 Leland Farm Road Ashland, MA 01721 617-891-2226 Call Mon.–Thurs. only

Rome-Utica Linda A. Kane 302 Hartford Place Utica, NY 13502

Los Angeles Carol A. Grosvenor, president PO Box 43677 Los Angeles, CA 90043 213-673-0986

New York Metropolitan Brenda Pena, president Box B 67-09 136th St. Flushing, NY 11367 212-244-4270

St. Louis Rita Sisul, acting president Box 12907 St. Louis, MO 63141 314-925-5291

Puget Sound Susan Pietrowski 16602 NE 18th St. Bellevue, WA 98008

Women who are not near a chapter can get a list of members in their immediate areas by writing National President Linda Taylor, 3573 Greenfield Ave., Los Angeles, CA 90034 (213-557-8797).

The AWC was formed to support women in computer fields with career counseling and a network of job contacts, as well as seminars, workshops and scholarships.

The Rich Get Richer

The affluence of a school and its community is the most important factor in whether a school uses computers for instruction, says a recent study by Market Data Retrieval of Westport, CT.

The study says that 46 percent of those school districts spending over \$75 per student for instructional materials have instructional computers as compared to 20 percent of those spending under \$30 per student. Thirty percent of the schools in upper income areas use computers for instruction, as compared to 12 percent of low-income area schools. The study also reports that of 15,442 U.S. school districts, 6441, or 42 percent, use instructional computers. Also, 15,918 of 84,226 public school buildings—or 19 percent—have classroom computers.

Grade level and size of the school are also factors. Some 43 percent of senior high schools, 26 percent of junior high schools and 12 percent of elementary schools use computers. Almost 60 percent of high schools with over 1000 students have computer-aided instruction, as compared to 24 percent of small high schools.

World Book On Line

The CompuServe Information Service will soon be offering an electronic version of the World Book Encyclopedia to its subscribers.

The encyclopedia, which is still in the developmental stage, will offer the basic editorial content of the printed version, as well as several enhancements.

"As the project develops I wouldn't be surprised if the encyclopedia includes extras, in the form of customer feedback where they could ask questions," says Richard A. Baker, CompuServe's editorial director. "Or World Book may break out certain sections of the Encyclopedia to be continually updated and revised." This latter feature, he says, could provide current information on rapidly changing events in the world.

Baker says that these possibilities are based on the kinds of services other information providers like to include.

No date has been set for start-up of the encyclopedia.

A Boost for Atari?

Atari is going to give Apple and Tandy some stiff competition as a result of Sears' and IBM's decision to sell the 800 in their business machine stores, says a recent report from International Resource Development, Inc.

The report says that Atari, a division of Warner Communications, has recognized the importance of reaching the business market, and will thus gain a significant market share.

Throw That Kid an Atari

Twenty-one outstanding freshmen at Rensselaer Polytechnic Institute in Troy, NY, have received Atari 800 computer systems as part of an academic scholarship program.

The winners—15 men and six women were chosen on the basis of academic achievement and Scholastic Aptitude Test scores. Their SAT averages were 732 out of 800 for verbal and 761 of 800 for math.

The students can use their micros for special projects and compete for a \$1000 prize to be awarded at the end of the academic year.

The Ataris will become the students' personal property when they receive their undergraduate degrees.

RPI has developed an extensive computer education program, which includes an IBM 3033 mainframe and 400 terminals on campus.

New Mag for Big Blue

IBM's new Personal Computer was barely on the loading docks when Software Communications, Inc., revealed plans to launch a magazine for the computer.

PC, billed as "the independent guide to the IBM Personal Computer," will be piloted by David Bunnell. Bunnell, who most recently was managing editor at Osborne/McGraw-Hill, was also editor at one time of *Personal Computing* magazine, and has coauthored a book with Adam Osborne called *A Beginner's Guide to Microcomputers.*

Software Communications gave no date for publication of the new magazine. \Box



With practice, you can master Rubik's Cube with this Apple simulation program.

Rubik's Cube Demystified

By Curtis and Lillian J. Cooper



Screen display of the Applesoft Rubik's Cube program. (Photo by Harold Nelson)

Program listing. Rubik's Cube simulation in Applesoft BASIC. PRINT "THIS PROGRAM SIMULATES RUBIK'S CUBE" 10 20 30 REM REM INITIALIZE RUBIK'S CUBE 40 REM 50 DIM R(5,5,5),R1(5,5,5),A(5,5),B(5,5),C(5,5),D(5,5) 60 FOR I = 1 TO 5: FOR J = 1 TO 5: FOR K = 1 TO 5 70 R(1,J,K) = 0 80 NEXT K: NEXT J: NEXT I 90 FOR I = 2 TO 4: FOR J = 2 TO 4 100 R(1,I,J) = 1:R(I,I,J) = 15:R(I,J,1) = 4 110 R(5,I,J) = 9:R(I,5,J) = 2:R(I,J,5) = 13 120 NEXT J: NEXT I 130 REM 40 REM 130 REM REM MIX RUBIK'S CUBE 140 150 REM INPUT "INPUT NUMBER OF MIXES";N 160 170 Z\$ = FOR I = 1 TO N 180 190 X = INT (6 * RND (1)):Y = INT (3 * RND (1)) 200 IF X < > 0 THEN 220 210 X = "R": GOTO 310 220 IF X < > 1 THEN 230 X\$ = "F": GOTO 310 1 THEN 240

This program, in Applesoft BASIC using low-resolution graphics, simulates Rubik's Cube. The problem is to take any arrangement of the cube and restore it to its pristine state.

In solving Rubik's Cube, each face on the cube can turn clockwise or counterclockwise. In addition, different views of the cube are obtained by rotating the cube about axes through the center squares of the top and bottom faces, right and left faces, and front and back faces.

Program Notes

The program uses an array R, dimensioned to 5 by 5 by 5, as its representation for Rubik's Cube. Colors are stored numerically as follows:

Magenta 1 Orange 9 Blue 2 Green 4 White 15 Yellow 13.

More

The F face (see photo for face identification) is stored in the middle 3 by 3 squares where x = 1. The R face is stored in the middle 3 by 3 squares where y = 1. The D face is stored in the middle 3 by 3 squares where z = 1. Similarly, the B face is stored in the middle 3 by 3 squares where x = 5; the L face is stored in the middle 3 by 3 squares where y = 5; and the U face is stored in the middle 3 by 3 squares where z = 5.

Address correspondence to Curtis and Lillian J. Cooper, 803 E. Clark, Warrensburg, MO 64093.

The program contains two big subroutines. One subroutine is used to rearrange the cube. The following notation, similar to that in James F. Nourse's The Simple Solution to Rubik's Cube, is used by the program to change the cube.

Summary of Moves

R+-Turn R face one quarter turn clockwise

R--Turn R face one quarter turn counterclockwise

R2–Turn R face one half turn

F+-Turn F face one quarter turn clockwise

F--Turn F face one quarter turn counterclockwise

F2-Turn F face one half turn

L+-Turn L face one quarter turn clockwise

L--Turn L face one quarter turn counterclockwise

L2-Turn L face one half turn

D+-Turn D face one quarter turn clockwise

D--Turn D face one quarter turn counterclockwise

D2-Turn D face one half turn

U+-Turn U face one quarter turn clockwise

U--Turn U face one quarter turn counterclockwise

U2-Turn U face one half turn

B+-Turn B face one quarter turn clockwise

B--Turn B face one quarter turn counterclockwise

B2-Turn B face one half turn

MFR# where # is 1, 2, or 3-Rotate the cube about the axis passing through the center squares of the up (top) and down (bottom) faces. Move F to R face 1, 2, or 3 times.

MFU# where # is 1, 2, or 3-Rotate the cube about the axis passing through the center squares of the right and left faces. Move F to U face 1, 2, or 3 times.

MUR# where # is 1, 2, or 3-Rotate the cube about the axis passing through the center squares of the front and back faces. Move U to R face 1, 2, or 3 times.

Several moves can be performed on the cube by concatenating together any of the above moves.

The second subroutine draws the cube. Two views are displayed on the screen. The first view shows the corner formed by the up, right and front faces as the corner closest to the viewer. The second view has the opposite corner (formed by the down, left and back faces) closest to the viewer. The faces are each labeled (see photo).

The program begins by initializing the cube and asking how many moves you want it to make to mix up the cube. It is then randomly mixed the number of times specified and the resulting cube is displayed. The program asks you to input your move or moves. Invalid move entries are rejected and you are asked to reenter your move. If S is input, the program stops. Otherwise the resulting cube is displayed and another move is requested.

Enjoy exploring this color-graphics version of Rubik's Cube.

References

Nourse, James G. The Simple Solution to Rubik's Cube (New York: Bantom Books, 1981).

Singmaster, David. Notes on Rubik's 'Magic Cube' (Hillside, New Jersey: Enslow Publishers, 1980).

Listing continued. ea. 240 IF x < > 2 THEN 260 250 $x^{6} = "L"_{12}$: GOTO 310 260 IF x < > 3 THEN 280 270 $x^{6} = "U"_{12}$ GOTO 310 280 IF x < > 4 THEN 300 290 $x^{6} = "B"_{12}$ GOTO 310 300 $x^{6} = "D"_{13}$ 310 IF y < > 0 THEN 330 320 $y^{6} = "+"_{12}$ GOTO 360 330 IF y < > 1 THEN 350 340 $y^{6} = "-"_{12}$ GOTO 360 350 $y^{6} = z^{6} + x^{6} + y^{6}$ 370 NEXT I 370 NEXT I 380 GOSUB GOSUB 500 390 GOSUB 2050 400 REM 410 420 REM CHANGE RUBIK'S CUBE REM 430 INPUT "INPUT MOVE "; Z\$ GOSUB 500 440 450 GOSUB 2050 460 **GOTO 430** 470 REM 480 REM PERFORM MOVES 490 REM FOR I = 1 TO 5: FOR J = 1 TO 5: FOR K = 1 TO 5 500 510 R1(I, J, K) = R(I,J,K)520 NEXT K: NEXT J: NEXT I 530 IF Z\$ = "" THEN RETURN 540 X\$ = MID\$ (Z\$,1,1) 550 IF X\$ = "S" THEN 3100 560 IF X\$ = "M" THEN 1250 570 REM 580 REM MOVE FACES 590 REM 590 REM 600 Y\$ = MID\$ (Z\$,2,1) 610 IF X\$ < > "R" THEN 710 620 FOR I = 1 TO 5: FOR J = 1 TO 5 630 A(I,J) = R(I,1,J):B(I,J) = R(I,2,J) 640 NEXT J: NEXT I 650 GOSUB 1720 750 GOSUB 1800 760 IF E = 1 THEN 1670 770 FOR I = 1 TO 5: FOR J = 1 TO 5 780 R(1,I,J) = A(I,J):R(2,I,J) = B(I,J)790 NEXT J: NEXT I 790 NEAT J: NEAT 1 800 GDTD 1200 810 IF X\$ < > "L" THEN 910 820 FDR I = 1 TD 5: FDR J = 1 TD 5 830 A(I,J) = R(I,5,J):B(I,J) = R(I,4,J) 840 NEXT J: NEXT I 850 GDSUB 1800

 900
 GUTU 1200

 910
 IF X\$ < > "B" THEN 1010

 920
 FOR I = 1 TO 5: FOR J = 1 TO 5

 930
 A(I,J) = R(5,I,J):B(I,J) = R(4,I,J)

 940
 NEXT J: NEXT I

 950
 GUSUB 1720

 960
 IF E = 1 TUEN 1070

 950 GOSUB 1720 960 IF E = 1 THEN 1670 970 FDR I = 1 TO .5: FOR J = 1 TO 5 980 R(5,1,J) = A(1,J):R(4,1,J) = B(I,J)990 NEXT J: NEXT I 1000 GOTO 1200 1010 IF X% $\langle \rangle$ "U" THEN 1110 1020 FDR I = 1 TO 5: FOR J = 1 TO 5 1030 A(I,J) = R(I,J,5):B(I,J) = R(I,J,4)1040 NEXT J: NEXT I 1050 GOSUB 1720 1060 IF E = 1 THEN 1670 1070 FOR I = 1 TO 5: FOR J = 1 TO 5 (More



Listing continued. 1080 R(I,J,5) = A(I,J):R(I,J,4) = B(I,J)1090 NEXT J: NEXT I 1000 GOTD 1200 1100 GOTD 1200 1110 IF X\$ $\langle \rangle$ "D" THEN 1670 1120 FOR I = 1 TO 5: FOR J = 1 TO 5 1130 A(I,J) = R(I,J,1):B(I,J) = R(I,J,2) 1140 NEXT J: NEXT I 1150 GDSUB 1800 1150 GISUB 1800 1160 IF E = 1 THEN 1670 1170 FOR I = 1 TO 5: FOR J = 1 TO 5 1180 R(I,J,1) = A(I,J):R(I,J,2) = B(I,J) 1190 NEXT J: NEXT I 1210 GOTD 570 670 S 1210 GOTO 530 1220 REM 1230 REM CHANGE VIEWING CORNERS 1240 REM 1250 X\$ = MID\$ (Z\$,2,1):Y\$ = MID\$ (Z\$,3,1)1260 S\$ = MID\$ (Z\$,4,1)1270 IF S\$ $\langle \rangle$ "1" AND S\$ $\langle \rangle$ "2" AND S\$ $\langle \rangle$ "3" THEN 1670 1280 N = VAL (S\$) 1290 IF X\$ $\langle \rangle$ "F" THEN 1540 1300 IF Y\$ $\langle \rangle$ "F" THEN 1420 1310 Z\$ = MID\$ (Z\$,5) 1320 FDR K = 1 TD N 1320 FDR K = 1 TD N 1340 FDR L = 1 TD F FOR $\lambda = 1$ TD F 1250 X\$ = 1260 S\$ = MID\$ (Z\$,2,1):Y\$ = MID\$ (Z\$,3,1) 1360 NEXT J: NEXT I 1370 FOR I = 1 TO 5: FOR J = 1 TO 5 1380 R(6 - J,I,3) = A(I,J) 1390 NEXT J: NEXT I 1400 NEXT K 1420 IF Y\$ < 1430 Z\$ = MIP 1410 GOTD 530 > "U" THEN 1670

 1430
 Z\$ = MID\$ (Z\$,5)

 1440
 FOR
 K = 1
 TO N

 1450
 Z\$ = "R+L-" + Z\$

 1460
 FOR I = 1
 TO 5:
 FOR J = 1
 TO 5

 1470
 A(I,J) = R(I,3,J)
 1480
 NEXT J:
 NEXT I

 1490 FOR I = 1 TO 5: FOR J = 1 TO 5 1500 R(J,3,6 - I) = A(I,J)1510 NEXT J: NEXT I 1520 NEXT K 1530 GOTO 530 IF X\$ < > "U" THEN 1670 IF Y\$ < > "R" THEN 1670 1540 1550 1560 Z\$ = MID\$ (Z\$,5) 1570 FOR K = 1 TO N 1580 Z\$ = "F+B-" + Z\$ 1500 $I^{*} = I^{+}I^{-} + I^{*}$ 1590 FOR I = 1 TO 5: FOR J = 1 TO 5 1600 A(I,J) = R(3,I,J) 1610 NEXT J: NEXT I 1620 FOR I = 1 TO 5: FOR J = 1 TO 5 1630 R(3,6 - J,I) = A(I,J)1640 NEXT J: NEXT I 1650 NEXT K 1660 **GOTO 530** 1630 GUU 330 1670 PRINT "INVALID MOVE, TRY AGAIN." 1680 FOR I = 1 TO 5: FOR J = 1 TO 5: FOR K 1690 R(I,J,K) = R1(I,J,K) 1700 NEXT K: NEXT J: NEXT I 1 TO 5 1710 RETURN 1720 E = 0 1730 IF Y\$ < > "+" THEN 1750 1740 GOSUB 1950: RETURN 1750 IF Y\$ < > "-" THEN 1770 GOSUB 1880: RETURN 1760 1770 IF Y\$ < > "2" THEN 1790 GOSUB 1880: GOSUB 1880: RETURN 1780 1790 E = 1: RETURN 1800 E = 0 IF Y\$ < > "+" THEN 1830 1810 GOSUB 1880: RETURN IF Y\$ < > "-" THEN 1850 1820 1830 GOSUB 1950: RETURN IF Y\$ < > "2" THEN 1870 1840 1850 GOSUB 1880: GOSUB 1880: RETURN 1860 1860 GOSUB 1880: GOSUB 1880: RETURN 1870 E = 1: RETURN 1880 FOR I = 1 TO 5: FOR J = 1 TO 5 1890 C(I,J) = A(I,J):D(I,J) = B(I,J) 1900 NEXT J: NEXT I 1910 FOR I = 1 TO 5: FOR J = 1 TO 5 1920 A(6 - J,I) = C(I,J):B(6 - J,I) = D(I,J) 1930 NEXT J: NEXT I 1940 PETURN 1940 RETURN 1950 FOR I = 1 TO 5: FOR J = 1 TO 5 1960 C(I,J) = A(I,J):D(I,J) = B(I,J)1970 NEXT J: NEXT I 1980 FOR I = 1 TO 5: FOR J = 1 TO 5 1990 A(J,6 - I) = C(I,J):B(J,6 - I) = D(I,J) 2000 NEXT J: NEXT I 2010 RETURN 2020 REM 2030 PRINT RUBIK'S CUBE REM 2040 REM 2050 TEXT 2060 GR 2070 COLOR= 0 2080 X1 = 9:Y1 = 39:X2 = 6:Y2 = 36:X3 = 3:Y3 = 33:X4 = 0:Y4 = 30:W2 = 12:W3 = 15:W4 = 18 2090 FOR I = 0 TO 15 2100 PLOT X1,Y1 - I: PLOT X2,Y2 - I: PLOT X3,Y3 - I: PLOT X4,Y4 - I: PLOT W2,Y2 - I: PLOT W3,Y3 - I: PLOT W4,Y4 - I 2110 NEXT (More

2120 X1 = 9:Z1 = 39:Z2 = 34:Z3 = 29:Z4 = 24:Y2 = 21:Y3 = 18:Y4 = 152130 FOR I = 0 TO 9 2140 PLOT X1 + I,Z1 - I: PLOT X1 + I,Z2 - I: PLOT X1 + I,Z3 - I: PLOT X1 + I,Z4 2150 PLOT X1 - I,Z1 - I: PLOT X1 - I,Z2 - I: PLOT X1 - I,Z3 - I: PLOT X1 - I,Z4 2160 PLOT X2 + I,Y2 - I: PLOT X3 + I,Y3 - I: PLOT X4 + I,Y4 - I 2170 PLOT W2 - I,Y2 - I: PLOT W3 - I,Y3 - I: PLOT W4 - I,Y4 - I 2180 NEXT I 2190 X1 = 30:X2 = 27:X3 = 24:X4 = 21:Y1 = 21:Y2 = 24:Y3 = 27:Y4 = <math>30:W2 = 33:W3 = 36:W4 = 392200 FOR I = 0 TD 15 2210 PLDT X1,Y1 - I: PLDT X2,Y2 - I: PLDT X3,Y3 - I: PLDT X4,Y4 - I: PLDT W2,Y2 - I: PLDT W3,Y3 - I: PLDT W4,Y4 - I 2220 NEXT I 2230 X1 = 30:Z1 = 6:Z2 = 11:Z3 = 16:Z4 = 21 FOR I = 0 TO 9 2240 2250 PLOT X1 - I,Z1 + I: PLOT X1 - I,Z2 + I: PLOT X1 - I,Z3 + I: PLOT X1 - I,Z4 + I 2260 PLOT X1 + I,Z1 + I: PLOT X1 + I,Z2 + I: PLOT X1 + I,Z3 + I: PLOT X1 + I,Z4 + I PLOT X2 + I,Y2 + I: PLOT X3 + I,Y3 + I: PLOT X4 + I,Y4 + I PLOT W2 - I,Y2 + I: PLOT W3 - I,Y3 + I: PLOT W4 - I,Y4 + I 2270 2280 NEXT I 2290

 NEXT 1
 PRINT "
 UP (TOP)
 BACK

 PRINT "
 FRONT
 RIGHT

 X1 = 0:X2 = 7:Y1 = 37:Y2 = 36 FOR J = 2 TO 4:
 FOR K = 2 TO 4

 2300 LEFT DOWN (BOTTOM) " 2310 2320 2330 2340 I = 1GOSUB 2990 2350 FOR I = 0 TO 3 PLOT X1 - 3 * (J - 2), Y1 - I - 5 * (K - 2) - 3 * (J - 2) PLOT X2 - 3 * (J - 2), Y2 - I - 5 * (K - 2) - 3 * (J - 2) 2360 2370 2380 2390 NEXT I 2400 NEXT K: NEXT J 2410 X1 = 10:X2 = 11:Y1 = 37:Y2 = 36 2420 FOR I = 2 TO 4: FOR K = 2 TO 4 2430 J = 1GOSUB 2990 2440 PLOT X1 + 3 * (I - 2), Y1 - J - 5 * (K - 2) - 3 * (I - 2) PLOT X2 + 3 * (I - 2), Y2 - J - 5 * (K - 2) - 3 * (I - 2) 2450 2460 2470 2480 NEXT J NEXT K: NEXT I 2490 2500 X1 = 32:X2 = 31:Y1 = 22:Y2 = 21 2510 FOR I = 4 TO 2 STEP - 1: FOR K = 2 TO 4 2520 J = 5GOSUB 2990 2530 PLOT X1 + 3 * (4 - 1), Y1 - J - 5 * (K - 2) + 3 * (4 - 1) PLOT X2 + 3 * (4 - 1), Y2 - J - 5 * (K - 2) + 3 * (4 - 1) 2540 2550 2560 2570 NEXT J 2580 NEXT K: NEXT I 2590 X1 = 28:X2 = 29:Y1 = 22:Y2 = 21 2600 FOR J = 4 TO 2 STEP - 1: FOR K = 2 TO 4 2610 I = 52620 **GOSUB 2990** PLOT X1 - 3 * (4 - J), Y1 - I - 5 * (K - 2) + 3 * (4 - J) PLOT X2 - 3 * (4 - J), Y2 - I - 5 * (K - 2) + 3 * (4 - J) 2630 2640 2650 2660 NEXT I 2670 NEXT K: NEXT J 2680 X1 = 7:X2 = 8:X3 = 9:X4 = 10:X5 = 11 2690 Y1 = 21:Y2 = 22:Y3 = 23:Y4 = 22:Y5 = 21 2700 FOR I = 2 TO 4: FOR J = 2 TO 4 2710 K = 5 GOSUB 2990 2720 2730 PLOT X1 + 3 \$ (I - 2) - 3 \$ (J - 2), Y1 - 3 \$ (J - 2) - 3 \$ (I - 2) PLOT X5 + 3 \$ (I - 2) - 3 \$ (J - 2), Y5 - 3 \$ (J - 2) - 3 \$ (I - 2) PLOT X5 + 3 \$ (I - 2) - 3 \$ (J - 2), Y5 - 3 \$ (J - 2) - 3 \$ (I - 2) PLOT X5 + 3 \$ (I - 2) - 3 \$ (J - 2), Y5 - 3 \$ (J - 2) - 3 \$ 2740 2750 FOR K = 0 TO 2 PLOT X2 + 3 * (I - 2) - 3 * (J - 2), Y2 - K - 3 * (J - 2) - 3 * (I - 2) PLOT X4 + 3 * (I - 2) - 3 * (J - 2), Y4 - K - 3 * (J - 2) - 3 * (I - 2) 2760 2770 2780 NEXT K FOR K = O TO 4 2790 PLOT X3 + 3 * (I - 2) - 3 * (J - 2), Y3 - K - 3 * (J - 2) - 3 * (I - 2) NEXT K 2800 2810 NEXT J: NEXT I X1 = 28:X2 = 29:X3 = 30:X4 = 31:X5 = 32Y1 = 24:Y2 = 23:Y3 = 22:Y4 = 23:Y5 = 24FOR I = 4 TO 2 STEP - 1: FOR J = 4 TO 2 STEP - 1 2820 2830 2840 2850 2860 GOSUB 2990 2870 2880 PLOT X1 + 3 \ddagger (4 - 1) - 3 \ddagger (4 - J), Y1 + 3 \ddagger (4 - J) + 3 \ddagger (4 - I) PLOT X5 + 3 \ddagger (4 - 1) - 3 \ddagger (4 - J), Y5 + 3 \ddagger (4 - J) + 3 \ddagger (4 - I) 2890 PLOT X2 + 3 * (4 - I) - 3 * (4 - J),Y2 + 2900 2910 - J) PLOT X4 + 3 = (4 - I) - 3 = (4 - J), Y4 + K + 3 = (4 - J) + 3 = (4 - I)2920 2930 NEXT K 2940 FOR K = 0 TO 4 PLOT X3 + 3 * (4 - 1) - 3 * (4 - J), Y3 + K + 3 * (4 - J) + 3 * (4 - 1) NEXT K 2950 2960 2970 NEXT J: NEXT I 2980 RETURN 2990 > 1 THEN 3010 IF R(I,J,K) < COLOR= 1: RETURN 3000 IF R(I, J, M) < 15 THEN 3030 3010 3020 COLOR= 15: RETURN 3030 IF R(I,J,K) > 4 THEN 3050 COLOR= 4: RETURN 3040 3050 IF R(I,J,K) 9 THEN 3070 3060 COLOR= 9: RETURN IF R(I, J,K) > 2 THEN 3090 3070 COLOR= 2: RETURN COLOR= 13: RETURN 3080 3090 3100 PRINT "THANK YOU FOR PLAYING." 3110 END

Hello. This is the APPLE talking. The message is: Don't byte your APPLE. Use COGNIVOX to speak to it! I am now listening for your reply . . . Let's face it. Voice I/O is a fascinating and efficient way to communicate with computers. And now, thanks to VOICETEK, Voice I/O peripherals are easily available, easy to use and very affordable. If you own an APPLE II computer, COGNIVOX model VI0-1003 will enable your computer to understand your spoken commands and talk back with clear, natural sounding voice. COGNIVOX can be trained to recognize up to 32 words or short phrases chosen by the user. To train COGNIVOX to recognize a new word, you simply repeat the word three times under the prompting of the system. COGNIVOX will also talk with a vocabulary of 32 words or phrases chosen by the user. This vocabulary is independent of the recognition vocabulary, so a dialog with the computer is possible. The speech output is natural sounding since it is a digital recording of the user voice using a data compression algorithm. For applications requiring more than 32 words, you can have two or more vocabularies of 32 words and switch back and forth between them. Vocabularies can also be stored on disk. COGNIVOX VI0-1003 comes complete with microphone, power supply, software on cassette and extensive manual, ready to plug in and use. It plugs into the paddle connector and thus it leaves the valuable expansion slots free for other peripherals. Software provided with the unit includes demonstration programs and two voice operated, talking video games! It is also very easy to incorporate voice in your own programs. A single statement from BASIC is all that is needed to either recognize or say a word. COGNIVOX can be used as an educational tool, a data entry device when hands and/or eyes are busy, an aid to the han-

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And for you Z-80 puzzle buffs, here's a program to simulate Rubik's Cube and thus reduce the risk of thumb-joint injury.

First Aid For Cuber's Thumb

By Paul A. Turvill



Photo 1. The pristine Rubik's Cube.

ubik's Cube—also known as the Magic Cube, and a number of less complimentary names by numerous harried puzzle fans-is the current intellectual puzzle rage. The puzzle is especially intriguing to mathematics, engineering and science buffs, for a number of reasons. Mechanically, it does things that at first glance would seem impossible, even to many experienced mechanical engineers. Mathematically, it is fascinating, having the ability to be arranged and rearranged into 227× $3^{14} \times 5^3 \times 7^2 \times 11$ configurations -more than 4.3×10^{19} permutations!

Address correspondence to Paul A. Turvill, 4733 Bel Roma Road, Livermore, CA 94550. Cube solvers around the worldknown as *cubists*—have become so enthralled with Rubik's Cube that it now occupies much of the spare time of literally millions of Earth's citizens. So popular and so intriguing is it that it has received attention on page one of *The Wall Street Journal* and the front cover of *Scientific American*.

Douglas Hofstadter's *Scientific American* article (March 1981, p. 20) is probably one of the best summaries of the cube's possibilities yet published. Hofstadter goes into mechanical construction, mathematical considerations and various approaches to developing solution algorithms. He also discusses in some detail a standard system of notation designed to permit cubists to readily exchange information about their solution efforts.

While Hofstadter's article is highly recommended, the following description should give a basic understanding of the device and point out the usefulness of the listed computer programs. Notation and terminology are based on those introduced by Hofstadter.

A Cube in the Hand

Rubik's Cube rests nicely on the palm of the hand. Each of its six faces is subdivided into nine equal *facelets*. In the starting position, or *pristine state*, each of the cube's major faces is a different uniform color (see Photo 1).

The cube is cut between facelets in fact, it consists of 26 visible *cubies* (the centermost space is assumed to be unoccupied). Further, the 26 cubies are interlocked so that the nine cubies that make up each of the six major faces may be rotated as a group (see Photo 2).

By rotating any one face, you can partially rearrange the four adjacent faces. Thus, a series of 90-degree rotations of the various faces can quickly *scramble* the arrangement of the colored facelets.

Most cubists have had great difficulty establishing even a few common predetermined patterns, not to mention returning their cubes to the pristine state. A number of algorithms have been developed with varying degrees of success.

The Programs

These computer programs—one in BASIC (Listing 1), and one in Z-80 assembly language (Listing 2)—are intended to help you make sequences of moves to take the cube from one state to another. The programs oper-

	Rotat	ion		
Face	CW	CCW	CCW	
Up (top)	U	u		
Down (bottom)	D	d		
Left side	L	1		
Right side	R	r		
Front	F	f		
Back	В	b		
	Table 1.			

ate essentially identically, although it will be seen that the machine-language code generated by the assembly-language program is far more efficient in memory requirements and operating speed. Because of their similarity, the following discussion applies equally to both.

The notation used (based on the Hofstadter article) is as follows: the major faces are identified in accordance with their positions on a cube held stationary in relation to the viewer—Up, Down, Left, Right, Front and Back (see Fig. 1).

For simplicity and ease of presentation on a two-dimensional alphanumeric display device (and printer), the cube is *unfolded* so that its six faces can be seen simultaneously (see Fig. 2).

Once the program is loaded and running properly, the legend Move Sequence: will appear at the top of the screen, with a representation of the unfolded cube laid out below, in its pristine state (see Sample run in Fig. 3). Thereafter, keying any of the 12 legal move commands will cause the appropriate face to be rotated by 90 degrees, and the four adjacent faces to be rearranged accordingly. The Move Sequence will be updated and the display modified to reflect the cumulative effect of all move commands.

Table 1 summarizes the 12 permissible move commands and their effects; in the table, CW indicates clockwise, or "right" rotation, and CCW means counterclockwise, or "left." The notation differs somewhat from that of the Hofstadter article. To retain the simplicity afforded by single character commands, these programs use a combination of up-



percase (for CW) and lowercase (CCW) characters.

In addition to the 12 move commands, three additional commands are available:

• P (Print) produces a hard copy of the current screen.

N (New) reinitializes the cube to the pristine state or starting position.
X(eXit) returns control to the system monitor (or the interpreter in the case of BASIC).

Languages

Some comments are in order regarding programming languages and formats. Many differences exist among the various forms of BASIC. Cube is written to run in a modified form of Digital Group Business BASIC 1.0, which contains a number of shortcuts (the option to use # for PRINT, for example), and has its own approach to the handling of string variables. It should not be too difficult for the moderately capable reader to make the necessary conversions to nearly any other form of BASIC having string capabilities. Explanatory REM statements are included in the BASIC program where they may be useful.



Photo 2. Rubik's Cube with one face partly rotated.

guages, while usually considered more difficult to write and debug, are generally more universal since the machine-language codes they produce can normally be made to run on just about any machine based on the same or similar microprocessor technology. That is, any assembly program written for one Z-80 machine can generally be made to run on another Z-80 system, provided the I/O port assignments and peripheral driver routines are made compatible. Further, machine code is usually

highly efficient as compared to the

Programs written for assembly lan-

```
Listing 1. The BASIC listing of the Cube program.
REM * RUBIK'S CUBE PUZZLE SIMULATOR PROGRAM *
1010
     REM * BASIC VERSION 1.00 BY PAUL A. TURVILL
1020
     1030
     REM ********************
                               1040
1050
     REM *
1060
     REM * INITIALIZE VARIABLES
1070
     REM *
1080
     DIM U$(9),D$(9),L$(9),R$(9),F$(9),B$(9)
     DIM X$(9),Y$(9),Q$(113),A$(1)
1090
1100
     Q$=" " : N=0
     FOR I=1 TO 9
U$=U$+"U" : D$=D$+"D"
1110
1120
       L$=L$+"L" : R$=R$+"R"
1130
1140
       F$=F$+"F" : B$=B$+"B"
1150
       Q$=Q$+Q$
1160
       NEXT I
1170
     REM *
     REM * DISPLAY INITIAL SCREEN - NOTE THAT THE SYMBOL "#"
1180
1190
     REM * IS USED THROUGHOUT THIS PROGRAM TO REPRESENT THE
     REM * "PRINT" STATEMENT.
1200
1210
     REM *
1220
     GOSUB 1500
1230
     REM *
     REM * OUTPUT CURSOR CHARACTER
1240
1250
     REM *
1260
      #CHR$(8);CHR$(95);CHR$(8);
1270
     REM *
1280
     REM * GET COMMAND AND DECODE IT
     REM *
1290
     KEYIN A$ : #A$;
IF A$="U" THEN GOSUB 2030
1300
1310
1320
     IF AS="u" THEN GOSUB 2110
     IF A$="D" THEN GOSUB 2190
1330
     IF AS="d" THEN GOSUB 2260
1340
     IF A$="L" THEN GOSUB 2330
1350
1360
     IF A$="1" THEN GOSUB 2440
                                                       (More
    IF AS="R" THEN GOSUB 2550
1370
```

Microcomputing, January 1982 33

"BASIC program plus interpreter" required to perform the same duties.

Table 2 compares the two versions of Cube. Readers interested in such things might wish to develop versions of both to verify or refute the comparisons contained in the table.

The computer simulation has a number of advantages over the actual Rubik's Cube, especially for beginning cubists. Unscrambling a randomly scrambled cube can take from a couple of hours to several weeks; on the computer, instant recovery requires only the entry of an N command.

Moving from one structured pattern to another often requires surprisingly few moves, although discovering the exact combination of moves required may involve a great many trial-and-error iterations and numerous dead ends. Once a desired configuration is achieved on the video terminal, entering a P command will print not only the current configuration, but a record of up to the last 113 moves. (In the event the computer-wielding cubist makes 113 moves without achieving a desired result, the computer takes over and

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Listing 1 continued. 1380 IF A\$="r" THEN GOSUB 2660 1390 IF A\$="F" THEN GOSUB 2770 1400 IF AS="f" THEN GOSUB 2870 IF A\$="B" THEN GOSUB 2970 1410 1420 IF A\$="b" THEN GOSUB 3070 IF A\$="N" THEN #""; : RUN 1430 1440 IF A\$="X" THEN #""; : END 1450 IF A\$="P" THEN GOSUB 3340 1460 GOTO 1260 1470 REM * 1480 REM * SCREEN/PRINTER FORMATTING ROUTINE REM * 1490 1500 CURSOR 0 : #"Move Sequence: ";Q\$; IF A\$="p" THEN #"" 1510 FOR I=1 TO 9 1520 IF (I=1 OR I=4 OR I=7) THEN #"" : #TAB(23); 1530 1540 #U\$(I,I);" "; 1550 NEXT I #"" : #"" 1560 1570 FOR I=0 TO 2 1580 #TAB(12); 1590 FOR J=1 TO 3 : K=3*I+J 1600 #L\$(K,K);" "; 1610 NEXT J 1620 #" "; FOR J=1 TO 3 : K=3*I+J 1630 #F\$(K,K);" "; 1640 1650 NEXT J #" ", 1660 FOR J=1 TO 3 : K=3*I+J 1670 1680 #R\$(K,K);" "; 1690 NEXT J #" "; 1700 1710 FOR J=1 TO 3 : K=3*I+J #B\$(K,K);" "; 1720 1730 NEXT J #"" : NEXT I 1740 1750 FOR I=1 TO 9 IF (I=1 OR I=4 OR I=7) THEN #"" : #TAB(23); 1760 1770 "; #D\$(I,I);" 1780 NEXT I #"" : #"" : #"Next Move: "; 1790 IF N=113 THEN N=0 : A\$="P" 1800 1810 RETURN 1820 REM * 1830 REM * STRING HANDLING ROUTINES - EACH FACE OF CUBE IS REM * REPRESENTED BY A STRING VARIABLE, NINE CHARACTERS 1840 1850 REM * IN LENGTH. TOP ROW OF FACE AS DISPLAYED ON SCREEN REM * IS REPRESENTED BY POSITIONS 1, 2, AND 3; MIDDLE 1860 1870 REM * ROW BY 4, 5, AND 6; AND BOTTOM ROW BY 7, 8, AND 9. REM * PARTIAL STRINGS ARE DEPICTED BY THE VARIABLE NAME 1880 REM * FOLLOWED BY THE STARTING AND ENDING POSITIONS IN 1890 REM * PARENTHESES [EXAMPLE: BOTTOM ROW, FRONT FACE IS 1900 1910 REM * F\$(7,9)]. IF ONLY ONE POSITION IS GIVEN IN PAREN-REM * THESES, IT IS ASSUMED THAT ALL CHARACTERS FROM 1920 REM * NUMBERED POSITION TO THE END ARE INTENDED [EXAMPLE: 1930 1940 REM * U\$(4) IS EQUIVALENT TO U\$(4,9)]. IN ANY STRING REM * TRANSACTION THE NUMBER OF CHARACTERS ALTERED IS 1950 REM * GOVERNED BY THE SHORTER SUBSTRING [EXAMPLE: THE 1960 REM * STATEMENT "F\$(1)=L\$(1,3)" WILL CAUSE THE FIRST 1970 1980 REM * THREE CHARACTERS OF F\$ TO BE SET TO THE FIRST THREE REM * CHARACTERS OF L\$]. 1990 2000 REM * REM * UP FACE, CLOCKWISE (CW) ROTATION 2010 REM * 2020 2030 X\$=U\$: GOSUB 3140 : U\$=Y\$ 2040 X\$=L\$ L\$(1) = F\$(1,3) : F\$(1) = R\$(1,3)2050 2060 R\$(1) = B\$(1,3) : B\$(1) = X\$(1,3)2070 GOTO 1500 2080 REM * REM * UP FACE, COUNTERCLOCKWISE (CCW) ROTATION 2090 REM * 2100 X\$=U\$: GOSUB 3190 : U\$=Y\$ 2110 2120 X\$=L\$ L\$(1)=B\$(1,3) : B\$(1)=R\$(1,3) 2130 2140 R\$(1) = F\$(1,3) : F\$(1) = X\$(1,3)2150 GOTO 1500 2160 REM * 2170 REM * DOWN FACE, CW 2180 REM * X\$=D\$: GOSUB 3140 : D\$=Y\$ (More 2190

automatically prints a hard copy, before starting to overwrite the previous Move Sequence.)

The printed record of moves made can then be manually edited for redundancy (U1 followed immediately by Lu, for example), and the resultant edited sequence quickly verified in another run.

Working with both computer and cube, the cubist can systematically apply real moves to the cube after perfecting each sequence painlessly on the machine. A couple of fairly simple sequences exist that clearly illustrate the cube's possibilities. First try UdR1FbUd; then uuddllrrffbb (or UUDDLLRRF-FBB); then combine these and others. Vast numbers of other combinations will suggest themselves, but exercise (continued on page 46)





Fig. 2. Unfolding the cube for the video display.





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CHIPS & DALE ~ 170 P.O. BOX 31607, DEPT M Seattle, Washington Zip 98103 1-206-524-9126 CHIPS& DALE Specializing in memory Chips Listing 1 continued. 2200 X\$=L\$(7)2210 LS(7) = BS(7) : BS(7) = RS(7) : RS(7) = FS(7) : FS(7) = XS(7) = XS(72220 GOTO 1500 REM * 2230 REM * DOWN FACE, CCW 2240 2250 REM * 2260 X\$=D\$: GOSUB 3190 : D\$=Y\$ 2270 X\$=L\$(7) L\$(7) = F\$(7) : F\$(7) = R\$(7) : R\$(7) = B\$(7) : B\$(7) = X\$2280 2290 GOTO 1500 2300 REM * REM * LEFT FACE, CW 2310 REM * 2320 2330 X\$=L\$: GOSUB 3140 : L\$=Y\$ 2340 X\$ = U\$U\$(1)=B\$(9) : U\$(4)=B\$(6,6) : U\$(7)=B\$(3,3) 2350 B\$(3)=D\$(7,7) : B\$(6)=D\$(4,4) : B\$(9)=D\$(1)
FOR I=1 TO 7 STEP 3 2360 2370 2380 D\$(I) = F\$(I,I) : F\$(I) = X\$(I,I)2390 NEXT I 2400 GOTO 1500 2410 REM * More Move Sequence: U U U

U U U

II U TI F F F В В L L L R R R B R L L F F F R R В B B L F В B B LL F F R R R L D D D D D D D D D Next Move: Move Sequence: UdRlFbUd F F F F U F F F F D DD R R R U U U L T. T. В L F R U R U L D L D R D D D R R R U U U L L L B B R В D B

Next Move:

Move Sequence: UdRlFbUduuddllrrffbb

BBB

			F	В	F						
			В	U	В						
			F	В	F						
D	U	D	R	L	R	U	D	U	L	R	L
U	L	U	L	F	L	D	R	D	R	В	R
D	U	D	R	L	R	U	D	U	L	R	L
			В	F	В						
			F	D	F						
			В	F	В						

Next Move:

Fig. 3. The cube, as it appears on the video display, in its original state and as it appears after two Move Sequences.
Listing 1	continue	d.
	2420	REM * LEFT FACE, CCW
	2430	REM *
	2440	X\$=L\$: GOSUB 3190 : L\$=Y\$
	2450	
	2460	FOR $I=1$ TO / STEP 3 US(I) - FS(I I) - FS(I I)
	2480	NEXT T
	2490	DS(1) = BS(9) : $DS(4) = BS(6,6)$: $DS(7) = BS(3,3)$
	2500	$B_{3}(3) = X_{3}(7,7) : B_{3}(6) = X_{3}(4,4) : B_{3}(9) = X_{3}(1)$
	2510	GOTO 1500
	2520	REM *
	2530	REM * RIGHT FACE, CW
	2540	REM *
	2550	X\$=R\$: GOSUB 3140 : R\$=Y\$
	2560	X \$ = U \$
	2570	FOR $I=3$ TO 9 STEP 3
	2580	$U_{2}(1) = F_{2}(1,1) : F_{2}(1) = D_{2}(1,1)$
	2590	NEXT 1 $D_{2}^{2}(2) - P_{2}^{2}(7, 7) = D_{2}^{2}(6) - P_{2}^{2}(4, 4) = D_{2}^{2}(0) - P_{2}^{2}(1)$
	2610	$D_{2}(3) = B_{2}(7,7) : D_{2}(6) = B_{2}(4,4) : D_{2}(9) = B_{2}(1)$
	2620	GOTO 1500
	2630	REM *
	2640	REM * RIGHT FACE, CCW
	2650	REM *
	2660	X\$=R\$: GOSUB 3190 : R\$=Y\$
	2670	X \$ = U \$
	2680	U\$(3) = B\$(7,7) : U\$(6) = B\$(4,4) : U\$(9) = B\$(1)
	2690	$B_{S}(1) = D_{S}(9) : B_{S}(4) = D_{S}(6, 6) : B_{S}(7) = D_{S}(3, 3)$
	2700	FOR $I=3$ TO 9 STEP 3
	2720	$D\varphi(\tau) = r\varphi(\tau,\tau) : r\varphi(\tau) = X\varphi(\tau,\tau)$
	2720	COTO 1500
	2740	REM *
	2750	REM * FRONT FACE, CW
	2760	REM *
	2770	X\$=F\$: GOSUB 3140 : F\$=Y\$
	2780	X \$ = U \$
	2790	U\$(7) = L\$(9) : U\$(8) = L\$(6) : U\$(9) = L\$(3)
	2800	L\$(3)=D\$(1,1) : L\$(6)=D\$(2,2) : L\$(9)=D\$(3)
	2810	D\$(1) = R\$(7) : D\$(2) = R\$(4,4) : D\$(3) = R\$(1,1)
	2820	R\$(1) = X\$(7,7) : R\$(4) = X\$(8,8) : R\$(7) = X\$(9)
	2830	GOTO ISUU
	2850	REM * FRONT FACE, COW
	2860	REM *
	2870	X\$=F\$: GOSUB 3190 : F\$=Y\$
	2880	X \$ = U \$
	2890	U\$(7) = R\$(1) : U\$(8) = R\$(4) : U\$(9) = R\$(7)
	2900	R\$(1)=D\$(3,3) : R\$(4)=D\$(2,2) : R\$(7)=D\$(1,1)
	2910	D\$(1) = L\$(3,3) : D\$(2) = L\$(6,6) : D\$(3) = L\$(9)
	2920	L\$(3) = X\$(9) : L\$(6) = X\$(8,8) : L\$(9) = X\$(7)
	2930	GOTO ISUU
	2950	REM * BACK FACE, CW
	2960	REM *
	2970	X\$=B\$: GOSUB 3140 : B\$=Y\$
	2980	X \$ = U \$
	2990	U\$(1) = R\$(3,3) : U\$(2) = R\$(6,6) : U\$(3) = R\$(9)
	3000	R\$(3)=D\$(9) : R\$(6)=D\$(8,8) : R\$(9)=D\$(7)
	3010	D\$(7) = L\$(1) : D\$(8) = L\$(4) : D\$(9) = L\$(7)
	3020	L\$(1)=X\$(3,3) : L(4)=X$(2,2)$: L(7)=X$(3,3)$
	3030	GOTO 1500
	3040	REM * PACK FACE CCW
	3060	REM *
	3070	X\$=B\$: GOSUB 3190 : B\$=Y\$
	3080	X\$=U\$
	3090	U\$(1) = L\$(7) : U\$(2) = L\$(4, 4) : U\$(3) = L\$(1, 1)
	3100	L\$(1) = D\$(7,7) : L\$(4) = D\$(8,8) : L\$(7) = D\$(9)
	3110	D\$(7) = R\$(9) : D\$(8) = R\$(6) : D\$(9) = R\$(3)
	3120	R\$(3) = X\$(1,1) : R\$(6) = X\$(2,2) : R\$(9) = X\$(3)
	3130	GOTO 1500
	3140	GOSUB 3240
	3150	$r_{\varphi}(1) = x_{\varphi}(7)$: $r_{\varphi}(2) = x_{\varphi}(4, 4)$: $Y_{\varphi}(3) = X_{\varphi}(1, 1)$ $v_{\varphi}(4) = v_{\varphi}(8, 8)$. $v_{\varphi}(6) = v_{\varphi}(2)$
	3170	$Y_{S}(7) = X_{S}(9) + Y_{S}(8) = X_{S}(6) + Y_{S}(9) = X_{S}(3)$
	3180	RETURN
	3190	GOSUB 3240
	3200	Y\$(1) = X\$(3,3) : Y\$(2) = X\$(6,6) : Y\$(3) = X\$(9)
	3210	Y \$ (4) = X \$ (2, 2) : Y \$ (6) = X \$ (8)
	3220	Y\$(7) = X\$(1) : Y\$(8) = X\$(4) : Y\$(9) = X\$(7)
	3230	RETURN
	3240	Y = X : $N = N + 1$: $U > (N) = A$

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Listing 1 continued.

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```
3250
      IF N,113 THEN Q$(N+1)=" "
3260
      RETURN
3270
      REM *
3280
      REM
          * HARDCOPY ROUTINE - "FILL" STATEMENT IS EOUIVALENT
      REM * TO "POKE," AND IS USED HERE TO TEMPORARILY ADJUST
3290
      REM * OUTPUT LINE LENGTH TO PREVENT PRINTER FROM OVER-
3300
      REM * RUNNING PAPER WIDTH. "OPEN" AND "CLOSE" STATEMENTS
3310
3320
      REM * TURN OUTPUT DEVICES ON AND OFF.
3330
      REM *
3340
      CLOSE (CRT,E) : OPEN (PRINTER,E)
3350
      FILL 12890,64 : A$="p"
3360
      # " "
3370
      GOSUB 1500
     FOR I=1 TO 12 : #"" : NEXT I
CLOSE (PRINTER,E) : OPEN (CRT,E)
3380
3390
3400
     FILL 12890,132 : A$=" "
3410
     GOTO 1500
```

	the second s	onon susasses
	Bytes of	f Code
	BASIC	Assembly
Interpreter	17,920	0 (1)
Main Program	5,507	2,224
Variables	329	0 (2)
Printer Driver	0 (3)	768
	(1011) (2010)	
Total Bytes	23,756	2,992
	Execution	n Times
Each Command	2.0 sec.	0.1 sec.
20 Commands (4)	44.0 sec.	5.4 sec.

Notes:

(1) Assembly-language program need not be present while application program is running.

- (2) Variable storage locations included in main program. (3) Printer driver included in BASIC interpreter.
- (4) Includes operator reaction times between keystrokes.

Table 2. Comparison of features of the BASIC and assembly versions of the Cube program.

		Lis	sting	2.	Z-80 as	sembly-la	inguage	e version of th	e Cube program.
0000					0100		ST	0	
0000					0110	*			
0000					0120	*****	****	******	*****
0000					0130	* RUBI	K'S C	UBE PUZZLE	SIMULATOR PROGRAM *
0000					0140	* VERS	ION 1	.00 B	Y PAUL A. TURVILL *
0000					0150	*****	*****	*** MARCH,	1981 ***********
0000					0160	*****	*****	********	*****
0000					0170	*			
0000	18	15			0180	START	JR	BEGIN	
0002	C3	18	01		0190		JP	UPDATE	RESTART VECTORS
0005	C3	88	E3		0200		JP	EDITOR	
0008	C3	6A	E3		0210		JP	KEYIN	
000B	C3	70	F3		0220		JP	TRMOUT	
000E	C3	8A	08		0230		JP	PRINT	
0011	C3	BO	EF		0240		JP	LPRTR	
0014	C3	00	00		0250		JP	0	
0017	31	8A	08		0260	BEGIN	LD	SP,STAK	SET STACK POINTER
001A	11	7F	07		0270		LD.	DE, MOVES	INITIALIZE
001D	OE	71			0280		LD	C,113D	MOVE
001F	D5				0290		PUSH	DE	SEQUENCE
0020	EB				0300		EX	DE,HL	RECORD
0021	41				0310		LD	B,C	
0022	36	AO			0320	BEGIN1	LD	M,240	
0024	23				0330		INC	HL	
0025	10	FB			0340		DJNZ	BEGIN1	
0027	Dl				0350		POP	DE	
0028	3E	D5			0360	INIT	LD	A, 'U'	INITIALIZE
002A	32	F2	07		0370		LD	(U1),A	CUBE
002D	32	F4	07		0380		LD	(U2),A	TO
0030	32	F6	07		0390		LD	(U3),A	STARTING
0033	32	F8	07		0400		LD	(U4),A	POSITION
0036	32	FC	07		0410		LD	(116) 7	()





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Li								
LI		-						
	isting	2 00	ontin	ued.	~			
	0039	32	FE	07	0420		LD	(U7),A
	003C	32	00	08	0430		LD	(U8),A
	003F	32	02	08	0440		LD	(U9),A
	0042	3E	C4		0450		LD	A, 'D'
	0044	32	40	08	0460		LD	(D1).A
	0047	32	4F	08	0470		LD	(D2) A
	0047	22	46	00	0470		LD	(D2),A
	004A	32	50	08	0480		LD	(D3),A
	004D	32	52	08	0490		LD	(D4),A
	0050	32	56	08	0500		LD	(D6),A
	0053	32	58	08	0510		LD	(D7),A
	0056	32	5A	08	0520		LD	(D8),A
	0059	32	5C	08	0530		LD	(D9),A
	005C	3E	CC		0540		L.D	A. 'T.'
	0055	32	04	08	0550		ID	(11) 7
	OOSE	22	04	00	0550		LD	
	0061	32	06	08	0560		LD	(L2),A
	0064	32	08	08	0570		LD	(L3),A
	0067	32	1C	08	0580		LD	(L4),A
	006A	32	20	08	0590		LD	(L6),A
	006D	32	34	08	0600		LD	(L7),A
	0070	32	36	08	0610		LD	(L8) . A
	0073	32	38	08	0620		LD	(1.9) A
	0076	20	50	50	0620		ID	
	0076	SE	10	00	0630		LD	
	0078	32	10	08	0640		LD	(L1),A
	007B	32	12	08	0650		LD	(R2),A
	007E	32	14	08	0660		LD	(R3),A
	0081	32	28	08	0670		LD	(R4),A
	0084	32	2C	08	0680		LD	(R6),A
	0087	32	40	08	0690		LD	(R7),A
	0087	32	42	08	0700		LD	(88) A
	AGOO	22	42	00	0700		LD	
	008D	32	44	08	0710		LD	(R9),A
	0090	3E	C6		0720		LD	A, 'F'
	0092	32	OA	08	0730		LD	(F1),A
	0095	32	0C	08	0740		LD	(F2),A
	0098	32	OE	08	0750		LD	(F3),A
	009B	32	22	08	0760		LD	(F4) - A
	OOOF	22	26	00	0770		ID	
	OODI	22	20	08	0790		LD	(FO),A
	LAOU	32	3A	08	0780		LD	(F ⁷),A
	00A4	32	3C	08	0790		LD	(F8),A
	00A7	32	3E	08	0800		LD	(F9),A
	OOAA	3E	C2		0810		LD	A, 'B'
	OOAC	32	16	08	0820		LD	(B1),A
	OOAF	32	18	08	0830		LD	(B2) A
	OOR	22	10	00	0030		LD	(D2) A
	UUB2	32	IA	08	0840		LD	(B3),A
	0085	32	ZE	08	0850		LD	(B4),A
	00B8	32	32	08	0860		LD	(B6),A
	OOBB	32	46	08	0870		LD	(B7),A
	OOBE	32	48	08	0880		LD	(B8),A
	0001	32	4A	08	0890		L.D	(B9) .A
	00004	52		000	0900	*	50	(23) / 11
	0004				0900	+	DI DI	
	00C4				0910	* SCREE	EN DIS	SPLAY ROUTINE
	00C4				0920	*		
	00C4	21	6F	07	0930	DISPLY	LD	HL, SCREEN
	00C7	C5			0940			
	0008	D7			02.0		PUSH	BC
	0009				0950		PUSH	BC 20
	2003	CI			0950		PUSH RST POP	BC 20 BC
	0007	Cl			0950 0960	0	PUSH RST POP	BC 20 BC
	OOCA	Cl			0950 0960 0970	*	PUSH RST POP	BC 20 BC
	00CA 00CA	Cl			0950 0960 0970 0980	* * COMM2	PUSH RST POP AND IN	BC 20 BC NPUT AND RECOGNITION
-	00CA 00CA 00CA	Cl			0950 0960 0970 0980 0990	* * COMMA *	PUSH RST POP AND IN	BC 20 BC NPUT AND RECOGNITION
M	00CA 00CA 00CA 00CA	Cl			0950 0960 0970 0980 0990 1000	* * COMMA * GETCMD	PUSH RST POP AND IN RST	BC 20 BC NPUT AND RECOGNITION 30
m	00CA 00CA 00CA 00CA 00CB	Cl DF E7			0950 0960 0970 0980 0990 1000 1010	* * COMMA * GETCMD	PUSH RST POP AND IN RST RST	BC 20 BC NPUT AND RECOGNITION 30 40
THE STATE	00CA 00CA 00CA 00CA 00CB 00CC	Cl DF E7 FE	D5		0950 0960 0970 0980 0990 1000 1010 1020	* * COMMA * GETCMD	PUSH RST POP AND IN RST RST CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U'
THE REAL	00CA 00CA 00CA 00CA 00CB 00CC	Cl DF E7 FE 28	D5		0950 0960 0970 0980 0990 1000 1010 1020	* * GETCMD	PUSH RST POP AND IN RST RST CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U'
The second secon	00CA 00CA 00CA 00CA 00CB 00CC 00CC	Cl DF E7 FE 28	D5 57		0950 0960 0970 0980 0990 1000 1010 1020 1030	* * GETCMD	PUSH RST POP AND IN RST RST CP JR CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT
	00CA 00CA 00CA 00CA 00CB 00CC 00CC 00CC	Cl DF E7 FE 28 FE	D5 57 F5	111111 111111 111111 111111 111111 11111	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040	* * GETCMD	PUSH RST POP AND IN RST RST CP JR CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'u'
M	00CA 00CA 00CA 00CA 00CB 00CC 00CC 00D0 00D2	Cl DF E7 FE 28 FE CA	D5 57 F5 AD	01	0950 0960 0970 0980 0990 1000 1010 1020 1030 1030 1040	* * GETCMD	PUSH RST POP AND IN RST RST CP JR CP JP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'u' Z,UPLT
THE REAL PROPERTY OF THE REAL	00CA 00CA 00CA 00CB 00CC 00CC 00CC 00D0 00D2 00D5	Cl DF E7 FE 28 FE CA FE	D5 57 F5 AD C4	01	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060	* * COMMA * GETCMD	PUSH RST POP AND IN RST RST CP JR CP JP CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' z,UPRT 'u' z,UPLT 'D'
- M	00CA 00CA 00CA 00CB 00CC 00CC 00DC 00D2 00D5 00D7	Cl DF E7 FE 28 FE CA FE CA	D5 57 F5 AD C4 33	01 02	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060 1070	* * GETCMD	PUSH RST POP AND IN RST CP JR CP JP CP JP CP JP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'u' Z,UPLT 'D' Z,DNRT
THE SECOND SECOND	00CA 00CA 00CA 00CB 00CC 00CC 00DC 00D2 00D2 00D5 00D7 00DA	Cl DF E7 FE 28 FE CA FE CA FE	D5 57 F5 AD C4 33 E4	01 02	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060 1070 1080	* * COMM7 * GETCMD	PUSH RST POP AND IN RST RST CP JR CP JP CP JP CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'u' Z,UPLT 'D' Z,DNRT 'd'
THE SECOND SECOND	00CA 00CA 00CA 00CB 00CC 00CC 00DC 00D2 00D5 00D7 00DA 00DC	C1 DF E7 FE 28 FE CA FE CA FE CA	D5 57 F5 AD C4 33 E4 B9	01 02 02	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060 1070 1080 1090	* * GETCMD	PUSH RST POP AND IN RST RST CP JR CP JP CP JP CP JP CP JP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNLT
THE REAL PROPERTY OF THE REAL	00CA 00CA 00CA 00CB 00CC 00CC 00DC 00D2 00D2 00D5 00D7 00DA 00DC	C1 DF E7 FE 28 FE CA FE CA FE CA FE	D5 57 F5 AD C4 33 E4 B9 CC	01 02 02	0950 0960 0970 0980 0990 1000 1020 1020 1030 1040 1050 1060 1070 1080 1090	* * GETCMD	PUSH RST POP AND IN RST RST CP JP CP JP CP JP CP JP CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNRT 'd' Z,DNLT 'L'
THE SECOND SECONDO SECONDO SECOND SECOND SECOND SECOND SECONDO SEC	00CA 00CA 00CA 00CB 00CC 00CC 00DC 00D2 00D5 00D7 00DA 00DC	C1 DF E7 FE 28 FE CA FE CA FE CA FE CA FE	D5 57 F5 AD C4 33 E4 B9 CC	01 02 02	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060 1070 1080 1090 1100	* * GETCMD	PUSH RST POP AND IN RST RST CP JP CP JP CP JP CP JP CP JP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'u' Z,UPLT 'D' Z,DNRT 'd' Z,DNLT 'L' 'L' Z, TEPT
	00CA 00CA 00CA 00CB 00CC 00DC 00D2 00D5 00D7 00DA 00DC 00DF 00DF	C1 DF E7 FE 28 FE CA FE CA FE CA FE CA FE CA	D5 57 F5 AD C4 33 E4 B9 CC 3F	01 02 02 03	0950 0960 0970 0980 0990 1000 1010 1020 1020 1040 1050 1060 1070 1080 1090 1100	* * COMMA * GETCMD	PUSH RST POP AND IN RST RST CP JP CP JP CP JP CP JP CP JP CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'u' Z,UPLT 'D' Z,DNLT 'L' Z,LTRT 'L'
	00CA 00CA 00CA 00CB 00CC 00CC 00D2 00D5 00D7 00DA 00DC 00DF 00E1 00E4	C1 DF E7 FE 28 FE CA FE CA FE CA FE CA FE	D5 57 F5 AD C4 33 E4 B9 CC 3F EC	01 02 02 03	0950 0960 0970 0980 0990 1000 1010 1020 1020 1030 1040 1050 1060 1070 1080 1090 1100 1110 1120	* * GETCMD	PUSH RST POP AND IN RST RST CP JR CP JP CP JP CP JP CP JP CP JP CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNRT 'd' Z,DNLT 'L' Z,LTRT '1'
	00CA 00CA 00CA 00CB 00CC 00DC 00D2 00D5 00D7 00DA 00DC 00DF 00E1 00E4 00E6	C1 DF E7 FE CA FE CA FE CA FE CA FE CA	D5 57 F5 AD C4 33 E4 B9 CC 3F EC C5	01 02 02 03 03	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060 1070 1080 1090 1100 1110 1120	* * GETCMD	PUSH RST POP AND IN RST RST CP JR CP JP CP JP CP JP CP JP CP JP CP JP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNRT 'd' Z,DNLT 'L' Z,LTRT '1' Z,LTLT
	00CA 00CA 00CA 00CB 00CC 00DC 00D2 00D5 00D7 00DA 00DC 00DF 00DF 00E1 00E4 00E6 00E9	C1 DF E7 FE 28 FE CA FE CA FE CA FE CA FE CA FE CA FE	D5 57 F5 AD C4 33 E4 B9 CC 5 EC C5 D2	01 02 02 03 03	0950 0960 0970 0980 0990 1000 1020 1030 1040 1050 1060 1070 1080 1090 1100 1120 1120	* * GETCMD	PUSH RST POP AND IN RST RST CP JR CP JP CP JP CP JP CP JP CP JP CP CP CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPRT 'D' Z,UPRT 'd' Z,DNLT 'L' Z,LTRT '1' Z,LTLT 'R'
	00CA 00CA 00CA 00CB 00CC 00DC 00D2 00D5 00D7 00D7 00DA 00DC 00DF 00E1 00E4 00E9 00EB	C1 DF E7 FE 28 FE CA FE CA FE CA FE CA FE CA FE CA FE CA	D5 57 F5 AD C4 33 E4 B9 CC 57 EC C5 D2 4B	01 02 02 03 03 04	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060 1070 1080 1090 1100 1110 1120 1140 1150	* * GETCMD	PUSH RST POP AND IN RST RST CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNRT 'd' Z,LTRT '1' Z,LTRT '1' Z,LTRT '1' Z,RTRT
	00CA 00CA 00CA 00CB 00CC 00DC 00D2 00D5 00D7 00D4 00D7 00DF 00DF 00E1 00E4 00E6 00E9 00E5	C1 DF E7 FE 28 FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA	D5 57 F5 AD C4 33 E4 B9 CC 57 EC C5 D2 4B F2	01 02 02 03 03 04	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060 1070 1080 1090 1100 1120 1130 1140 1150	* * GETCMD	PUSH RST POP AND IN RST RST CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP CP CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNRT 'd' Z,DNLT 'L' Z,LTRT '1' Z,LTRT 'I' Z,LTRT 'r'
	00CA 00CA 00CA 00CA 00CC 00CC 00D2 00D5 00D7 00D5 00D7 00DA 00D6 00DF 00E1 00E4 00E6 00E9 00E8	C1 DF E7 FE 28 FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA	D5 57 F5 AD C4 33 E4 B9 CC 3F EC C5 D2 4B F2	01 02 02 03 03 04	0950 0960 0970 0980 0990 1000 1020 1030 1040 1050 1070 1080 1070 1080 1090 1110 1120 1130 1140 1150	* * GETCMD	PUSH RST POP AND IN RST RST CP JR CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP TP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNRT 'd' Z,DNLT 'L' Z,LTRT 'I' Z,LTLT 'R' Z,RTRT 'r' Z, TTT
	00CA 00CA 00CA 00CA 00CC 00CC 00DC 00DC	C1 DF E7 FE 28 FE CA CA FE CA CA CA FE CA CA CA CA CA CA CA CA CA CA CA CA CA	D5 57 F5 AD C4 33 E4 B9 CC 5 C5 D2 4B F2 D1	01 02 03 03 04 04	0950 0960 0970 0980 0990 1000 1020 1030 1040 1050 1040 1050 1060 1070 1080 1090 1100 1120 1120 1150 1160 1170	* * GETCMD	PUSH RST POP AND IN RST RST CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP	BC 20 BC NPUT AND RECOGNITION 30 40 40 10 2,UPRT 10 2,UPLT 10 10 10 10 10 10 10 10 10 10
	00CA 00CA 00CA 00CA 00CB 00CC 00DC 00D2 00D5 00D7 00DA 00DC 00DF 00DF 00DA 00DC 00DF 00DA 00DC 00DA 00DC 00DA 00DA	C1 DF E7 FE 28 FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE FE CA FE FE CA FE FE CA FE FE FE CA FE FE FE CA FE FE FE CA FE FE FE CA FE FE FE CA FE FE FE CA FE FE FE CA FE FE FE CA FE FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE CA FE FE FE CA FE FE FE CA FE FE FE CA FE FE FE FE FE FE FE FE FE FE FE FE FE	D5 57 F5 AD C4 33 E4 B9 CC 3F EC C5 D2 4B F2 D1 C6	01 02 03 03 04 04	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060 1070 1080 1100 1110 1120 1140 1150 1160 1170 1180	* * GETCMD	PUSH RST POP AND IN RST RST CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP CP CP CP CP CP CP CP CP CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNRT 'd' Z,DNRT 'L' Z,LTRT 'I' Z,LTRT 'I' Z,LTRT 'I' Z,RTRT 'r' Z,RTLT 'F'
	00CA 00CA 00CA 00CA 00CB 00CC 00DC 00DC 00D2 00D5 00D7 00DA 00DC 00DF 00DA 00DC 00DF 00DA 00DC 00DF 00DA 00DC 00DC 00DC 00DC 00DC 00DC 00DC	C1 DF E7 FE 28 FE CA FE CA FE CA FE CA FE CA FE CA FE CA	D5 57 F5 AD C4 33 E4 B9 CC 3F EC C5 D2 4B F2 D1 C6 57	01 02 03 03 04 04 05	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060 1070 1080 1090 1100 1120 1130 1140 1150 1160 1170 1180 1190	* * GETCMD	PUSH RST POP AND IN RST RST CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPRT 'D' Z,DNRT 'd' Z,DNLT 'L' Z,LTRT 'I' Z,LTRT 'I' Z,RTRT 'r' Z,RTLT 'F' Z,FRRT
	00CA 00CA 00CA 00CB 00CC 00DC 00D2 00D7 00D7 00D7 00D4 00E1 00E4 00E9 00E8 00E9 00E8 00E5 00F5	C1 DF E7 FE 28 FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE FE CA CA FE CA CA CA FE CA CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA FE CA	D5 57 F5 AD C4 33 E9 CC 57 EC D2 4B F2 D1 C6 57 E6	01 02 03 03 04 04 05	0950 0960 0970 0980 0990 1000 1020 1030 1040 1050 1070 1080 1070 1080 1090 1100 1120 1130 1140 1150 1160 1170 1180 1190 1200	* * GETCMD	PUSH RST POP AND IN RST CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP CP JP CP CP CP CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNRT 'd' Z,DNLT 'L' Z,LTRT 'I' Z,LTRT 'I' Z,RTRT 'r' Z,RTRT 'F' Z,FRRT 'f'
	00CA 00CA 00CA 00CA 00CE 00CC 00DC 00D2 00D5 00D7 00D7 00D7 00E1 00E4 00E6 00E9 00E9 00E9 00E9 00E9 00F3 00F3 00F8	C1 DF E7 FE 28 FE CA CA FE CA FE CA FE CA CA CA CA CA CA CA CA CA CA CA CA CA	D5 57 F5 AD C4 33 E9 CC 57 EC 50 2 4B F2 D1 C6 57 E6 DD	01 02 03 03 04 04 05 05	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060 1070 1100 1100 1100 1110 1120 1130 1140 1150 1160 1170 1180 1190 1200 1210	* * GETCMD	PUSH RST POP AND IN RST RST CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNRT 'd' Z,DNLT 'L' Z,LTRT 'I' Z,LTRT 'I' Z,RTRT 'F' Z,RTLT 'F' Z,FRLT
	00CA 00CA 00CA 00CA 00CB 00CC 00CC 00DC 00D2 00D2 00D7 00DA 00DC 00DA 00DC 00DF 00EB 00EB 00EB 00EB 00EB 00F5 00F3 00F5	C1 DF E7 FE 28 FE CA CA FE CA CA CA CA CA CA CA CA CA CA CA CA CA	D5 57 F5 AD C4 33 E4 B9 CC 3F C5 D2 4B F2 D1 C6 57 E6 D2 C2	01 02 03 03 04 04 05 05	0950 0960 0970 0980 0990 1000 1010 1020 1030 1040 1050 1060 1070 1080 1090 1100 1120 1130 1140 1150 1150 1170 1180 1190 1220	* * GETCMD	PUSH RST POP AND IN RST RST CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP CP CP CP CP CP CP CP CP CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNRT 'd' Z,DNRT 'I' Z,LTRT 'I' Z,LTRT 'I' Z,RTLT 'F' Z,FRRT 'f' Z,FRRT 'f' Z,FRRT 'B'
	00CA 00CA 00CA 00CA 00CB 00CC 00DC 00D2 00D5 00D7 00D7 00D7 00D4 00E4 00E9 00E9 00E8 00E9 00E8 00F3 00F3 00F3	C1 DF E7 FE 28 FE CA CA FE CA CA CA FE CA CA CA CA CA CA CA CA CA CA CA CA CA	D5 57 F5 AD C4 33 E4 B9 C5 F2 D2 4B F2 D1 C6 57 E6 D1 C2 C2 C2	01 02 03 03 04 04 05 05	0950 0960 0970 0980 0990 1000 1020 1030 1020 1030 1050 1070 1080 1070 1080 1090 1100 1120 1130 1140 1150 1150 1150 1170 1180 1190 1200 1220	* * GETCMD	PUSH RST POP AND IN RST CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP TP CP TP CP TP CP	BC 20 BC NPUT AND RECOGNITION 30 40 'U' Z,UPRT 'U' Z,UPLT 'D' Z,DNRT 'd' Z,DNLT 'L' Z,LTLT 'R' Z,RTRT 'F' Z,RTLT 'F' Z,FRLT 'B' Z,FRLT 'B' Z,FRLT 'B'
	00CA 00CA 00CA 00CB 00CC 00DC 00DC 00D2 00D7 00D7 00D7 00D7 00D4 00E9 00E9 00E9 00E9 00E9 00E9 00F5 00F5 00F8 00FA	C1 DF FE 28 FE CA CA FE CA CA CA FE CA CA CA CA CA CA CA CA CA CA CA CA CA	D5 57 F5 AD C4 33 E4 B9 CC 57 E5 D2 E5 D1 C6 57 E6 DD C2 63 C2 63 C2 C2 C2 C2 C2 C3 C4 C4 C5 C5 C5 C5 C5 C5 C5 C5 C5 C5 C5 C5 C5	01 02 03 03 04 04 05 05 05	0950 0960 0970 0980 0990 1000 1020 1030 1040 1050 1040 1050 1060 1070 1080 1090 1100 1120 1130 1140 1150 1160 1170 1180 1190 1220 1210	* * GETCMD	PUSH RST POP AND IN RST CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP JP CP	BC 20 BC NPUT AND RECOGNITION 30 40 40 10 2,UPRT 10 2,UPLT 10 10 10 10 10 10 10 10 10 10
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Listing 2 continued	Colored and the second second	
Listing 2 continued.	1000	
0107 FE CE	1260 C	P N
0109 CA 17 00	1270 J.	P Z,BEGIN
OTOC FE D8	1280 C	P X
010E CA 00 E0	1290 J	P Z, MONITR
OIII FE DO	1300 C	P 'P'
0113 CC 8A 08	1310 C.	ALL Z, PRINT
0116 18 AC	1320 J	R DISPLY
0118	1330 *	
0118	1340 * "UPDAT	E" KEEPS TRACK OF MOVES MADE
0118	1350 *	
0118 12	1360 UPDATE L	D (DE),A
0119 13	1370 II	NC DE
OILA 3E AO	1380 L	D A.240
011C 12	1390 Li	D (DE) A
011D 0D	1400 DI	EC C
OILE CO	1410 R	ET NZ
011F 11 7F 07	1420 1.	D DE MOVES
0122 OF 71	1430 11	
0124 FF	1440	CT 50
0125 18 90	1450	
0125 18 50	1450 5	R DISPLY
0127	1400 * 11 - 110	
0127	1470 - 0 = 0P	SURFACE, CLOCKWISE ROTATION
0127	1480 *	
0127 CF	1490 UPRT R	ST 10
0120 JA FZ 0/	1500 LI	D A, (UI)
0128 47	1510 LI	D B,A
012C 3A FE 07	1520 LI	D A, (U7)
012F 32 F2 07	1530 LI	D (U1),A
0132 3A 02 08	1540 LI	D A, (09)
0135 32 FE 07	1550 LI	D (U7),A
0138 3A F6 07	1560 LI	D A, (U3)
013B 32 02 08	1570 LI	D (U9),A
013E 78	1580 LI	D A,B
013F 32 F6 07	1590 LI	D (U3),A
0142 3A F4 07	1600 LI	D A, (U2)
0145 47	1610 LI	D B,A
0146 3A F8 07	1620 LI	D A, (U4)
0149 32 F4 07	1630 LI	D (U2),A
014C 3A 00 08	1640 LI	D A, (U8)
014F 32 F8 07	1650 LI	D (U4),A
0152 3A FC 07	1660 LI	D A. (U6)
0155 32 00 08	1670 LI	D (U8),A
0158 78	1680 LI	D A.B
0159 32 FC 07	1690 LI	
015C 3A 04 08	1700 LI	$D = A_{-}(L_{1})$
015F 47	1710 11	
0160 3A 0A 08	1720 L	D A, (F1)
0163 32 04 08	1730 LI	D (L1),A
0166 3A 10 08	1740 LI	D A, (R1)
0169 32 0A 08	1750 LI	D (F1),A
016C 3A 16 08	1760 LI	D A. (B1)
016F 32 10 08	1770 1	D (R1).A
0172 78	1780 LI	D A.B
0173 32 16 08	1790 1.1	D (B1),A
0176 34 06 08	1800 11	D A. (L2)
0179 47	1810	D B.A
0173 33 00 08	1820 11	D A. (F2)
0170 32 06 08	1830 11	D (1.2) A
0180 34 12 08	1840	D A. (B2)
0183 32 00 08	1850 11	D (F2) A
0186 33 18 08	1860	$D = A_{-}(B_{-}^{2})$
0189 32 12 09	1870	D (B2) A
0100 32 12 00	1880	
0100 78	1000	
0180 32 18 08	1090 L	
0190 3A 08 08	1900 L	D D D D
0193 4/	1030 L	D B,A
0194 3A OE 08	1920 L	D (F3)
0197 32 08 08	1930 L	D (L3),A
019A 3A 14 08	1940 L	D A, (R3)
019D 32 OE 08	1950 L	D (F3),A
OIAO 3A 1A 08	1960 L	D A, (B3)
01A3 32 14 08	1970 L	D (R3),A
01A6 78	1980 L	D A,B
01A7 32 1A 08	1990 L	D (B3),A
01AA C3 C4 00 '	2000 J	P DISPLY
OIAD	2010 *	Martin Martin Charles Starter
OIAD	2020 * u = UP	SURFACE, COUNTERCLOCKWISE
OIAD	2030 *	OBSOLER ADDOLARS WERETING
OLAD CF	2040 UPLT R	ST 10
01AE 3A F2 07	2050 L	D A, (U1)
01B1 47	2060 L	D B,A
01B2 3A F6 07	2070 L	D A, (U3)
01B5 32 F2 07	2080 L	D (U1),A
0188 38 02 08	2090 1.	D A (119) (More

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029F 47	3010	LD	B,A	
02A0 3A 4A 08	3020	LD	A, (B9)	
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02BE 3A 50 08	2100	LD	A, (D3)	
0201 32 40 08	3180	LD	(D1),A	
02C4 3A 5C 08	3130	LD	A, (D9)	
02C7 32 50 08	3200	LD	(D3),A	
02CA 3A 58 08	3210	LD	A, (D7)	
02CD 32 5C 08	3220	LD	(D9),A	
02D0 78	3230	LD	A,B	
02D1 32 58 08	3240	LD	(D7) .A	
02D4 3A 4E 08	3250	LD	A. (D2)	
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0209 37 56 08	3270	ID	A (D6)	
0200 34 50 08	3270	LD	A, (DO)	
02DB 32 4E 08	3280	LD	(D2),A	
02DE 3A 5A 08	3290	LD	A, (D8)	
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02E7 32 5A 08	3320	LD	(D8),A	
02EA 78	3330	LD	A,B	
02EB 32 52 08	3340	LD	(D4),A	
02EE 3A 34 08	3350	LD	A, (L7)	
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0364	34	36	08	3840		LD	A. (T.8)	
0367	32	10	08	3850		ID	(14) 7	No. of the second
0367	22	20	00	2000		TD		
US6A	SA	20	08	3000		LD	A, (LO)	
036D	32	36	08	3870		LD	(L8),A	
0370	20	20	00	2000		TD	ATEN A	in the second second second
0371	32	20	08	3890		LD	(LO),A	
0374	3A	F2	07	3900		LD	A, (U1)	
0377	47			3910		LD	B,A	0.000
0378	3A	4A	08	3920		LD	A, (B9)	Station Street State
037B	32	F2	07	3930		LD	(U1),A	Commence and the star
037E	3A	4C	08	3940		LD	A. (D1)	Scrimentel versons
0381	32	40	08	3950		LD	(B9) A	
0201	27	07	00	3960		TD	(D)//A	
0384	JA	UA	00	3900			A, (F1)	3A 10 08 00 04800
0387	32	40	08	3970		LD	(DI),A	ale a contraction of the
038A	78			3980		LD	A,B	36 40 04 1820
038B	32	OA	08	3990		LD	(F1),A	0288
038E	3A	F8	07	4000		LD	A, (U4)	0088 80.38 07
0391	47			4010		LD	B,A	ARAL HO HA PAR
0392	34	32	08	4020		LD	A. (B6)	A Second Se
0395	32	FR	07	4030		LD	(114) A	President State Ball
0300	27	50	08	4040		ID	A (D4)	
0398	SA	22	00	4040		LD	(DG)	
039B	32	32	08	4050		LD	(B6),A	
039E	3A	22	08	4060		LD	A, (F4)	and subsection
03A1	32	52	08	4070		LD	(D4),A	
03A4	78			4080		LD	A,B	ALL
03A5	32	22	08	4090		LD	(F4),A	
03A8	3A	FE	07	4100		LD	A. (U7)	
03AB	47			4110		LD	BA	
0370	27	77	00	4120		TD	7 (02)	
USAC	AC	IA	08	4120		TD	A, (B3)	
U3AF	32	FE	07	4130		LD	(U/),A	11 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1
03B2	3A	58	08	4140		LD	A, (D7)	0861 4980
03B5	32	1A	08	4150		LD	(B3),A	32 20 38 4990
03B8	3A	3A	08	4160		LD	A, (F7)	
03BB	32	58	08	4170		LD	(D7),A	
03BE	78			4180		LD	A.B	
			and the second second second					
103BF	32	30	08	4190		T.D	(F7) A	
03BF	32	3A	08	4190		LD	(F7),A	
03BF 03C2	32 C3	3A C4	08 00	4190 4200	There	LD JP	(F7),A DISPLY	110021
03BF 03C2 03C5	32 C3	3A C4	08 00	4190 4200 4210	*	LD JP	(F7),A •DISPLY	COUNTEDCI OOVUI CE
03BF 03C2 03C5 03C5	32 C3	3A C4	08 00	4190 4200 4210 4220	* * 1 =	LD JP LEFT	(F7),A •DISPLY SURFACE,	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5	32 C3	3A C4	08 00	4190 4200 4210 4220 4230	* * 1 = *	LD JP LEFT	(F7),A •DISPLY SURFACE,	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5	32 C3 CF	3A C4	08	4190 4200 4210 4220 4230 4240	* * 1 = * LTLT	LD JP LEFT RST	(F7),A DISPLY SURFACE, 10	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6	32 C3 CF 3A	3A C4 04	08 00 08	4190 4200 4210 4220 4230 4240 4250	* * 1 = * LTLT	LD JP LEFT RST LD	(F7),A •DISPLY SURFACE, 10 A,(L1)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C6	32 C3 CF 3A 47	3A C4 04	08 00 08	4190 4200 4210 4220 4230 4240 4250 4260	* * 1 = * LTLT	LD JP LEFT RST LD LD	(F7),A •DISPLY SURFACE, 10 A,(L1) B,A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03CA	32 C3 CF 3A 47 3A	3A C4 04 08	08 00 08 08	4190 4200 4210 4220 4230 4240 4250 4260 4270	* * 1 = * LTLT	LD JP LEFT RST LD LD LD	(F7),A •DISPLY SURFACE, 10 A,(L1) B,A A,(L3)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03CA 03CD	32 C3 CF 3A 47 3A 32	3A C4 04 08 04	08 00 08 08 08	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280	* * 1 = * LTLT	LD JP LEFT RST LD LD LD LD	(F7),A DISPLY SURFACE, 10 A,(L1) B,A A,(L3) (L1),A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03CA 03CD 03D0	32 C3 CF 3A 47 3A 32 3A	3A C4 04 08 04 38	08 00 08 08 08 08 08 08	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4290	* * 1 = * LTLT	LD JP LEFT RST LD LD LD LD LD	(F7),A -DISPLY SURFACE, 10 A,(L1) B,A A,(L3) (L1),A A,(L9)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03CA 03CD 03D0 03D3	32 C3 CF 3A 47 3A 32 3A 32	3A C4 04 08 04 38 08	08 00 08 08 08 08 08 08 08	4190 4200 4210 4220 4230 4240 4250 4260 4260 4270 4280 4290 4300	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A,(L1) B,A A,(L3) (L1),A A,(L9) (L3),A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03CA 03CD 03D0 03D3	32 C3 CF 3A 47 3A 32 3A 32 3A	3A C4 04 08 04 38 08 34	08 00 08 08 08 08 08 08 08 08	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4290 4310	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A (L7)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03CA 03CD 03D0 03D0 03D3 03D6	32 C3 CF 3A 47 3A 32 3A 32 3A	3A C4 04 08 04 38 08 34 39	08 00 08 08 08 08 08 08 08 08 08 08	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4290 4300 4310	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD	(F7), A DISPLY SURFACE, 10 A,(L1) B,A A,(L3) (L1),A A,(L9) (L3),A A,(L7) (L2),2	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03CA 03CD 03D0 03D3 03D6 03D9	32 C3 CF 3A 47 3A 32 3A 32 3A 32 3A	3A C4 04 08 04 38 08 34 38	08 00 08 08 08 08 08 08 08 08 08 08 08	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4290 4300 4320	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A,(L1) B,A A,(L3) (L1),A A,(L9) (L3),A A,(L7) (L9),A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03CA 03CD 03D0 03D3 03D6 03D9 03DC	32 C3 CF 3A 47 3A 32 3A 32 3A 32 78	3A C4 04 08 04 38 08 34 38	08 00 08 08 08 08 08 08 08 08	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4290 4300 4310 4320 4320	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A,(L1) B,A A,(L3) (L1),A A,(L9) (L3),A A,(L7) (L9),A A,B (COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03CA 03CD 03D0 03D3 03D6 03D9 03DC	32 C3 CF 3A 47 3A 32 3A 32 3A 32 78 32	3A C4 04 08 04 38 08 34 38 34 34	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4260 4260 4270 4280 4290 4300 4310 4320 4330 4340	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A,(L1) B,A A,(L3) (L1),A A,(L9) (L3),A A,(L7) (L9),A A,B (L7),A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03CA 03CD 03D0 03D3 03D6 03D9 03DC 03DD 03DC	32 C3 CF 3A 47 3A 32 3A 32 3A 32 3A 32 3A 32 3A	3A C4 04 08 04 38 08 34 38 34 38 34 06	08 00 08 08 08 08 08 08 08 08 08 08 08	4190 4200 4210 4230 4240 4250 4260 4270 4280 4290 4300 4310 4320 4330 4330 4330	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A,(L1) B,A A,(L3) (L1),A A,(L9) (L3),A A,(L7) (L9),A A,B (L7),A A,(L2)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03CA 03D0 03D3 03D6 03D9 03DC 03D0 03D2 03D0 03D2 03D2 03D2 03D2	32 C3 CF 3A 47 3A 32 3A 32 3A 32 3A 32 3A 47	3A C4 04 08 04 38 08 34 38 34 38 34 06	08 00 08 08 08 08 08 08 08 08 08 08 08	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4290 4280 4290 4300 4310 4320 4330 4340 4350 4360	* * 1 = * LTLT	LD JP LEFT RST LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L7) (L9),A A,B (L7),A A, (L2) B,A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03CA 03D0 03D3 03D6 03D9 03DC 03D0 03D2 03D2 03D2 03D2 03D2 03D2 03D2	32 C3 CF 3A 47 3A 32 3A 32 3A 32 3A 32 3A 47 3A	3A C4 04 08 04 38 08 34 38 34 06 20	08 00 08 08 08 08 08 08 08 08 08 08	4190 4200 4220 4230 4240 4250 4260 4270 4280 4290 4300 4310 4320 4330 4330 4340 4350 4360 4370	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L7) (L9),A A,B (L7),A B,A A, (L2) B,A A, (L6)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03CA 03CD 03D0 03D0 03D0 03D0 03D0 03D0 03E0 03E	32 C3 CF 3A 47 3A 32 3A 32 3A 32 3A 32 3A 47 3A 32 3A 47 3A	3A C4 04 08 04 38 08 34 38 34 06 20 06	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4290 4300 4310 4310 4310 4330 4340 4350 4360 4370 4380	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A DISPLY SURFACE, 10 A,(L1) B,A A,(L3) (L1),A A,(L3) (L1),A A,(L3) (L3),A A,(L3) (L3),A A,(L1) (L9),A A,(L2) B,A A,(L6) (L2),A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03CA 03CD 03D0 03D0 03D0 03D0 03D0 03D0 03D2 03D2	32 C3 CF 3A 47 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 04 08 04 38 08 34 38 34 06 20 06 36	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4300 4310 4330 4340 4330 4340 4350 4360 4370 4390	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1), A A, (L9) (L3), A A, (L7) (L9), A A, B (L7), A A, (L2) B,A A, (L6) (L2), A A, (L8)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D2 03D0 03D2 03D0 03C4 03D9 03E4 03E7 03E4	32 C3 CF 3A 47 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 04 08 04 38 08 34 38 34 06 20 06 36 20	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4280 4300 4310 4320 4330 4340 4350 4360 4370 4380 4360	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L7) (L9),A A, (L7) (L9),A A, (L2) B,A A, (L6) (L2),A A, (L8) (L2),A A, (L8)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03CA 03D0 03D0 03D0 03D0 03D0 03D0 03D0 03E3 03E4 03E4 03E7 03EA	32 C3 CF 3A 47 3A 32 3A 32 3A 32 3A 47 3A 32 3 3A 32 32 3A 32 32 3 3A 32 32 3 3 32 32 3 32 32 32 32 32 32 32	3A C4 04 08 04 38 08 34 38 34 06 20 06 36 20 06	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4220 4220 4230 4240 4250 4260 4270 4280 4300 4310 4320 4330 4330 4340 4350 4360 4370 4380 4390	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L7) (L9),A A,B (L7),A B,A A, (L2) B,A A, (L6) (L2),A A, (L8) (L6),A A, (L6)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03CA 03D0 03D0 03D0 03D0 03D0 03D0 03D2 03D2	32 C3 CF 3A 47 3A 32 3A 32 3A 32 3A 47 3A 32 3A 32 3A 32 3A 32 3A 32 3A	3A C4 04 08 04 38 08 34 38 34 06 20 06 36 20 1C 26	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4270 4280 4270 4280 4290 4300 4310 4330 4340 4350 4360 4370 4380 4390 4400 4400	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L7) (L9),A A, (L7) (L9),A A, (L2) B,A A, (L6) (L2),A A, (L8) (L6),A A, (L4) (L9),A A, (L4)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CF 3A 47 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 04 08 04 38 08 34 38 34 06 20 06 36 20 1C 36	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4300 4310 4320 4330 4340 4350 4340 4350 4360 4370 4380 4340 4320 4340 4320 4340 4320 4320 432	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1), A A, (L9) (L3), A A, (L9) (L3), A A, (L7) (L9), A A, (L2) B,A A, (L6) (L2), A A, (L8) (L6), A A, (L4) (L8), A A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CF 3A 47 3A 32 3 32 3 32 32 3 32 32 32 32 32 32 32	3A C4 04 08 04 38 08 34 38 34 06 20 06 36 20 1C 36	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4300 4310 4320 4330 4340 4350 4360 4350 4360 4370 4380 4390 4410 4420	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L7) (L9),A A, (L7) (L9),A A, (L7) (L2),A A, (L6) (L2),A A, (L8) (L6),A A, (L4) (L8),A A,B (L4),A A,B (L4),A A,B (L4),A A,B (L4),A A,B (L4),A A,B (L4),A A,B (L4),A A,B (L4),A (COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03CA 03D0 03D3 03D6 03D9 03DC 03D0 03E3 03E4 03E7 03EA 03F7 03F7	32 C3 CF 3A 47 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 04 08 04 38 04 38 34 38 34 06 20 06 36 20 1C 36	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4270 4280 4270 4280 4300 4320 4330 4340 4350 4330 4340 4350 4370 4380 4390 4400 4420 4420	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L7) (L9),A A, (L7) B,A A, (L2) B,A A, (L6) (L2),A A, (L8) (L6),A A, (L4),A (L4),A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03CA 03D0 03D0 03D0 03D0 03D0 03D0 03D0 03E0 03E	32 C3 CF 3A 32 3A 32 3A 32 78 32 3A 32 3A 32 3A 32 3A 32 3A 32 3A 32 3A	3A C4 04 08 04 38 08 34 38 34 38 34 06 20 06 36 20 06 36 20 1c F2	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4300 4310 4320 4330 4340 4350 4340 4350 4360 4390 4390 4400 4410 4420 4440 4450	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L7) (L9),A A, (L7) (L9),A A, (L2) B,A A, (L2) B,A A, (L6) (L2),A A, (L6) (L6),A A, (L4) (L8),A A, B (L4),A A, (U1)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CF 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 04 08 04 38 08 34 38 34 06 20 06 36 20 06 36 20 01 236 10 F2	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4300 4310 4320 4330 4340 4350 4340 4350 4360 4370 4380 4340 4440 4420 4440 4450 4460	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L9) (L3),A A, (L2) B,A A, (L6) (L2),A A, (L8) (L6),A A, (L8) (L6),A A, (L4) (L8),A A, (U1) B,A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CF 3A 47 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 04 08 04 38 08 34 38 34 06 20 06 36 20 1C 36 1C F2 0A	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4220 4230 4240 4250 4260 4260 4280 4300 4310 4320 4330 4340 4350 4340 4350 4360 4370 4380 4390 4440 4420 4440 4440 4440 4440	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L7) (L9),A A, (L7) (L9),A A, (L2) B,A A, (L2) B,A A, (L6) (L2),A A, (L6),A A, (L4),A A,B (L4),A A, (U1) B,A A, (U1) B,A A, (U1)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C6 03C9 03CA 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03E0 03E	32 C3 CF 3A 47 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 04 08 04 38 08 34 38 34 06 20 06 36 20 1C 36 1C F2 0A F2	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4270 4280 4270 4280 4300 4320 4330 4340 4350 4330 4340 4350 4370 4380 4370 4380 4390 4400 4440 4440 4440 4440 4480	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L3) (L3),A A, (L9) (L3),A A, (L9) (L3),A A, (L7) (L9),A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) A, (L2) B,A A, (L4) (L2),A A, (L4) (L2),A A, (L4) (L2),A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L4) (L3),A A, (L4) (L3),A A, (L4) (L2),A A, (L4) (L3),A A, (L4) (L3),A A, (L2) B,A A, (L4) (L3),A A, (L4) (L3),A A, (L4) (L3),A A, (L4) (L3),A A, (L4) (L3),A A, (L4) (L3),A A, (L4) (L3),A A, (L4) B,A A, (L1) B,A A, (L1) B,A A, (L2) B,A A, (L2) B,A A, (L4) (L3),A A, (L1) B,A A, (L1) B,A B,A B,A B,A B,A B,A B,A B,A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03CA 03D0 03D0 03D0 03D0 03D0 03D0 03D0 03D	32 C3 CF 3A 47 3A 32 3 3A 32 3 3 3 3	3A C4 08 04 38 08 34 38 34 06 36 20 06 36 20 06 36 20 01 136 1C F2 0A F2 4C	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4300 4310 4320 4330 4340 4350 4340 4350 4360 4390 4390 4440 4450 4440 4440 4440 4440	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L9) (L3),A A, (L7) (L9),A A, (L2) B,A A, (L6) (L2),A A, (L6) (L6),A A, (L8) (L6),A A, (L4) (L6),A A, (L4) (L6),A A, (L4) (L6),A A, (L4) (L6),A A, (L4) (L6),A A, (L4) (L6),A A, (L7) (L1),A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L1) B,A A, (L2) B,A A, (L1) B,A A, (D1) B,A A, (D1)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CF 3A 47 3A 32 3 3 3 3	3A C4 08 04 38 34 38 34 06 20 06 36 20 1C 36 20 1C 52 0A F2 0A F2 0A	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4300 4310 4320 4330 4340 4330 4340 4350 4360 4370 4380 4340 4440 4420 4440 4440 4450 4440 4450 445	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L9) (L3),A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L6) (L2),A A, (L8) (L6),A A, (L8) (L6),A A, (L4) (L8),A A, (L4) (L8),A A, (L4) (L1),A A, (L1) B,A A, (L2) B,A A, (L1) B,A A, (D1) (F1), A A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CF 3A 47 3A 32 3 3A 32 3 3 32 3 3 32 3 3 32 3 3 32 3 3 3 3	3A C4 08 04 38 34 38 34 06 20 06 36 20 1C 36 20 1C 20 6 20 1C 20 6 20 1C 20 6 20 1C 20 6 20 20 20 6 20 20 20 20 20 20 20 20 20 20 20 20 20	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4280 4300 4310 4320 4330 4320 4330 4340 4350 4360 4350 4360 4370 4380 4390 4420 4420 4420 4420 4420 4420 4420 44	* * 1 = * * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L3) (L3),A A, (L9) (L3),A A, (L9) (L3),A A, (L7) (L9),A A, (L7) (L2),A A, (L2) B,A A, (L6) (L2),A A, (L6) (L2),A A, (L6) (L2),A A, (L4) (L4),A A, (U1) B,A A, (U1) B,A A, (U1) A, (U1),A A, (D1) (F1),A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03CA 03D0 03D0 03D0 03D0 03D0 03D0 03D0 03D	32 C3 CF 3A 47 3A 32 3 3A 32 3 3A 32 3A 32 3A 32 3A 32 3A 32 3A 32 3A 32 3A 32 3A 32 3A 32 3A 32 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 08 08 38 38 34 38 34 06 36 20 06 36 20 06 36 20 01 23 6 1C F2 4C 0A 4A A	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4270 4280 4270 4300 4320 4330 4330 4340 4350 4330 4340 4350 4340 4350 4340 4440 44	* * 1 = * LTLT	LD JP LEFT RST LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L7) (L9),A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L6) (L2),A A, (L8) (L6),A A, (L4) (L6),A A, (L4) (L6),A A, (L4) (L6),A A, (L4) (L1),A A, (D1) (F1),A A, (B9)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CF 3A 47 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 08 08 38 34 38 34 06 20 06 36 20 10 52 6 20 11 52 0A F2 4C 0A 4A 4C	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4300 4310 4320 4330 4340 4330 4340 4350 4360 4370 4380 4340 4430 4440 4440 4440 4440 444	* * 1 = * LTLT	LD JP LEFT RST LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1), A A, (L9) (L3), A A, (L9) (L3), A A, (L7) (L9), A A, (L2) B,A A, (L2) B,A A, (L6) (L2), A A, (L6) (L2), A A, (L8) (L6), A A, (L8) (L6), A A, (L4) (L8), A A, (L1) B,A A, (L2) B,A A, (L2), A A, (L2) B,A A, (L2), A A, (L3), A A, (L2), A A, (D1), (F1), A A, (B9) (D1), A A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CF 3A 47 32 3A 32 3 3A 32 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 08 04 38 08 34 38 34 06 20 06 36 36 20 1C 36 1C F2 4C 0A F2 4C 0A	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4300 4310 4320 4330 4340 4330 4340 4350 4340 4350 4340 4430 4440 444	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L9) (L3),A A, (L7) (L9),A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L6) (L2),A A, (L4) (L6),A A, (L4) (L6),A A, (L4) (L4),A A, (L4) (L4),A A, (L1) B,A A, (L2) B,A A, (L4) (L1),A A, (L2) B,A A, (L4) (L2),A A, (L4) (L1),A A, (L2) B,A A, (L4) (L1),A A, (L1) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L4) (L1),A A, (D1) (F1),A A, (B9) (D1),A A, (B)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CF 3A 47 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 04 08 04 38 08 34 38 34 38 34 06 20 06 36 20 1C 36 20 1C 52 4C 0A 4C 4C 4A	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4270 4280 4290 4300 4320 4330 4320 4330 4340 4350 4330 4340 4350 4370 4380 4370 4380 4390 4400 4430 4440 4440 4440 4440 4450 445	* * 1 = * LTLT	LD JP LEFT RST LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L3) (L3),A A, (L9) (L3),A A, (L9) (L3),A A, (L7) (L9),A A, (L2) B,A A, (L6) (L2),A A, (L6) (L2),A A, (L6) (L2),A A, (L6) (L2),A A, (L4) (L4),A A, (L4) (L4),A A, (L4) (L4),A A, (L4) (L4),A A, (L1),A A, (D1) (F1),A A, (B9) (D1),A A,B (B9),A	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CF 3A 47 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 08 04 38 08 34 38 34 06 20 06 36 20 1C 36 20 1C 52 1C F2 0A 4C 4C 4A F8	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4300 4310 4320 4330 4340 4350 4340 4350 4360 4370 4380 4390 4400 4410 4420 4420 4450 4450 4510 4550	* * 1 = * LTLT	LD JP LEFT RST LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A DISPLY SURFACE, 10 A, (L1) E,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L9) (L3),A A, (L2) E,A A, (L2) E,A A, (L6) (L2),A A, (L6) (L6),A A, (L4) (L6),A A, (L4) (L6),A A, (L4) (L6),A A, (L4) (L6),A A, (L4) (L6),A A, (L4) (L1),A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2),A A, (L2) E,A A, (L2) E,A A, (L2),A A, (L2) E,A A, (L2) E,A A, (L6) (L1),A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2),A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L6) (L1),A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L6) (L1),A A, (L2) E,A A, (L6) (L1),A A, (L2) E,A A, (L2) E,A A, (L6) (L1),A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L3) (L1),A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L2) E,A A, (L1) E,A A, (L1) E,A A, (D1) (F1),A A, (D1) (F1),A A, (U4) (B9),A A, (U4) (B9),A A, (U4) (B9),A A, (U4) (B9),A A, (U4) (B9),A A, (U4)	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CF 3A 47 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 08 04 38 08 34 38 34 06 20 06 62 00 1C 36 20 1C 52 0A F2 4C 4A 4A F8	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4300 4310 4320 4310 4320 4330 4340 4330 4340 4350 4340 4350 4380 4340 4420 4420 4420 4420 4420 4420 442	* * 1 = * LTLT	LD JP LEFT RST LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L9) (L3),A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L6) (L2),A A, (L2) B,A A, (L6) (L2),A A, (L8) (L6),A A, (L8) (L6),A A, (L4) (L4),A A, (U1) B,A A, (U1) B,A A, (U1) B,A A, (L9) (L1),A A, (L2) B,A A, (U1) B,A A, (D1) (F1),A A, (B9) (D1),A A, (U4) B,A A, (U	COUNTERCLOCKWISE
03BF 03C2 03C5 03C5 03C5 03C5 03C6 03C9 03C0 03D0 03D0 03D0 03D0 03D0 03D0 03D0	32 C3 CFF 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3A 32 3 3 3 3	3A C4 04 08 04 38 08 34 38 06 20 06 36 20 1C 52 4C 0A 4A F8 22	08 00 08 08 08 08 08 08 08 08 08 08 08 0	4190 4200 4220 4220 4220 4250 4260 4270 4280 4300 4310 4320 4330 4340 4350 4340 4350 4340 4350 4340 4430 4440 444	* * 1 = * LTLT	LD JP LEFT LD LD LD LD LD LD LD LD LD LD LD LD LD	(F7), A -DISPLY SURFACE, 10 A, (L1) B,A A, (L3) (L1),A A, (L9) (L3),A A, (L9) (L3),A A, (L7) (L9),A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L4) (L4),A A, (L4) (L4),A A, (L4) (L4),A A, (L4) (L4),A A, (L4) (L4),A A, (L4) (L4),A A, (L1) B,A A, (L1) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L4) (L1),A A, (B) (U1),A A, (D1) (F1),A A, (D1) (F1),A A, (D3) (D1),A A, (U4) B,A A, (U4) (C1),A A, (C1) B,A A, (C1) B,A A, (C1) B,A A, (C2) B,A A, (L2) B,A A, (L2) B,A A, (L2) B,A A, (L3) (L1),A A, (L2) B,A A, (L2) B,A A, (L4) (L1),A A, (D1) B,A A, (D1) (D1),A A, (D1) B,A A, (U4) (C1),A A, (D1) B,A A, (D1) (C1),A A, (D1) B,A A, (D1) (C1),A A, (D1) B,A A, (D1) (C1),A A, (D2) (C1),A A, (D1) B,A A, (C1) (C1),A A, (D1) B,A A, (C1) (C1),A A, (D1) (C1),A A, (D1) B,A A, (C1) B,A A, (COUNTERCLOCKWISE
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(from page 35)

caution: most patterns are not simple, and trying can be addictive!

Future Prospects

While it is beyond the scope of the programs offered here, far greater capability for Rubik's Cube simulation can be achieved. For example, a simple utility might be devised to preset a desired pattern on each face; this would be useful in discovering routines to move from one arrangement to another, or in unscrambling a scrambled Cube. Naturally, care would have to be exercised to ensure that "fixed adjacencies" (the invariable relationships at edges and corners) are not violated in such a preset capability.

Readers with more sophisticated graphics capability may wish to pursue some of the obvious extensions suggested by the basic concepts. The possibilities promised by full color and/or 3-D graphics are truly exciting.

Conclusion

While this application certainly falls into the games category, these are not game programs in the usual

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0438	32	34	08	4700		LD	(F7) A		
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0450	3A	40	08	4820		LD	A. (R7)		
0453	32	10	08	4830		LD	(R1).A		
0456	3A	44	08	4840		LD	A. (R9)		
0459	32	40	08	4850		LD	(R7),A		
045C	3A	14	08	4860		LD	A, (R3)		
045F	32	44	08	4870		LD	(R9),A		
0462	78			4880		LD	A,B		
0463	32	14	08	4890		LD	(R3),A		
0466	3A	12	08	4900		LD	A, (R2)		
0469	47			4910		LD	B,A		
046A	3A	28	08	4920		LD	A, (R4)		
046D	32	12	08	4930		LD	(R2),A		
0470	3A	42	08	4940		LD	A, (R8)		
0473	32	28	08	4950		LD	(R4),A		
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sense. More properly, they are problem-solving tools, representative of ways computers are used in scientific and engineering applications in industry and research. As with most computer applications, potential extensions to these programs range from the obvious and simple to the subtle and sophisticated.

In the Scientific American article, Hofstadter loosely associates Rubik's Cube with the once-popular and much older two-dimensional Fifteen Puzzle. An article and TRS-80 BASIC program for that puzzle, written by William L. Colsher, appeared in the February 1981 issue of Microcomputing. As awesome as the number of Fifteen Puzzle solutions may appear, Rubik's Cube makes the Fifteen Puzzle seem trivial by contrast: the cube has more than four million times as many solutions!

Even with the best of computer technology, it is improbable that every cube solution will ever be achieved. One hundred million computerized cubists, each producing solutions at the rate of one per second, would require more than 13,000 years to complete the task.

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04F6 3A	42	08	5490		LD	A, (R8)	
04F9 32	2C	08	5500		LD	(R6),A	
04FC 3A	28	08	5510		LD	A, (R4)	
04FF 32	42	08	5520		LD	(R8) . A	
0411 52	42	00	5520		TD	A D	
0502 78	100	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	5530			A,B	
0503 32	28	08	5540		LD	(R4),A	
0506 3A	F6	07	5550		LD	A, (U3)	
0509 47			5560		LD	B.A	
0507 37	16	08	5570		LD	A (B7)	
USUA SA	40	00	5570		LD	A, (B/)	
050D 32	F6	07	5580		LD	(U3),A	
0510 3A	50	08	5590		LD	A, (D3)	
0513 32	46	08	5600		LD	(B7),A	
0516 34	OF	08	5610		T.D	A. (F3)	
0510 32	FO	08	5620		ID	(D2) 7	
0519 32	50	08	5620		LD	(D3),A	
051C 78			5630		LD	A,B	
051D 32	OE	08	5640		LD	(F3),A	
0520 3A	FC	07	5650		LD	A. (U6)	
0522 47			5660		ID	BA	
0523 47	~		5000		LD	DIA	
0524 3A	2E	08	5670		LD	A, (B4)	
0527 32	FC	07	5680		LD	(U6),A	
052A 3A	56	08	5690		LD	A. (D6)	
0520 32	25	08	5700		LD	(B4) A	
0520 32	26	00	5710		ID	(D4) (RC)	
0530 3A	26	08	5710		LD	A, (F6)	
0533 32	56	08	5720		LD	(D6),A	
0536 78			5730		LD	A,B	
0537 32	26	08	5740		LD	(F6),A	
0530 30	02	08	5750		LD	A (119)	
OF 2D 47	02	00	5760		ID	R, (05)	
053D 47			5760		LD	D,A	
053E 3A	10	08	5770		LD	A, (B1)	
0541 32	02	08	5780		LD	(U9),A	
0544 3A	5C	08	5790		LD	A, (D9)	
0547 32	16	08	5800		LD	(B1),A	
0540 30	35	08	5810		TD	A (FQ)	
OJAA JA	26	00	5010		TD	A, (1)	
054D 32	5C	08	5820		LD	(D9),A	
0550 78			5830		LD	A,B	
0551 32	3E	08	5840		LD	(F9),A	
0554 C3	C4	00	5850		JP	DISPLY	
0557			5960	*			
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0557			5870	* F. =	FRONT	SURFACE,	CLOCKWISE
0557			5880	*			
0557 CF							
			5890	FRRT	RST	10	
0558 3A	OA	08	5890 5900	FRRT	RST LD	10 A.(F1)	
0558 3A	OA	08	5890 5900	FRRT	RST LD	10 A,(F1) B A	
0558 3A 055B 47	OA	08	5890 5900 5910	FRRT	RST LD LD	10 A, (F1) B,A	
0558 3A 055B 47 055C 3A	0A 3A	08 08	5890 5900 5910 5920	FRRT	RST LD LD LD	10 A,(F1) B,A A,(F7)	
0558 3A 055B 47 055C 3A 055F 32	OA 3A OA	08 08 08	5890 5900 5910 5920 5930	FRRT	RST LD LD LD LD	10 A,(F1) B,A A,(F7) (F1),A	
0558 3A 055B 47 055C 3A 055F 32 0562 3A	OA 3A OA 3E	08 08 08 08	5890 5900 5910 5920 5930 5940	FRRT	RST LD LD LD LD LD	10 A,(F1) B,A A,(F7) (F1),A A,(F9)	
0558 3A 055B 47 055C 3A 055F 32 0562 3A 0565 32	OA 3A OA 3E 3A	08 08 08 08 08	5890 5900 5910 5920 5930 5940 5950	FRRT	RST LD LD LD LD LD LD	10 A, (F1) B,A A, (F7) (F1),A A, (F9) (F7),A	
0558 3A 055B 47 055C 3A 055F 32 0562 3A 0565 32 0568 32	OA 3A OA 3E 3A OF	08 08 08 08 08 08 08	5890 5900 5910 5920 5930 5940 5950 5960	FRRT	RST LD LD LD LD LD LD LD	10 A, (F1) B,A A, (F7) (F1),A A, (F9) (F7),A A, (F3)	
0558 3A 0555 47 055C 3A 055F 32 0562 3A 0565 32 0568 3A	OA 3A OA 3E 3A OE	08 08 08 08 08 08 08 08	5890 5900 5910 5920 5930 5940 5950 5960	FRRT	RST LD LD LD LD LD LD LD LD	10 A, (F1) B,A A, (F7) (F1),A A, (F9) (F7),A A, (F3)	
0558 3A 055B 47 055C 3A 055F 32 0562 3A 0565 32 0568 3A 056B 32	OA 3A OA 3E 3A OE 3E	08 08 08 08 08 08 08 08 08	5890 5900 5910 5920 5930 5940 5950 5960 5960	FRRT	RST LD LD LD LD LD LD LD LD	10 A, (F1) B,A A, (F7) (F1),A A, (F9) (F7),A A, (F3) (F9),A	
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0558 3A 055B 47 055C 3A 055F 32 0562 3A 0565 32 0568 32 0568 32 0566 78 056F 32	OA 3A OA 3E 3A OE 3E OE	08 08 08 08 08 08 08 08 08	5890 5910 5910 5920 5930 5940 5950 5960 5970 5980 5990	FRRT	RST LD LD LD LD LD LD LD LD LD LD	10 A, (F1) B,A A, (F7) (F1),A A, (F9) (F7),A A, (F3) (F9),A A,B (F3),A	
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Listing 2 c	ontinu	ed.			6000			- 17.63		
	05AD	3A	20	08	6230		LD	(U8) A		
	05B0	3A	4E	08	6240		LD	A. (D2)		
	05B3	32	20	08	6250		LD	(L6),A		
	05B6	3A	28	08	6260		LD	A, (R4)		
	05B9	32	4E	08	6270		LD	(D2),A		
	05BC	78			6280		LD	A,B		
	05BD	32	28	80	6290		LD	(R4),A		
	0500	3A	02	08	6310		LD	A, (U9)		
	0503	34	08	08	6320		LD	B,A A, (1.3)		
	0507	32	02	08	6330		LD	(U9),A		
	05CA	3A	4C	08	6340		LD	A, (D1)		
	05CD	32	08	08	6350		LD	(L3),A		
	05D0	3A	40	08	6360		LD	A, (R7)		
	05D3	32	4C	08	6370		LD	(D1),A		
	05D6	78			6380		LD	A,B		
	05D7	32	40	08	6390		LD	(R7),A		
	05DA	C3	C4	00	6400		JP	DISPLY		
	0500				6420	* f =	FRONT	SURFACE	COUNTERCLOCKWISE	
	0500				6430	*	FROM	SURFACE	, COUNTERCLOCKWISE	
	05DD	CF			6440	FRLT	RST	10		
	05DE	3A	OA	08	6450		LD	A, (F1)		
	05E1	47			6460		LD	B,A		
	05E2	3A	0E	08	6470		LD	A, (F3)		
	05E5	32	OA	08	6480		LD	(F1),A		
	05E8	3A	3E	08	6490		LD	A, (F9)		
	05EB	32	OE	08	6500		LD	(F3),A		
	OSEL OSEL	3A	3A	08	6520		LD	A, (F/)		
	05F4	78	JE	00	6530		LD	A.B		
	05F5	32	3A	08	6540		LD	(F7),A		
	05F8	3A	OC	08	6550		LD	A, (F2)		
	05FB	47			6560		LD	B,A		
	05FC	3A	26	08	6570		LD	A, (F6)		
	05FF	32	20	08	6580		LD	(F2),A		
	0602	32	26	08	6600		LD	(F6) A		
	0608	34	22	08	6610		LD	(F4)		
	060B	32	3C	08	6620		LD	(F8),A		
	060E	78			6630		LD	A,B		
	060F	32	22	08	6640		LD	(F4),A		
	0612	3A	FE	07	6650		LD	A, (U7)		
	0615	47			6660		LD	B,A		
	0616	3A	10	08	6670		LD	A, (R1)		
	0619	32	FE	07	6680		LD	(U7),A		
	061C	3A	50	08	6690		LD	A, (D3)		
	0622	32	38	08	6710		LD	(R1),A		
	0625	32	50	08	6720		LD	(D3) .A		
	0628	78			6730		LD	A.B		
	0629	32	38	08	6740		LD	(L9),A		
	062C	3A	00	08	6750		LD	A, (U8)		
	062F	47			6760		LD	B,A		
	0630	3A	28	08	6770		LD	A, (R4)		
	0633	32	00	08	6780		LD	(U8),A		
	0636	3A	4E	08	6790		LD	A, (D2)		
	0639	32	28	08	6800		LD	(R4),A		
	0630	3A 32	20 4F	08	6820		LD	(D2) A		
	0642	78	46	08	6830		LD	A.B		
	0643	32	20	08	6840		LD	(L6) .A		
	0646	3A	02	08	6850		LD	A, (U9)		
	0649	47			6860		LD	B,A		
	064A	3A	40	08	6870		LD	A, (R7)		
	064D	32	02	08	6880		LD	(U9),A		
	,0650	3A	4C	08	6890		LD	A, (D1)		
	0653	32	40	08	6900		LD	(R7),A		
	0656	3A	08	08	6910		LD	A, (L3)		
	0659	32	40	08	6920		LD	(DI),A		
	0650	32	08	08	6940		LD	(I.3) A		
	0660	C3	C4	00	6950		JP	DISPLY		
	0663		- 1		6960	*	51	STOL DI		
	0663				6970	* B =	BACK	SURFACE,	CLOCKWISE	
	0663				6980	*				
	0663	CF			6990	BKRT	RST	10		
	0664	3A	16	08	7000		LD	A, (B1)		
	0667	47	10	0.0	7010		LD	B,A		
	0668	SA	46	08	7020		LD	A, (B7)		
	066F	34	44	08	7040		LD	(B1),A	1. 1 18 18 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-
	0671	32	46	08	7050		LD	(B7).A	(M	lore
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ng 2	continue	ed.							
	0674	3A	14	08	7060		LD	A, (B3)	
	0677	32	4A	. 08	7070		LD	(B9),A	
	067A	78			7080		LD	A,B	
	067B	32	1A	. 08	7090		LD	(B3),A	
	067E	3A	18	08	7100		LD	A, (B2)	
	0681	47			7110		LD	B,A	
	0682	3A	2E	08	7120		LD	A, (B4)	
	0685	32	18	08	7130	of nine l	LD	(B2),A	
	0688	3A	48	08	7140		LD	A, (B8)	
	068B	32	2E	08	7150		LD	(B4),A	
	068E	3A	32	08	7160		LD	A, (B6)	
	0691	32	48	08	7170		LD	(B8),A	
	0694	78			7180		LD	A,B	
	0695	32	32	08	7190		LD	(B6),A	
	0698	3A	F2	07	7200		LD	A, (U1)	
	069B	47		0130	7210		LD	B,A	
	0690	3A	14	08	7220		LD	A, (R3)	
	069F	32	F2	07	7230		LD	(U1),A	
	06A2	3A	5C	08	7240		LD	A, (D9)	
	06A5	32	14	08	7250		LD	(R3),A	
	06A8	3A	34	08	7260		LD	A, (L7)	
	06AB	32	5C	08	7270		LD	(D9),A	
	06AE	78			7280		LD	A,B	
	06AF	32	34	08	7290		LD	(L7),A	
	06B2	3A	F4	07	7300		LD	A, (U2)	
	06B5	47			7310		LD	B,A	
	06B6	3A	2C	08	7320		LD	A, (R6)	
	06B9	32	F4	07	7330		LD	(U2),A	
	06BC	3A	5A	08	7340		LD	A, (D8)	
	06BF	32	2C	08	7350		LD	(R6),A	
	06C2	3A	10	08	7360		LD	A, (L4)	
	06C5	32	5A	08	7370		LD	(D8),A	
	06C8	78		1.000	7380		LD	A,B	
	06C9	32	10	80	7390		LD	(L4),A	
	06CC	3A	F6	07	7400		LD	A, (U3)	
	06CF	41			7410		LD	B,A	
	06D0	3A	44	80	7420		LD	A, (R9)	
	0603	32	F.6	07	7430		LD	(U3),A	
	0606	3A	58	80	7440		LD	A, (D7)	
	0609	32	44	80	7450		LD	(R9),A	
	06DC	3A	04	08	7460		LD	A, (L1)	
	06DF	32	58	08	7470		LD	(D7),A	
	UGE2	18	04	00	7480		LD	A,B	
	OGES	32	04	08	7490		LD	(L1),A	
	OGEO	03	C4	00	7500	+	JP	DISPLY	
	06E9				7510	* h -	DACK	CUDEACE	COUNTRACTOR
	OGES				7520	* D =	BACK	SURFACE,	COUNTERCLOCKWISE
	OGES	CF			7540	DVID	DCM	10	
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	OGEA	17	10	08	7550		LD	A, (BI)	
	OGED	37	10	08	7570		LD	D,A	
	06F1	32	16	08	7580		LD	A, (BS)	
	06FA	32	10	08	7500		LD	(DI),A	
	0657	32	17	00	7500		TD	A, (D)	
	OGFA	32	16	08	7610		TD	(B3),A	
	06FD	32	40	08	7620		LD	A, (D/)	
	0700	78	AU	00	7620		LD	(B9),A	
	0701	32	16	08	7640		LD	A,D (D7) D	
	0704	32	10	00	7650		LD	(D/),A	
	0707	47	10	08	7650		LD	A, (B2) B A	
	0708	3A	32	08	7670		LD	A. (B6)	
	070B	32	18	08	7680		LD	(B2) A	
	070E	3A	48	08	7690		LD	A (B8)	
	0711	32	32	08	7700		LD	(B6) A	
	0714	3A	2E	08	7710		LD	A. (B4)	
	0717	32	48	08	7720		LD	(B8) A	
	071A	78			7730		LD	AB	
	071B	32	2E	08	7740		LD	(B4) A	
	071E	3A	F2	07	7750		LD	A. (111)	
	0721	47			7760		LD	B.A	
	0722	3A	34	08	7770		LD	A. (1.7)	
	0725	32	F2	07	7780		LD	(U1) A	
	0728	3A	5C	08	7790		LD	A. (D9)	
	072B	32	34	08	7800		LD	(L7) A	
	072E	3A	14	08	7810		LD	A. (R3)	
	0731	32	5C	08	7820		LD	(D9) A	
	0734	78			7830		LD	A,B	
	0735	32	14	08	7840		LD	(R3),A	- Alexander
	0738	3A	F4	07	7850		LD	A. (U2)	
	073B	47			7860		LD	B,A	
	073C	3A	1C	08	7870		LD	A, (L4)	
	073F	32	F4	07	7880		LD	(U2) . A	-
	0742	3A	5A	08	7890		LD	A. (D8)	More

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0748	3A 2	C 08	79	10	LD	A, (R6)	
074B	32 5	A 08	79	20	LD	(D8),A	
074E	78		79	30	LD	A,B	
074F	32 2	C 08	79	40	LD	(R6),A	procession in the second se
0752	3A F	6 07	79	50	LD	A, (U3)	
0755	47		79	60	LD	B,A	
0756	3A 0	4 08	79	70	LD	A, (L1)	
0759	32 F	6 07	79	80	LD	(U3),A	
075C	3A 5	B 08	79	90	LD	A, (D7)	
075F	32 0	4 08	80	00	LD	(L1),A	
0762	3A 4	4 08	80	10	LD	A, (R9)	
0765	32 5	B 08	80	20	LD	(D7),A	
0768	78		80	30	LD	A,B	
0769	32 4	4 08	80	40	LD	(R9),A	
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Editor's Conner **Micros in Science**

By Harry Nelson Microcomputing Technical Editor

Micros Practice Science

The sciences-human, social, biological and physical-have all required frequent and often very complex mathematical calculations. It is hardly surprising that scientists and students of science have sought better and better aids for performing calculations that are extremely repetitious, almost incomprehensibly complicated or simply very lengthy. Some early thinkers developed crude mechanical calculating devices. The trusty old slide rule was indispensable in situations that did not require more than a few decimal places of accuracy. Mainframe and then minicomputers have been a very expensive solution. Small calculators were much more accurate than the slide rules but could not handle or store data as the computers could.

The result was that large projects with very large budgets got their own computers. Smaller projects, labs, and science education facilities got access to time-sharing systemswhen they were lucky. Even those that did have access to a large system were often not lucky. Sometimes access was restricted to unusual hours, and if the system went down the only options were to just wait or do the work by hand.

It didn't take scientists long to realize that the computer could do more for them then just serve as a highpowered and expensive calculator. Computer models could be designed to simulate a variety of situations scientists wanted to study. And this could be done interactively with the researcher changing parameters of the situation being investigated to observe possible results. Computers could also be programmed to control experiments and record and analyze data from them. Again, as long as a project could maintain its own computer, there was little problem. But time-sharing presented more difficulties in these applications than in strict calculating operations.

Within the past few years many scientists have been discovering a powerful new tool that can be used in a variety of ways in their research. The microcomputer, used in conjunction with a larger system or as a stand-alone system, has started to emerge as a valuable tool for many scientific applications.

Sidney Fernbach, deputy associate director for scientific support at the Lawrence Livermore Laboratory, is a more than credible witness to this tendency (see "Scientific Use of Computers" in The Computer Age: A Twenty-Year View, edited by Michael L. Dertouzous and Joel Moses, The MIT Press, Cambridge, MA, 1979, p. 146). He says, "While the scientific community has been the user of most of the large computers built, interestingly enough, it also uses most of the minicomputers (and now microcomputers)....There is no doubt that the minicomputer will continue to be used heavily in the scientific laboratory...(but) growing availability and improving performance of microprocessors may change this somewhat

.... It seems clear that every experiment will have one or more processors tied to it for control, data acquisition and data analysis purposes.... Soon we will find the microprocessors far outnumber the minis."

Expanding on scientific networks, Fernbach writes, "What I picture is networks made up of computers of all varieties. These can be local networks or local networks tied to any number of remote systems. In each there will be a set of functional boxes or computers dedicated to specific functions. One or more may do nothing but print, another plot, another create pictures on film, another retrieve information from a local data bank. In other words, instead of a large-scale general purpose computer, I visualize a distributed system in which specific jobs are parceled out to specialists."

Fernbach's vision of only two years ago is reality today. There are a number of small (and I might add inexpensive) microcomputers available that are ideal, and in some cases have been designed for such dedicated single-functions jobs as equipment control and data acquisition. (See, for example, "Everyman's Computer System" by J. McKown and S. Sarns, Microcomputing, Dec. 1981, p. 32.)

Distributed intelligence networks are becoming almost commonplace. They are appearing in business offices as well as scientific laboratories (not to mention the Children's Television Workshop's Sesame Place). (See "(Distributed) Intelligence Networks in the Office" by Michael Brandt and Michael Bodner, Microcomputing, Oct. 1981, p. 80.)

Personal microcomputers are being used by many scientists today. One very interesting example involves some recent discoveries in "experimental" mathematics (that's right, there is such a thing as empirical mathematics and discoveries is the correct word to use for findings in that area). M. J. Feigenbaum of the Los Alamos National Laboratory has found some important characteristics of the phenomena known as strange attractors that occur in a variety of systems of interest to scientists ranging from meteorologists to physicists. (For an engaging introduction to this fascinating topic see Douglas Hofstader's "Metamagical Themas" column in the Nov. 1981 *Scientific American*, p. 22.) One thing that is striking about Feigenbaum's work, in the present context, is that some of his very important discoveries were made with the aid of a small computer and a calculator.

(The mention of meteorologists calls a recent news item to mind. The National Weather Service is in the process of installing a large national minicomputer-based system. But in the meantime, directors of some weather service centers have decided to purchase and use Zenith Z-89 microcomputers with modems rather than wait for completion of the large system.)

The science-related articles that follow, in addition to describing specific uses of microcomputers, indicate something of the flexibility and range of possible science applications. Obviously, we could not hope to cover the entire spectrum in a single issue. So, from time to time we will be printing more material on uses of micros in the sciences.

It also seems worth noting that new products are beginning to appear that facilitate the use of off-the-shelf microcomputers in the science lab. One such product, called Isaac (Cyborg Corp., Boston, MA), allows you to use an Apple for instrument control, data acquisition, electronic testing and process control. The manufacturer claims it can be easily used for applications in chemistry, engineering, psychology and physiology. It sounds like it turns a standard Apple into a versatile laboratory machine.

Cubist's Corner

Rubik's Cube has become so popular that its devotees have their own fashionable malady. Cubist's thumb has definitely replaced tennis elbow. So, in an endeavor to preserve the national health we have offered two cube simulation programs (one for the Apple and one for Z-80 systems) in this issue. But both programs only offer one mode of what we feel should be included in a *complete* cube program. The Coopers' and Paul Turvill's programs allow you to input a desired number of twists, which the computer then makes; then it is up to you to restore the cube. That's a fine first step. In fact, it is just like working with an actual Rubik's Cube. The next step would be to include a second mode in which you would mix up the cube and the computer would restore it. Such programs do exist—I have seen a few excellent ones for large computers and heard of a few for micros. In fact, we are in the process of reviewing a few for possible publication and would be interested in seeing more.

Micros and Minis

Last spring a somewhat unsettling situation came to my attention. A friend who had just earned his degree in computer science from a large state university and I were talking about job prospects in the computer field. He was concerned because, in spite of a good academic record, he was having some difficulty in finding a good position. He said that he was interested in gaining some programming experience and was especially interested in working with Pascal.

I couldn't understand why he was having any trouble at all finding a good job. We are constantly hearing about the need for good programmers. I asked what companies he had been talking to. He named several of the large minicomputer manufacturers and several companies that offer software support services for the products of these manufacturers. When I asked what microcomputer companies and software houses he had contacted, his answer astonished me, especially in light of the fact that he wanted to locate in the San Francisco area. He hadn't been in contact with any.

As we talked it became apparent that he was equating microcomputers with video games. He didn't think of micros as real computers. And worst of all he was completely unaware of the extremely large and rapidly growing microcomputer industry. He simply did not know it existed. It was disturbing to find that a good student could complete four years in a respected computer science program and never be made aware of one of the most dynamic segments of the computer industry. After doing some checking I found that my young friend's situation was not uncommon. I also learned of several educational institutions that do incorporate microcomputing into their programs. These schools are working to give their students a full picture of the field for which their graduates are being prepared. But there are still a number of highly respected schools that are not offering their students a complete preparation for their chosen field.

Several possible reasons for this exist, but two of them seem to stand out. The microcomputer field, as we all know but sometimes forget, is very new-by most accounts only about six years old. As a significant industry, microcomputing is even newer. And most computer science professors were trained during, or were part of, the minicomputer revolution. Then too, educational institutions are not always noted for their ability to rapidly change with the times, despite the best efforts of some of the faculty. (We have to sympathize with those who must try to convince an administration that is still paying for a large time-sharing system to go out and buy a significant number of new machines-but we have learned of some very creative strategies used by some individuals and departments to get around this obstacle for the benefit of their students.)

It still bothered me that a number of young computer professionals would have to gain their first microcomputing experience as on-the-job training. Feeling, however, that the computer-educational establishment was at least starting to move in the proper direction, I more or less put the mini/micro question out of my mind. But a recent article in a computer publication (see "Mini or Micro: Which Way to Go?" by John Seaman in Computer Decisions, Oct. 1981, p. 90) raised the question anew in a slightly different context. Here the question was posed in the context of which kind of system was most appropriate for business purposes. (It may be a bit unfair to single out Seaman's article, because one can find numerous articles containing some of the same information and I believe Seaman was trying to be objective. The information he was dealing with, however, made that impossible.)

The criteria for comparison in this article are:

- speed of operation
- •response time
- amount of memory
- control of a variety of peripherals
- hardware and software availability
 service

⁽continued on page 93)

This Apple program helps scientists gather data and analyze geologic research.

Uncovering the History Of the Earth

By Fred J. Gunther

Computers have contributed to important changes in the way scientists do science. Some advances, such as those in space research, are enormous and obvious; others are not. But the way data is collected, organized and analyzed has unquestionably changed in all branches of science, and microcomputers are the newest part of that change.

Most geologists are not mathematically or computer oriented. They are interested in the Earth, its rocks and minerals, its parade of plant and animal life through geologic time, its mountains and what caused them and its oceans and continents.

Even geologic research has



changed because of the use of computers. Earthquake data is recorded with much greater sensitivity. Indications of ore deposits can be detected in computer-processed images taken by satellites. Several technical journals publish articles by mathematical geologists concerning fossils, magnetism, ore deposits, storm waves and statistical tests. Data of all types can be processed much more efficiently and accurately.

When I was a graduate student, my first job as a laboratory assistant was to help a senior graduate student with his research. I was to take his handcalculated results for species percent data at each of many oceanographic collection stations and calculate an index of similarity for each and every pair of stations. The resulting numbers would enable the senior graduate student to draw a map of the ocean floor showing which stations had similar collections of animals. There were many stations, and many species, and it took weeks to calculate the matrix.

That same semester, I took a course in FORTRAN IV computer programming on a CDC-3300 (a big computer in 1967). By the time I was a senior graduate student, I had designed, written and debugged a computer

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Photo 1. Monitor display of Example Species/Specimens curve. The steepness of the curve indicates that new species are still being found at a rapid rate. For this reason many more specimens need to be examined to adequately know what the species composition of the sample is.

program that calculated the same index of similarity for all station pairs in a few seconds. In addition, it produced all of the other previously hand-calculated values for species abundance. And it calculated many other "nifty numbers" of use and interest to geologists and marine biologists.

Input Problems

To use my program, I still had to examine the samples, keep a tally of the number of specimens for each sample and keypunch the data onto computer cards.

Many other scientists face the same problems in data entry. Marine biologists often count the numbers of individuals for each species of plant or animal. Ecologists often pay close attention to both the type and the number of specimens for each species. Many scientific studies depend upon being able to tally the number of specimens for each species. The frequency distributions of species in each sample can be compared by eve or by computer program to indicate what the natural communities or groups of species are.

Some solutions to the data-entry problem have been suggested. The counted number of specimens can be entered onto a machine-readable form. The sense-marked form or card

SP\$(100)	The array of species ID codes. A string variable is used so that numbers and/or letters can form the ID code. Thus 33 is as valid as T33, and both
	spelling errors on input; each spelling variation is treated as a different species ID code.
COUNT(100)	The array of the counted number of specimens for each species. It is updated every time a new specimen ID code is entered.
TALLY%(1000)	The array for the number of species known at the time that each specimen was found. It is updated every time a new specimen ID code is entered.
NSP	The total number of species. It is updated each time a new species is entered.
LSP .	The total number of specimens. It is updated every time a specimen ID code is entered.
LABEL\$	A string variable with sample and project identification information. It is typed in by the analyst at the start of an analysis. It is stored on the disk to be read when an analysis is continued after an interruption.
NAME\$	A string variable for the name of the data file. It is used for disk storage and must be unique.
	at and the are relatively three to its of some interests the set of

Table 1. Important variables for PEG Microscope Helper program.

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can then be read by a computer in essentially the same way as for machine grading of multiple-choice examinations.

Data entry directly from sample material has been performed using large computers for automatic shape analysis, but only for special cases in medicine and genetics. Recently a microprocessor-based texture analysis station for cell and tissue samples, featuring direct data entry, has been advertised.

Fossils, however, must be identified by eye. Direct-entry computer systems cannot handle the variety in shapes and orientation encountered in the species-analysis of paleontologic, ecologic or geologic samples. Fossil specimens must be found, separated from the surrounding rock, cleaned, examined and finally identified and tallied by species.

I decided to use an Apple microcomputer to keep the tally for each species in a sample. The program presented here (Listing 1) allows the Apple to assist the scientist or technician in data collection and preliminary analysis. It's named the PEG Helper because I use it for research in

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Paleontology, Ecology and Geology. All I have to do is type in a code name or number each time I see a specimen. The computer does all the rest of the data entry, record-keeping and calculations. The program helps me to "work smart, not hard."

Bells and Whistles

SPECIMEN

Of course, once the data is in

SAMPLE

machine-readable form, other things can be done (Fig. 1). The program does much more than simply replace a tally sheet or a multi-key counter. A variety of important reports are produced from the data.

The program calculates the relative (percent) abundance of each species and prints this along with the tally and species ID code. (Sample 1.)

Sample 1. Printer copy of Species Abundance matrix. This is the data that would have to be tallied by hand and entered to a computer by punched cards if this program did not exist. This data is stored on a disk file for direct entry to computer programs that will do additional analyses.

SPECIES

COUNT	PERCENT 1, 28205128	ID CODE	2	2.56410256	26	is yeary difficult to keep I've do
-	2 54410254	70	1	1.28205128	52	it many times and know the pr
2	2.56410256	ated	1	1.28205128	41	lems involved well. The program
2	2.56410256	43	1	1.28205128	54	structions allow the computer
2	2.56410256	8/	1	1.28205128	3	keep the tally and to generate
1	1.28205128	30	1	1.28205128	44	continuously-updated plot for eve
1	1.28205128	24	2	2.56410256	72	single sample, at no extra effort to
1	1.28205128	68	1	1.28205128	37	analyst (Photo I).
1	1.28205128	of SignA	o plant o	1.28205128	86	Species diversity is one of the
1	1.28205128	49	1 1	1.28205128	59	"nifty numbers" mentioned earli
2	2.56410256	27	1	1.28205128	92	It is of interest to specialists in t
1	1.28205128	74	1	1.28205128	23	studies of modern and ancient grou
1	1.28205128	75	1	1.28205128	50	measure one aspect of population
1	1.28205128	61	110	1.28205128	89	group organization. Changes in div
2	2.56410256	8	species in	1.28205128	29	sity have been related to changes
5	6.41025641	69	ared by eye	1,28205128	32	the environment in many scienti
2	2.56410256	25	to indicate	mputer program	st by co	studies; it is common knowledge th
2	2.56410256	13	n salique	ne natural contra	t tarly	I there are fewer species and
3	3.84615385	39		or species are.	stonbs (10 WINE ALCONTROLOGY TO AND ALCONTROL
2	2.56410256	5		19172 (1556-5V61		oole and keynunch the datalon to
1	1.28205128	16		DIV	ERSIT	Y INDICES
2	2.56410256	7				
1	1.28205128	35	55 = N		TES	
1	1.28205128	99	00 - 1			
3	3.84615385	79				
2	2.56410256	47	12.394	6773 = MARGAL	_EF'S	INDEX
1	1.28205128	97				
2	2.56410256	73	. 97698	8823 = SIMPS	ON'S I	INDEX
1	1.28205128	40				
2		Tara III	-10.83	21596 = MC IN	NTOSH'	SINDEX
	2.56410256	57	maniferiori			and a second
	1.28205128	22	is entered.	aboy Cit maga mara wa	Uncan	and a state that the solution of the solution
1	1.28205128	62	1.6948	8065 = SHANNON	N'S IN	NDEX (INFORMATION THEORY)
2	2.56410256	42				
1	1.28205128	2				
1	1.28205128	28		REF	FERENC	ES
1	1.28205128	96	MAC AD	TUID 1945 DT		JIEW 40. 511-577
1	1.28205128	17	MC INT	OSH 1967 ECO	DGY 4	18(3): 392-404
1	1.28205128	84	SANDER	S 1968 AMERIC	CAN NA	TURALIST 102(925): 243-282
1	1.28205128	98			2 D	and dimension bet
1	1.28205128	82		Sample	2. Printer	copy of diversity data.

A graph showing the frequency of occurrence of new species as additional specimens are studied is a very useful report. Where the curve is steep, the analyst can expect to find more species as more specimens are examined. Where the curve is very flat, the analyst can expect that the examination of additional specimens is unlikely to produce additional species. The curve therefore can be used to predict the results of additional work to analyze the sample. If the curve is very flat, the cost of finding new species may be considered to be too high, and the analyst can stop.

A manual tally of the number of specimens vs the number of species is very difficult to keep. I've done it many times and know the problems involved well. The program instructions allow the computer to keep the tally and to generate a continuously-updated plot for every single sample, at no extra effort to the analyst (Photo 1).

Species diversity is one of those "nifty numbers" mentioned earlier. It is of interest to specialists in the studies of modern and ancient groups of animals or plants. It attempts to measure one aspect of population or group organization. Changes in diversity have been related to changes in the environment in many scientific studies; it is common knowledge that there are fewer species and in-

62	Microcomputing,	January 1982

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dividuals in Arctic regions than in tropical regions.

Many scientists have calculated the species diversity of the samples that they study. Of course, where there are many people, there are many different opinions. There are several opinions on how to measure the diversity of a sample, and so there are several algorithms. Each tries to answer the question, "Is this sample really different from that sample?"

The Helper program helps out in this case also. It calculates and prints several indices of diversity. The printer copy (Sample 1) with the different diversity values becomes part of the analysis file for the sample and project.

Program Code

The program code has three major sections (see Fig. 1). The program

first prints a title page and asks the user for information (Photo 2); it then sets up the initial conditions for that run (Listing 1, lines 90 to 950). Second, the program requests input for each species, and then processes the data (Listing 1, lines 900 to 1090yes, lines 900 to 950 are used by both setup and run portions of the program). Finally, when the input sequence is complete, the program writes the data onto a disk file (Listing 1, lines 2000 to 2170), and prints (lines 3000 to 5430) a hard copy of the results (Fig. 2 and Sample 1; also Sample 2). The program is so dependent upon user input for pacing that it is coded in linear (non-optimized) form (see Fig. 1 and Listing 1).

Program Use

I have already written a lot about how the program is used. However,

Listing 1. PEG Microscope Helper, written in Applesoft BASIC to take advantage of highresolution graphics to display the species/specimens curve.

```
90 CLEAR
      HOME : PRINT " PEG
100
                                                MICROSCOPE HELPER"
      INVERSE : PRINT "P",: NORMAL : PRINT "PALEONTOLOGY"
INVERSE : PRINT "E",: NORMAL : PRINT "ECOLOGY"
INVERSE : PRINT "G",: NORMAL : PRINT "GEOLOGY"
110
120
130
      PRINT : PRINT : INVERSE : PRINT "DR. FRED J. GUNTHER"
PRINT "9464 WANDERING WAY": PRINT "COLUMBIA MD 21045"
140
150
      NORMAL : PRINT : PRINT : PRINT "INPUT IS ID CODE FOR EACH SPECIMEN"
PRINT : PRINT : PRINT "OUTPUT IS:"
160
170
      LET MM$ = "SPECIES/SPECIMENS CURVE"
PRINT " -1- HGR":MM$
180
      PRINT " -1- HGR"; MM$

PRINT " -2- DISK COPY, SPECIES TALLY"

PRINT " -3- PRINTED "; MM$

PRINT " -4- PRINTED SPECIES TALLY"

PRINT " -5- PRINTED SPECIES DIVERSITY": PRINT : PRINT
190
200
210
220
230
      LET M$ = "ADJUST PRINTER AND (RETURN)"
PRINT M$: INPUT "SLOT NUMBER FOR PRINTER ";N
240
250
260
       PRINT : INPUT "SPECIAL PRINTER CONTROL CHARACTERS. ";CC$
300
       HOME : REM SET INITIAL CONDITIONS
       VTAB 10
310
      DIM SP$(100), COUNT(100): REM UP TO 100 SPECIES
DIM TALLY%(1000): REM UP TO 1000 SPECIMENS
320
330
      LET NSP = 0:LSP = 0
340
350
       INPUT "NEW SAMPLE OR CONTINUATION OF OLD?
                                                                         (NEW/OLD)
360
       IF IN$ = "NEW" THEN GOTO 600
      IF IN$ = "OLD" THEN GOTO 400
370
380
       PRINT : INVERSE : PRINT "UNEXPECTED RESPONSE"
390
       NORMAL : PRINT : GOTO 350
       HOME : PRINT "WHICH FILE? ('O' IF NOT HERE)"
400
410
       PRINT : PRINT CHR$ (4);" CATALOG"
      PRINT : INPUT NAME$
IF NAME$ = "O" THEN PRINT "INSERT NEW DISK": GOTD 350
420
430
      PRINT CHR$ (4);" OPEN ";NAME$
PRINT CHR$ (4);" READ ";NAME$
440
450
       INPUT LABELS: INPUT NSP: INPUT LSP
460
       FOR J = 1 TO NSP: INPUT COUNT(J)
470
480
       INPUT SP$(J): NEXT J
490
       PRINT CHR$ (4); " CLOSE "; NAME$
500
       GOTO 800
600
       PRINT "TYPE IN LABEL FOR THIS SAMPLE."
       PRINT : INPUT LABELS: PRINT : PRINT
620
       PRINT "IS THIS THE DISK YOU WANT TO STORE THE"
PRINT "DATA ON?": PRINT CHR$ (4),"CATALOG"
INPUT "(YES/ND)";IN$: IF IN$ = "YES" THEN GOTO 670
630
640
650
       INPUT "PUT PROPER DISK IN DRIVE AND (RETURN)"; IN$: GOTO 630
660
       PRINT : INPUT "GIVE FILE NAME (DO NOT USE ONE OF THE ABOVE)."; NAMES
670
       REM SETUP HGR GRAPH
800
       HOME : VTAB 21: HGR : HCOLOR= 3
HPLOT 0,0 TO 0,159 TO 279,159
PRINT ".....";: INVERSE : PRINT MM$
810
820
830
       NORMAL : POKE 34,23: VTAB 23
840
       LET Y = 159 - 2 * NSP
900
       IF Y < O THEN GOTO 1000
910
```

some details might be useful to you to see if you could use it in your applications.

The program has been used in a computer with the keyboard next to a microscope (for small fossils) or specimen-sorting tray (for large fossils) in a laboratory. The computer must be connected to a monitor, a disk drive and a printer.

The analyst first enters general sample information, starting a new file or continuing an old one as appropriate. S/he spreads the sample thinly over the surface of a small tray and carefully searches it for specimens. Usually, there are many grains of sand and few specimens. As each specimen is encountered, the analyst identifies it and types a short code name or number on the keyboard. A specimen that is new to the project must be given a new code ID and set



specimen that is new to the project must be given a new code ID and set to be run on systems with different configurations.

920 LET J = LSP 930 IF J > 280 THEN LET J = J - 280: GOTO 930 930 IF J > 280 THEN LET J = J - 280: GUID 930
950 HPLOT J,Y TO J,Y + 1
1000 PRINT "SPECIES CODE FOR NEXT SPECIMEN?"
1010 PRINT "('0' TO END)",
1020 INPUT IN\$: IF IN\$ = "0" THEN TEXT : POKE 34,0: GOTD 2000
1030 LET LSP = LSP + 1
1035 FOR J = 1 TO NSP:JJ = J
1040 IF IN\$ = SP\$(J) THEN GOTD 1070
1050 NEXT J:NSP = NSP + 1: REM ADD NEW SPECIES
1060 LET SP\$(NSP) = IN\$:JJ = NSP: REM STORE NEW SPECIES WORKING CODE
1070 LET TALLY2(LSP) = NSP LET TALLY% (LSP) = NSP 1070 1080 LET COUNT (JJ) = COUNT (JJ) + 1: REM UPDATE SPECIES ABUNDANCE MATRIX 1090 **GOTO 900** 2000 PRINT "WRITE DATA TO DISK FILE." PRINT CHR\$ (4); "OPEN"; NAME\$: REM WRITE DATA TO DISK PRINT CHR\$ (4); "WRITE"; NAME\$ 2110 2120 PRINT LABELS: REM KEEP ID WITH FILE PRINT NSP: REM NUMBER OF SPECIES PRINT LSP: REM NUMBER OF SPECIMENS 2130 2140 2150 FOR J = 1 TO NSP: PRINT COUNT(J): PRINT SP\$(J): NEXT 2160 2170 PRINT CHR\$ (4); "CLOSE"; NAME\$ PRINT CHR* (4); "CLOSE"; NAMME* TEXT : FLASH : PRINT M*: INPUT IN*: NORMAL PR* N: PRINT CC*: PRINT LABEL*: PRINT : PRINT : PRINT MM*: PRINT PRINT ,"0";: FOR J = 10 TO 100 STEP 10: PRINT "; J;: NEXT J: PRINT PRINT ,"**;: FOR J = 1 TO 10: PRINT "-----*";: NEXT : PRINT FOR J = 1 TO LSP: PRINT J,"*";: REM PRINT A LINE IF TALLY%(J) = 1 THEN PRINT "#": GOTO 3170 FOR JJ = 2 TO TALLY%(J): PRINT " ";: NEXT JJ: PRINT "#" 3000 3110 3120 3130 3140 3150 3160 NEXT J 3170 NEAT J FOR J = 1 TO 5: PRINT : NEXT : REM ABUNDANCE DATA PR# 0: PRINT M\$: INPUT IN\$ PR# N: PRINT CC\$: PRINT LABEL\$: PRINT : PRINT PRINT "SPECIMEN", "SAMPLE", SPECIES": PRINT "COUNT", "PERCENT", "IDCODE" FOR J = 1 TO NS: PRINT COUNT(J), 100 * COUNT(J) / LSP, SP\$(J): PRINT : NEXT 4000 4100 4110 4120 4130 PR# 0: PRINT MS: INPUT INS 5000 PR# N: PRINT CC\$: PRINT LABEL\$: PRINT : PRINT PRINT "", "DIVERSITY INDICES": PRINT : PRINT LET SSQ = 0:PSQ = 0:PLG = 0 5010 5020 5030 FRINT NSP; "=NUMBER OF SPECIES" FOR J = 1 TO NSP: LET P = COUND(J) / LSP 5040 5100 LET SSQ = SSQ + COUNT(J) 2 LET PSQ = PSQ + P 2 5110 5120 5130 LET PLG = PLG + P * LOG (P) * 0.4342945 5140 NEXT J 5200 LET DM = (NSP - 1) / LOG (LSP)LET DM = (NSP - 1) / LOG (LSP) LET DH = -1 * PLG LET DD = 1 - SQR (SSQ):DP = 1 - PSQ PRINT : PRINT : PRINT DM; "=MARGALEF'S INDEX" PRINT : PRINT : PRINT DD; "=SIMPSON'S INDEX" PRINT : PRINT : PRINT DD; "=SHANNON'S INDEX" PRINT : PRINT : PRINT DH; "=SHANNON'S INDEX (INFORMATION THEORY" PRINT : PRINT : PRINT : PRINT ", "REFERENCES": PRINT PRINT : MACARTHUR 1965 BIOL. REVIEW 40:511-533" PRINT "MACARTHUR 1965 BIOL. REVIEW 40:511-533" 5210 5220 5300 5310 5320 5340 5400 5410 PRINT "MCINTOSH 1967 ECOLOGY 48(3): 392-404" PRINT "SANDERS 1968 AMERICAN NATURALIST 102(925): 243-282" 5420 5430 6000 PR# 0: POKE 34,0: END

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aside for later identification; specimens of recognized species need not be set aside.

All records are kept by the computer. It is not necessary for the analyst to write down anything, other than the ID code for each set-aside specimen. The computer keeps all data up-to-date on internal files. It also plots in real time the species/specimens curve. At the end of the analysis, the computer prints disk copies of some files and hard copies of all files.

Because the analysis of a sample may take a long time, the program has the capability of reading a disk file. This allows the analyst to take a break (for coffee, lunch, or the end of the working day) after recording the data up to that time. The analyst can continue from that point after the program has read the stored data from the disk file. The computer printout for that sample will be in two or more parts, but that problem can be solved with scissors and tape.

The program should be useful not only to paleontologists (geologists who work with plant and animal fossils), but also to many other scientists and to anyone interested in the numbers of species of plants or animals found in one place. Even those who work with inorganic items, such as geologists who study sand grains, could find this program useful in collecting data about the "species" of heavy minerals. It might even be useful to a traffic analyst, who must count the numbers of different types of vehicles that pass a certain point of a road. It could assist in keeping track of the numbers and species of birds that visit a bird feeder, or the animals that visit a salt lick or a water hole. Let me know what uses you have found for the program.



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Red Hot Computing

By Paul T. Ward

Many laboratory phenomena require recording a rapidly changing dc voltage for later analysis. In my laboratory, I routinely measure the output of photomultiplier tubes, recording the glow of irradiated phosphors as they are heated. During the heating process, the phosphors give off varying amounts of light, depending on the type of radiation and the temperature.

In the past, this glow curve has



From left to right, IDS-440 Paper Tiger printer, Panasonic model UD702 thermoluminescent dosimeter reader, Apple II+, chart recorder and Tektronix oscilloscope with Polaroid camera attached.

		Program listing.
10	REM	A/D CONVERTER PROGRAM FOR
20	REM	INTERACTIVE STRUCTURE
30	REM	MODEL AI-02 ANLG-DGTL CONVTR
40	REM	A=BASE ADDRESS
50	REM	AP1=CONVERSION RESULT ADDRESS
60	REM	CH=CHANNEL # OF A/D CONVERTER
70	REM	V(I)= RESULT OF CONVRSN I
75	REM	P(I)= V(I) * SCALE FACTOR TO PLOT ON HI-RES PAGE ONE
80	REM	
82	D\$ =	CHR\$ (4) (More

been recorded on a fast chart recorder. This became less accurate as we increased the heating rate, due to the starting inertia of the paper and pen.

The next step was to use an oscilloscope with a Polaroid camera to eliminate the mechanical time lags. This works, but it is less than ideal due to the high cost, the small size of the picture and the tricky synchronization problem. The synchronization problem can be solved with a special storage screen oscilloscope, but this is very expensive and tends to smear the recording.

I needed a good, low-cost method of recording graphic data that's too fast for a conventional chart recorder and too slow for a normal oscilloscope.

The answer was to bring in my Apple II microcomputer and hook it up to the photometer in the lab through an analog-to-digital (A/D) converter. I used an Interactive Structures AI-02 converter, which is an eight-bit, 16-channel model. This device accepts dc voltages from 0-5V, and digitizes this into a number from 0-255.

The digitization is started by poking a base address (which depends on the slot number of the converter) with the number of the A/D channel

Address correspondence to Paul T. Ward, Radiological Health program, School of Public Health, The University of Michigan, Ann Arbor, MI 48109. connected. You get the result of the conversion by peeking at an address one byte higher than the base address.

By using the Program listing, I obtained a plot of the digitized data just like one from our storage screen oscilloscope running at 1 cm/sec. The data was plotted in high-resolution graphics as it was generated. If you need faster sampling rates, the plotting could be done later, since the values are stored in the V array.

An option at the end of the program stores the data as numbers, a highresolution picture or both. To restore the picture to the screen, first BLOAD the file it was saved in, then enter

GR:POKE - 16297,0

to restore the high-resolution screen. The screen image can be hard-copied on a dot-matrix printer with a graphics driver program. A short BASIC program is required to read the number data from the disk file.

Similarly, you can make a fast X-Y recorder by plotting one conversion against the other, recording from two A/D channels alternately. This technique is useful for examining the hysteresis loop of control systems too fast for conventional X-Y recorders.

Listing continued. DIM Q\$(5), NM\$(15) DIM V(280), P(280) 90 95 HGR : TEXT 100 A = 14592: REM SLOT #7 ANDRESS 110 AF1 = A + 1120 CH = 0: REM CHANNEL ZERO 130 CALL - 936: VTAB 10: PRINT "THIS PROGRAM READS A D.C. VOLTAGE FROM 140 PRINT : PRINT "O TO +5.0 VDC USING AN INTERACTIVE" PRINT : PRINT "STRUCTURES MODEL AI-02 A/D CONVERTER" 150 REM START CONVERSION VTAB 23: PRINT " PRESS ANY KEY TO CONTINUE" IF PEEK (- 16384) > 127 THEN GOTO 200 160 170 180 GOTO 180 190 936: VIAB 23: PRINT " RECORDING DATA " 200 CALL 210 HGR : HCOLOR= 3: HPLOT 0,0 TO 0,159: HPLOT 0,159 TO 279,159 220 FOR I = 0 TO 279 230 POKE AP1,CH 240 V(I) = PEEK (A) 250 P(I) = V(I) * 0.623: REM SCALE DATA TO FIT HI-RES PAGE ONE HPLOT I,(159 - P(I)) 260 270 NEXT I 280 CALL - 936: VTAB 23: PRINT " RECORDING FINISHED " 290 PRINT : INPUT " SAVE THIS DATA? ";Q\$ 300 IF LEFT\$ (Q\$,1) = "Y" THEN GOTO 350 310 PRINT : INPUT " ANOTHER RUN? ";Q\$ IF LEFT\$ (Q\$,1) = "Y" THEN GOTO 170 END 320 330 350 PRINT " WHAT FILENAME? (UP TO TEN CHARACTERS)": INPUT NM\$ INPUT " SAVE PICTURE TOO? ";PC\$ 360 PRINT D\$; "OPEN"; NM\$ PRINT D\$; "WRITE"; NM\$ 370 375 FOR K = 0 TO 279 380 PRINT V(K) 390 395 NEXT K PRINT D\$; "CLOSE" ; NM\$ 400 420 IF LEFT\$ (PC\$,1) = "Y" THEN GOTO 450 430 GOTO 310 450 NM\$ = NM\$ + ".PIC" PRINT D\$; "BSAVE "; NM\$; ", A\$2000, L\$2000" 470 490 GOTO 310

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This unique application for the H8 helps neurophysiologists crack the "last frontier of biology."

Tapping Into the Brain

By Robert M. Bradley

f all the organs in the body, the brain is perhaps the least understood. It is the last frontier of biology. Neurophysiologists have been able to gather much information on brain function by recording activity from the peripheral and central nervous systems and analyzing the resulting records. Until recently, this has been a tedious chore-investigators have had to rely on measurements from recordings photographed on a moving film passing across an oscilloscope screen. But the digital computer makes possible many types of analysis not possible before.

This interface for the Heath H8

measures the intervals between neural discharges and stores the data on disks for later study. It also stores in the data stream a marker to indicate the beginning and end of a stimulation. Once the interval data is stored, software can be used to convert intervals into frequency of impulses, and show the distribution pattern of the intervals with respect to time. The extent of the analysis is dependent primarily on the imagination and ingenuity of the researcher.

About Neurons

Neurophysiologists record electrical impulses produced by neurons. A

*INTERS	PIKE INT	TERUAL PRO	IGRAM-ISI	(P-			
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neuron, the basic building block of the central nervous system, is made up of a cell body with cytoplasmic extensions called axons and dendrites. A neuron usually has only one axon, but can have a number of dendrites.

All information travelling in the central nervous system passes along the axons to the dendrites, where it crosses a synapse to the axon of the next neuron in the chain. Thus, neural activity typically begins at a sense organ and is transmitted along the neurons to the central nervous system, where the information is processed. This processing can result in a number of actions, the most obvious involving muscle use.

Neurophysiologists are particularly interested in the functioning of sensory receptors, specialized dendrites sensitive to physical states. A series of these receptors senses the external environment and translates the information into signals used by the central nervous system.

For example, the retina converts light energy into neural energy. The neural energy consists of action potentials (spikes, neural discharges) that are sent along the neurons to the central nervous system. These action potentials are a coded message of the transduced external energy.

To understand how the brain works, the researcher must tap into the neural messages and decipher the

Robert M. Bradley is on the faculty of the Department of Oral Biology, School of Dentistry, University of Michigan, Ann Arbor, MI 48109.
neural code. This is analogous to using a logic tester in a computer circuit.

To do this, he must isolate single neurons and record their action potentials, while stimulating the receptors to which they are connected. This is done either by dissecting the peripheral nerves to isolate single axons, or advancing an electrode with a very small uninsulated tip into the brain or other parts of the central nervous system. In either case, an active electrode picks up the electrical activity of the isolated neuron, while an indifferent electrode placed in nearby tissue completes the circuit.

The neural activity is amplified and recorded on magnetic tape. After the experiment, the tape is replayed and the data is analyzed.

The recordings consist of a series of action potentials that occur at various intervals. An example of a small portion of such a recording is shown in Fig. 1. Note that the neural discharges are essentially a digital code. The action potentials from one neuron are of fixed magnitude, and last about 1 ms. The analog recording is then passed through a window discriminator, which converts the action potentials into standard TTL pulses. The neural data is now in the form that can be analyzed by a digital computer.

Since action potentials from one neuron are of a fixed magnitude, the neural code cannot be in the form of amplitude modulation, but rather must rely on frequency modulation. All the information relating to the magnitude and quality of the stimulus must be contained in a frequencymodulated code. For example, the neural discharge pattern from a single fiber connected to a taste bud must convey not only information on the concentration of the stimulus but also on what kind of chemical has been applied to the tongue (eg., salty, sour, bitter, sweet-tasting).

Hardware

A block diagram of the interface is shown in Fig. 2 and a full schematic in Fig. 3. A crystal-controlled clock is set at a frequency of 1 kHz to give a pulse every 1 ms. These pulses are counted by a 16-bit binary counter. The least-significant byte of this count goes to one eight-bit input port, and the most-significant byte to a second port. One bit of an output port is used to reset the counter. A third port is used for input from the data pulses as well as the mark (stimulus beginning and end) and end analysis pulses. Since a 16-bit counter is used, 65,536 ms is the maximum interval that can be counted, which is more than sufficient for most neural data. The interface functions therefore in a very straightforward manner.

The computer first resets the counters, and then looks at the pulse mark and end port. When it meets a data pulse, the computer gets the input from the binary counters, resets the counters and looks for the next pulse. Whenever the mark bit is set, the computer then stores the next series of intervals in a second storage location. The reset pulse now not only resets the counters but also the mark bit.

The same series of events takes place when the mark pulse is set again (end of stimulation period). Finally after the poststimulus period the end bit is set and data analysis is finished. If the mark facility is not required, both the hardware and software become much simpler to design. Often, however, the time of stimulus onset can be very accurately determined and recorded on a second channel of the analog recording during the experiment. On playback, the stimulus marker channel can be used to control the mark input bit.

The schematic diagram is, for the most part, self-explanatory. The three input ports are neatly implemented using an 8255 programmable peripheral interface integrated circuit (see P. F. Goldsbrough's *Microcomputer Interfacing with the 8255 PPI Chip*). One of the ports is split into a four-bit input and four-bit output port.

I ran into a problem in the early design stages: the computer could store the interval data in a shorter time than the length of the data pulse. It therefore appeared to the computer as if a further input pulse was present when in fact it was not. To get around this problem, I used a ''one and only one synchronizer'' described in Don Lancaster's *TTL Cookbook*.

The incoming data pulse is used to gate a 1 μ s clock pulse, which is used to set a flip-flop. Thus, the data pulse is converted to a pulse that the computer can reset once the interval has been stored. In effect, the incoming pulse is held until the computer acknowledges its presence. The use of this circuit gives very accurate interval measures.

The same type of circuit is used for the mark input pulse. The rest of the circuitry consists of address decod-



Fig. 1. a) Oscilloscope tracing of action potentials recorded from the chorda tympani nerve in a rat. b) TTL output pulses produced when the action potentials of 1a are passed through a window discriminator.



Fig. 2. Block diagram of an interface designed to measure the intervals between neural impulses.

ers, input control logic and switch debounce logic. For this application, the mark and end bits are set by momentary push-buttons. As I mentioned before, this could easily be done by using pulses recorded on magnetic tape during the experiment.

List

Software

I originally wrote the software in BASIC, which was far too slow for the speed of the neurophysiological data. The software listing of Fig. 4 is therefore in assembly language. A BASIC program analyzes the interval data stored on disk. (I haven't included mine here, since the program must be suited to individual needs.) Besides the fact that speed is not critical here, it would take me years to write a program in assembly language to analyze the data.

Analyzed data is plotted on both a line printer and an X-Y plotter through D-A converters. Statistical analyses are also printed on the line printer.

The initial part of the program sets up the transfer characteristics of the 8255. The program then asks for the output file name, and waits for the

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	MOU	M.A	*STORE IT	
	INX	H	*BUMP IT	
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	LXI	B.0000D	*SET UP DATA POINT COUNTER	
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user to type a carriage return to begin data entry. A program loop constantly examines the data input port, looking for data pulses, mark pulses or the stop bit. Prestimulus intervals are stored in one block of memory, stimulus intervals in another and poststimulus intervals in a third. The size of the assigned blocks are generous, and can be adjusted according to your needs.

Once the data has been entered, the program enters a binary-to-ASCII conversion routine, and the data is written to the output file (usually a disk). When the pre-, during- and post-blocks of memory are sequentially written to the output file, an asterisk is placed in the data stream on the disks between the blocks of data. Thus, when the disk is subsequently read, the BASIC program can use these markers in data analysis.

Because the program is written for the Heath disk operating system, it uses various system calls and begins above the first 8K of memory. These may have to be altered to run on other machines.

Conclusions

We've been using this system in the

Listing 1 continued.		State Markey	
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laboratory for some time now, and are pleased with the results.

Someone may ask why I didn't design the interface to measure frequency directly since the neural code is frequency modulated. It would in fact have been much simpler to do this, and only an eight-bit binary counter would have been required. However, average frequency obscures many of the subtleties of neural discharge patterns that may be an important part of the code. By measuring intervals between action potentials, all forms of data analysis become possible, including instantaneous and average frequency.

Techniques such as have been described here are neither new nor original, and have been used for some time by individuals with access to large, expensive computer systems. With the advent of small, relatively inexpensive computers, this facility is available to most neurophysiology laboratories.





Fig. 3. Schematic diagram of the interface designed to measure the intervals between neural impulses. The interface is configured for the Heath H8 computer and the bus connections are therefore defined for that machine.

Ever wonder what puts the twinkle in those little stars? Well, at the Strasenburgh a microcomputer is responsible for those special effects.

Planetarium Shows With a Difference

By Susannah C. West

I magine you're sitting in a planetarium, waiting for the show to start. The lights dim slowly and stars appear on the darkened dome above you, as clean and bright as if you were miles out in the country. The show begins. But in this show, you see and experience much more than stars. Comets streaking across the sky. The eerie flicker of the Aurora Borealis. A tiny earth as seen from space, revolving silently, high on the dome above you. A violent blinding flash, so sudden that it shakes you in your seat—a sun going nova.

Many modern planetarium shows feature such spectacular special effects, rivaling those in today's movies. With the help of a computer to automatically coordinate the production of these special effects, they can be astonishingly realistic.

A Computer-Automated Planetarium

The Strasenburgh Planetarium of the Rochester Museum & Science Center in Rochester, NY, is a leading example of a computerized planetarium. When the Strasenburgh opened in 1968, a custom-designed system controlled by a PDP-8 computer produced its shows' effects. Last summer, the planetarium switched from the PDP-8 to a microcomputer system designed specifically for producing multimedia shows—the MC-10 Media Control System, manufactured by R. A. Gray, Inc. of San Diego, CA.

The decision to switch was prompted by the fact that the PDP-8 was obsolete-parts and service were becoming increasingly difficult to obtain. After 13 years, the old system was still working "virtually perfectly," according to planetarium director Don Hall, who adds that "to get the kind of service we've had out of it is just miraculous. However, it was obvious that we had to junk a working system and buy something to replace it, just so we would get parts and service and be confident that we were going to be able to remain in business."



Photo 1. Strasenburgh Planetarium of the Rochester Museum & Science Center. (Photo by William G. Frank.)

The careful search for a new system took about a year, and others besides the MC-10 were considered. The staff found out about the MC-10 through word of mouth—from a former Strasenburgh intern who had gone on to the Reuben H. Fleet Space Theater in San Diego, which uses an MC-10 to produce its special effects.

"The MC-10 is essentially a microprocessor that is built by another San Diego company called Gnat," explains Hall. "They build the brain, you might say, and then R. A. Gray builds the various modules that allow it to control the devices in the planetarium theater. So if you have ten Carousel projectors that you want to control in the theater, you buy ten Carousel units as part of your computer system. You buy just what you need, and you can expand the system, because it is modular."

The planetarium staff planned the switch-over carefully. After receiving the MC-10 equipment, they spent about four months learning about the system and interfacing it with the planetarium's devices. During this phase, the PDP-8 continued to produce the special effects for shows.

On June 21, 1981, the final installation began, right on schedule. It took five days to move out the old equipment, move in the new equipment and plug it in. "Except for a few initial difficulties," says chief technician Carl Dziedziech, "she's been quite good—hasn't given us any problems."

R. A. Gray describes the MC-10 as a 'general-purpose media controller

Susannah C. West (224 Selye Terrace, Rochester, NY 14613) is a free-lance writer.

designed especially for recording and playbacks of multimedia presentations." The hardware consists of two disk drives, used to record and store performance information, two monitors, a keyboard and a variety of modules that can control up to 120 devices at one time. These can include not only equipment like lights and projectors, but also tape machines, speakers, robots and puppets.

The MC-10 incorporates three levels of operation. The highest level (maintenance) allows development of all features of the operating environment. Devices can be added or removed from the working environment and named as they will be displayed on the monitors. When it becomes necessary, the system can also be tested for maintenance.

The second level (production) allows editing and storage of "scripts" of performances. Because the system recognizes commands in English, programming is no problem, even for the computing novice.

The third level (operation) is for playback and setup. The play mode recalls previous performances. The setup mode allows user control of devices in real-time without recording for review and experimentation without editing.

At either of the first two levels, disks can be produced to allow functions at or below that level and no higher. Thus, disks for production are unable to destroy or modify the basic system features and controls; and disks for playback cannot be erased or edited by operators. This scheme provides both protection and security.

Recording Shows with the MC-10

"When we want to record a 45-minute show," says Hall, "we break it up into ten or 20 shorter sequences which are each only a few minutes long. We go into the theater with the script with the cues marked in the margin. Two or three people are standing there at the console with their hands on the controls, and are actually giving the show."

The soundtrack for the show has already been taped and is played.

"One person's reading the script," Hall continues, "and he says the cues to the technicians who are operating the effects. And the narrator says, 'And so the rocket takes off for Mars,' and the person giving the cue says, 'All right, fade up C3, hit the non-dim

B-RECORD DISK TIME 37:17:03 7 NAME: SYSTEM DEMONSTRATION REV: A-PLAY DISK TIME 12:48:00 END: 54:47:00 REV: 6 NAME: SYSTEM DEMONSTRATION TRACKS AVAILABLE: 54 BASE TIME: 15:02:12 BLOCKS ASSIGNED: 2 _ 8 9 LTIA LT2A LT3A LT4A LT5A LT1B LT2B LT3B LT4B LT5B LT1C LT2C LT3C LT4C LT5C 17% 17% 17% 17% 0% 20% 20% 20% 0% 0% 0% 0% 80% 0% 0% RED RED RED YEL BLUE BLUE BLUE GRN GRN STEP STEP FOOT WHT WHT TAPE SPK1 SPK2 SPK3 SPK4 SPK5 SPK6 SPK7 SPK8 PLAY 7 4 7 4 76 ASMT 21 21 ----NEW DISK RAMP SWITCH DEVICE INFO FIND W/E BLOCK INFO RECORD ADV CANCEL ALL CANCEL CMDS DISSOLVE FLASH NEXT TIMER VALUE OFFSET RELAY WAIT END GO OPEN BLOCK PLAY ADV REPEAT BLOCK HOME TRAYS CANCEL DISK ERASE W/E 2 INIT TIMERS CROSSFADE EXEC BLOCK SET BASE POSIT TRAY SET TIMER DELETE BLOCK FADE LEVEL FADE, DEVICE, TIME, DURATION, INITIAL VALUE, END VALUE

SP1A SP2A SP3A SP4A SP5A SPOT HUE ZOOM VIEW X Ø% Ø% Ø% 0% 0% 20% BLUE 50 52 5 SIZE NMBR m35 40 42 40 m36 SIZE YEL SP3R SP5B IRIS ROT SP1B SP2B SP4R BRT SHAP 20% 20 -126 20% 60% 60% 60% 209 0% RND 37 SHUT EVEN 31 41 36 32 OPEN ----SP1C SP2C SP3C SP4C SP5C 40% 40% 40% 40% 409 44 41 29 28 45 SP1D SP2D SP3D SP4D SP5D SE1 SE4 SE7 SE1Ø SE13 SE16 20% 0% 80% Ø% Ø\$ Ø\$ 7Ø\$ 20% Ø% Ø% Ø% FIRE SEA RAIN SNOW LTNG CLD 24 4Ø m38 m36 27 SE2 SE5 SE8 SE11 SE14 SE17 Ø% 0% Ø% Ø% Ø% Ø% OFF OFF OFF OFF OFF OFF BALL STRB SE3 SE6 SE9 SE12 SE15 SE18 PANA PANB FILM 99% Ø\$ ØS 20 STOP 26% Ø% 0% 0% 5 Ø% OFF OFF OFF 8 8 MOVE DOUS OPEN BLST OFF OFF TIMER: Ø6=37:16:04 Ø7=37:16:12 << Ø8=ØØ:ØØ:ØØ >> Ø9=ØØ:ØØ:ØØ 1Ø=ØØ:ØØ:ØØ

Fig. 1. Typical video display. (Source: R. A. Gray, Inc.)

What Makes The Stars Shine?

Although the universe is not actually a sphere, it is convenient to think of it that way. To reproduce the stars in a planetarium sky via its star projector, the celestial sphere is approximated with an icosadodecahedron, a 32-sided solid made up of pentagons and hexagons.

R=>FA,LT1A,N,P2ØS,C,Ø

Each star which falls inside one of these areas is reproduced as a tiny opening in a transparent photographic slide. These holes vary in size according to the brightness of the actual stars. Each slide is lit by a central light source, which passes through the holes and focuses on the planetarium dome. A planetarium projector also incorporates individual projectors which reproduce the brightest stars in the sky, the sun, the moon and the five visible planets.

A number of firms make plane-(continued on p. 82)

(continued from p. 81)

tarium projectors which follow the same principle. But the Strasenburgh's projector is a very special one. It's a Zeiss model VI-a Rolls-Royce among planetarium projectors. Built by the West German firm of Carl Zeiss, Inc., it includes many sophisticated components. The most complex of these is the moon projector, which reproduces the phases of the moon and five kinds of lunar eclipses. It also features a sun projector capable of showing the sun's position in the sky for any day of the year, and ten kinds of solar eclipses.

The Star Theatre

With a star projector like the Zeiss, you'd expect the Strasenburgh's Star Theatre to be special too, and it is. It seats 240 people under its 65-foot diameter dome. The seats swivel and recline so you can look up at the dome without getting a stiff neck. You hear the narration from speakers built into the chairs, next to your ears, and music and sound effects from speakers set in the dome.

Narration, music and sound effects are sent to the theater from the control room, which contains the recorders and amplifiers. A projection gallery surrounding the theater contains about 300 projectors which are aimed at different parts of the planetarium sky. The number of projectors varies according to the number needed for the various shows running at any particular time.

The planetarium features several shows simultaneously. A 45-minute show which explores such things as phenomena of the universe or space exploration runs several times a day and in the evening. A 20-minute minishow about the seasonal sky also runs in the evening.

There are shows designed for family audiences, preschool shows which combine live action with star projections, and shows for school groups. In addition, there are special shows, like the 3-D light show which ran during the summer of 1981. And the planetarium staff is always working or shows that will replace current ones when their runs are through.



Photo 2. Chief technician Carl Dziedziech at Planetarium console. MC-10 is in background to the left. (Photo by Victor A. Costanzo, Jr.)

and fade up E4.' And those cues 'cause' the rocket to take off for Mars.''

Sequences are rarely right the first time. With the old system, perfecting a sequence was laborious, even if only one problem occurred, because the entire sequence would have to be rerecorded. But the MC-10, Hall explains, "allows us to edit the show, once it's been put in, much more easily. If just one thing needs to be done, like a light that fades down just a little too quickly, that part alone can be edited without affecting the other parts of the sequence that don't need changing."

When a show is being recorded, "the computer is scanning all the controls on the console. If anything is moved, it notes its position, and the next time the computer scans around, it will compare the second scan with the first scan; if anything has moved, it makes a note of where it is now. When it comes to the playback of those instructions, we tell the computer, 'Now play back the show.' The computer grabs hold of the controls and will actually operate them.''

To develop programs more conveniently, and to have a backup system, two computers were purchased. One computer "sits in the control room and gives the show," says Hall. The other "allows a person to sit in his office, use the typewriter keyboard attached to it and the two monitors, and program the show, just watching numbers appear and change on the screen, take the program on the floppy disk, put it in the computer in the theater, and adjust it there. So recording can be done off-line."

Planetarium Console

The planetarium console is located at the back or side of any planetarium theater. It is here that the operator sits to deliver a show, manipulating knobs and buttons to project images on the dome and operating the stan projector so that the appropriate stars will appear. If it's a live rather than recorded show, he delivers the lecture.

The Strasenburgh's console was originally built for use with the PDP-8, but when the decision was made to switch to the MC-10, the console was almost completely redesigned by a time-motion studies expert. Its appearance is quite similar, but there are also differences. For instance, many of the special effects control knobs were replaced with slider controls.

The MC-10 is also part of the console. The video displays show the operator what's going on with the special effects: which projectors are on at any given moment and what their brightness is. By watching the monitors, the operator can easily tell, for example, if a projector bulb is burnt out or if an effect is out of sequence. School shows are usually run manually with a live lecturer, and so the console was designed to allow operation without the MC-10.

Results

Audiences can't really detect the difference between a show produced by the old system and one produced by the MC-10. However, there *are* differences—and all to the good. Formerly, it took five people two full days to record a show. In contrast, the first shows produced using the MC-10 were recorded by four people in about five hours. As the staff becomes more accustomed to the system, they will be able to record shows in even less time.

In addition, more complicated effects can be achieved with the MC-10. It gives a greater degree of control, so that technicians can do precisely what they want with the effects. The current show, which opened in mid-October 1981, features effects that would have been impossible or very difficult to produce using the old system.

Future for the MC-10

Although the planetarium staff is pleased with the MC-10's performance, there's still a lot of work to be done. Right now, only the special ef-

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Photo 3. Close-up of MC-10. (Photo by Victor A. Costanzo, Jr.)

fects are controlled by the system.

However, work has begun on inter-

facing it with the planetarium's star

where we'll be changing over func-

tions one at a time, interfacing on a piecemeal basis, testing as we go

along," says Dziedziech, adding that

"not all the system gets automat-

ed-only those functions that are

used 80-90 percent of the time will be computerized." The projector will

"It will be a one-on-one situation

projector to control its operation.

be automated by the spring of 1982. Through this combination of technology and theater, the Strasenburgh Planetarium will strive to produce high-quality shows that will both teach and entertain.

References

The MC-10 Media Control System was developed by R. A. Gray, Inc., 9181 Chesapeake Drive, San Diego, CA 92123. 714-560-4162.

The internal computer was manufactured by Gnat Computers, Inc., Building 6, 7895 Convoy Court, San Diego, CA 92111. 714-560-0433.

For more information about the Strasenburgh Planetarium, contact: Donald S. Hall, Director, Strasenburgh Planetarium, Rochester Museum & Science Center, 657 East Ave., PO Box 1480, Rochester, NY 14063. 716-271-4320.



Photo 4. Planetarium's Star Theatre with Zeiss Star Projector in center. (Photo by William G. Frank.)

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Microcomputing, January 1982 85

Immune to the effects of poisonous substances, the Apple microcomputer is a perfect lab assistant to measure toxic health hazards.

The Toxic Apple

By Paul E. Gurba, Rolf A. Deininger and Carl F. Berger, Jr.

O REM AMINCO DATA LOGGING PROGRAM 10 GOTO 110 20 NS = 030 FOR I = 1 TO 300 40 NS = NS + 150 X = PEEK (-16384): IF X > 127 THEN 360 60 POKE AP1, CH: R(I) = PEEK (A)70 PRINT R(I) * .0483 80 FOR D = 1 TO DL: NEXT D 90 NEXT I 100 GOTO 360 110 HOME : PRINT " THIS PROGRAM STORES" 120 PRINT " DATA TAKEN FROM THE AMINCO" 130 PRINT " SPECTROPHOTOMETER" 140 FOR I = 1 TO 1500: NEXT I 150 HOME : A = -14592: AP1 = A + 1: DS = CHRS (4): CH = 2160 DIM R(300) 170 PRINT "WHAT IS THE SAMPLE NAME": INPUT SN\$ 180 PRINT "ENTER DATE": INPUT DT\$ 190 PRINT "NAME OF OPERATOR": INPUT NOS 200 PRINT "WHAT TIME BASE ARE YOU USING": INPUT T 210 IF T > = 5 AND T \leq = 50 THEN GOTO 230 220 PRINT "THE TIME BASE SHOULD BE BETWEEN 5 AND 50": GOTO 200 230 IF T = 5 THEN DL = T * 21.7 240 IF T = 50 THEN DL = T * 120250 IF T = 20 THEN DL = T * 28.6 260 IF T = 10 THEN DL = T * 24.7270 PRINT "ABSORBTION SCALE"; 280 INPUT AB 290 PRINT "DO YOU WANT TO SAVE THE DATA": INPUT SV\$ 300 FAC = .0483310 PRINT "TO START OR STOP TAKING DATA, PRESS ANY KEY" 320 X = PEEK (-16384)330 IF X < 127 THEN 320 340 POKE - 16368,0 350 GOTO 20 360 PRINT NS;" DATA POINTS TAKEN." 370 IF SV\$ = "Y" THEN 390 380 GOTO 460 390 PRINT D\$;"OPEN";SN\$ + "." + DT\$ 400 PRINT DS; "WRITE"; SNS + "." + DTS 410 PRINT SN\$: PRINT DT\$: PRINT NO\$: PRINT T: PRINT AB: PRINT NS 420 FOR I = 1 TO NS 430 PRINT R(I) 440 NEXT I 450 PRINT D\$;"CLOSE"; SN\$ + "." + DT\$ 460 END

Listing 1. Program used to collect and save data generated by the Aminco analyzer.

Toxicology is the science which deals with the effects of toxic substances (such as pesticides) on living organisms.

To determine the potential and actual health hazard, scientists often measure enzymatic reactions. Many of the pesticides are commonly evaluated for their ability to inhibit acetylcholinesterase (an enzyme), which is important in nervous system functions. The enzyme activity is monitored by the light absorption of a colored complex of DTNB (dithionitrobenzoic acid) and thiocholine, which is released during the course of the reaction. The change in light absorption is monitored continuously with time at 412 nm (nanometers), and the result is recorded on an x-y recorder.

The enzyme activity is then computed using the slope of the tracing along with other parameters such as cuvette volume, amount of protein and molar extinction coefficient. Materials which are inhibitory to acetylcholinesterase will show a lower activity than a control compound.

Although the computation of such enzyme activities is not difficult, the task can be time-consuming when a large number of compounds need to be screened. Additionally, the tracing obtained is not always linear, so there is a need for some way of obtaining a slope by methods less biased than eyeballing it. Once the raw data is collected, statistics and report gener-

Address correspondence to Paul E. Gurba, Rolf A. Deininger, and Carl F. Berger, Jr., Department of Environmental and Industrial Health, School of Public Health, The University of Michigan, Ann Arbor, Michigan 48109.



Photo 1. Aminco recording spectrophotometer with Apple II.

ation are often necessary. We decided therefore to explore the use of an Apple microcomputer for data logging and analysis.

The System

Photo 1 shows the instrument used in our studies: a recording spectrophotometer marketed by the American Instrument Company under the name Aminco. It consists of a photomultiplier, dual monochrometers and an x-y recorder. The signals to the recorder are available at an output port. A small operational amplifier system (shown with an Interactive Structures A/D converter in Photo 2) scales the output voltage of the Aminco by a factor of about 80. The circuit consists of an LM308 operational amplifier with an input resistance of 13k ohms and a 1 Megohm feedback resistor to produce the desired amplification. A .01 microfarad capacitor is used for noise and internal compensation. The sample is then processed by an eight-bit A/D converter.

Listing 1 shows the program used to collect the data from the instrument. Statements 110 through 340 acquire information on the sample, operator and analysis. Statements 230 through 260 set the delay times for various speeds of analysis. Statement 150 sets the proper slot addresses of the A/D converter, channel number and amplification factor. In response to pressing a key, the actual sampling loop begins at statement 20 and ends at statement 100. Up to 300 samples (which is much more than enough) can be taken. Statements 360 through 460 record all data and the other information on the disk.

O REM AMINCO DATA ANALYZER 10 ONERR GOTO 80 20 DIM R(400) INPUT "WHAT DATA FILE DO YOU WANT? ";FI\$ 30 40 D\$ = CHR\$ (4)50 PRINT D\$; "OPEN"; FIS: PRINT D\$; "READ"; FIS 60 INPUT SNS: INPUT DTS: INPUT NOS: INPUT T: INPUT AB: INPUT NS 70 FOR I = 1 TO NS: INPUT R(I): NEXT I PRINT D\$;"CLOSE";FI\$ 80 90 CALL - 936: HGR : HCOLOR= 3: SCALE= 3: ROT= 0 100 HPLOT 0,0 TO 279,0 TO 279,159 TO 0,159 TO 0,0 110 XINC = 279 / NS:YINC = 159 / 255 FOR I = 1 TO NS 120 130 X = XINC * I:Y = 159 - YINC * R(I)140 HPLOT X, Y: NEXT I 150 GET TS VTAB 21: PRINT "ADJUST PADDLE FOR LOW DATA POINT, PRESS A KEY" 160 170 GOSUB 440 180 IB = INT (X / 255 * NS)190 VTAB 21: PRINT "ADJUST PADDLE FOR HIGH DATA VALUE, PRESS ANY KEY" 200 GOSUB 480 210 IE = INT (X / 255 * NS) 220 TEXT 230 REM SLOPE 240 AD = .0445250 SX = 0:SY = 0:XY = 0:X2 = 0:N = 0260 FOR I = IB TO IE 270 X = I / 20280 PRINT "X= ";X,"Y= ";R(I) * AD 290 N = N + 1300 SX = SX + X:SY = SY + R(I) * AD310 XY = XY + X * R(I) * AD: X2 = X2 + X * X320 NEXT I 330 SL = (SX * SY - N * XY) / (SX * SX - N * X2)340 AS = AB * SL 350 PRINT "THE SLOPE IS ";SL: PRINT "YOU USED ";N;" DATA POINTS" 360 PRINT "INPUT MILLILITERS VOLUME": INPUT MV PRINT "INPUT THE MOLAR EXTINCTION COEFICIENT": INPUT E 370 380 PRINT "INPUT MILLIGRAMS PROTEIN": INPUT P 390 MO = (AB / 10) * (1 / E) * (MV / 1000)400 TI = T * (1 / 60)410 SP = SL * (MO / TI / P) 420 PRINT "THE SPECIFIC ACTIVITY IS ";SP 430 END 440 REM LINES 1010-1030 DEFINE CURSOR 450 FOR I = 0 TO 11: READ BYTE: POKE 768 + I, BYTE: NEXT I 460 DATA 1,0,4,0,63,9,9,63,18,36,36,0 470 POKE 232,0: POKE 233,3 480 X = PDL (0) * 1.0941:Y =PDL (1) * .6235 490 XDRAW 1 AT X,Y 500 FOR D = 1 TO 60: NEXT D 510 XDRAW 1 AT X,Y 520 U = PEEK (-16384): POKE - 16368,0530 IF U < 127 THEN 560 540 HPLOT X,0 TO X,159 550 RETURN 560 GOTO 480

Listing 2. Program used to analyze the data.

Listing 2 shows the program used

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Photo 2. Amplifier board with A/D converter.

for analyzing the data. Statements 30 through 80 read the data from the specified file. Statements 90 through 140 plot the data on the Apple highresolution screen. Using the paddles, the operator defines with a flashing cursor on the screen the range of data to be selected. Statements 450 through 470 define the cursor shape, and statements 480 through 550 draw the cursor on the screen and then delineate the range of the data selected. Statements 230 through 330 calculate the slope of a least squares line through the data. Statements 360 through 380 ask for further pertinent

information, and lines 390–410 finally calculate the desired result of specific activity.

Conclusion

Use of the Apple for measurement of enzyme activity saves us time in the laboratory. Besides collecting the raw data, we can easily do data reduction, statistics, and report generation of results which are stored in the Apple. Furthermore, we can transfer our data and results to a large mainframe computer for other types of analyses by attaching our modem to the Apple.

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(from page 59)

There are two fundamental problems with the study of these criteria in that article. First of all, much of the information is just plain false, and secondly, the most significant use of microcomputers in a large (or small) business application is not even considered.

Let's take a look at what I consider to be some of the misinformation. One expert points out that the typical 16-bit micro offers substantially less arithmetic precision that a 32- or 48-bit mini or supermini. "The runof-the-mill 16-bit micro might offer seven digits of accuracy, which would be fine for payroll, but wouldn't do in the stress analysis of an aircraft element," he says. "The 48-bit Harris 800 supermini (which sells in full-system configuration for about \$400,000) offers 20 decimal digits of precision, which can be a big help to an engineer."

Well, IBM's new Personal Computer offers 17-digit precision at a cost of under \$3000. That's quite a price difference for three decimal places. (Also the Atari 800 and the TRS-80 in double-precision mode offer 16-digit precision.)

"Typically, the user can address 256 bytes of memory in the typical 16-bit micro.... This limits the size of the programs that can be used and the amount of data the program can compute on at any one time."

In a strictly technical sense that's absolutely true. Minis can directly address millions of bytes of memory. But with a good disk operating system (especially using hard disks) and good I/O programming, a micro can handle the same applications and the same amount of data with some time difference and with a huge cost difference.

A mini manufacturer is quoted as saying, "One of the biggest differences between a micro and a mini is that today's micros have very limited capabilities.... Minis, on the other hand, are inherently more flexible and generally expandable in terms of software migration to bigger systems." Another key factor, he says, is that minis have a friendly operating system and the user can readily run multiple applications.

Granted, no single micro has the capabilities of a good mini—but in many applications a system of micros

can offer the same capabilities as a mini at a significant cost difference. Such micro systems can be just as flexible and expandable as a mini. And micros, just as minis, have friendly operating systems and can run multiple applications (see, for example, "Multiprocessor or Multitask" by Ken Barbier in the June 1981 *Microcomputing*, p. 34).

Another mini user quoted in Seaman's article says, "If I wanted to build a flight simulator for a Boeing 747, there is no micro or micro software that can handle the algorithms involved."

True. If I had to build a Boeing 747 flight simulator I too would want to use a mini (though, in fact, a system of micros could do a very respectable job), but how many businesses need a computer system with the capability to build a flight simulator for a Boeing 747? Also, you can buy, off the shelf,

A system of micros can offer the same capabilities as a mini at a significant cost difference.

flight simulators for smaller aircraft that run on small micros.

"General Automation's (Anaheim, CA) Nocode software system permits development of applications software in a much shorter time and with a smaller staff. Nocode runs on GA's Instacode computer system.... Nocode will not run on microcomputers."

Nocode sounds like a fine system that does the same job as software like Pearl II and The Last One, which run on a variety of microcomputers. By the way, the Nocode system sells for \$40,000 to \$150,000—that's two to three decimal places of difference from the cost of the micro software.

This is only an indication of the misinformation that the computer customer has to sift through. Whether it results from ignorance of what micros can do, or from a desire to sell more costly products for higher commissions, is an open question. Let the buyer beware. The second problem with Seaman's article is one of omission. There is no discussion of the use of microcomputers in a networked environment with either a mini or larger micro as a system host.

A network of microcomputers, which may or may not include a mini, can be the ideal solution for many applications. It is an alternative that renders most of the mini-vsmicro arguments moot. If networking is brought into the discussion, there is virtually no difference between mini systems and systems of micros except, possibly, price. The cost of a micro network in which the micros can also serve as terminal work stations for a mini would actually be more costly than a conventional mini/terminal system, but the differences in computing power, number of possible work stations and productivity could well be worth the difference for very large applications. (For more information on networking see Brandt and Bodner's article on distributed intelligence networking and the Oct. 1981 issue of BYTE.) But for most applications networking will present a significantly less costly alternative.

Networking also offers a different perspective on the questions of service and down time. The good mini manufacturers by and large have excellent service organizations. Many micro manufacturers are working to catch up. But use of a network greatly diminishes the significance of the service and down-time issues. Put quite simply, if one computer in a network is down the entire system is not brought to a grinding halt. The others can, in the worst case, still be used as stand-alone systems. Some power may be lost while service or replacement is carried out, but some production can continue. This makes a network a truly attractive alternative to either a mini or a micro single-computer system that is completely down when the one processor is down.

Minicomputers are excellent machines and indispensable for many jobs-it would be foolhardy to argue otherwise. But there are a significant number of applications where micros and networking are the answer. Micros will not completely replace minis, just as minis have not completely replaced mainframes. The propagation of misinformation about what different systems can and can't do has to be harmful to the entire computer industry in the long run (and it isn't helping faculties to convince their administrations of the need for a variety of equipment to best prepare their students for work in that industry.

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Radio Shack's gamble on the 6809 over the Z-80 pays off in a full-featured Color Computer at a low price.

Changing Chips In Midstream

By Michael A. Wolf

If you're like me, a dyed-in-thewool 68XX user, you've been wishing a big company would select a 68XX microprocessor for a low-cost, serious home computer. You've been gritting your teeth every time someone announces a new 6502 or Z-80based product.

Well, Radio Shack has done it their TRS-80 Color Computer has a 6809 microprocessor. Not only that, but look at these features: color graphics, RS-232, joystick and cassette interface, sound, 4K bytes of programmable random-access memory (RAM) expandable to 16K and an 8K byte read-only memory (ROM) BASIC. All for \$399. I bought it on the spot and took it home.

The Color Computer comes in a 13³/₄ by 14³/₄ by 3¹/₂ inch package weighing about five pounds. It has a 53-key keyboard, and displays 16 lines of 32 characters on a standard



Color Computer screen displays using Extended Color BASIC. (Photos by Harold Nelson.) 96 Microcomputing, January 1982 TV set. A slot in the right side accepts a plug-in ROM pack for prepackaged programs. If they don't suit you, you can write your own, using the excellent Microsoft BASIC provided.

Also included are a user's manual, a learner's guide to Color BASIC (as good or bad as the TRS-80 Level I book) and a quick reference card listing all the commands in the BASIC.

I hooked it up to a TV, using the supplied cable and antenna switch, and started running some sample programs. My first impressions were favorable. The keyboard takes some getting used to-it feels different from a regular keyboard-but it isn't bad. My old TV took some adjusting to get a good display, but when properly set up, it was quite satisfactory, giving vivid colors and nice black-ongreen characters. The standard graphics are coarse at low resolution (64 by 32 pixels), but finer resolution (up to 256 by 192 pixels) is possible with 16K machines and Extended BASIC.

The Package

About this time, curiosity got the better of me and I opened the case to see how they could sell so much for so little. What I found is an example of how large-scale integrated (LSI)

Address correspondence to Michael A. Wolf, Atomic City Electronics, Arizona Ave., Los Alamos, NM 87544. circuits have simplified computer design in the past few years. Not counting the power supply, the Color Computer has just 23 integrated circuits (ICs). By comparison, a TRS-80 Model I has about 80 ICs.

The Color Computer is based on three main chips. One is the processor itself, a 6809E (the E means external clock). Another is the 6847 video-display generator (VDG) chip. It contains nearly all the circuitry necessary to interface with the TV. The other is a 74LS783 synchronous-address multiplexer (SAM), which is a combination clock generator, dynamic-RAM controller and memory mapper.

In addition to these LSI chips, there are eight RAM chips (4027s for the 4K machine, 4116s for the 16K version); two 6821 parallel-interface adapter (PIA) chips, which handle most of the I/O; and a single 68364 ROM containing the 8K Color BASIC. Also included is a handful of support chips. The power supply occupies about onethird of the single circuit board, and the computer section of the board is enclosed in a metal shield to conform to the Federal Communication Commission's radio frequency interference standards.

There are four jacks on the rear for two joysticks, a cassette recorder and an RS-232 interface. The RS-232 is a 600 bits-per-second (bps) interface suitable for a printer. Radio Shack offers software and a modem to make your Color Computer useful as a ter-





Fig. 1. Block diagram.



minal for videotext. The data rate is easily changeable up to 2400 bps by a POKE statement from BASIC.

The cassette port is a 1500 bps interface to a standard cassette recorder, with motor control, and it operates similarly to a TRS-80 Model I. It is three times as fast (and it doesn't have the dependence on volume settings that the earlier model had). It tookonly three tries to get the proper setting on my recorder (not the recommended model), and I've had few problems since then that weren't caused by me.

The video interface is a compromise. To get 32-character lines requires all the video bandwidth you can get out of a color TV through the antenna input. To get more characters would require a color monitor, which costs about twice as much as the Color Computer. Also, the VDG's character generator doesn't put out lowercase letters. They compromise by allowing lowercase in strings. The computer displays them in reverse video.

However, when you send them out the RS-232 interface, they go out as lowercase and are printed as such on a printer. This is better than a TRS-80 Model I, which had no provision for lowercase at all. Several modifications were designed to overcome this in the Model I, and it would be possible to modify the Color Computer too, since the 6847 allows for an external character generator.

The connector for the external pro-

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gram packs is a 40-pin edge connector, which has more signals available than just those necessary for a ROM pack. Radio Shack did their homework on this. Not only are all the address, data and important control lines available; there are two decoded select lines for programs and I/O.

Also, a signal on one of the pins lets you disable any of the internal resources and substitute external I/O or memory anywhere in the address space. This allows such tricks as overlaying special routines on top of the BASIC, adding external RAM anywhere in memory or substituting an external I/O port for the one that's in the box. It looks like they planned for a future expansion bus.

Control may be easily transferred to your own machine-language routines upon interrupt by poking a jump instruction at the appropriate memory location.

How Does It All Tie Together?

First, look at the block diagram in Fig. 1. The microprocessor and VDG share the RAM, using a technique called interlacing. During part of a machine cycle, memory is accessed by the video generator, and during the rest of the cycle by the processor. This is made possible by the consistent machine cycle length of the 68XX family of processors. Each machine cycle has two memory cycles. The first provides the data for the video generator; the data is latched halfway through the cycle. The second access is for the processor. All this juggling is handled by the SAM.

The SAM has provisions that let you select either graphics mode, the base address of the display memory, the type of memory used (up to 96K is possible) and even select between two types of memory maps.

The joysticks use a six-bit digital-toanalog (D/A) converter and a comparator to generate numbers from 0-63proportional to the voltage on the joystick connectors. This could be used for a number of things in addition to joysticks. The voltage must be between 0 and +5 V.

VDG

Let's look further at the 6847 video display generator (VDG). The VDG has two alphanumeric, two semigraphics and eight full-graphics modes.

• A/G (alpha/graphics) switches from alpha/semigraphics mode to full-graphics mode.

• A/S (alpha/semigraphics) switches from alpha to one of the two semigraphics modes.

• INV causes the alpha display to be reversed (green-on-black or black-on-green).

•INT/EXT lets you use an external character generator in the alphanumeric mode, and switches between the two semigraphics modes.

•GM0, GM1 and GM2 are the fullgraphics control lines, and control the various graphics options, from 64 by 32 pixels (picture elements) to 256 by 192.

•CSS, color set select, switches sets of graphics colors and background color for the graphics modes with limited color selections.

The machine comes up in the alpha/ semigraphics mode, and is in semigraphics 4 when in semigraphics. Each character space is divided into four pixels, which can either be black or one of eight colors, but the whole character space must be the same color. A POKE 65314,16 switches to semigraphics 6, which limits you to two sets of four colors but gives you 64 by 48 pixels. These are more nearly square, and thus make graphics look better. However, Set, Reset and Point don't work in this mode. It also switches to external character mode, so alphanumerics are not usable.

The graphics modes are also available but require more memory than BASIC allows in a 4K machine, so are limited to a 16K box. They also re-

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BASIC

Color BASIC is an 8K Microsoft BA-SIC which compares closely with TRS-80 Level II BASIC, with special instructions for the color, sound and joystick functions, plus a few enhancements. Since Level II is 12K BASIC and Color BASIC is only 8K, there are also some functions not present in Color BASIC. But it shouldn't be too difficult to adapt programs from one system to the other.

Missing in Color BASIC are the AUTO, TRACE and EDIT functions, which makes entering and debugging programs more difficult. Only one cassette is supported, but the cassette control takes eight-character file names and includes the SKIPF instruction, which will skip files on a cassette and go to the end of the last file on the tape to add new files. CLOADM permits loading machine-language files with an offset, if desired.

SYSTEM is replaced by EXEC (a), which allows going to a machine-lan-

guage program at address (a). PRINT USING is missing, as are the DEF functions and the error traps. In the string functions only STRING\$ is missing in Color BASIC. The ninedigit floating-point arithmetic is a compromise between Level II's sixdigit single-precision and 16-digit double-precision arithmetic. Missing are all the instructions relating to defining variable types.

Most common statements are present in standard Color BASIC. Also available is Extended Color BASIC, which includes high-resolution graphics, complex sounds, extensive graphics commands, a real-time clock, program editing, user-defined functions and machine-language routines, plus most of the statements missing in Color BASIC. It costs \$99.

You can also buy several canned programs, including chess, checkers, music composing, personal finance, pinball, a diagnostic for ROM and software to convert the Color Computer to a terminal. Compatible hardware includes a printer, a telephone modem and joysticks.

RAM expansion to 16K bytes is easily done by replacing the 4K RAM chips with 4116s and changing two jumpers clearly labeled on the board. These are available from several sources for less than \$30.

RAM expansion beyond 16K is possible but not as easy. You can get 32K by adding another set of 4116 RAMs the problem is mostly mechanical. Obtaining 64K is possible with greater difficulty, as some software has to be changed. Kits to enable these expansions are available from Atomic City Electronics, 3195 Arizona Ave., Los Alamos, NM 87544.

Conclusions

The Color Computer is a low-cost, full-function computer suitable for most general-purpose computer use. Although limited by the restrictions of the display for some uses, it is well-suited for video games, and is easily expanded for more memory and I/O devices.

Radio Shack says they will soon offer a disk, and I know of accessories being designed at several companies. So it looks like a good start for a nice system. And the low price should mean a lot of sales, and soon, a lot of software.





A PET computer and a Pioneer video disk player combine to open up a wide range of applications in the educational field.

A Computer/Video Disk Combo That Really Works!

By Paul Anderson and Everett Q. Carr

People have been waiting for a practical video disk since they were first announced by Philips and RCA almost ten years ago. Film studios saw big bucks in marketing films that had already run in the movie

houses and on TV. Computer manutacturers hoped for a cheap \$10 crash-proof archival memory consisting of a billion and a quarter bytes of ROM. Some educators believed that the video disk was a critical element

Laser Illuminated/Optically Scanned

- 1. Pioneer of Japan
- 2. Pioneer Electronics of the US Laserdisk VP-1000
- 3. MCA Discovision (IBM and MCA)
- 4. Magnavox (No Remote Control)
- 5. Sony of Japan
- 6. Philips of Holland
- 7. Thompson CSF of France (Disks not compatible with those of 1–6)

Software: All except Magnavox Thompson CSF

Needle in a Groove

- 1. RCA
- 2. Zenith
- 3. CBS

Software: RCA

Grooveless with Needle

- 1. JVC of Japan
- 2. GE
- 3. Thorn/EMI of England

Software: JVC

Characteristics

All players have 1/2-hour and one-hour playing time per side, use a HeNe 1 MW gas laser, twochannel stereo (40 Hz to 20 Hz), have pushbutton controls, can operate single frame (freeze action), slow, fast forward and reverse and have picture frames numbered (1/2-hour only). The 1/2-hour versions operate at constant angular motion with disk rotating at 1800 rpm. The one-hour play time is obtained by changing disk rotation from 1800 rpm at the inside of the disk to 600 rpm at the outside of the disk, therefore operating on constant linear velocity for double play time.

Thompson CSF uses transparent information coating and system refocuses to read both disk sides without turnover. Software unknown.

The needle has a capacitor plate on its face forming a variable capacitor as a function of the disk groove variations with respect to the conductive vinyl base of the record. Needle is subject to wear and disk cannot be played continuously on a single frame. Disk grooves are $40 \times$ closer than on a hi-fi record.

Needle position is servo-controlled and tracks an information band next to the signal band. There is needle wear, and continuous play on a single track may not be feasible.

Table 1. Video disk systems comparison.

in the information technology revolution that would transform schools, maybe even eliminate them entirely.

To find out if this latter notion had any basis in fact, we built our own information transfer system. It consists of a 32K PET 2001 computer and an adapter that allows the PET to control the Pioneer video disk player (fig. 1). We have also developed software that controls the disk player. The result is that we have been able to construct an instructional program in which the student interacts with the computer and the disk on the player.

The first program is called Weather and uses an MCA-Discovision disk entitled ''What Makes it Rain?'' (#64-006). It costs just \$9.95. The description that follows should allow anyone interested to duplicate the system and verify our test results as an example of computer-aided video disk instruction.

The Computer/Video Disk System

The Pioneer video disk system is a superb piece of electronic and electromechanical wizardry. It uses a 1 MW HeNe gas laser to illuminate the video disk information tracks and has a 4002 internal microprocessor and a 4001 data processor for the logic and

Paul Anderson, an unpaid member of the planetarium staff, has been a student at Rensselaer Polytechnical Institute at Troy, NY. Everett Q. Carr is director of the Herkimer BOCES Planetarium (Herkimer, NY 13350) and responsible for its honors student programs and a microcomputer instructional program series that lends out computers. control of 25 switching functions that affect the player operations. The electromechanical system not only takes care of vertical motion in the disk rotating at 1800 rpm, but also follows individual TV picture tracks 1.6 micrometers (63 microinches) apart. A full half-hour of TV contains 54,000 TV pictures (30 frames per second × 60 seconds per minute × 30 minutes per half hour).

Pioneer manufactures video disk players for Discovision Associates and Magnavox. Almost 11,000 of the Discovision players have been sold to General Motors and its car dealers. In single quantity, this player costs \$3000. The big advantage is that a computer interface and connector are built-in. Another version packaged for Magnavox is supplied without an interface or remote control.

The Pioneer player with its remote control access has proved straightforward to adapt to computer control. The only exception is covered later. However, the Pioneer player is only one of four competitive video disk systems. All of them are incompatible, with differences much like those between cassette and magnetic disk recording systems of the leading manufacturers. For example, we cannot interchange tapes or disks among the three leading manufacturers. A comparison of the systems is given in Table 1. It should be obvious that the noncontact readout systems from Philips, Pioneer, Sony, Magnavox and MCA-Discovision, all of which have interchangeable disks, are superior for classroom and other instructional uses.

The chief reason for our preference of the noncontact systems is the wear-out mechanism. RCA uses a diamond stylus that contains a capacitor plate to sense signals in the record groove recorded on a 900 MHz carrier signal. The JVC scheme uses a sapphire stylus that has a capacitor plate but is servo-controlled to track signal information in a grooveless recording system. While there are no tests to confirm the data, the life of a diamond stylus is approximately 3000 hours, compared to 2000 hours for the sapphire stylus and 100,000 hours for the gas laser. The choice is therefore obvious.

But more than that, the MCA Discovision disks have each of the 30,000 + frames of "What Makes It Rain?" numbered, and they can be selected for display by remote control or with the built-in keyboard using a numeric keypad. The internal microprocessor is programmed to allow slow motion, fast scan, variablespeed scan and single-frame indexing, all in forward or reverse motion. It is also possible to select an individual frame by number for freezeframe viewing. There is no wear to the disk, because there is no disk contact for readout.



Fig. 1. A computer/video disk system.



Fig. 2. RU-1000 Pioneer remote control. The switches S1 to S29 are the functional push buttons on the remote control, as the figure shows. The IC-1 appears to be a custom chip to convert switch closures to a chain of 38 kHz pulses as an output. The crystal XI is a 455 kHz piezo-ceramic resonator, used generally in AM radio IF stages to replace IF transformers. The transistors Q1 and Q2 are a Darlington-connected line driver. The remote control can be used as a wired unit by connecting an audio connector cable to J1. The diodes D1 to D4, however, are LEDs operating at about 9400 A, well into the infrared range. D6 is a visible region LED.



Fig. 3. Pioneer player control signals. One data pulse string is ten cycles of an approximately 38 kHz clock. The coding for a logical 0 is 0.93 ms, a short period between data pulse strings. The logical 1 is twice the logical 0 period, 1.86 ms. The word string delivered to the player is ten bits long; therefore it consists of 11 actual data pulses. Of the ten bits used, five bits are a fixed code; the remaining five bits can form up to a maximum of 32 commands.

Video Disk Adapter

Pioneer's remote control unit (RU-1000) was a parts bin for a new adapter between the PET and the disk player. The RU-1000 contains both a wired connection to control the player and an infrared wireless link. A schematic of the RU-1000 is shown in Fig. 2. IC-1 is apparently a custom MOS chip which scans the keyboard of the RU-1000 and outputs a coded 38 kHz chain corresponding to up to 30 different switch closures. The pulse chain sequences are shown in Fig. 3.

In our adapter, the switch closures are simulated by the two CD 4051 circuits, IC-2 and IC-3, which accept the eight-bit inputs from the PET user port. The PTP-1 PET to PIONEER adapter schematic is shown in Fig. 4. The circuit board layout is given in



Fig. 4. PET to Pioneer adapter. In our adapter the IC-1, M50110P, was removed from the original remote control because the separate IC was not available from Pioneer. The infrared optical link was eliminated and only the wired link was used. The reason was the IR LEDs have peak current requirements of nearly 1 A, and the power we used was the PET (200 mA maximum) second cassette 5 V source. IC2 and 3 are multiplexers which, to the custom IC-1, look like switch closures which, on the input to the PET, are logical load for the user port VIA.

Fig. 5. Power for the adapter is taken from the second cassette source, which is rated for at least 200 mA; the adapter draws less than 50 mA.

The Video Disk Driver Program

The Video Disk Driver program was written to exercise a Pioneer disk player regardless of what disk is in place on the player. It allows, for example, the command to the player S1950 in response to the program query COMMAND STRING-->); the player searches for TV picture frame number 1950 and waits, with frame 1950 displayed continuously. An alternative command of S1950S would command the player to search for TV picture frame 1950 and run the player forward from that frame.

The Weather Instruction Program

For the Discovision disk "What Makes It Rain?" we have given an interactive program, Weather, which uses some 3600 frames or about two minutes of disk play time. The brief program contains four questions from lines 1010–1260, 2020–2041, 3010–3270 and 4010–4250. In each question, the student has three possible answers. The computer responds positively to a correct answer, lets the student try again if the response is wrong or reviews the video information before trying the question again.

The review of the video is controlled by the specification of the variable Q8, and a delay loop beginning at line 13000 determines how long the player is allowed to operate. A calculation in line 13030 accounts



Fig. 5. Full-size PTP-1 printed circuit board layout.

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BY CHAMELEON SOFTWARE

a cas e







BALROG

Meet the Chromatic Dragon face-to-flame in BALROG, the first in the MACES & MAGIC Series. This fantasy adventure features one of the largest data bases ever created for a microcomputer role playing game. Not only can you create completely individual characters, but you may also choose from a huge inventory of specific weapons and armor items. Freeform input combined with choices suggested by the program makes the discovery of the more secret areas of the dungeon a real challenge!

STONE OF SISYPHUS

The STONE OF SISYPHUS carries you to a 'thinking man's'' dungeon, wherein you must apply your skills to effect survival and to realize your goals. This is an unfriendly subterranean world populated by hideous monsters, and dripping with fabulous treasures — the latter enticing you to face the former! Your survival hinges upon hard intellect, as opposed to the wispy uncertainty of chance, so be prepared to draw deeply from your intellectual reservoir! And — the responsiveness of the program to the individual qualities of your character make this grand adventure frustratingly enjoyable for hundreds of hours before all of its elusive secrets can be unlocked!

MORTON'S FORK

The third entry in the Maces & Magic series, MORTON'S FORK transports you into a world bereft of natural laws — a realm populated by magical beings and strange creatures. The scenario is set within the confines of an ancient wizard's fortress. Through your keyboard input, you equip your warrior with armor, weapons, and gold, as well as with desirable personal attributes. Only then will you be able to face the dangers of MORTON'S FORK! Features include multiple skill levels and a comprehensive manual describing the colorful Maces & Magic world.

MACES & MAGIC are fantasy adventures involving you and your computer. Armed only with your wits, a microcomputer, and the software provided, you can become the hero or the meal your destiny dictates. You create a character, equip him (or her) with suitable weapons and armor, and enter the dungeon in search of fame and fortune. Neither is particularly easy to obtain.

If you are successful in avoiding or conquering the various monsters, traps, enchantments and illusions set by our nefarious dungeonmasters, you may escape with riches and glory. Your name and deeds will be recorded for posterity in the records of the dungeon. More importantly, you'll be alive. You may then use the same character in his more experienced and wealthy form when you enter dungeons on later occasions.

In each dungeon there are random events which occur, but in the vast majority of cases the skill of the player in making correct choices determine the outcome of the game. The majority of instructions are furnished within the program in the form of appropriate prompts.

There are many ways to meet an untimely demise in the dungeon. Monsters and such are just one of the lines of defense between you and the treasures stored there. Various traps await the unwary (and the wary too). Some are lethal, while others are merely unpleasant or inconvenient. It pays to be suspicious. Beware of orcs bearing gifts.

The object of the whole exercise is not just to fight the monsters and collect treasure. You have to get out alive to enjoy it. In every dungeon there is at least one exit. It is possible to escape from each and every dungeon with a whole skin. We state that fact here because players often believe this not to be true. We really aren't out to get you. Not really....

Once you successfully exit from the dungeon you will have an opportunity to save your character for further adventures in this and other dungeons. Your treasures will be converted to their gold equivalent and your weapons and armor stored in bat guano. When you start another adventure, you may call up your experienced character for another trip. The only limitation is that once a character is killed, he may re-incarnated three times; after that, he is gone forever. No second chances, no tears, no breast beating. Gone, Kaput, Finished. You will have the distinction of adding to the dungeon statistics, however. A sort of second hand immortality in recognition of a nice try. No glory or cash though. CHARCE1

	Maces & Ma By Chameleol	agic Seri	es	ST Worl	ONE OF	drive systems	\$29.95
	BALF	ROG		TRS-80 48K DIS	SK Model 3 SK	012-0100 052-0100	\$29.95 \$34.95
AND	requires 2 dr TRS-80 32K DISK Model 1 TRS-80 48K DISK Model 3	ive system 012-0099 012-0099	\$29.95 \$29.95	APPLE 2 PLUS with Appl WORKS 0	esoft in ROM	48K	\$29.95
	THOUGH DISK MOUGHS	M	ORTON	'S FORK		042 0100	
		Works	s on 1 or 2	drive systems	s		
and the second second		TRS-80 32K DISI	K Model 1	012-0113	\$29.95		
		TRS-80 48K DISH	K Model 3	012-0143	\$29.95		
	•	APPLE 2 PLUS with Apples	or APPLE 2 soft in ROM	- 48K			
		WORKSON	3.2 OR 3.3	042-0113	\$29.95		

for search time lags that may be a function of our particular Pioneer player dynamics. We would have preferred to be able to advance the disk to a specific frame. The calculation is necessary because there is no data line available from the player which indicates the frame number. Undoubtedly, it is available internally at the microprocessor but it would be necessary to open the player and modify the circuits. The system shown seems accurate within a few frames over short time intervals. Moreover, it can be made precise with a small amount of effort.

The program uses about 15,380 bytes of RAM. It could be compressed into fewer bytes with a little effort.

We have used simple graphics that often hint to the children the correct answer. Our third-grade visitors to the planetarium seem pleased with what they see and hear. When the correct answer is given, it is reinforced visually with a printed text of the words of the disk monologue. A child will receive several reviews of new words. This is especially helpful when third-grade children are exposed for the first time to terms like



precipitation, rendezvous, evaporation and reservoirs.

Authoring a Disk Program

Authoring a disk program means a systematic approach to developing an instructional program. This, of course, involves both the video disk and the computer program. Of necessity, we did not create an original video disk. That cost was well beyond our own resources. Our project therefore involved construction of a useful computer instruction around an available disk.

Within that constraint, the major task was to use the disk player as an audiovisual editing machine with the weather disk. Both frame numbers and the monologue were recorded manually, using the disk player's regular remote control. This is a working script from which it is possible to isolate factual information, the individual concepts and principles involved. This is an iterative process. It took a half-dozen or more passes and uncounted isolated playbacks. However, we became more proficient with time.

The method we used in the computer program development was to design two program modules. The first was the Quiz Module, in a multiple choice format. The second was the Disk Driver module. The combination of the two modules is a practical approach to an authoring system using available low-cost disks and the common language resident in the popular microcomputers, BASIC.

The PET, with its user port so accessible and easy to program, is a powerful tool in this enterprise. For those not interested in a construction project, ADN Co. (62 Benedict Ave., Ilion, NY 13351) has an adapter that works with the PET. It can also be supplied for the Commodore VIC-20.

Test Results

Two groups totalling 137 thirdgrade students were exposed to the first two minutes of the video disk "What Makes It Rain?" Sixty-seven percent of the first class of 74 students and 72 percent of the second class of 73 answered test questions correctly. These children were attending our regular planetarium laboratory class about weather. The results were 12 percent and 14 percent higher than with a conventional teaching session consisting of a chalkboard and lecture.

The combination of computer and video disk appears to be superior to conventional methods. The work continues. We hope interested teachers will attempt to duplicate the experiments.

1 09=50
2 REM VIDEO DISK DRIVER WRITTEN
3 REM 10/30/80 BY PAUL D. ANDERSON
5 REM COMMAND SUMMARY AT LINES
6 REM 13000-14000
10 DIM TX(15)
20 005UB 12000
30 INPUT "COMMAND STRING>":CS\$
35 PRINT
40 605118 10000
50 PDINT PDINT
60 COTO 20
14000 FOR 01-1 TO LEN(CS#)
19919 02-000/MID#/CC# 01 111:000UD 11999
10010 Q2-HSC(HID*(CS*)Q1,17) 00305 11000
10020 NEXT
10030 RETURN
11000 IF 02257 UK 02(48 THEN 11020
11010 Q3=1X(Q2-47)-0010 11060
11020 IF 02272 UK 02070 THEN 11040
11030 Q3=TX(Q2-59):GOTO 11060
11040 W3=0
11045 IF 02=80 THEN 03=1X(14)
11050 IF Q2=83 THEN Q3=TX(15)
11060 PRINTCHR\$(Q2); POKE 59471,Q3
11070 FOR J=1 TO D9 : NEXT
11080 POKE 59471,0
11090 FOR J=1 TO D9 : NEXT
11100 RETURN
12010 DATA 86,22,38,70,54,82,18,34,66
12020 DATA 50,81,52,69,53,83
12020 FOR J=1 TO 15:READ TX(J) : NEXT
12030 POKE 59459,255
12040 RETURN
13000 REM **** COMMAND SUMMARY ***
13010 REM NUMBERS "0"-"9"
13020 REM SEARCH "S"
13030 REM PAUSE "P"
13040 REM PLAY "G" (GO)
13050 REM FRAME "F"
13060 REM STILL "H" (HALT)

Video Disk Driver program.

More

Weather interactive video disk/computer program.

10 GOSUB 12000 : REM INITIALIZE VIDEO
20 REM DISK STUFF
85 PRINT""":POKE 59468,12
90 PRINT: PRINT: PRINT: PRINT: PRINT
1000 PRINT""":POKE 59468,12
1010 PRINT" OOT ON ONO
1020 PRINT" //
1930 PRINT" () () ()
TAAA PRINT UJJJJ COUCEOU
1050 PPINT" (())) (), (())
1200 PRINT WHAT ARE CLOUDS?" PRINT
1210 PRINT (1) CLOUDS OPE MORE OF THE PAPTICLES" PRINT
1216 PRIMI (1) CLOBS THE TIDE OF THE PRIMITELES TRAIT
1220 PRINT (2) ODE RESERVOIRS OF
1230 PRINT HIRBURNE WHIER PRINT
1240 PRINT (3) CLODES HE DOST PHETICLES
1250 PRINT" HELD OP BY COLD HIR HND WIND." PRINT
1260 PRINT TYPE 1, 2 OR 3;
1270 INPUT AA
1280 IFAA=2 GOTO 1700
1290 PRINT "D": PRINT: PRINT: PRINT: POKE 59468, 14
1300 PRINT"SORRY, THAT IS INCORRECT" : PRINT

106 Microcomputing, January 1982



Now with added words! *	
Now with added words. *	
	Listing continued.
CI CITTDIP MAIITU	4020 PRINT" SUN N
	4030 PRINT"
	4040 PRINT"
	4050 PRINT
	4060 PRINT"\\\\\\ 1 1
	4070 PRINT" ^ ^ ^
	4080 PRINT"
and the second	4100 PRINT"
ELF II VERSION	4200 PRINT" WHERE DOE
	4210 PRINT" CLOUDS CO
for S100, Elf II, Apple From COO 05 kit	4230 PRINT" (2)WATER EVAP
TRS-80, Level II*	4240 PRINT" (3)WATER VAPO
Now - teach your computer to talk.	4250 PRINT" TYPE 1,2
increasing interaction between you	4260 INPUT DR 4270 IE DO-2 THEN 4700
increasing interaction between you	4300 PRINT""" PRINT PRINT
and your machine.	4310 PRINT" OH DEAR, THATS
That's right: the ELECTRIC MOUTH actually lets your computer talk! Installed	4320 PRINT" TYPE YES OR N 4330 INPUT DB*
ess, industrial and commercial applications, and in games, special projects.	4340 IF DB\$="Y" THEN 4000
& D. education, security devices — there s no end to the ELECTRIC MOUTH s isefulness. Look at these features:	4500 PRINT WOULD YOU LIKE
Supplied with 143 letters/words/phonemes/numbers. capable of producing	4510 PRINT" TYPE YES UR N 4520 INPUT DC#
Expandable on-board up to thousands of words and phrases with additional	4530 IF DC\$="N" THEN 50000
speech ROMs (see new speech ROM described below).	4540 CS\$="S2780S":GOSUB100
computers.	4550 CS\$="G":GOSUB10000
Get ELECTRIC MOUTH to talk with either Basic or machine language (very easy to use, complete instructions with examples included).	4560 Q8=580:GOSUB13000
Uses National Semiconductor's "Digitalker."	4700 PRINT "" POKE59468.14
speakers.	4710 PRINT "GREAT! YOU'VE I
Installs in just minutes.	4711 CS\$="S2780S":GOSUB100
rinciple of Operation: The ELECTRIC MOUTH stores the digital equivalents	4712 CS\$="6":GOSUB10000 4714 08=605:GOSUB12000
imply are called for by your program and then synthesized into speech. The	4820 PRINT FROM THE OCEANS
LECTRIC MOUTH system requires none of your valuable memory space ex-	4830 PRINT"CONTINUOUSLY RE
orts (user selectable) are used.	4840 FOR I=0 TO 3000:NEXT:
SPOKEN MATERIAL INCLUDED (Vox I)	4850 PRINT" SUMETIMES
wo nineteen cancel down is of second du	4870 PRINT" OBSERVE THE I
three twenty case equal it off set e v	4875 PRINT" IN DETAIL." F
five forty 400hertz tone feet left out speed g x	4890 PRINT"TIME TO MOVE A
seven sixty 20ms silence fuel lesser parenthes's start i z	4900 FORX=0T05000:NEXT:GOT
tight seventy 40ms silence gallon limit percent stop j nine eighty 80ms silence go low please than k	10000 REM PARSING ROUTINE
en ninety 160ms silence gram lower plus the l	10010 FOR Q1=1 TO LEN(CS\$)
welve thousand centi greater meter pound try n	10020 Q2=HSU(HID\$(US\$,Q1,1 10030 NEXT
ourteen zero comma high milli rate volt p	10040 RETURN
ifteen again control higher minus re weight q ixteen ampere danger hour minute ready a r	11000 IF Q2>57 OR Q2<48 TH
seventeen and degree in near right b s	11010 Q3=TX(Q2-47):GOT0110
ADDITIONAL VOCABULARY NOW AVAILABLE (VOX II)	11030 Q3=TX(Q2-59):GOT0110
abort complete fifth light put station	11040 Q3=0
adjust copy first lock range system	11045 IF Q2=80 THEN Q3=TXC
alert crease fourth more receive test	11050 IF 02=83 THEN 03=1XC
all "de" forward move record "th"	11070 FOR J=1 TO Q9 : NEXT
assistance dial gas no red third	11080 POKE 59471,0
attention door, get normal repair this blue east going north repeat turn	11090 FOR J=1 TO Q9 : NEXT
brake "ed" green not replace under	12000 DIM TX(15)
buy enter heat open safe waiting	12010 DATA 86,22,38,70,54,
called "er" help or secure was	12020 DATA 50,81,52,69,53,
caution "eth" hurts pass select water celsius evacuate hold per send west	12030 FOR J=1 TO 15 : REHI
centigrade exit hot power service wind	12040 00-50
incuit failure income side window	12040 Q9=50 12050 POKE 59459,255
nature incorrect pressure slow yellow	12040 Q9=50 12050 POKE 59459,255 12060 RETURN
igar fahrenheit intruder process slower yes lose fast key pull smoke zone	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 05 EDEMES LICT
igar fahrenheit intruder process slowe yes lose fast key pull smoke zone old faster level push south	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRMMES, PICTU 13020 04=(08#2)+TI
gar fahrenheit intuder prossure slow yellow ose fast key pull smoke zone old faster level push south	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRAMES. PICTU 13020 04=(08#2)+TI 13030 IF 0457I THEN 04=04+
igar fahrenheit intuder pressure slow yellow lose fast key pull smoke zone faster level push south	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRMMES, PICTU 13020 Q4=(Q8#2)+TI 13030 IF Q4>TI THEN Q4=Q4+ 13040 C\$#="H":GOSUB10000;F
igar fahrnheit inturder pressure slow yellow lose fast key pull snoke zone faster level push south zone Registered Trademarks	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRMES. PICTL 13020 Q4=(Q8#2)+TI 13030 IF Q4)TI THEN Q4=Q44 13040 C54="H":GOSUB10000"F 13060 REM STILL "H" (HAL
Registered Trademarks	12840 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRAMES. PICTU 13020 04-(03%2)+TI 13030 IF 04>TI THEN 04=04+ 13040 CS\$="H":GOSUB10000:F 13060 REM STILL "H" (HAL 19000 D9=50 19010 DMTX((5))
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Registered Trademarks Continental U.S.A. Credit Card Buyers Outside Connecticut TO ORDER Call Toll Free: 800-243-7428	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM RATRANT ROUTINE TO 13010 REM RATRANES, PICTU 13020 Q4=(Q3#2)+TI 13030 IF Q4)TI THEN Q4=Q4- 13040 CS#="H":GOSUB10000:F 13060 REM STILL "H" (HAL 19060 D9=50 19010 DIMTX(15) 19020 GOSUB22000 19030 INPUT"COMMAND STRING
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Registered Trademarks Continental U.S.A. Credit Card Buyers Outside Connecticut TO ORDER Call Toll Free: 800-243-7428 To Order From Connecticut, or For Technical Assistance, call (203) 354-9375 NETRONICS R&D LTD.	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRMES, PICTL 13020 04=(08#2)+TI 13030 IF 04>TI THEN 04=04+ 13040 CS\$="H":GOSUB10000:F 13060 REM STILL "H" (HAL 13060 REM STILL "H" (HAL 19000 D9=50 19010 DIMTX(15) 19020 GOSUB22000 19035 PRINT 19040 GOSUB22000 19035 PRINT 19040 GOSUB20000 19050 PRINT:RINT 19060 GOT019030 20010 02=85C(MID\$(CS\$,01,1
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Gar fast moorrect key pressure pull slow yes Good fast key pull sinke zone Registered Trademarks Continental U.S.A. Credit Card Buyers Outside Connecticut TO ORDER Call Toll Free: 800-243-7428 To Order From Connecticut, or For Technical Assistance, call (203) 354-9375 NETRONICS R&D LITD. Stor Connecticut, or For Technical Assistance, call (203) 354-9375 Please send the items checked below: Stor "Electric Mouth" kit w/Vox1 \$ 99.95 Stor "Electric Mouth" kit w/Vox1	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRMES, PICT 13020 04=(08#2)+TI 13030 IF 04>TI THEN 04=04+ 13040 CS\$="H":GOUBI0000:F 13060 REM STILL "H" (HAL 19000 D9=50 19010 DIMTX(15) 19020 GOSUB22000 19035 PRINT 19040 GOSUB20000 19050 PRINT:RINT 19040 GOSUB20000 19050 PRINT:RINT 19040 GOSUB20000 19050 PRINT:RINT 19060 GOT019030 20000 FOR 01=1T0LEN(CS\$) 20010 Q2=ASC(MID\$(CS\$,01,1 20020 NEXT 20030 RETURN 21000 IF 02>57 OR 02<48 TH 21000 IF 02>57 OR 02<48 TH 21020 IF 02>72 OR 02<70 TH 21030 Q3=TX(02=59):GOT0210 21020 JF 02>59:GOT0210
Gar fast moorrect key pressure pull slow yes Slow guid sinke zone Registered Trademarks Continental U.S.A. Credit Card Buyers Outside Connecticut TO ORDER Call Toll Free: 800-243-7428 To Order From Connecticut, or For Technical Assistance, call (203) 354-9375 NETRONICS R&D LTD. 333 Litchfield Road, New Milford, CT 06776 Dept K 8 Slow "Electric Mouth" kit w/Vox1 \$ 99.95 Ston "Electric Mouth" kit w/Vox1 \$ 99.95 Apple "Electric Mouth" kit w/Vox1 \$ 119.95	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM Q8 FRMES, PICTL 13020 Q4=(Q3#2)+TI 13030 DF Q45TI THEN Q4=Q4+ 13040 CS\$="H":GOSUB10000 R 13060 REM STILL "H" (HAL 13060 REM STILL "H" (HAL 13060 GSUB22000 19030 INPUT"COMMAND STRING 19030 SPRINT 19040 GSUB22000 19030 PRINT:PRINT 19040 GSUB22000 19050 PRINT:PRINT 19040 GSUB22000 19050 PRINT:PRINT 19040 GSUB22000 19050 PRINT:PRINT 20000 FOR Q1=1TOLEN(CS\$) 20010 Q2=RSC(MID\$(CS\$,Q1,1) 20020 NEXT 20030 RETURN 21000 IF Q2:S7 OR Q2<48 TH 21000 IF Q2:S7 OR Q2<59 (IF Q2:S7 OR Q2<50 TH 21040 Q3=TH 21040 Q3=TH 21040 Q3=TH 21040 Q3=TH 21040 IF Q2:S7 OF Q2:Q2 21040 IF Q2:Q2 21040 IF Q2:Q2 21040 IF Q2:Q2 21040 IF Q2:Q2 21040 IF Q2:Q2 21040 IF Q2 21040 IF
Gar Continental U.S.A. Credit Card Buyers Outside Connecticut *Registered Trademarks Continental U.S.A. Credit Card Buyers Outside Connecticut TO ORDER Call Toll Free: 800-243-7428 To Order From Connecticut, or For Technical Assistance, call (203) 354-9375 NETRONICS R&D LTDD. .333 Llichfield Road, New Millord, CT 06776 Please send the items checked below: □ 500 "Electric Mouth" kit w/Vox1 \$ 99.95 EIFII "Electric Mouth" kit w/Vox1 \$ 99.95 Apple "Electric Mouth" kit w/Vox1 \$ 99.95 Apple "Electric Mouth" kit w/Vox1 \$ 99.95 OLOW Cascond Set) \$ 39.95	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRMES, PICTL 13020 04=(03#2)+TI 13030 IF 04>TI THEN 04=044 13040 C\$#="H":GOSUB10000:F 13060 REM STILL "H" (HAL 13040 D9=50 19010 DIMTX(15) 19020 GOSUB22000 19030 INPUT"COMMAND STRING 19030 INPUT"COMMAND STRING 19030 INPUT"COMMAND STRING 19040 GOSUB20000 19050 PRINT:PRINT 19040 GOSUB20000 19050 PRINT:PRINT 19040 GOSUB20000 19050 PRINT:PRINT 19040 GOSUB20000 19050 PRINT:PCINT 20020 NEXT 20030 RETURN 20030 RETURN 20030 RETURN 21000 IF 02>57 OR 022(48 TH 21010 03=TX(02-47):GOTO 21 21020 IF 02>59 :GOT02 21020 IF 02>59 :GOT02 21040 03=7(02-59):GOT02 ST 21040 03=7(02-59):GOT02 ST 21040 IF 02>70 R 02<70 TH 21030 IF 02>70 R 02<70 TH 21030 IF 02>70 R 02<70 TH 21030 IF 02=80 THEN 03=TX(12) 21050 IF02=83 THEN 03=TX(12) 21050
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Gar fast moorrect key pressure pull slow symmetry Good fast herebreit key pull slow symmetry yes Registered Trademarks Continental U.S.A. Credit Card Buyers Outside Connecticut TO ORDER Call Toll Free: 800-243-7428 To Order From Connecticut, or For Technical Assistance, call (203) 354-9375 NETRONICS R&D LIDD. Satury Symmetry Please send the items checked below: Sympt K8 Sing "Electric Mouth" kit w/Vox1 Sing "Electric Mouth" kit w/Vox1 Apple "Electric Mouth" kit w/Vox1 Sing set on wird tested units instead of kits. VOX1 I postage & insurance Sing and units instead of kits. VOX II postage & insurance Sing and units instead of kits. VOX II postage & insurance	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM MAIT ROUTINE TO 13010 REM 08 FRMMES, FICTU 13020 04=(03#2)+TI 13030 IF 04711 THEN 04=04+ 13040 CS4="H":GOSUB10000:F 13040 CS4="H":GOSUB10000:F 13040 CS4="H":GOSUB10000:F 13040 GOSUB22000 19030 INPUT"COMMAND STRING 19030 INPUT"COMMAND STRING 19035 PRINT 19040 GOSUB22000 19055 PRINT 19040 GOSUB22000 19050 PRINT:PRINT 19040 GOSUB20000 19050 PRINT:PRINT 20000 FOR 01=1TOLEN(CS\$) 20000 FOR 01=1TOLEN(CS\$) 20000 RETURN 20030 RETURN 21030 IF 02757 OR 02<48 TH 21030 03=TX(02=47):GOTO 21 21020 IF 02757 OR 02<48 TH 21030 03=TX(02=59):GOTO216 21045 IF 02=83 THEN 03=TX(1) 21050 IF 02=83 THEN 03=TX(1) 21050 IF 02=83 THEN 03=TX(1) 21050 PRINT CHR8(02):POKE 21070 FORJ=1 TO D9:NEXT 21070 FORJ=1 TO D9:NEXT
Bar Insure fast Incorrect key pressure pull slow yellow Shee fast key pull slow yes Registered Trademarks Continental U.S.A. Credit Card Buyers Outside Connecticut TO ORDER Call Toll Free: 800-243-7428 To Order From Connecticut, or For Technical Assistance, call (203) 354-9375 NETRONICS R&D LITD. 333 Lichfield Road, New Milford, CT 06776 Dept K8 Shoo "Electric Mouth" kit w/Vox1 \$ 99.55 Shoo "Electric Mouth" kit w/Vox1 \$ 119.35 TR-Sed Level II "Electric Mouth" kit w/Vox1 \$ 119.35 OxXII (Second Word Set) \$ 39.55 Add \$20.00 for wired tested units instead of kits. VOX II postage & insurancer \$ 100. all others in stread of kits. VOX II postage & insurancer \$ 100. all others in stread of kits. VOX II postage & insurancer \$ 100. all others in the ad insurancer Total Enclosed \$	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRMES, PICTL 13020 04=(03#2)+TI 13030 IF 045TI THEN 04=044 13040 CS\$="H":GOSUB10000 R 13060 REM STILL "H" (HAL 13040 CS\$="H":GOSUB22000 19030 INPUT"COMMAND STRING 19030 INPUT"COMMAND STRING 19030 RENT 19040 GOSUB22000 19030 RENT 19040 GOSUB22000 19050 PRINT:PRINT 19040 GOSUB22000 19050 PRINT:PRINT 19040 GOSUB22000 19050 PRINT:PRINT 20000 FOR 01=1TOLEN(CS\$) 20010 GOT019030 20010 G2=85C(MID\$(CS\$,01,1 20020 NEXT 20020 NEXT 20020 RETURN 21000 IF 0257 OR 02<48 TH 21000 IF 0257 OR 02<48 TH 21090 FOR 2157 OR 02<48 TH 21090 FOR 2157 OR 02<48 TH 21090 FOR 2157 OR 02<48 TH 21090 PF 0257 OR 02 21040 Q3=0 21045 IF 02=80 THEN 03=TX(1 21050 I
Bergistered Trademarks Continental U.S.A. Credit Card Buyers Outside Connecticut TO ORDER Call Toll Free: 800-243-7428 To Order From Connecticut, or For Technical Assistance, call (203) 354-9375 NETRONICS R&D LTD. 333 Litchfield Road, New Milford, CT 06776 Dept K 8 Please send the items checked below: 5100 "Electric Mouth" kit w/Vox1 \$ 99.55 OND "Electric Mouth" kit w/Vox1 \$ 99.55 OVXII (Second Word Set) Add Saloo for wired tested units instead of kits. VOX II postage & insurance Cotal Enclosed \$ Personal Check	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRMES, PICTL 13020 04=(03#2)+TI 13030 IF 045TI THEN 04=044 13040 CS\$="H":GOSUB10000 R 13060 REM STILL "H" (HAL 13060 REM STILL "H" (HAL 13060 REM STILL "H" (HAL 13060 REM STILL "H" (HAL 13060 GOSUB22000 19030 INPUT"COMMAND STRING 19030 INPUT"COMMAND STRING 19030 INPUT"COMMAND STRING 19030 FRINT:PRINT 19040 GOSUB22000 19050 PRINT:PRINT 19040 GOSUB22000 19050 PRINT:PRINT 19040 GOSUB22000 19050 PRINT:PCINT 20000 FOR Q1=1TOLEN(CS\$) 20010 Q2=R5C(MID\$(CS\$,01,1 20020 HEXT 20030 RETURN 21000 IF Q257 OR 02<48 TH 21080 FG Q2=75 OR 02<48 TH 21080 IF Q257 OR 02<48 TH 21080 IF Q257 OR 02<48 TH 21080 IF Q257 OR 02<48 TH 21080 FG PRINT CHR*(Q2):POID210 21045 IFQ2=80 THEN 03=TX(1) 21040 Q3=TX(02-59):GOTD212 21040 Q3=TX(02-59):GOTD212 21040 Q3=TX(02-59):GOTD212 21040 Q3=TX(02-59):GOTD212 21040 Q3=TX(02-59):GOTD212 21040 Q3=TX(02-59):GOTD212 21040 Q3=TX(02-59):GOTD212 21040 Q3=TX(02-59):GOTD212 21040 PICT D19:NEXT 21080 POKE59471.0 21090 FORJ=1 TO 19:NEXT 21090 RETURN 21090 RETURN 21090 RETURN 20090 PIGTB 86: 20: 29: 29: 29: 70 54
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Gar fast moorrect key pressure pull slow yes Book sanke zone Registered Trademarks Continental U.S.A. Credit Card Buyers Outside Connecticut TO ORDER Call Toll Free: 800-243-7428 To Order From Connecticut, or For Technical Assistance, call (203) 354-9375 Dept K8 Please send the items checked below: Sino "Electric Mouth" kit w/Vox1 Sino "Electric Mouth" kit w/Vox1 Sino "Stectric Mouth" kit w/Vox1 Sino "Stectric Mouth" kit w/Vox1 Sino "Stectric Mouth" kit w/Vox1 Sino "Electric Mouth" kit w/Vox1 Sino "Sino "Sino postage and insurance Sino al check	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRMES, FICTL 13020 04=(03#2)+TI 13030 IF 04711 THEN 04=04+ 13040 CS4="H":GOSUB10000:F 13040 CS4="H":GOSUB10000:F 13040 CS4="H":GOSUB10000:F 13040 GOSUB22000 19030 INPUT"COMMAND STRING 19030 INPUT"COMMAND STRING 19035 PRINT 19040 GOSUB22000 19050 PRINT:PRINT 19040 GOSUB22000 19050 PRINT:PRINT 19040 GOSUB20000 19050 PRINT:PRINT 20000 FOR 01=1TOLEN(CS\$) 20000 FOR 01=1TOLEN(CS\$) 20000 GOT019030 20010 02=RSC(MID*(CS*,01.1 20020 NEXT 20030 RETURN 21000 IF 02757 OR 02<48 TH 21000 IF 02757 OR 02<48 TH 21000 IF 02757 OR 02<48 TH 21030 03=TX(02=59):GOT0210 21045 IF02=83 THEN 03=TX(1) 21050 IF02=80 THEN 03=TX(2) 21050 IF02=90 THEN 03=TX(2) 21050 IF02=90 T
Gar fast moorrect key pressure pull slow slower yes Bogo distance fast pull slow yes Registered Trademarks Continental U.S.A. Credit Card Buyers Outside Connecticut TO ORDER Call Toll Free: 800-243-7428 To Order From Connecticut, or For Technical Assistance, call (203) 354-9375 NETRONICS R&D LITD. 333 Lichfield Road, New Milford, CT 06776 Dept K8 Sino "Electric Mouth" kit w/Vox1 Sino "Electric Mouth" kit w/Vox1 Sino "Electric Mouth" kit w/Vox1 Sino "Selectric Mouth" kit w/Vox1 Sino all others \$300 postage and insurance. Conn. res. add sales tax. Total Enclosed \$	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM MAIT ROUTINE TO 13010 REM 08 FRMES, PICTL 13020 04=(03#2)+TI 13030 IF 045TI THEN 04=04+ 13040 CS\$="H":GOSUB10000 R 13060 REM STILL "H" (HAL 13040 CS\$="H":GOSUB2000 19010 DIMTX(15) 19020 GOSUB22000 19030 INPUT"COMMAND STRING 19030 FRINT 19040 GOSUB22000 19030 RETUT"COMMAND STRING 19030 RENT 19040 GOSUB22000 19050 PRINT:PRINT 19040 GOSUB22000 19050 PRINT:PRINT 19040 GOSUB22000 19050 RETURN 20000 FOR 01=1TOLEN(CS\$) 20010 GOT019030 20010 G2=85C(MID\$(CS\$,01,1 20020 NEXT 20020 NEXT 20030 RETURN 21000 IF 0257 OR 02<48 TH 21010 G3=TX(02=47):GOTO 21 21020 IF 0257 OR 02<48 TH 21010 G3=TX(02=59):GOTO210 21040 Q3=0 21045 IF02=80 THEN 03=TX(1 21050 IF02=83 THEN 03=TX(1 21050 IF02=81 TO D9:NEXT 21090 FORJ=1 TO D9:NEXT 21090 FORJ=1 TO D9:NEXT 21090 FORJ=1 TO D9:NEXT 21090 BTH 56,31,52,69,53, 22020 POKE 59459,255
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Barrier Incorrect key pressure puil key pressure puil puil smoke slow south yes south Registered Trademarks Continental U.S.A. Credit Card Buyers Outside Connecticut TO ORDER Call Toll Free: 800-243-7428 To Order From Connecticut, or For Technical Assistance, call (203) 354-9375 NETRONICS R&D LIDD. 333 Litchfield Road, New Milford, CT 06776 Please send the items checked below: 5100 "Electric Mouth" kit w/Vox1 \$ 99.95 Electric Mouth" kit w/Vox1 5100 "Electric Mouth" kit w/Vox1 \$ 99.95 Electric Mouth" kit w/Vox1 5100 "Electric Mouth" kit w/Vox1 \$ 119.95 YVOXII (Second Word Set) Cotal Enclosed \$ Personal Check Cashler's Check/Money Order Personal Check Cashler's Check/Money Order Visa Master Charg.: (Bank No.	12040 09=50 12050 POKE 59459,255 12060 RETURN 13000 REM WAIT ROUTINE TO 13010 REM 08 FRAMES. PICTU 13020 04-(0842)+TI 13030 IF 04>TI THEN 04=04+ 13040 CS\$#="H":GOSUB10000:R 13060 REM STILL "H" (HAL 19060 D9=50 19010 DIMTX(15) 19020 GOSUB22000 19030 INPUT"COMMAND STRING 19030 INPUT"COMMAND STRING 19030 RETURN 19060 GOT019030 20000 FOR 01=1T0LEN(CS\$) 20010 02=ASC(MID\$(CS\$,01.1 20020 NEXT 20030 RETURN 21020 IF 02>57 OR 02<48 TH 21020 IF 02>50 OR 02 2000 IF 07 IF 00 IF 0
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108 Microcomputing, January 1982
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Apple II

SANTA BARBARA, CA. 93120 - M2 (805) 966-1140 The TRS-80 and the IP-225 get together with this simple interface circuit.

Upgrade Your IDS Printer

By Peter E. Noeth

The Integral Data Systems IP-225 is a good dot matrix printer with graphics capability. Unfortunately, as delivered, it will not directly interface to the TRS-80 Model I line-printer port. The following circuitry will allow this interface with a minimum of effort and cost.

Basic Problem

The difficulty lies in two areas. First, the strobe pulse in the TRS-80 is only 1.5 µs long and the IP-225 requires a minimum of 4 µs pulse. Second, the acknowledge pulse occurs 100 μ s after the strobe is active. The printer status routine in the TRS-80 checks for this pulse to be active approximately $35-40 \ \mu s$ after it outputs a character (strobe active). If it does not see an active pulse the printer routine assumes the printer is ready and outputs the next character. (See Figs. 1 and 2.)



The circuit as shown in Fig. 3 will correct the above problems. In the circuit, the 74121 is used as a pulse stretcher to provide a 7 µs strobe pulse to the printer logic board. When the strobe from the TRS-80 goes low, the set input on the 7474 forces the Q output high. This will remain until cleared. When the ACK pulse from the IP-225 returns high (printer ready), it clocks the D input, which is tied low, and resets the Q output low. The result of this action provides an ACK active pulse to the TRS-80 as soon as the strobe is active, so no delay is evident to the printer status routine in the TRS-80 and no characters will be lost.

Interconnection

FROM

J

I built my circuit on a two-inch-

74121

то

ACK

square piece of perfboard using sockets for the two integrated circuits. I insulated the underside of the board with a piece of light cardboard and mounted it to the support between the transformer and the printer logic board on the bottom side of the IP-225, using RTV adhesive. This position allows you to break the leads coming from the printer logic board to the 25-pin interface connector on the back of the IP-225 to insert the new interface board. I also ran two wires from the ground and 5 V power bus on the printer logic board to provide the required power for the new interface. (See Fig. 4 for the connections.)

Although I designed this interface for the IP-225, it also could be used with any parallel I/O printer to be interfaced to the TRS-80 that does not meet the as-originally-designed timing requirements of the strobe and acknowledge pulses.





PRINTER FROM PRINTER



Fig. 2. Timing activity on interface circuit.

Fig. 3. IP-255 interface circuit.

7474

Fig. 4. Interface board interconnection.

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4	DAYYEAR	Day of year a particular date falls on	
5	LEASEINT	Interest rate on lease	
6	BREAKEVN	Breakeven analysis	
7	DEPRSL	Straightline depreciation	
8	DEPRSY	Sum of the digits depreciation	
9	DEPRDB	Declining balance depreciation	
10	DEPRDDB	Double declining balance depreciation	
11	TAXDEP	Cash flow vs. depreciation tables	
12	CHECK2	Prints NEBS checks along with daily register	
3	CHECKBK1	Checkbook maintenance program	
14	MORTGAGE/A	Mortgage amortization table	
15	MUITMON	Computes time needed for money to double triple et	10
16	SALVAGE	Determines salvage value of an investment	"
17	PDVADIN	Pate of return on investment with variable inflows	
8	PPCONST	Rate of return on investment with constant inflows	
0	FFFFCT	Effective interest rate of a leap	
50	EVAL	Enture vehice of an investment (compound interest)	
20	DVAL	Procent value of a fisture amount (compound interest)	
12	LOANDAY	Amount of neumont on a loss	
2	DECIVITY	Amount of payment on a loan	
23	REGWITH	Equal withdrawais from investment to leave 0 over	
4	SMPDISK	Simple discount analysis	
5	DATEVAL	Equivalent & nonequivalent dated values for oblig.	
20	ANNUDEF	Present value of deferred annuities	
1	MARKUP	% Markup analysis for items	
28	SINKFUND	Sinking fund amortization program	
29	BONDVAL	Value of a bond	
90	DEPLETE	Depletion analysis	
51	BLACKSH	Black Scholes options analysis	
32	STOCVAL1	Expected return on stock via discounts dividends	
33	WARVAL	Value of a warrant	
4	BONDVAL2	Value of a bond	
35	EPSEST	Estimate of future earnings per share for company	
6	BETAALPH	Computes alpha and beta variables for stock	
17	SHARPE1	Portfolio selection model-i.e. what stocks to hold	
8	OPTWRITE	Option writing computations	
9	RTVAL	Value of a right	
0	EXPVAL	Expected value analysis	
1	BAYES	Bayesian decisions	r
2	VALPRINF	Value of perfect information	L
3	VALADINF	Value of additional information	Г
4	UTILITY	Derives utility function	-
5	SIMPLEX	Linear programming solution by simplex method	L
6	TRANS	Transportation method for linear programming	
7	EOQ	Economic order quantity inventory model	
8	QUEUE1	Single server queueing (waiting line) model	
9	CVP `	Cost-volume-profit analysis	
0	CONDPROF	Conditional profit tables	
1	OPTLOSS	Opportunity loss tables	
2	FQUOQ	Fixed quantity economic order quantity model	
		it to use this mode most	

59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspevres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
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In this and the following article, Kilobaud Microcomputing takes a close look at this highly touted printer from C. Itoh. The consensus is...

Spotlight on the Starwriter

By Mark J. Borgerson

If you can wait a minute, we can save you \$1000," claims C. Itoh about its Starwriter printer. But how much is a minute? After connecting my new Starwriter to my Apple II, I decided to find out.

I printed a page of text on the Starwriter, and then printed the same text on a Qume. The result: the Qume (\$3415) took 123 seconds, while the Starwriter (\$2230) took 173 seconds. The Starwriter, then, took about 42 percent longer than the Qume.

In a large office, where speed is important to efficiency, the extra printout time might not be worth the savings. But as a consultant and freelance writer, I can always find something to do while the printer cranks out my latest manuscript. I can also find a lot of things to do with \$1185.

Two Steps

The engineers at C. Itoh took two steps to achieve the \$1000 price reducțion. First, they replaced the expensive and complicated servo drive mechanism that Qume, NEC and Diablo printers use to position the printhead with a high-resolution stepping motor. The motor's limited stepping speed is probably responsible, at least in part, for the lower

Address correspondence to Mark J. Borgerson,² 1624 NW Kings Blvd., Corvallis, OR 97330. print speed of the Starwriter. Second, they used an 8085 microprocessor as a system controller and minimized the complexity of the printer's electronics.

As far as I can tell, they cut no corners in the mechanical assembly of the printer. The case is cast-aluminum, well-covered inside with sound-deadening foam. The printer frame is a hefty aluminum casting, and the bearings, guide rails and cables controlling the printhead all seem comparable in quality to the more expensive daisywheel printers.

My printer came with a standard Centronics parallel interface. An RS-232 serial interface is also available as an option. The printer is plugcompatible with a number of interfaces for the Apple—I chose the Epson interface (generally sold with the Epson MX-80) because it costs about \$90 less than the Apple Centronics interface. The Epson card is completely hardware- and software-compatible with the Apple interface.

The Starwriter has several internal switches which allow you to select operating modes for the printer. A toggle switch inside the front cover lets you select ten or 12 characters per inch. The standard printer is equipped with a ten-pitch Courier print wheel. (The printer uses the widely-available Diablo print wheels and ribbons.) A set of DIP switches inside the rear cover control functions such as default form length and auto line-feed.

RCOM/BD ORTVAD	b Bold-Face Print can be used	2 NE 7 887 8 96
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	10,20 and 30.	1.52
	t This command moves the print head to	-
	the next tab stop.	
	Example 1.	
		N



The Starwriter/Starwriter II daisywheel printer.

One of the most important option switches controls the printer mode. This switch has two positions: serial mode and line mode. In the line mode, the printer will not print any characters until the full line is received. The printer will then print bidirectionally and use logic-seeking to minimize printhead movement. Sequences of space characters are converted to a single, continuous head movement. This mode is about 17 percent faster than the serial mode (I used the serial mode in the print speed comparison), but the printer will respond to only a few special commands.

In the serial mode, the printer responds to all the Qume control sequences, but prints unidirectionally. This cuts the print speed, but lets you use the reverse line-feed, tabbing and direct carriage control features the same as you would with a Qume. Since a lot of word processing software uses these features, you will probably want to use this mode most of the time. If however, you plan to do a lot of long program listings, the line mode may appeal to you.

Example 1 shows some of the special features available in the Qume emulation mode. It's a portion of the demonstration text provided with a software package I wrote called Stardriver, which extends the capabilities of the Apple-Writer word processor to let you include special print mode commands in your text.

Only One Problem

In the first six weeks that I owned Starwriter, I printed a number of short articles and two drafts of a 150-page book. With one small exception, the printer performed flawlessly. The exception had to do with the paper advance motor: the stepper motor which drives the platen and tractor feed is a little less powerful than I would like. At one time it stalled under load and caused several lines to overprint. I discovered that this is only a problem with heavy paper. The paper guide puts the paper under tension by running it between a metal plate and several foam pressure pads. The combination of heavy paper, friction and the weight of the paper (which sits in a box on the floor) was too much for the motor. I removed the paper guide (which I didn't need anyway) and have had no problems since.

A second problem might arise if

you intend to implement a graphics program that uses extensive forward and reverse paper movements. The Starwriter tractor feed grips the paper only after it passes the platen. The Qume tractor, on the other hand, grips the paper both before and after it goes around the platen. This means that the Qume actually pulls the paper back when doing reverse line feeds. The Starwriter tractor will only pull the paper forward. Reverse movements depend on the platen friction. Thus, a possible registration problem may arise if you try multiple reverse paper movements.

Conclusion

If you can tolerate the loss in printer throughput and want to save a thousand dollars or more, take a close look at the Starwriter from C. Itoh. It is a well-designed, ruggedly constructed printer with a number of nice features. Among the most important of these is the printer's ability to imitate the Qume printer in applications where the special control codes of the Qume are employed. The printer also uses Diablo print wheels and ribbons, which are available through computer stores and office supply outlets in most cities. ... it's a lotta printer for the money.

Letter-Quality Printer For the Budget-Minded

By William L. Colsher

The C. Itoh Starwriter has been a reliable and easy-to-use printer for my Apple III system, and I recommend it to anyone who needs letterquality output on a budget.

I bought an Apple III back in December of 1980, primarily for word processing. The dealer warned me that the software would not be available for some time, but I went ahead with the purchase so I could become familiar with the system as quickly as

BPS	S1	S2
2400	open	open*
1200	closed	open
600	open	closed
300	closed	closed
Parity	S 5	S6
even	open	open
odd	open	closed*
none	closed	open
Charac	ter Lengt	h S3
7 Bits		closed*
8 bits		open
Stop Bi	ts	S 8
1		closed*
2	in the second	open
*Indicat	tes factory	setting.

Address correspondence to William L. Colsher, 1711 Robin Lane, Lisle, IL 60532. possible. I decided to forego a printer until Word Painter, Apple's word processor, came to market.

I soon discovered the power of VisiCalc III and Business Basic, and almost as quickly realized that I still needed a printer. What good is a Visi-Calc back order report if you can't print it out?

Since I planned to use the Apple III for word processing, it seemed sensible to purchase a letter-quality printer. Apple distributes the Qume, but I felt that it was a little high-powered (and expensive) for my needs. A little research turned up the C. Itoh Starwriter. At a price about \$1000 less than the other letter-quality printers on the market, it looked like the machine for me. Naturally, something had to be sacrificed for that much money. My Starwriter prints at 25 characters per second, roughly half the speed of the more costly machines. But for my purposes, time is not critical.

The Starwriter is a massive unit. It weighs 19.5 kilos almost 43 pounds. A look inside the ousing reveals the reason: the mechanism is supported by a massive die-cast aluminum frame. This printer is solid.

Since the Apple III does not yet have a parallel printer interface card, connecting the Starwriter was not quite the plug-it-in-and-print operation it often is with Centronics-type machines. Further, since the Apple III does nearly everything with software, getting the built-in serial port



My Apple III and a C. Itoh Starwriter, being checked out at my dealer. Note the size of the printer relative to the 12-inch monitor and the Apple.

to talk with the outside world involves more than flipping a couple of switches to set the data rate.

The Apple III serial port is configured as data terminal equipment (DTE). This allows the Apple III to function with the correct software as a smart terminal. Since a printer is also a DTE device, you need a modem eliminator, which is simply a short piece of cable that connects the pin the Apple III is sending on to the pin the printer expects to receive data on. Without the modem eliminator, the Apple III would send data on the same pin that the printer is trying to send data on—something like two deaf and blind people talking to each other.

Apple supplies a modem eliminator with each Apple III, so the wiring is simple. Plug the eliminator into the Apple and then plug the printer cable into the other end of the modem eliminator.

As I mentioned earlier, the Apple III uses software to control operation. There are no DIP switches to set the data rate and format. Instead, there is a device driver. All of the Apple III's input-output operations are handled by these routines. This allows enormous freedom in writing applications programs, since all devices look the same to the program (e.g., by calling a disk driver ".PRINT-ER" your 10M Winchester can be used to spool printed output for later physical printing).

In order to alter a device driver, use a program called the System Configuration Program (SCP) that is supplied on the Apple III utilities disk.

I personally dislike poking around

arwriter will f	ed back down!
ed	up half a space. The ESC U sequence will fe
t is also possible to ne carrier pitch in ossible to use this n	o set the vertical spacing in 1/48 inch increments and 1/120 inch increments. By using these commands it is machine as a graphics printer
-	
-	
	here and her
	PRINT#1.CHR\$(27).'E02'.CHR\$(27).'L01'
/	pi=3.14159 FOR theta=0 TO 2*pi STEP (1/24) tabfactor=INT(SIN(theta)*48)+100 PRINT#1; TAB(tabfactor);'.' NEXT theta
the second se	
Sample 1. Pri	ntout showing Starwriter's sub- and superscript abilities.
	Race SUB T
	Value 1—Data Rate
Value	Value 1—Data Rate Speed
Value 03	Value 1—Data Rate Speed 110 baud (Teletype speed)
Value 03 04	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed)
Value 03 04 06	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed)
Value 03 04 06 07	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud
Value 03 04 06 07 08	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed)
Value 03 04 06 07 08 09	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud
Value 03 04 06 07 08 09 0A	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed)
Value 03 04 06 07 08 09 0A 0C	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud
Value 03 04 06 07 08 09 0A 0C 0E	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud
Value 03 04 06 07 08 09 0A 0C 0E	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud
Value 03 04 06 07 08 09 0A 00 02 0E Value	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud Value 2—Data Format Format
Value 03 04 06 07 08 09 0A 0C 0E Value 22	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud Value 2—Data Format Format
Value 03 04 06 07 08 09 0A 0C 0E Value 22 26	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud 9600 baud Value 2—Data Format Format 7 bits, odd parity 7 bits, even parity
Value 03 04 06 07 08 09 0A 0C 0E Value 22 26 2A	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud 9600 baud Value 2—Data Format Format 7 bits, odd parity 7 bits, even parity 7 bits, mark parity
Value 03 04 06 07 08 09 0A 0C 0E Value 22 26 2A 2F	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud 9600 baud Value 2—Data Format 7 bits, odd parity 7 bits, even parity 7 bits, mark parity 7 bits, space parity
Value 03 04 06 07 08 09 0A 0C 0E Value 22 26 2A 2E 00	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud 9600 baud Value 2—Data Format Format 7 bits, odd parity 7 bits, even parity 7 bits, even parity 7 bits, nark parity 7 bits, no parity 8 bits no parity
Value 03 04 06 07 08 09 0A 0C 0E Value 22 26 2A 2E 00 42	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud 9600 baud Value 2—Data Format Format 7 bits, odd parity 7 bits, even parity 7 bits, even parity 8 bits, no parity 8 bits, no parity
Value 03 04 06 07 08 09 0A 0C 0E Value 22 26 2A 2E 00 42 46	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud Speed 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud Pointer Format Format Points, odd parity 7 bits, odd parity 7 bits, mark parity 7 bits, no parity 8 bits, no parity 6 bits, odd parity
Value 03 04 06 07 08 09 0A 0C 0E Value 22 26 2A 2E 00 42 46 4A	Value 1—Data Rate Speed 110 baud (Teletype speed) 134.5 baud (Selectric speed) 300 baud (normal telecommunications speed) 600 baud 1200 baud (normal printer speed) 1800 baud 2400 baud (C. Itoh printer speed) 4800 baud 9600 baud Data Format Format Format 7 bits, odd parity 7 bits, even parity 7 bits, mark parity 7 bits, no parity 6 bits, even parity 6 bits, even parity 6 bits, mark parity

1. Boot the Apple III using the System Utilities disk. 2. Select option 3-System Configuration Program (SCP). 3. Select SCP function 1-add a driver file. 4. Place the disk with the driver file you want to alter in disk drive 2. If you have only one disk drive, remove the System Utilities disk and use that disk drive. (Be sure to substitute ".D1" for ".D2" when it appears below.) 5. In response to the prompt "enter driver file name:" type: .d1/sos.driver and press return. 6. Press return when the file has loaded to go back to the SCP menu. 7. Select SCP function 3-edit driver parameters. 8. Enter the number of the ".PRINTER" driver when the program asks for it. 9. Select item 5-configuration block data-when you are asked for a number. 10. Use the cursor keys to move the box to the value you want to alter. 11. Press return when you have made all the changes you want. 12. Press return to leave the edit driver parameters screen. 13. Press return to leave the select driver to be edited screen. 14. Select SCP function 5-generate new system. 15. Enter a new driver file name; for example, .d2/new.driver. 16. When the new driver file has been written, press return to go back to the SCP menu. 17. Select option 7-Quit. 18. Select option 4-Quit. 19. Reboot the Apple III with the disk containing your new driver file. In **Business Basic:** UNLOCK SOS.DRIVER (return)

> RENAME SOS.DRIVER,OLD.DRIVER (return) RENAME NEW.DRIVER,SOS.DRIVER (return)

When you boot using that disk you will be using your new drivers.

Table 3. Changing a device driver.

in hardware with lots of moving parts. For me, the simplest course was to alter the device driver to agree with what my new printer expects. Table 3 shows the procedure for changing a driver. As you can see from Table 2, Apple has allowed for just about any printer that uses RS-232C interfacing. Just a few keystrokes and you're ready to print.

After setting up the new device and connecting the printer, I was ready to check it all out. So after booting Business Basic I opened the ".PRINTER" file and sent out a print command. Nothing happened. I checked the cables. (There are no screws on the eliminator cable to hold it, the Apple III and the printer cable together: one of Apple's few oversights with this machine!)

After considerable head-scratching, I discovered the rather unusual "paper-out" mechanism on the Starwriter. It's incorporated into the paper feed rack rather than into the platen support, as on my Epson MX-80. I put the paper in correctly and printed out "test...test...test" a few times, and then began to explore some of the other capabilities of my new machine.

I had expected a very basic printer for my money, but I soon found that the Starwriter has some interesting capabilities. Table 4 lists the various control codes available on the Starwriter. The most interesting are the vertical and horizontal spacing controls.

Sample 1 shows some of the things that I've learned to do so far. I expect

to make good use of the super- and subscripting feature, particularly if Apple brings out a graphing package for use with this type printer. You can do some pretty fair plotting on the Starwriter. Apple has a plotting package for the old Apple II that uses the Qume printer in much the same manner. If control codes are universal, as implied in the Starwriter manual, it should be easy to adapt the existing code to the Apple III.

Drinting Speed	25 characters per second
Frinding Speed	1/120 inch min
Horizontal Spacing	1/120 men mm.
Vertical Spacing	1/48 inch min.
Carriage return time	1 second
Line feed time	40 msec (1/6 inch)
Paper width	381 mm maximum
Number of copies	3
Font	Diablo plastic wheel compatible
Power	90-127 VAC, 50/60 Hz, 70 W
Dimensions	625 mm wide, 380 mm deep, 258 mm high
Weight	19.5 kg

Code	Function
FF	Form feed
ESC D	Half line feed down
ESC U	Half line feed up
ESC SP	Printing
ESC 1	Set horizontal tab 1 to present position
ESC 2	Clear all H tabs
ESC 9	Left margin set
ESC 0	Right margin set
ESC L (d1) (d2)	vertical spacing set in 1/48-inch increments
ESC E (d1) (d2)	horizontal space set in 1/120-inch increments
ESC ((list)	Tab set list where list is of the form d1d2
erstrict abilities	to a maximum of 16 locations.
	Tabs are absolute
ESC SUB I	Reset
Table 4 Printer	control codes. (From Starwriter User's Manual.)





CRT CONTROLLER	6522 APPLE II INTERFACE	81-260 "SLIM"	JBE I MICROCOMPUTER
This intelligent CRT Controller uses an 8085A CPU & an 8275 In- tegrated CRT Controller. it features: 25 lines (80 char./line) 5 5x7 dot matrix 9 Upper & lower case 7 Two 2716's (controller & char. generator) 8 Serial interface RS232 & TTL 9 Baud rates of 110, 150, 300, 600, 1200, 2400, 4800 and 9600 8 Keyboard scanning system 9 Unencoded keyboard required 9 Uses + 5V & ± 12V Power Sup- plies 9 Does not have graphic capabilities.	The JBE 6522 Parallel Interface for the Apple II Computer, plugs directly into any slot 1 through 7 in the Apple. This card has 2 6522 VIA's that provide: • Four 8 bit bi-directional I/O ports • Four 16 bit programmable timer/counters • Serial shift registers • Handshaking A 74LSO5 is for timing. Four 16 pin sockets provide easy connections to other peripheral devices. (Dip jumpers with ribbon cables are also available from JBE The 6522 Parallel I/O card interfaces to the JBE EPROM programmer.	Single board large scale Integra- tion Microcomputer. This 4.5 x 6.5 board uses the 6502 Microprocessor, two 6522 VIA's, four 2114 RAM's, 2516, 2716 or 2532 EPROM. The fully buffered 22/44 pin bus is similar to the KIM®, SYM®, and AIM® expan- sion connector. The four 8 bit I/O ports connect through 16 pin dip sockets. This board was designed for control and is ideal for Per- sonal and OEM use.	JBE's 7.75 x 11.75 6502 base
Documentation includes program listing and composite video cir- cuit. Bare Board only (withdoc) \$39.95 2716 Char. Gen. A7 \$19.95 2716 Program A12 \$19.95	Understandingofmachinelanguagerequiredtousethisboard.Inputsand outputsare TLcompatible.79-295A\$69.95 Assembled79-295K\$59.95 Kit79-295B\$19.95 Bareboard	 Four 2114 RAM's (2K bytes) One EPROM 2516 or 2532 Crystal clock 1 Mhz Requires 5V 1AMP Power 4.5 x 6.5 card Power on reset Fully buffered-expandable Solder mask-both sides 	Microcomputer has the capacity for 16K of EPROM 4K of RAM, 8 Parallel Ports and 1 Serial Port. Monitor and Tiny Basic are also available The fully populated version includes:
A-D CONVERTER	SPEECH SYNTHESIZERS	Use your Apple II Computer, JBE	• 16502 CPU
JBEs 16 channel A-D Converter plugs into your Apple II computer. It uses an ADC0817 which incorporates a 16 channel multiplexer and an 8 bit A-D Converter. The 16 inputs are high impedance and the voltage range is 0 to 5.12 volts. Conversion time is \$100 µsec. The resolution is 8 bits or 256 steps, linearity is ± 1/2 step. Two 16 pin DIP sockets are used for input, GND & reference voltage connections. There are 3 single bit TL inputs. Doc. includes sample program.	JBEs Speech Synthesizers use the Votrax SC-01 Phoneme Syn- thesizer chip. The SC-01 phonetically synthesizes con- tinuous speech of unlimited vocabulary. The SC-01 contains64 different phonemes and 4 levels of inflection accessed by an 8 bit code. It requires 10 Bytes per se- cond for continuous speech. Both boards have an audio amp for direct consection to are 8 obm	b522 Parallel Interface card and EPROM Programmer as a development system for SLIM. Prices: 81-260A \$199.95 Assembled 81-260K \$149.95 Kit 81-260B \$ 39.95 Bare Board 6502 MICROCOMPUTER	 4 6522 VIA (8 Parallel I/O Ports) 1 AY5-1013 (Serial I/O Ports) 8 2114 RAM (4K) 2 2716 EPROM (Monitor 8 Tiny Basic) The partially populated version includes: 1 6502 CPU 1 6522 VIA (2 Parallel I/O Ports) 1 4/5-1013 (Serial I/O Port)
81-132K Kit \$69.95 81-132B Bare Board \$29.95	speaker.	6502 MPU, 6522 VIA, 2716 EPROM, 2114	• 22114 RAM (1K)
EPROM PROGRAMMER	user programs, a phoneme chart and listing of coded words to help you get started. Documentation for the Apple II® Speech Syn- thesizer includes adisk with many user programs. 81-088 Apple II Speech Synthesizer \$139.95 81-120 Parallel Input Speech Synthesizer \$149.95 Prices include the SC-01 Chip SC-01 sold separately for \$75.95	HAM single board computer. Single 5 volt power supply at 400 Ma. Two in- dependent 8 bit I/O ports with hand- shake lines. RC controlled 1 Mhz clock. Complete documentation. I/O lines use 50 pin edge connector. Data and ad- dress lines are not accessible. Mod. for 2532 is included. EPROM is not includ- ed. 1K RAM, 2K EPROM, 2 I/O ports. 80-153 Assm. \$110.95 80-153 Kit \$ 89.95 80-153 Bare Board \$ 19.95	Monitor) Both versions include sockets for 2716s or 2532s, 8 16 pin sockets for I/O interfac ing and a DB25 connector for RS232. All address and data lines are brought off the board to the 50 pin edge connector. (similar to the Apple II bus)
socket is used for the EPROM. Comes	EPROM EXPANSION CARD	Z-80 MICROCOMUTER	This board also features power on reset and cassette
Writing and reading EPROM's in the Apple II or Apple II Plus. Cables available separately. 80-244A Assm. \$49.95 80-244K Kit \$39.95 80-244B Bare Board \$24.95 PARTS 6502 MPU \$9.95 6522 VIA \$9.95 2-80 MPU \$9.95 Z-80 PIO \$9.95 2716 \$14.95 50 pin conn. \$5.95 Dip Jumper 2 ft. \$4.95	JBE EPROM Expander for the Apple II holds six 5V 2716s for a total of 12K bytes of EPROM. This board takes the place of the on board ROM in the Apple. It is software switchable by the same technique used by the Apple II firmware card. Solder jumpers are for reset to the Apple ROM or EPROM Expansion Card. Use JBE EPROM Programmer and Parallel I/O to program your EPROMs. EPROMs sold separately. 81-085A Assm. \$59.95 81-085B Bare Board \$39.95	Z-80 MPU, Z-80 PIO, 2716 EPROM, 2114 RAM single board computer. Single 5 voit power supply at 300 Ma. Two in- dependent 8 bit I/O ports with hand- shake lines. RC controlled 2Mhz clock. Complete documentation. I/O lines use 50 pin edge connector. Data and ad- dress lines are not accessible. Mod. for 2532 is included. EPROM is not includ- ed. 1K RAM, 2K EPROM, 2 I/O ports. 80-280 Assm. \$129.95 80-280 Bare Board \$ 19.95	interface. 81-030 C Fully Populated \$349.95 81-030M Partially Populated \$249.95 81-030B Bare Board \$89.95 2716 EPROM (with Monitor) \$19.95 2715 EPROM (with Tiny Basic \$19.95

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You'll be amazed at how gregarious your North Star can be with this communications program to send and receive data and communicate with remote time-share systems or other microcomputers.

Expand Your Horizon

By Patrick Corry

It should be easy! Many intriguing projects begin with this thought. So it was when we decided to transfer a BASIC program from a time-shared minicomputer to our North Star Horizon microcomputer.

Of course, I knew that there are several dialects of BASIC, many of which are customized for a specific environment. But in some cases editing problems are minimal. For example, Hewlett-Packard BASIC and North Star BASIC are similar.

We planned to move the program without retyping. The time-shared system listed a program. Then we promptly shifted the connector from the acoustic coupler to the console port of the Horizon. After waiting an

ON BALL	
	and a state of the
	20
SH NO CORDO	-
	Sector se

Fig. 1. Crossover cable. Use 25 pin connectors.

appropriate time we connected the terminal to the Horizon and tried to list the acquired text. Surprisingly, nothing had been received! Since then the mystery has been solved.

We have written a program which enables the operator of the Horizon's terminal to conveniently:

•Exchange data with information networks and computerized bulletin boards

•Store data received in programmable random-access memory (RAM) or on disk for subsequent display, transmission or printout

•Download programs transmitted by remote time-share computers or other personal computers.

• Edit text by means of a BASIC program

• Cause BASIC to accept a sequence of ASCII characters contained in RAM as an input program.

There are three categories of problems associated with our method of data transfer.

To specify operation of both serial ports with one stop bit and a seven-bit code we modified DOS 5.2 (origin zero) as follows:

1. Boot DOS and type LF DOS 4000

2. Type GO M0E00 and use the DS command to change the bytes at 4892 (hexadecimal)

and 4896 from EC to 7A

Type OS to return to DOS
 Type SF DOS 4000

5. Reboot DOS

Table 1. Stop bit modification of North Star DOS 5.2.

The Connection Problem

According to the widely-used RS-232C convention, both computers and modems transmit data on line 3 of the connecting cable. They both receive data on line 2. Therefore, the connecting cable between the Horizon's second serial port and the acoustic coupler must cross-connect lines 2 and 3.

A direct solution is to buy or make a crossover cable (see Fig. 1). Another solution is to wire a switch to the motherboard of the Horizon which will let you change the status of the second serial port between modem and terminal modes. If you select the latter option, consult the hardware manual (HRZ-D, p.72) supplied with your Horizon.

The Timing Problem

Most systems with which we communicate exchange data at the rate of 300 bits per second (bps)—about 30 characters per second. Therefore after accepting a character from the modem the Horizon must be ready to receive the next character after a delay of no more than 1/30 of a second. Within this allotted time the received character must be processed and transmitted to the terminal for dis-

Address correspondence to Patrick Corry, 11 Beechwood Drive, Shirley, NY 11967. play. Since our terminal also operates at 300 bps, it requires 1/30 of a second after receiving one character before it can accept the next.

The consequences of these timing constraints are illustrated in Fig. 2. As shown, the terminal must accept characters at least as fast as the remote source sends them. Otherwise, characters will not only be absent from the display but also will not be stored in the Horizon! Therefore, it is critical that the Horizon send characters to the terminal using the minimum number of stop bits.

The DOS supplied with the Horizon can be easily personalized to send one stop bit. All that is needed is to change two bytes of DOS 5.2 from EC (hexadecimal) to 7A. See Table 1 for specific instructions. If your terminal operates at a higher data rate than that of the remote (sending) computer, this modification should not be necessary. In any case, the Horizon must not use too much time before sending received characters to the terminal. The fastest procedure is to have the Horizon simply store the character in a RAM buffer and immediately transmit the character to the terminal. The NSCOM program, which is written in BASIC, uses machine-language subroutines to achieve the speed necessary for this procedure (see Listing 1).

The Software Problem

For communication with an external source we connect the data cables as shown in Fig. 3. In addition, special software is needed to allow the Horizon to simultaneously accept input from two sources. Furthermore, we want the capability of storing part or all of the communicated data. If the data is the text of a program it should be accessible to the North Star interpreter. These operations are selected by input to the BA-SIC program, NSCOM. The relevant command menu is given in Table 2.

Our solution is to partition the available RAM space by use of the MEMSET command so that the directing program, NSCOM, and the stored communications may coexist. (See Table 3.) The upper limit of space available to NSCOM is chosen to yield the maximum room in memory for the ramfile. This limit was found by experimentation and is defined by the variable M in the second line of NSCOM. The start of the ramfile is labeled S and satisfies S = M + 50. Communication: This command allows full duplex communication between the console terminal and a computer or modem connected to the Horizon's second serial port.

Display: The contents of the ramfile is listed on the console terminal. Control C may be used to stop the listing.

Echo: The contents of the ramfile is transmitted out the second serial port by means of a subroutine called ECHO. This subroutine will only transmit a character after the preceding character has been echoed back by the remote system. A control "C" entered at the console will abort the transfer and invoke the communication mode.

Feed: This command causes the set of ASCII characters stored in the ramfile to be sent to the BASIC interpreter which is coldstarted.

Garbage removal: This command calls a machine-language subroutine which writes nulls over any sequence of characters in the ramfile that are not bounded by a number and a carriage return.

Kill: The end of file marker is filled in the first cell of the ramfile. Therefore new data will be written over previously received data.

Load: A request is sent to the DOS to load

into RAM the diskfile whose name is input. The usual DOS naming conventions and responses are observed.

Message: This command will send the message specified by the data in the third line of NSCOM to the second serial port. In the DATA line, control characters are indicated by a leading "+" sign. For example, a carriage return is specified by a "+M". See Appendix 4 of the North Star Software Manual for the control codes. At the completion of the message the communication mode is entered.

Print: The contents of the ramfile is sent out the second serial port. Use a standard data cable to connect this port to a printer. Alternatively the ramfile could be sent out a parallel port if one is implemented.

Save: A request is sent to DOS to save the ramfile on diskette. The usual DOS naming conventions and responses are observed.

Unkill: The command negates the effect of the kill command by replacing the character at the first cell of the ramfile.

Where?: The end of the ramfile and the highest available RAM address are found. The user should not attempt to store data beyond this address.

NOTE: A disk directory may be obtained by typing a 1 or a 2 depending on the drive of interest.

Table 2. NSCOM commands-type only the first letter.

Listing 1.

1 REM -> NSCOM BY PATRICK CORRY - 9/2/81 5 IF EXAM(95)<>237 THEN CHAIN "SETUP" \ REM->VERIFY INITIALIZATION OF USR'S 10 DATA " +M SIGN-0N MESSAGE +M" 15 W1=237\Cl=100\Fl=44\Gl=0\Dl=50\Zl=211\REM->USR STARTS 20 M=21000\ REM->ADDRESS OF HIGHEST BYTE AVAILABLE TO BASIC 30 S=M+50 \REM->S IS THE START OF THE RAMFILE (S= 21050=523AHEX) 35 REM->RESERVE 50 BYTES FOR DOS COMMANDS 40 DIM W6(50) 40 DIM NS(50) 50 IF EXAM(3593)+256*EXAM(3594)=M THEN 80 50 IF EXAM(3593)+256*EXAM(3594)=M THEN 80 60 If PLEASE MEMSET TO ",M," AND RUN AGAIN"\END\ REM->ALLOW ROOM FOR RAMFILE 80 IF Q=0 THEN 920\ REM->CHECK FOR AVAILABLE RAM 90 IF PREE(0) > 75 THEN 100\1\1\!"***RUN AGAIN***"\END 100 !FREE(0) 110 !" COMMAND", 110 1" COMMAND", 120 INPUT C\$ 130 IF C\$="S" THEN 410 140 IF C\$="K" THEN 1070 150 IF C\$="U" THEN 1090 170 IF C\$="T" THEN 580 180 IF C\$="C" 190 IF C\$="P" THEN 300 THEN 680 200 IF C\$="L" THEN 410 220 IF C\$="M" THEN 800 230 IF C\$="D" THEN 680 240 IF C\$="D" THEN 680 250 IF C\$="W" THEN 920 250 IF C\$="G" THEN 106 IF CS="G" THEN 920 IF CS="G" THEN 1060 I. CS="1" THEN 1100\IF CS="2" THEN 1100 IF CS="E" THEN 1200 255 257 260 I"(C)OMMUNICATE OR (D)ISPLAY OR (F)EED " 265 I"OR (G)ARBAGE REMOVAL OR (K)ILL OR (L)OAD OR" 270 I"(M)ESSAGE OR (S)AVE OR (P)RINT OR (W)HERE OR (1) OR (2) 290 GOTO 90 299 REM-> COMMUNICATIONS MODE 300 E=CALL(W1,S)\ REM->FIND CURRENT END OF RAMFILE 310 !"CURRENT END OF RAMFILE ",E 320 !"COMMUNICATION MODE"\ E1=E 526 IF CONNECTION MODE $\langle EI=E \\ 330 E=CALL(C1, E) \\ 350 IF E=EI THEN 370 \\ 360 IF E<2C1 THEN 380 \\ 370 I'NO EXTERNAL DATA FILED IN RAM."$ 3801 I'NO EXTERNAL DATA FILED IN RAM."390 GOTO 90 390 GOTO 90 400 REM-> CREATE DISK IMAGE OF RAMFILE OR LOAD RAMFILE FROM DISK 410 IF C\$<>"L" THEN 440 \REM-> C\$ IS "L" OR "S" 420 I"LOAD RAM FROM WHICH DISK", \GOTO 480 440 E=CALL(W1,S) 450 B= INT((E-S+1)/256)+1\ REM->CALCULATE # OF BLOCKS 460 I"SAVE RAMFILE ENDING AT ",E," IN WHICH DISK", 480 I"FILE",\INPUT F\$\IF C\$="L"THEN 510 490 CREATE F\$,B,10 (More

The end of the ramfile is the first address which holds the value 06. These definitions result in 50 bytes of free space which can be used to store commands issued to North Star DOS 5.2. By use of this command buffer we have dramatically reduced the time needed to save and load files. Programmers should note that this technique can be applied to give DOS a sequence of commands in a more general context.

How to Set Up NSCOM

To use the unmodified version of NSCOM given here you need a computer running North Star DOS 5.2 with origin 0000 (hexadecimal) and BASIC with origin 0E00. Also required is a minimum of 24K bytes of continuous RAM starting at zero and two serial ports addressed in the standard manner. The user subroutines called occupy memory locations 0 to 255.

To enter NSCOM and its satellite machine-language routines you must type and save two BASIC programs: NSCOM and SETUP (see Listings 1 and 2). When SETUP is run the machine-language routines are filled into RAM starting at address 0000, and a chain to NSCOM is executed. When you type NSCOM you may omit the REM statements since they are not destinations for branch statements.

The boundaries of NSCOM, the command buffer, and the ramfile may be changed by modifying lines 20 and 510 of NSCOM. You should redefine M in line 20 and the command string in line 510. These changes will allow you to increase the size of the ramfile if you shrink BASIC or use floating-point BASIC. The command string must contain the value of S expressed in hexadecimal notation. A useful modification for users having parallel printers is to change the device code in line 720. Users of single-density systems should modify line 450.

How to Use NSCOM

NSCOM has three modes of operation: command, communication and storage. After SETUP is completed the command mode is entered. As shown in Table 2, the C command will invoke the communication mode. In this mode two-way communication with an external source is possible. Two control characters have special meaning. Control Q will cause a return to the command mode and Control F will invoke the storage

Listing 1 continued.

510 M\$=C\$+"F "+F\$+" 523A"+CHR\$(13)\ REM->DOS COMMAND STRING 515 REM->M+1 IS THE START OF THE COMMAND BUFFER 520 FOR J=1 TO LEN(M\$)\FILL M+J,ASC(M\$(J,J))\NEXT J 530 FILL M+J,06\ REM->END OF COMMAND MARKER 540 FILL 65,40\FILL 66,01\REM->MODIFY USR TO JUMP TO DOS 550 Q=CALL(D1,M+1)\REM->SEND DOS COMMAND 560 FILL 65,40\FILL 66,40\ REM->SEPLACE JUMP TO BASIC COLD 1 560 FILL 65,40\FILL 66,40\ REM->SEPLACE JUMP TO BASIC COLD 1 560 FILL 65,40\FILL 66,40\ REM->SEPLACE JUMP TO BASIC COLD 1 560 FILL 65,40\FILL 66,40\ REM->SEPLACE JUMP TO BASIC COLD 1 560 FILL 65,40\FILL 66,40\FILL 66,40\FILL 65,40\FILL 6 560 FILL 65,0\FILL 66,14\ REM->REPLACE JUMP TO BASIC COLD START 570 GOTO 90 580 REM-> FEEDER RESETS MEMSET TO Q9 AND COLD STARTS BASIC 600 FOR J= 95 TO 98\FILL J,0\NEXT J\ REM->MODIFY USR TO COLD START BASIC 605 FILL 3598,165\ REM->SET MAXIMUM LINE LENGTH E=CALL(W1,S) "FEEDING BASIC RAM FROM ",S+1," TO ",E "REMOVE GARBAGE FIRST",\INPUT F\$ IF F\$="NO" THEN 650 CABBAGE 610 620 625 630 640 Q=CALL(G1,S)\REM-> REMOVE GARBAGE 650 Q=CALL(F1,S+1)\ REM->FEEDS BASIC RAMFILE -NO RETURN 65Ø 67Ø REM->DISPLAY AND PRINT COMMANDS-680 E=CALL(W1,S) 500 ERRSET 90,Q,Q,REM->TO CONTINUE PROGRAM ON CONTROLC 700 FOR J= S+1 TO E 710 IF CS <> "P"THEN 730 720 I#1,CHR\$(EXAM(J)), REM->MOD. DEVICE CODE FOR PAR. PRINTERS 720 730 !CHR\$(EXAM(J)), NEXT J ERRSET\ GOTO 90 REM->MESSAGE DATA AT 3RD LINE 740 750 800 READ M\$\ 1"MESSAGE:" FOR J=1 TO LEN(M\$) IF M\$(J,J)<>"+" THEN 850 J=J+1XX=ASC(M\$(J,J))-64\GOTO 860 81Ø 82Ø 830 840 X=ASC(M\$(J,J))
!#1,CHR\$(X), \! CHR\$(X), 850 860 IF X<>13 THEN 890 FOR K=1 TO 3000\NEXTK\1 \ REM->TIME LOOP FOR REMOTE COMPUTER 87Ø 880 890 NEXT J 900 GOTO 300\ REM-> ENTER COMMUNICATION MODE 910 REM-> FINDS THE END OF THE RAMFILE-E=CALL(W1,S) !"THE END OF THE RAMFILE IS ",E 920 930 940 REM->FIND THE HIGHEST ADDRESS OF THE CONTIGUOUS RAM 950 IF Q9<>0 THEN 1020 950 J=41 Z9=EXAM(S+1) 970 J=J+1\ Q=J*512-1\IF Q < S THEN 970 980 Z=EXAM(Q) < FILL Q,6 990 IF EXAM(Q)<6 THEN 1010 1000 FILL Q,7 GOTO 970 1010 Q9=Q-512 1015 Q8=INT(Q9/256)\FILL 46,Q8\FILL 45,Q9-256*Q8\REM->PREPARE MEMSET FOR FEEDER 1020 !"SPACE REMAINING: ",Q9-E 1030 FILL Q9,6\ REM->PLACE ENDMARK FOR SAFETY 1040 !"HIGHEST AVAILABLE RAM ADDRESS: ",Q9 1050 GOTO90 1050 GOTO90 1060 Q=CALL(G1,S)\ GOTO 90\REM-> USR TO NULLOUT GARBAGE CHARACTERS 1070 !"RESTARTING RAMFILE" 1080 Z9=EXAM(S+1)\FILLS+1,6\GOTO 90\ REM->KILL-NEW DATA OVERWRITES RAMFILE 1090 FILL S+1,Z9\ GOTO 90\ REM->UNKILL- CONTINUES RAMFILE 1000 M\$= "LI"+C\$+CHR\$(13)+CHR\$(13)+CHR\$(13)\REM->CREATE DOS COMMAND 1110 GOTO 520 1199 REM -> INTIALIZE FOR ECHO ROUTINE-1200 FUL 65 20) FUL 65 20 1200 FILL 65,21\ FILL 66,0 1205 Q=CALL(D1,S+1) 1207 FILL 65,0\FILL 66,14\ REM->REPLACE JUMP TO BASIC COLD START 1210 !\GOTO 300

```
5 REM-> SETUP FOR NSCOM - PATRICK CORRY 9/2/81
10 FOR J=0 TO 244
20 READ X
30 FILL J,X
40 NEXT J
50 CHAIN "NSCOM"
100 DATA 235,006,000,035,126,254,006,200,203,064,032,022,254,013
110 DATA 040,243,254,010,040,239,254,058,242,040,000,254,048,250
120 DATA 040,000,006,255,024,225,254,013,032,221,024,217,054,000
130 DATA 024,215,033,255,191,034,009,014,237,083,250,000,033,067
140 DATA 042,250,000,126,254,006,040,008,035,034,250,000,042,254
160 DATA 000,201,033,080,010,034,017,001,042,254,000,014,034,254,000
150 DATA 042,250,000,126,254,006,040,008,035,034,250,000,042,254
160 DATA 000,201,235,205,062,010,032,014,219,002,230,127,254,017
180 DATA 000,201,235,205,062,010,032,014,219,002,230,127,254,017
180 DATA 004,205,142,000,024,225,245,205,120,010,032,251,241,211
200 DATA 004,205,142,000,024,025,132,000,205,070,010,032,251,241,211
200 DATA 004,201,245,205,112,010,032,251,241,211,002,201,062,060
210 DATA 205,142,000,062,013,205,132,009,054,006,062,062,205,142
230 DATA 209,24,172,219,005,230,002,040,227,219,004,230,127,119
240 DATA 190,032,006,035,205,142,000,024,213,043,054,006,062,062,205,142
230 DATA 000,024,172,219,005,230,002,040,227,219,004,230,127,119
240 DATA 190,032,006,035,205,132,000,205,070,010,042,062,062,205,142
230 DATA 000,024,172,219,005,230,002,040,227,219,004,230,127,119
240 DATA 190,032,006,035,205,132,000,205,070,010,040,008,205,241
250 DATA 014,205,067,000,205,132,000,205,070,010,040,008,205,241
260 DATA 014,205,067,000,205,132,000,205,070,010,040,008,205,241
```

Listing 2.

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TRS80 MODEL 1 LEVEL II COMPATIBLE	YES	YES	NO
48K BYTES RAM	YES	YES	YES
CASSETTE BAUD RATE	500/1000	500	500/1500
FLOPPY DISK CONTROLLER	SINGLE/ DOUBLE	SINGLE	SINGLE/ DOUBLE
SERIAL RS232 PORT	YES	YES	YES
PRINTER PORT	YES	YES	YES
REAL TIME CLOCK	YES	YES	YES
24 X 80 CHARACTERS	YES	NO	NO
VIDEO MONITOR	YES	YES	YES
UPPER AND LOWER CASE	YES	OPTIONAL	YES
REVERSE VIDEO	YES	NO	NO
KEYBOARD	63 KEY	53 KEY	53 KEY
NUMERIC KEY PAD	YES	NO	YES
B/W GRAPHICS, 128 X 48	YES	YES	YES
HI-RESOLUTION B/W GRAPHICS, 480 X 192	YES	NO	NO
HI-RESOLUTION COLOR GRAPHICS (NTSC), 128 X 192 IN 8 COLORS	YES	NO	NO
HI-RESOLUTION COLOR GRAPHICS (RGB), 384 X 192 IN 8 COLORS	OPTIONAL	NO	NO
WARRANTY	6 MONTHS	90 DAYS	90 DAYS
TOTAL SYSTEM PRICE	\$1,914.00	\$1,840.00	\$2,187.00
LESS MONITOR AND DISK DRIVE	\$1,450.00	\$1,375.00	102

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10 REM->CHANGES ALL SINGLE QUOTAION MARKS, CHR\$(39) 20 REM-> TO DOUBLE QUOTATION MARKS, CHR\$(34) 30 PRINT " RAMFILE START", \INPUT S 40 S=S+1 50 IF EXAM(S)=6 THEN END 60 IF EXAM(S)=39 THEN FILL S,34 70 GOTO 40 Listing 3.

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mode. In the storage mode all characters received from the external source are stored in the ramfile. Now the only special character recognized is control-R, which causes a return to the communication mode. Although the user is responsible for not entering too large a ramfile, a warning is given when data is lost. This overflow condition is indicated by an uninitiated jump from storage to command mode (see Fig. 4).

In a work session with NSCOM you might take these steps:

1. Load and run SETUP.

2. The K command is used to restart the ramfile.

3. The C command is used to enter the communication mode.

4. Log on to a remote system and a BASIC program is fetched.

5. The LIST command is typed and terminated with a control F instead of the usual carriage return. The console will display an open bracket and a carriage return will be transmitted.

6. After the listing is completed a Control R is typed to return to communication mode. You may log off the remote system at this time.

7. A Control Q is typed to return to command mode.

8. The Save command is used to store the ramfile on diskette (a precaution).

9. The Feed command is used to send the ramfile to the BASIC interpreter.

10. The program is edited and saved using the utilities of North Star BASIC.

In another session you could log on to an information network such as The Source or Compuserve and search for data. After the desired data is located, it could be simultaneously listed on the terminal and stored in the Horizon's RAM. Later it could be saved on disk and printed.

The Feed command allows the BASIC interpreter to process a sequence of ASCII characters stored in RAM in the same way that a stream of characters coming from a terminal is handled. Therefore you can manipulate a program text while it is stored in RAM using BASIC programs. You can use this feature to do specialized editing. For example, all single quotation marks can be converted to double (see Listing 3). You can also create a series of DATA lines from the contents of memory. The data lines in the setup program were obtained by use of the program in Listing 4.

How NSCOM Works

The BASIC program NSCOM calculates and partitions the available RAM, prints prompts and status information and manipulates ramfiles. The files may be saved on disk, listed on the terminal, or transmitted out the second serial port. NSCOM calls five machine-language subroutines: GARBAGE NULLING (Listing 5), FEEDER, COMMUNICATION MODE, and ECHO (Listing 6) and EOT? (Listing 7). GARBAGE NULL-ING will write null characters over any character in the ramfile which is not surrounded by a number and a carriage return.

FEEDER is used to send commands to DOS, programs to BASIC, or characters to the ECHO subroutine. Accordingly NSCOM must modify the FEEDER subroutine. The initialization process for FEEDER changes the character-in call used by DOS 5.2. Characters are now obtained from RAM instead of the console port. Depending on which entry point to FEEDER is used the characters are sent either to DOS, to ECHO or to a cold-started BASIC. Communication mode alternately checks the two serial ports and sends characters received from one port to the other port. Upon receipt of a control-F, a jump is made to a routine which consecutively fills RAM with the characters entering the second serial port. It may be possible to upload the text contained in the ramfile to an external computer by use of the E command, which calls the ECHO subroutine. This routine transmits the ramfile out the second serial port with the constraint that the echo of a character must be received before the next character is sent. The effectiveness of this simple handshaking depends upon the software of the remote computer. The subroutine EOT? finds the address of the first cell of the ramfile that holds a value of 06 (the endmark). This address is



Fig. 3. Horizon back view.

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HexadecimalDecimal0000-00FFMachine-language subroutines0-2550100-0DFFDOS 5.2256-30E00-421DBASIC (unshrunk)3584-421E-5208NSCOM176925209-5239Command Buffer21001523A-RAMtopRamfile21050

0-255 256-3583 3584-16925 176926-21000 21001-21049 21050-RAMtop

Table 3. Memory map-NSCOM standard configuration.

10 REM>= CREATES RAMFILE WITH ASCII DATA LINES FROM RAM CONTENTS 15 D\$=" DATA " 20 S=21050\ A=S 30 !"START OF USR, END OF USR",\INPUT W,U 35 IF N= 0 THEN 80\ REM -> N COUNTS ITEMS PER DATA LINE 40 REM ->GET NEXT BYTE 50 B=EXAM(W)\GOSUB 110\ N=N+1 55 W=W+1\IF W=U+1 THEN 105 60 IF N= 20 THEN 80 70 A=A+1\FILL A, ASC(",")\GOTO40 80 A=A+1\FILL A, 13\A=A+1\FILLA,10 85 L=L+1\B=L\GOSUB 110 90 FOR K= 1 TO 6\FILL A+K,ASC(D\$(K,K))\ NEXT K 100 A=A+6\N=1\ GOTO 40 105 FILL A+1,13\FILL A+2,6\ END 110 REM->A=NEXT AVAILABLE ADDRESS\ B=BYTE VALUE 130 A=A+1\FILL A,INT(B/10)+48\B=B-10*INT(B/10) 160 A=A+1\FILL A,B+48\ RETURN

Listing 4.

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00FA 00FC 00FE 0A50 BFFF 0E09 0111

placed in the HL register pair and passed back to NSCOM. Note that NSCOM uses the DE register pair when passing an address to the subroutines.

As mentioned, NSCOM also modifies the FEEDER routine when sending commands to DOS. Without this modification FEEDER would. cold-start BASIC and allow it to use all the available RAM. When any BASIC program is running, the utilization of RAM is limited by the MEMSET command. This limitation will preserve the ramfile even if NSCOM is scratched and another BASIC program entered. Therefore you may stop NSCOM, load and run your own program, and then reload NSCOM without disturbing the ramfile. At the completion of a session of NSCOM use, BASIC should be cold-started in order to utilize all the available RAM.

Under development are procedures which allow the BASIC editing commands to be used on the text stored in the ramfile. A version of NSCOM which does not use the locations 0-255 is nearing completion. Improvements can be made in the software handshaking in the Message and Echo commands. The amount of space available for the ramfile can be increased by separating those commands which are only used once from NSCOM. These routines would be saved as a BASIC program which could be chained to from NSCOM.

Further streamlining can be achieved by removing REMs and spaces from NSCOM which were included to improve legibility. We are developing the capability of transmitting a break signal used by some remote systems. The ramfile could serve as an input buffer or be used for rapid sorting without disk access delays. Also to be explored are applications of NSCOM's facility for giving DOS and BASIC a sequence of commands without operator intervention.

An enhanced version of NSCOM on double-density disk will be commercially available. The hardware supplied with your Horizon allows for many communication options. I have enjoyed developing some relevant software.



Fig	1
rig.	4.

			The second second	
			TITLE	GARBAGE NULLING
			REMOVES GARB	AGE FROM RAMFILE
			DE PASSED FR	OM NSCOM WITH START RAMFILE
0010			RADIX 16	
0010			780	
			PHASE OOH	
0000	FD		FY DE HI	HISE HI AS POINTER
0000	EB Of OO	PESET.	LD B OOH	FLAC PESET _ NOT IN BASIC LINE
0001	00 00	COUNT.	TNC HI	POINT TO NEXT PYTE
0003	23	COUNT:	ID A (HI)	FUINT TO NEXT DITE
0004	7E		CD OGU	GET CHAR
0005	FE 00		CP UOH	IS IT THE EUT MARKER?
0007	C8		RET Z	; IF SO RETURN TO NSCOM
8000	CB 40		BIT 0,B	TE TH LTHE LOOK BOD OD
A000	20 16		JR NZ, EOL?	; IF IN LINE LOOK FOR CR
0000	FE OD		CP ODH	;CR OK
000E	28 F3		JR Z, COUNT	many and a la miner of a start of the second
0010	FE OA		CP OAH	;LF OK
0012	28 EF		JR Z, COUNT	
0014	FE 3A		CP 3AH ;>'9''	?
0016	F2 0028		JP P, REPLACE	
0019	FE 30		CP 30H ;< '0	' ?
001B	FA 0028		JP M, REPLACE	
001E	06 FF		LD B, OFFH	;SET FLAG - IN BASIC LINE
0020	18 E1		JR COUNT	
0022	FE OD	EOL?:	CP ODH ;CR II	NDICATES END OF LINE
0024	20 DD		JR NZ, COUNT	
0026	18 D9		JR RESET	IT WAS THE EOL!
0028	36 00	REPLACE	:LD(HL),00H	REPLACE GARBAGE WITH NULL
A500	18 D7		JR COUNT	The second s
			. DEPHASE	
			Listing 5.	



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Listin	g 6 continued.	
0E04 0E00 0A3E 0A46 0A70		WARM EQU OEO4 ;BASIC'S WARM START COLD EQU OEO0 ;BASIC'S COLD START ISTO EQU OA3EH ;DOS 5.2 STATUS ROUTINES IST1 EQU OA46H OSTO EQU OA70H
0A78 002C 002F 0032 0036	21 BFFF 22 0E09 ED 53 00FA 21 0043	OST1 EQU OAOA78H ;FEEDER ROUTINE INITD: LD HL,MEMSET ;HL=MEMSET FOR NEW BASIC LD(HIMEM),HL ;SET MEMSIZE FOR NEW BASIC INIT: LD(STPOINT),DE ;DE PASSED FROM NSCOM - START RAMFILE LD HL,FEEDER ;HL = START OF FEEDER INPUT ROUTINE LD HL,FEEDER ;HL = START OF FEEDER INPUT ROUTINE
0039 003C 0040 0043 0046 0049	22 0111 ED 73 00FC C3 0E00 22 00FE 2A 00FA 7E	LD(VECI),HL ;CURRENT INFOINCE IN NOT THE SD HOW FEDERAL LD(STSP),SP ;SAVE BASIC'S STACK POINTER JP COLD ;NSCOM WILL OVERWRITE THIS ADDR FOR DOS COMMANDS FEEDER: LD(STHL),HL ;SAVE BASIC'S HL LD H., (STPOINT) ;HL POINTS TO NEXT CHAR LD A,(HL) ;GET CHAR CD 06
0044 004C 004E 0052 0055 0056 0056 0057 0057 0063	28 08 23 22 00FA 24 00FE 29 21 0A50 22 0111 24 00FE ED 7B 00FC C9	JR Z, RESTOR ; IF EOT THEN RESTORE VECT TO DOS CHARIN INC HL ;INCREMENT RAM POINTER LD (STPOINT), HL ;STORE ADDRESS NEXT CHAR LD HL, (STHL) ; RETRIEVE BASIC'S OR DOS HL RET ;GO BACK TO BASIC OR DOS RESTOR: LD HL, NORMAL ;HL = ADDRESS NORMAL IN ROUTINE LD (VECT), HL ;CURRENT IN ROUTINE IS NOW NORMAL LD HL, (STHL) ;RETRIEVE BASIC'S STACK POINTER RET ;RETURN IN CONTROL TO NSCOM OR BASIC
0064 0065 0068 006A	EB CD 0A3E 20 0E DB 02 F6 7F	FACE OU ;NSCOM - COMMUNICATION MODE ;DE FASSED FROM NSCOM WITH START OF RAMFILE TALK: EX DE, HL ;INIT HL AS POINTER LOOKCON:CALL ISTO JN NZ, LOOKEXT ;IF NO CHAR LOOK AT SECOND PORT IN A, (02) ;GET CONSOLE CHAR.
006E 0070 0071 0073 0075 0078	E 11 C8 FE 06 28 23 CD 0084 CD 0.846 CD 0.846	CP 11H ; Q -> BACK TO NSCOM RET Z ; BACK TO COMMAND MODE OF NSCUM CP 06H ; T -> ENTER STORAGE MODE JR Z, INITFIL ;STORE COMMUNICATION IN RAMFILE CALL SENDEXT ;OTHERWISE SEND CHAR LOOKEXT:CALL ISTI
007B 007D 007F 0082 0084 0085 0088	20 E0 DB 04 CD 008E 18 E1 F5 CD 0A78 20 FB	IN A., LOUNCON ; IF NUL LOUK AT CONSOLE IN A. (04) ;GET EXT. CHAR. CALL SENDCON JR LOOKCON ;LOOK AT CONSOLE AGAIN SENDEXT:PUSH AF WAITEXT:CALL OSTI JR NZ, WAITEXT
008A 008B 008D 008E 008F 0092	F1 D3 04 C9 F5 CD 0A70 20 FB	POP AF ;RETRIEVE CHAR. OUT (04),A RET SENDCON:PUSH AF ;SAVE CHAR. WAITCON:CALL OSTO JR NZ, WAITCON
0094 0095 0097 0098 009A 009D	F1 D3 02 C9 3E 3C CD 008E 3E 0D	OUT AF ;REINLEVE CHAR. OUT (02),A ;SEND CHAR. RET PAGE 60 INITFIL:LD A,3CH ;A='<' CALL SENDCON ;SHOW "<" FOR STORAGE MODE LD A,0DH ;A=CR
009F 00A2 00A4 00A6 00A8 00AA 00AA	CD 0084 DB 03 E6 02 28 11 DB 02 E6 7F FE 12	CALL SENDEXT SEND CR STOPFIL7:IN A.(03) ;CHECK CONSOLE AND 02 JR Z.FILLRAM ;IF NO CHAR INPUT CONTINUE STORAGE MODL IN A.(02) AND 7FH CP 12H ;IS CHAR A CONTROL R?
00AE 00B0 00B2 00B4 00B7	20 09 36 06 3E 3E CD 008E 18 AC	JR NZ,FILLRAM ;IF NOT CONTINUE FILLING RAM LD (HL),06 ;WRITE EOF MARKER LD A,3E ;A='>' CALL SENDCON JR LOOKCON ;CONTINUE TALK MODE ;STORAGE MODE FOR NSCOM ;THE FOLLOWING STORES COM IN RAM UNTIL ^R FROM CONSOLE
00B9 00BB 00BD 00BF 00C1 00C3	DB 05 E6 02 28 E3 DB 04 E6 7F 77	FILLRAM: IN A,(05) ;GET STATUS BYTE AND 02 JR Z,STOPFIL? ;IF NOTHING THERE LOOK AT CONSOLE IN A,(04) ;GET CHAR FROM SECOND PORT. AND 7FH LD(HL),A ;STORE CHAR AT HL LOCATION
00C4 00C5 00C7 00C8 00CB 00CD	BE 20 06 23 CD 008E 18 D5 28 36 06	GP(HL) ; VERIFY CHAR STORED JR NZ, WARN ; IF OUT OF RAM WARN INC HL ; INCREASE RAM POINTER CALL SENDCON ; DISPLAY CHAR JR STOPFIL? WARN: DEC HL ;SET HL TO EOT LD/HL DOG - WETTE FOT MARKER
00D0 00D3 00D6 00D9 00DC	C3 0E04 CD 0043 CD 0084 CD 0846 28 08	JP WARM ;WARN USER BY STARTING BASIC ;ECHO ROUTINE ECHO: CALL FEEDER ;GET CHAR AND CHECK FOR END OF RAMFILE CALL SENDEXT ;SEND CHAR TO REMOTE SYSTEM ECHOLOOK:CALL IST1 ;LOOK FOR ECHO JR Z.RECEIVE :IF READY SHOW CHAR
00DE 00E1 00E4 00E6 00E8 00EB	CD 0AF1 CA 0056 18 F3 DB 04 CD 008E 18 E6	CALL OAFIH ;CHECK CONSOLE FOR ^C JP Z, RESTOR JR ECHOLOO ;WAIT FOR ECHO RECEIVE:IN A, (04) CALL SENDCON ;SHOW CHAR JR ECHO .DE PHASE
001	0	TITLE EOT ;FIND EOT MARKER:06H ;DE=START ADDRESS FROM NSCOM .RADIX 16 .Z80
00E 00F 00F 00F 00F	EE EB EF 23 F0 7E F1 FE 06 F3 20 FA F5 C9	.PHASE OEEH ;THIS ROUTINE RELOCATES EX DE, HL ;HL=DE=RAMFILE START SEARCH: INC HL LD A,(HL) ;A=CHAR CP 06H ;IS IT THE EOT? JR NZ,(SEARCH) RET ;PASS HL TO BASIC .DEPHASE
		Listing 7.

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Here's a bit of Sorcerer magic that lets you use monitor commands in BASIC programs.

The Sorcerer Reveals Hidden Commands

By C. Kevin McCabe

The Exidy Sorcerer hides processing routines for 14 monitor commands deep within its 2716 PROMs. With a few waves of the Sorcerer's magic wand, a majority of these commands can also be used without change within BASIC programs.

Along with other operations, there are monitor routines to:

configure the Sorcerer's input/output by selection of appropriate monitor- or user-supplied drivers;
load, move, inspect, save and execute machine code and data;

•test RAM memory bit-by-bit; and

• specify prompt characters and tape header information.

Each of these commands can be specified in a BASIC string variable, along with any necessary or optional parameters, as shown in Table 1. The utility subroutines in Listing 1 place the command string into the monitor's input buffer, then call the appropriate command processor via BASIC's USR statement. On completion of the command—which might change an output driver, obtain data from the keyboard or execute a machine-language routine in RAM—control

Address	Command	Function
E4D3	DU XXXX [YYYY]	Display contents of memory.
E538	EN XXXX	Load hex byte into memory.
E597	GO XXXX	Execute program at XXXX.
E78A	LO [name] [U] [XXXX]	Load file from tape U.
E562	MO XXXX YYYY [S] [ZZZZ]	Copy memory block-to-block
E845	PR = X	Change to specified prompt.
E638	SA [name] XXXX YYYY [U]	Save memory on tape U.
E5A2	SE $F = XX$	Set file type header byte.
	I = K	Input from keyboard.
	= P	Input from parallel port
	= S	Input from serial port.
	= XXXX	Input via driver at XXXX.
	O = L	Output to Centronics
	= P	Output to parallel port
	= S	Output to serial port
	= V	Output to video screen
	= XXXX	Output via driver at XXXX.
	S = XX	Set display delay to XX.
	T = X	Data rate = 300 [X = 1], 1200 [0].
	X = XXXX	Set autoexecute address.

Table 1. Sorcerer monitor commands.

jumps back to the BASIC program.

The result is full control over I/O processing and many other monitor functions within BASIC programs. A related benefit arises from use of standard monitor commands and parameters, making the BASIC software nearly self-documenting.

To understand this bit of Sorcerer magic, let's take a closer look at the monitor's organization. In addition to the 4K of PROM beginning at E000H, the top 176 (B0H) bytes of RAM are dedicated to the monitor. The upper 111 (6FH) bytes of this area serve as a scratchpad RAM work area.

Assume that MRAM is the lowest address in this 111 byte RAM work area. What's hidden at MRAM and the following bytes? Lots of goodies! There are bytes to specify I/O driver routine addresses, tape header information, cassette tape and motor status, output delay and input prompt and cursor location. Whenever a monitor command requires such information to perform its function, or changes one of the parameters, the appropriate RAM location in the work area is read or updated.

Certainly, a BASIC program could PEEK and POKE about in the work area to change I/O devices, for example—but that's the hard way. Even

Address correspondence to C. Kevin McCabe, 115 South LaSalle, Suite 3300, Chicago, IL 60603. worse, that method is almost incomprehensible within a BASIC program. The BASIC statements POKE MRAM + 63,147: POKE MRAM + 64,233may select the Centronics output driver, but they don't convey that meaning to the programmer as readily as the monitor's equivalent SET 0=L command.

A Better Way

There must be a better way—and there is. The secret lies in the 60 bytes beginning at MRAM which form the monitor's input buffer. When keys are struck following a monitor prompt, the ASCII value of each input character is placed left-justified in the buffer. A carriage return (13 decimal, or 0DH) terminates the monitor's input routine.

A portion of the warm start processor WARM checks the first two bytes in the buffer against a PROM table containing the command characters. If a match is found, the monitor jumps to the associated command processor code and executes the command. If there's no match, an error message is output instead. In either event, a return address is first pushed onto the stack; all processor and error routines end with a Z-80 return command, which pulls the address from the stack and makes an unconditional jump back into WARM.

But why use the keyboard to enter commands? A BASIC program can easily poke ASCII values into the input buffer. Lines 30000-30030 in Listing 1 take the string specified by CMD\$ and place it, along with an added carriage return character, in the input buffer beginning at MRAM. So far, so good—but there are two possible hitches.

The first problem is finding the elusive MRAM; since the work area lies at the top of installed memory, MRAM varies from Sorcerer to Sorcerer. However, the monitor provides a machine-independent solution. On each cold start, the monitor tests memory locations for usability, beginning at location 0000H. When the first unusable location is found (by failure of a location to receive and hold a test value) the monitor assumes that it has exceeded installed memory. An address counter is decremented by one, then the resulting 16-bit address is stored at 0F000-0F001H. As is usual with Z-80 operations, the low-order byte is stored in the lower location.

Lines 40000-40030 in Listing 1 cal-

culate MRAM by PEEKs to those locations. For systems with more than 32K of installed memory, the subroutine also converts the resulting decimal address to the necessary negative form.

Ideally, the monitor's own parser in the WARM routine would be used to identify and execute the command poked into the buffer. The second possible hitch comes from the behavior of the monitor after execution of the command. To be useful in a BASIC program, the monitor commands should execute and then return control to BASIC. However, entry into the command processors through WARM causes a return to WARM, not BASIC.

The solution is BASIC's USR command, which executes the machine code at a specified address, then returns control to BASIC. The two bytes at 260–261 (104–105H) are used as a jump vector to the address of the desired code routine. A call to USR jumps to the specified code and begins execution; when a return is encountered, BASIC regains control.

Summary

That gives the final ingredient to the Sorcerer's brew. In addition to the text of the desired monitor command, the program uses another string with the appropriate processor address from Table 1. Lines 10000– 20020 convert the four digits of a hex address string to decimal, and POKE them into the two-byte USR hook.

Mixed together, these ingredients provide easy BASIC control of monitor functions. MRAM is found by an initial call to line 40000. The desired monitor function is specified by an equate to the string CMD\$; the address of the desired processor is equated to CP\$. A call to line 20000 converts and shifts the strings to the proper locations, transfers control to the processor, then retakes command on completion. Additional monitor commands can follow, if desired.

Listing 2 illustrates use of this process. Notably, the program logic is clear even without the remark statements. The first 256 bytes of memory are output to the Centronics printer, then saved at 300 bits per second on tape unit 1. New values are input to the same area of memory from tape unit 2, at 1200 bits per second. Those values—which must terminate with a Z-80 return command of 0C9H—are executed, and control returns to BASIC for the final video message.

All that with only a few equates and subroutine calls—and it's nearly self-documenting to boot. That's powerful magic from your Sorcerer!

```
10000 REM--Convert hex address byte to decimal equivalent
10010 VHI = ASC(LEFT$(HEX$,1))-48: IF VHI>9 THEN VHI = VHI-7
10020 VLO = ASC(RIGHT$(HEX$,1))-48: IF VLO>9 THEN VLO = VLO-7
10030 VDEC = 16 * VHI + VLO: RETURN
20000 REM--Poke hex address equivalent into USR hook
20010 HEX$ = LEFT$(CP$,2): GOSUB 10000: POKE 261, VDEC
20020 HEX$ = RIGHT$(CP$,2): GOSUB 10000: POKE 260, VDEC
30010 REM--Poke monitor command into monitor RAM & execute it
30010 CMD$ = CMD$+CHR$(13): FOR J=0 TO LEN(CMD$)-1
30020 POKE J+MRAM, ASC(MID$(CMD$,J+1,1)): NEXT J
30030 J = USR(J): RETURN
40010 REM--Locate first byte of monitor work area
40010 MRAM = 256 * PEEK(-4095) + PEEK(-4096)
40020 IF MRAM > 32767 THEN MRAM = MRAM - 65536
40030 MRAM = MRAM - 110: RETURN
```

Listing 1. Utility subroutines.

100 REM--Example program (requires use of Listing 1 routine) 110 GOSUB 40000: REM--Find MRAM = location of input buffer 120 CMD\$="SE O=L": CP\$="E5A2": GOSUB 20000: REM--Centronics out 130 CMD\$="DU 0 FF": CP\$="E4D3": GOSUB 20000: REM--Video out 150 CMD\$="SE O=V": CP\$="E5A2": GOSUE 20000: REM--Video out 150 CMD\$="SE T=1": GOSUB 20000: CMD\$="SA XAMPL 0 FF" 160 CP\$="E638": GOSUB 20000: REM--Save memory at 300 baud 170 CMD\$="Lo 2 0 FF": CP\$="E5A2": GOSUB 20000: REM--Set 1200 baud 180 CMD\$="Lo 2 0 FF": CP\$="E78A": GOSUB 20000: REM--Load memory 190 CMD\$="GO 0": CP\$="E597": GOSUB 20000: REM--Execute code 200 PRINT "Tha..tha..that.stat's all, folks!": END

Listing 2. Example program.

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SIGNATURE These prices do not include shipping an after publication date for delivery. (All v Foreign orders please add \$10.00 for all	id handling. Please add \$1.50 for th olumes will be shipped UPS if the c mail per item or \$5.00 for surface	e first item; \$ 1.00 for each additiona omplete street address is provided: o mail per item. Delivery outside the U.	I item in the U.S. and Canada. Allow 4-6 wee therwise shipment will be 4th class book rat .S. varies. Prices are subject to change witho	eks

This BASIC text disassembler gives new meaning to the word versatility when programming the PET.

The Revealing Truth About PET's Memory

By Charles R. Trahan

While writing a CBM 2001 program to create files on a CGRS PEDISK, I ran into a common problem. The PEDISK operating system requires you to specify the maximum number of records when a new file is

		Program listing. The MEMSEE program	for the CBM 2001.
49900	REM	*** MEMSEE (MEMORY SEE) ***	
49902	:		
49904	REM	CHUCK TRAHAN	
49906	REM	4 CONGRESS COURT	
49908	REM	QUAKERTOWN, PA 18951	
49910	REM	215-536-0264	
49912	:		
49914	REM	APPEND TO END OF BASIC FROG	
49916	REM	RUN 50000.	
49918	REM	MEMSEE WILL DISASSEMBLE	
49920	REM	BASIC CODE IN MEMORY.	
49922	1		
49990	REM	PROG INIT - USER INPUTS	
50000	POKE	59468, 12: PRINT"HIT S TO STOP": INPUT"HI	ADDRESS "; TP
50001	INPU'	T"LO ADDRESS ."; AD: AD=AD-1: IFTP=OTHENT	P=99999:REM TOP DEFAULT
50002	INPU	T"STOP @ LN .";LN:IFAD<1THENAD=1023:F	EM BOTTOM DEFAULT
50003	IFLN:	=OTHENLN=99999: INPUT"STOP @ EDT Y";A\$:	C=ABS (A\$="Y")
50004	INPU	T"LISTING N";A\$:L=ABS(A\$="Y")	
50006	INPU'	T"HARD COPY N"; A\$: A=ABS(A\$="Y")	
50007	IFAT	HENINPUT"DEVICE # 4"; D: OPEND, D: PRINT	#D, CHR\$(12): CMDD
50008	PRIN	T:PRINT"ADDRESS", "CONTENT TEXT":PRINT	
50010	:		
50011	REM I	BEGIN DISASSEMBLY - PEEK & CHECK FOR O	
50012	GOSU	B62000: IFPKTHEN60000	CONTAINS OTHER THAN O
50014	:		
50015	REM B	END OF LINE OR END OF TEXT CHECK	
50020	IFPE	EK (AD+1) ORPEEK (AD+2) ORAD< 1024THEN61000	CHECK FOR 3 0'S OR BELOW BASIC
50030	A\$="	END OF TEXT": GOSUB63300: REM	3 O'S END OF BASIC TEXT FOUND
20033	REM		END OF RUN CHECKS FOLLOW
50034	REM		DISPLAY NEXT 2 ADDRESSES
50035	FORI	=1T02:GJSUB62000:A\$="":GOSUB63300:	NEXT: IFCTHEN50045 STOP @ EOT
50040	IFAD	TPTHEN50012	NOT @ TOP
50043	:	an det	Looppication of the State
50044	REM	END OF RUN - TERMINATE ACCORDING TO US	ER INPUTS
50045	IFLT	HENIFDTHENPRINT#D, CHR\$(12): CMDD: REM	NEW PAGE FOR HARD COPY LISTING
50050	IFLTH	HENPRINT:LIST:REM	PROG LISTING @ END OF RUN
50054	IFDT	HENPRINT#D, CHR\$ (12): CLOSED: REM	CLOSE CHANNEL TO PRINTER
50055	END		
50060	:		
59999	REM	CHECK IF QUOTES MODE OR PET TOKEN MODE	
60000	IFNO	TFANDPK>127ANDPK<203THENGOSUB63000:GOTO	150040 NOT IN QUOTES MODE
60001	IFPK:	=320RPK=160THENA\$="":G0T060019	SPACE OR SHIFTED SPACE
60002	IFPK:	=130RPK=141THENA\$="CARRIAGE RETURN":GOT	060019 CARRIAGE RETURN CHAR.
60003	A\$=CH	HR\$ (PK): IFPK>29THEN60010	ASCII CHAR. ASSIGNED
60004	IFPK:	=29THENA\$="CURSOR >":GOT060019	PEEK>29 IS SPECIAL CHAR
60005	IFPK	(170RPK)20THEN60019	NOT IN 'SPECIAL' RANGE
60006	A\$="(CURSOR V": IFPK>17THENA\$="REVERSE ON": IF	PK>18THENA\$="CURSOR HOME
60007	IFPK.	>19THENA\$="DELETE":REM	PET'S 'DELETE' KEY
80008	GOLO	50019	
60009	1		
60010	IFPK:	=131THENA\$="RUN":GDT060019	SPECIAL CASE ASCII'S
60011	IFPK:	=157THENA\$="CURSOR _":GOT060019	THESE 2 ARE ODD NUMBERS
60012	IFPK«	(145URPK>148THEN60019	NORMAL ASCII CHAR.
60013	A\$="(CURSUR ": IFPK>145THENA\$="REVERSE OFF":	IFFK2146THENAS="CLEAR SCREEN
60014	IFPK:	147THENAS="INSERT":REM	PET'S INSERT' KEY
60019	GOSUI	B63300: GU1050040	PRINT RESULTS & CONT.
			More

opened. I wanted the user to be able to specify this parameter and have it allocated dynamically in my program. But the DOS requires a numeric constant, not a variable.

The problem could be easily solved with Commodore's BASIC by having the user input the number of records he will require and then poking the ASCII equivalent of the input into the correct location in the OPEN statement in the program. So I needed to determine the exact memory locations (in decimal) that had to be poked.

The detective work started with the machine-language monitor. I tried to locate the line and statement that opened the new file. This can be done, but it's tricky. PET stores different ASCII codes for the same character in main memory and in screen memory. Not only must you know what to look for, but using the monitor requires hex to decimal conversion.

All this caused me to write MEMSEE. MEMSEE should be loaded before you start writing your new program if you don't have an append utility available. Line numbers start at 50000, so it won't interfere with the program line numbers.

When you want to do some poking in your program, enter the POKE

Address correspondence to Charles R. Trahan, 4 Congress Court, Quakertown, PA 18951. command with a dummy address; i.e., POKE 0000,32 then RUN 50000. An examination of the printout (or carefully watching the CRT display) will yield the exact decimal address of interest.

There are a couple of bonuses to running MEMSEE. You will learn how the PET stores your program in memory. The end-of-line marker, link-to-next-line and line numbers become easy to see. In the PET's memory what you see is not always what you get. For instance, BASIC commands are stored as one-byte tokens. MEMSEE displays what's in memory in decimal, and what it really means to the programmer.

In addition to viewing your BASIC text, you can examine the operating system's working space, addresses 512 to 634, and you'll see your lastused strings residing there. You can look at the top of user's memory where strings are stored, or just above BASIC text where variables are stored. You may be able to recall lost data this way.

Running the Program

Slightly less than 3K bytes are required for MEMSEE. Even the longest BASIC program usually sets aside at least this amount for string storage and arrays, so MEMSEE can be appended to the end of most programs and deleted when no longer required. Admittedly, this is tedious if you have no DELETE utility. When you first load or append MEMSEE you should remove the REM statements.

When you RUN 50000, you'll see the prompt HIT S TO STOP. Runs get rather lengthy so you have the option of terminating them at any time with the S key. Don't use the stop key or files won't be closed.

The prompts HI ADDRESS, LO ADDRESS will appear next. Enter any decimal addresses you want.

The next prompt, STOP @ LN, is asking for a line number at which to end the run. Hitting RETURN will default to 99999, this being greater than any possible line number. The line number you enter does not have to actually be in your program. The run will terminate when the line number in memory is greater than the one you entered.

If you default on line number, you will be asked STOP @ EOT. This stands for end of BASIC text. Respond with Y or N. Remember, if you stop at EOT rather than a line num-

Listing continued. 60998 : 60999 REM CALCULATE LINK & LINE NUMBERS 61000 IFAD<1024THENA5**----**:GOSUB63300:GOT050012 BELDW BASIC - IN 61002 F=0:A5**END OF LINE*:IFAD=1024THENA5**START BASIC TEXT 61005 GOSUB63300:GOSUB62000:A5**LINK*+STR\$(PK+256*PEEK(AD+1)):GOSUB63300 61007 GOSUB62000:A5**-----*:GOSUB63300 BELOW BASIC - INVALID 61010 GOSUB62000: P=PK+256*PEEK(AD+1): A\$="LINE #"+STR\$(P): GOSUB63300 CHECK FOR ENDING LINE# 61015 IFP=>LNTHEN50045 61020 GOSUB62000:A\$="----": GOSUB63300: GOT050012 61021 : 61999 REM LOOK @ PET'S MEMORY HERE 62000 AD=AD+1:PK=PEEK(AD):GETK\$:IFDTHENCMDD:REM 62010 IFK\$="S"THEN50045 62015 IFPK=34THENF=NOTF:REM BUMP ADDRESS & PEEK IT CHECK FOR STOP 'S' KEY KEEP TRACK OF QUOTES 62020 RETURN 62020 RETURN 62021 : 62090 REM BASIC TOKEN LODK-UP TABLE 63000 A\$="END": IFPK>128THENA\$="FOR": IFPK>129THENA\$="NEXT": IFPK>130THENA\$="DATA 63020 IFPK>131THENA\$="INPUT#": IFPK>132THENA\$="INPUT": IFPK>133THENA\$="DATA 63030 IFPK>134THENA\$="READ": IFPK>133THENA\$="INPUT": IFPK>135THENA\$="BATA 63040 IFPK>137THENA\$="RUN": IFPK>138THENA\$="LET": IFPK>136THENA\$="RESTORE 63050 IFPK>147THENA\$="CBOSUB": IFPK>148THENA\$="RETURN": IFPK>142THENA\$="REM 63060 IFPK>143THENA\$="STOP": IFPK>144THENA\$="GAVE": IFPK>145THENA\$="VERIFY 63070 IFPK>145THENA\$="DEF": IFPK>154THENA\$="CONT": IFPK>145THENA\$="VERIFY 63080 IFPK>145THENA\$="DEF": IFPK>153THENA\$="CONT": IFPK>154THENA\$="PRINT# 63090 IFPK>152THENA\$="PRINT": IFPK>153THENA\$="CONT": IFPK>154THENA\$="LIST 63100 IFPK>155THENA\$="CLR": IFPK>155THENA\$="CONT": IFPK>150THENA\$="SS 63110 IFPK>155THENA\$="CLR": IFPK>152THENA\$="TAB</THENA\$="SIFFK>160THENA\$="SGET 63120 IFPK>161THENA\$="NEW": IFFK>162THENA\$="TAB</THENA\$="TAB</THENA\$="TO 63120 IFPK>164THENA\$="NEW": IFFK>164THENA\$="THEN": IFFK>167THENA\$="NOT 63130 IFPK>164THENA\$="SFC(": IFFK>164THENA\$="THEN": IFFK>167THENA\$="TO 63120 IFPK>164THENA\$="NEW": IFFK>164THENA\$="THEN": IFFK>167THENA\$="TO 63130 IFFK>164THENA\$="SFC(": IFFK>164THENA\$="THEN": IFFK>167THENA\$="NOT 63140 IFFK>168THENA\$="STEP": IFFK>164THENA\$="THEN": IFFK>167THENA\$="NOT 63140 IFFK>168THENA\$="STEP": IFFK>164THENA\$="THEN": IFFK>167THENA\$="NOT 63140 IFFK>168THENA\$="STEP": IFFK>164THENA\$="THEN": IFFK>167THENA\$="-62021 : 63140 IFPK>168THENA\$="STEP": IFPK>169THENA\$="+": IFPK>170THENA\$= 63145 IFPK>171THENA\$=". 03149 IFFK.3171THENA5=".":IFFK>173THENA5="^":IFFK>174THENA5="AND 03150 IFFK>172THENA5="OR 03150 IFFK>175THENA5="OR 03160 IFFK>176THENA5="V:IFFK>177THENA5="=":IFFK>178THENA5=" 03165 IFFK>176THENA5="SGN 03170 IFFK>180THENA5="GN 03170 IFFK>180THENA5="INT":IFFK>181THENA5="ABS":IFFK>182THENA5="USR 03170 IFFK>183THENA5="FRE 03170 IFFK>183THENA5="FRE 63180 IFPK>184THENA\$="PDS":IFPK>185THENA\$="SOR":IFPK>186THENA\$="RND 63185 IFPK>187THENA\$="LOG 63190 IFPK>188THENA\$="EXP": IFPK>189THENA\$="COS": IFPK>190THENA\$="SIN 63195 IFPK>191THENA\$="TAN 63200 IFFK>1921HENA4="ATN": IFFK>193THENA4="PEEK": IFFK>194THENA4="LEN 63201 IFFK>195THENA4="ATN": IFFK>196THENA4="VAL": IFFK>197THENA4="ASC 63220 IFFK>195THENA4="CHR4": IFFK>199THENA4="LEFT4": IFFK>200THENA4="RIGHT4 63230 IFFK>201THENA4="MID4": IFFK>202THENA4="------": IFFK=255THENA4=CHR4 (222) 63231 63299 REM DISPLAY RESULTS HERE 63300 PRINTAD, PK; SPC(10-LEN(STR\$(PK)))A\$;: IFD=OTHENPRINT 63310 RETURN

101 9	THE ALL THE PARTY	STO MALENNA	
	1015	0	
	1016	0	
	1017	0	
	1018	247	
	1019	231	1
	1020	4	
	1021	207	F
	1022	0	UONORS:
	1023	142	RETURN
	1024	0	START BASIC TEXT
	1025	55	LINK 1079
	1026	4	
	1027	80	LINE # 50000
			MICPSON MX-70 S388
	3772	0	END OF LINE
Conness Store	3773	211	LINK 3795
	3774	14	IDENTED A DE GARCE PORQA DE LA
	3775	68	LINE # 63300
	3776	247	
	3777	153	PRINT
	3778	65	H I C THE ARE I VER UNDER CONTROL OF THE
	3779	68	SIL MYSCEPES 22.50
	3780	44	ZARAN AND TRANSPORT
	3781	80	SPUID NIY ST CHIMING (1990)
	3782	(5	K
	3783	44	and and the second second and
	3784	65	STHERE ATTAL INTER STOCKET A STOCKET AND SHITTERS
	3785	36	seattonero manuna minana
	3786	59	A their (box of 10)
	3787	58	Sinch Double Density - Long and
	3788	139	IF IF I I I I I I I I I I I I I I I I I
	3789	68	Denter Money Order Cashering D. C
	3790	178	Chack Cadded Check Paraonal
	3791	48	
	3792	167	THEN
	3793	153	PRINT
	3794	0	END OF LINE
	3795	217	LINK 3801
	3796	14	
	3797	78	LINE # 63310
	3798	247	
	3799	142	RETURN
	3800	0	END OF TEXT
	3801	0	
	3802	0	OVIA YARABARASI

Sample run. Starts below BASIC text, terminates at line 50000 and is rerun from address 3772 to the end of text.



ber, MEMSEE will be included in the disassembly.

Answer Y or N to LISTING. If you answer yes, a program listing will be given at the end of run. When the listing is complete, type GOTO 50054 and RETURN to properly close all files.

If you answered no, you will be asked if you want hard copy. A yes answer to either question will cause the prompt DEVICE # to be displayed. This permits hard copy to any printer.

After device #, or a no answer to the listing and hard copy prompts, the run will start. If your display is on the screen, it will scroll at a fairly readable rate. The S key will end the listing immediately, or use the stop key and CONT command to freeze the display. The scroll can be slowed down with the OFF/RVS key in the usual manner.

Program Description

A poke to graphics mode in line 50000 is required for a correct printout. Parameters are then entered in lines 50000 to 50008.

Line 50010 determines if a 0 was

found marking the end of a line. Line 50020 then checks for two more 0's marking the end of BASIC text.

If no 0's were found, the program branches to line 60000. The variable F indicates quotes mode and determines if peeks greater than 127 will be tokens (numeric values representing BASIC commands) or special PET characters such as cursor control. The proper token is looked up in lines 63000 to 63230 or the special character in lines 60001 to 60014. Values failing the special character check are assigned as ASCII in line 60003.

If an end-of-line 0 was found, but not followed by two more 0's, a branch is taken (line 50020) to line 61000. This is where the link and line numbers are calculated and displayed.

One special case is when the address is below 1024, start of BASIC. This is handled in lines 50020 to 61000. Addresses above the BASIC storage area will be seen as BASIC and print mostly nonsense, but string and variable storage should still be apparent.

Type in the program and try a run. You will see it disassemble itself.



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VISA

Change those North Star backslashes to colons and commas to semicolons before printing a listing—in three seconds or less!

Backslashes to Colons

By John A. Bryant

North Star BASIC makes unusual backslash and the comma. While many BASICs use the comma and the semicolon, North Star uses only the comma and gives it the meaning other BASICs attach to the semicolon. Also, in North Star the backslash is used instead of the colon to separate statements on the same line.

To add to all the confusion, my printer doesn't recognize a backslash. So before I send a listing to someone, I have to put in colons or backslashes by hand and change all the commas to semicolons.

It occurred to me that someone with a computer shouldn't be doing all that tedious work, so I dashed off an assembly-language program to quickly make the changes. The program was suggested by Rinaldo Prisco's space remover program in the January 1981 *Mircocomputing* (p. 40).

My program, like Prisco's, operates on the BASIC program while it is in memory, and thus is lightning-fast. It should be assembled to load at some free area that will not be occupied by the BASIC program—either high memory or below DOS. When it finishes its work, it returns you to BASIC, and the modified program can be either directed to the screen or printer with the LIST command, or saved to disk for later printing.

Address correspondence to John A. Bryant, 6648 N. Canandaigua Road, Holcomb, NY 14469.

How It Works

The program examines each byte of the BASIC program in memory and checks to see if it is a backslash (5C in hexadecimal) or a comma (2C). If the byte does represent one of those characters, it is replaced by the appropriate character, by means of a move immediate (MVI) instruction.

Remarks and matter within quotes or parentheses branch to the REM, QUOTE and PAREN routines, so that commas there are not changed. However, since my printer won't print a backslash, I designed the program to convert backslashes to colons no matter where they are found.

The SKIP routine is used to skip over line-number references, since they may contain the hexadecimal values of a backslash or a comma. North Star BASIC uses a 1 to mark the end of the program, so line 180 checks to see if the end of the program in memory has been reached, in which case a jump is made to an entry point for BASIC (line 170).

Entering the Program

The program is short; anyone with an assembler can enter it quickly using assembly-language mnemonics, and can then assemble it at any location. Note that the hex value at line 130 represents the last byte of BASIC, and the value at line 170 is a BASIC entry point. The values given are for release 5.0; if you are using a different version, you'll have to enter the appropriate values.

Even if you don't have an assembler and don't know assembly language from Latin, you can still enter and use this program.

The right-hand two-thirds of Listing 1 shows the assembly-language coding with remarks; the left columns represent the assembled version, assembled at 0000H. Listing 2 shows just the assembled version, assembled not at 0000H, but at the top of memory in a 32K machine with memory from 2000H to 9FFFH. Note that the four hexadecimal digits at the far left are the memory locations where the values shown at the immediate right are stored. When there is one two-digit value to the right, the memory locations increment by one; when there are two, the next location is incremented by two, and so on.

With that background, here's how to enter and save this program without an assembler:

•Decide whether you want to locate the program at 0000H or at 9F8BH.

•Load one of North Star's monitors at a location that will not overlap DOS or the area where the program is to be placed.

•Use the DS (display storage) feature of the monitor. If you're assembling at 0000H, enter DS 0, followed by a carriage return (otherwise, enter DS 9F8B, then the carriage return). The monitor will display the value at that location, followed by an equals sign.

•You then enter 21, press the space bar (not the carriage return), 9D, space bar, 5F, space bar, 23, space bar, and so on until you get to the end of the assembly listing, at which time you should press the carriage return. (Actually, at lines 130 and 170 you should enter the appropriate values for your version of North Star BASIC, as explained above. Note that when you're using the monitor they are entered backwards, that is, 5F9D would be entered 9D 5F.)

•Return to DOS by entering OS (Operating System), followed by a carriage return.

•Now create a file on a disk to hold the program by using the DOS CR and TY commands. For example, enter CR REPLACE 2 (carriage return), then TY REPLACE 1 0 (carriage return) or TY REPLACE 1 9F8B (carriage return), depending on where you located it.

• Finally, type SF REPLACE 0 (car-

L TA	BLE							
6	. Ka			0670		END	and the second s	;END
36 3	A			0660		MVI	M, JAH	;SUBSTITUTE A COLON
C2 6	2 0			0650		TNZ	PAREN	; BACKSLASH (
CA O	3 00	,		0630		JZ	NEW	BACKSLASUS
FE O	D			0620		CPI	ODH	;END OF LINE?
CA O	C 00	0		0610		JZ	CHECK	Participation and the second
FE 2	9			0600		CPI	29H	; PARENTHESES CLOSED?
7E				0590		MOV	A,M	; WITHIN PARENTHESES
23	E			0580	PAREN	INX	Ĥ	; ROUTINE FOR CHARS.
C3 4	C 00)		0570		JMP	QUOTE	,
36 3	A	-		0560		MVT	M. JAH	SUBSTITUTE A COLON
C2 A	C 00	He I		0550		TNZ	OLIOTE	; DACKDLADIT
CA O	3 00	,		0530		JZ	NEW 5CH	BACKELACUS
FE O	D			0520		CPI	ODH	;END OF LINE?
CA O	C 00)		0510		JZ	CHECK	
FE 2	2			0500		CPI	22H	;QUOTE CLOSED?
7E				0490		MOV	A,M	; WITHIN QUOTES
23	B			0480	QUOTE	INX	Н	; ROUTINE FOR CHARS.
C3 0	C 00)		0470		JMP	CHECK	
36 3	A			0460		MVI	M, JAH	SUBSTITUTE A COLON
C2 3	B Of)		0440		INZ	REM	; DACKSLASH?
CA O	3 00	,		0430		JZ	NEW	DACKET ACHO
FE OI	D			0420		CPI	ODH	;END OF LINE?
7E				0410		MOV	A,M	A THE PARTY OF THE PARTY OF THE
23				0400	REM	INX	Н	; ROUTINE FOR REMARKS
C3 00	C 00)		0390		JMP	CHECK	
36 3	A			0380		MVI	M, JAH	; SUBSTITUTE A COLON
C2 0	c 00)		0370		JNZ	CHECK	, shousing it
FE 50				0360	NEXT	CPT	SCH	BACKSLASH2
30 31 C3 0				0350		TMD	CHECK	SUBSTITUTE A SEMICOLON
22 3	1 00	,		0330		JNZ	M 3DU	CIDENTNIME & CENTOOLON
FE 20	C			0320		CPI	2CH	; COMMA?
CA 63	2 00)		0310		JZ	PAREN	
FE E	0			0300		CPI	OEOH	;LEFT PARENTHESIS?
CA 40	C 00)		0290		JZ	QUOTE	State of the state
FE 2	2			0280		CPI	22H	;QUOTE?
CA 31	B 00)		0270		JZ	REM	
FE SI	F			0260		CPI	8FH	REMARK?
CA O	3 00)		0240		JZ	NEW	FEND OF LINE?
CA O	A 00	,		0230		CPT	SKIP	FND OF LINE?
FE 92	A	64		0220		CPI	9AH	;REFERENCED LINE NO.?
7E	1.1			0210		MOV	A,M	
23				0200	CHECK	INX	Н	;GO TO NEXT BYTE
23				0190		INX	Н	
23	-			0180	SKIP	INX	Н	; SKIP OVER LINE NO.
CA O	4 21	, 19		0170		JZ	2D04H	YES-JUMP TO BASIC
FE O	1			0160		CPT	A,M	FUT VALUE AT H IN A
23				0140	NEW	INX	Н	;SKIP BYTE FOR # CHRS/I
21 91	D 51			0130	-	LXI	H, 5F9DH	; LAST BYTE OF BASIC
4.764				0120	;			
				0110	;			
				0100	HEX V	ALUE	AT LINE 170	IS ENTRY POINT OF BASIC.
				0090	HEX V	ALUE	AT LINE 130	IS LAST BYTE OF BASIC.
				0080	;			
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riage return) or SF REPLACE 9F8B (carriage return), as the case may be.

Using REPLACE

Any time you wish to modify a BASIC program for printing, load BASIC, load the program to be modified, use BYE to drop into the DOS, then type GO REPLACE (carriage return). Quick as a wink, the program will be modified and you will return to BASIC, where you can either list the modified program to the screen or printer or save it to disk. To modify additional programs once REPLACE has been loaded, merely load the program to be modified, press control-C, then enter JP 0 or JP 9F8B. Again, the program will be modified and you'll be back in BASIC in a flash.

This program is so fast that if you haven't been returned to BASIC and the READY prompt hasn't been printed within about three seconds after running REPLACE, something is wrong. You should reboot (press reset) and check to make sure RE-PLACE has been entered correctly and the other steps have been followed correctly.

One last point should be made with





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reference to using REPLACE. If you edit any line of the BASIC program after running REPLACE on it, any semicolons or colons in that line will be changed back to commas or backslashes by routines within BASIC. While that can be prevented by a couple of FILLs, it is easier to just run REPLACE again.

9F8B	21	9D	5F				
9F8E	23						
9F8F	7E						
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9F95	23						
9F96	23						
9F97	23						
9F98	7E						
9F99	FE	9A					
9F9B	CA	95	9F				
9F9E	FE	OD					
9FA0	CA	8E	9F				
9FA3	FE	8F					
9FA5	CA	C6	9F				
9FA8	FE	22					
9FAA	CA	D7	9F				
9FAD	FE	EO					
9FAF	CA	ED	9F				
9FB2	FE	2C					
9FB4	C2	BC	9F				
9FB7	36	3B					
9FB9	C3	97	9F				
9FBC	FE	5C	1				
9FBE	C2	97	9F				
9FC1	36	32	-				
9FC3	C3	97	9F				
9FC6	23	51	JE				
9FC7	75						
OFCR	FF	00					
OFCO	CA	OF	OF				
OFCA	EF	5C	JE				
9FCD	C2	CG	OF				
9FCF	02	20	91				
9FD2	30	JA 07	0.7				
9FD4	03	97	91				
9FD7	23						
9FD8	7E	-					
9FD9	FE	22	-				
9FDB	CA	97	9F				
9FDE	FE	OD					
9FE0	CA	8E	9F				
9FE3	FE	5C					
9FE5	C2	D7	9F				
9FE8	36	3A					
9FEA	C3	D7	9F				
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9FEE	7E						
9FEF	FE	29					
9FF1	CA	97	9F				
9FF4	FE	OD	-				
9FF6	CA	8E	9F				
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Faced with hundreds of different solutions to a problem, you can determine the best one with these optimization techniques.

Which Way Is Best?

By Louis C. Graue

Everyone wants to do things efficiently. These computer techniques present optimization solutions to people who have little time to develop expertise in mathematical programming, decision-makers working on any quantitative project, and people who never liked mathematics because it was too difficult.

You don't need to know any math, except how to read equations and inequalities involving variables and arithmetic operations. You need to know enough BASIC to understand FOR...NEXT loops. The necessary programs are very short.

If a problem has less than a million feasible solutions, the computer's speed lets you test every one of them and pick the best. When billions of solutions are feasible, you take random samples of millions of them and find the optimum of that sample. The first two examples below illustrate how to test all possible solutions. The last example shows how to use the Monte Carlo technique.

Maximum Profit

Suppose your company manufactures products A and B at a profit of \$50 and \$75, respectively. You know that department 1 takes ten hours to make product A and six hours to make product B. Department 2 requires five hours to make product A and 14 hours to make product B. Department 1 has no more than 200 man-hours available per day. Department 2 has no more than 300 manhours per day available. You wish to find the number of units of A and B that should be made to maximize the profit.

Let x be the number of units of product A and y the number of units of product B. The relevant information can be summarized as follows: Maximize P = 50x + 75y subject to $10x + 6y \le 200$ and $5x + 14y \le 300$. Notice that the inequalities restrict x to be no larger than 20 and y to be no larger than 21.

Program listing 1 examines all $20 \times 21 = 420$ feasible solutions in a few seconds and prints the best solution. Line 20 declares the variables to be integers. In line 30 we initialize the variable PM to be less than any possible maximum. Zero is sufficient here since all of the variables are nonnegative integers.

The FOR...NEXT loops consider the following ordered pairs: (0,0), (0,1), (0,2),...,(0,21), (2,0), (2,1), (2,2),...,(2,21),...,(20,21). The first

10 ' pROGRAM 1
20 DEFINT X,Y,P
30 PM=0
40 FOR X=0 TO 20:FOR Y=0 TO 21
50 IF 10*X+6*Y>200 GOTO 90
60 IF 5*X+14*Y>300 GOTO 90
70 P=50*X+75*Y
80 IF P>PM THEN PM=P:XM=X:YM=Y
90 NEXT Y:NEXT X
100 PRINT"THE SOLUTION IS:"
110 PRINT" X =";XM;", Y =";YM;", AND MAXIMUM P =";PM
120 END

Program listing 1. Programs written for the TRS-80.

of these pairs to satisfy the constraints of lines 50 and 60 will get to line 70 and evaluate the P function. Then line 80 compares this P function value with the current value of PM, which is 0. Therefore, P will be larger and is stored in PM (along with the x, y values that produced P), erasing 0. This process continues, and each time a P value is greater than the currently stored PM value (the maximum so far), the program jumps to the storage area and stores the new maximum. Finally, at the end of the program, the current stored maximum is the true maximum, because all possible solutions have been considered.

Minimum Delivery Cost

You have two sources for a product and three locations (A, B and C) where you need supplies. A needs ten units, B needs eight units and C needs 30 units. Source 1 can furnish 30 units and source 2 has 18 units. The cost of delivering one unit from source i to location j is shown in Table 1.

How should the 48 units needed be ordered to minimize the cost of delivery?

Let A1 be the number of units from source 1 to location A, A2 the number of units from source 2 to location A and so on. The problem can then be summarized as follows: Minimize C = 620A1 + 66B1 + 72C1 + 58A2+ 132B2 + 104C2, subject to A1 + B1 + C1 = 30, A2 + B2 + C2 = 18, A1 + A2 = 10, B1 + B2 = 8 and C1 + C2 = 30.

Address correspondence to Louis C. Graue, 624 Campbell Hill Road, Bowling Green, OH 43402. From the constraints you can see that A1 must be less than or equal to 10 (A1 + A2 = 10), and B1 must be less than or equal to 8 (B1 + B2 = 8). Also, C1 must be equal to 30 - A1 - B1. A2 must be less than or equal to 10 (A1 + A2 = 10), and B2 must be less than or equal to 8 (B1 + B2 = 8). Also, C2 must equal 18 - A2 - B2 (A2 + B2 + C2 = 18).

Program listing 2 examines all 9801 $(11 \times 9 \times 11 \times 9)$ feasible solutions and takes just over four minutes to complete the problem. By placing the print statement within the loops, each currently stored minimum will be printed (so you will have something to watch while waiting for the solution). The last one printed will be the best solution.

Eight units should be ordered from source 1 for location B; 22 units from source 1 for location C; ten units from source 2 for location A, and eight units from source 2 for location C to minimize the delivery costs, which will be \$35.24.

Monte Carlo Programming

If a problem has ten variables and each has only ten values, then you will have 10^{10} cases to examine. At the rate of one set of values per millisecond, 10^7 seconds is required to examine them. This is something more than 10^5 hours, or about ten years. To obtain a solution in a reasonable amount of time, take a random sample of a million feasible solutions and find the optimum of that sample using the same techniques explained above.

How good is the answer obtained by this method? Statistical procedures have been used to show that in any practical problem the answer is nearly optimum. However, even if this were not true, you would still have the best course of action out of millions of decisions. This method may not have been practical in the days when we had to pay dearly for computer time, but many microcomputers are turned off for the majority of the time. If this is the case, they could be working on the Monte Carlo programming problem for part of that time.

To illustrate the Monte Carlo technique, you seek to maximize

$$\begin{split} P &= X_{1}^{2} + X_{2}^{2} + 3X_{3}^{2} + 4X_{4}^{2} + 2X_{5}^{2} - 8X_{1} - 2X_{2} \\ &- 3X_{3} - X_{4} - 2X_{5} \\ subject to \\ X_{1} < 100, \ X_{2} < 100, \ X_{3} < 100, \\ X_{4} < 100, \ X_{5} < 100 \\ X_{1} + X_{2} + X_{3} + X_{4} + X_{5} < 401 \end{split}$$

 $\begin{array}{l} X_1 + 2X_2 + 2X_3 + X_4 + 6X_5 < 801 \\ 2X_1 + X_2 + 6X_3 < 201 \\ X_3 + X_4 + 5X_5 < 201 \end{array}$

with all variables non-negative integers.

There are 10 billion sets of values to be checked. Look at a random sample of 1 million points and take the one that gives a maximum P. Examine Program listing 3 and notice that we have not set up a FOR... NEXT loop for each variable as we did in the previous examples. We have set up one outside FOR...NEXT loop on J running from 1 to 1,000,000. Each time I assumes a new value, line 40 assigns each variable X1, X2, X3, X4 and X₅ a random value between 0 and 99. This set of values is checked as before, and the current best value is stored in PM. We get a printout of the form $(X_1, X_2, X_3, X_4, X_5)$ PM each time a new maximum is found. This shows the set of values giving the current maximum. The last value printed is the maximum P for the 1 million points checked.

I've run this program three times and the best value optained so far was 50420 at (50, 97, 0, 99, 1).

Conclusion

By following the examples, you should be able to write a program to solve optimization problems. You only need to substitute your function and constraints in place of the ones in the examples. The variables must have integer values. The variable which stores the extreme value must be initialized larger than any possible value of the function if you're seeking the minimum, or smaller than any possible value if you are finding a maximum.

If you wish to learn more about these techniques, I suggest the book *Computer Optimization Techniques* by William Conley (Petrocelli Books, Inc.). It's well written, elementary and contains a large number of examples.

	En va			n unden og sun sumbær næmme
	Source 1 2	To Location A \$6.20 \$.58	To Location B \$.66 \$1.32	To Location C \$.72 \$1.04
10 + 15 DE 20 CM 30 FC 40 CJ 50 IE 60 IE 70 IE 80 C=	PROGRAM BFINT A,B H=32700 DR A1=0 T 1=30-A1-E 7 A1+A2<> 7 B1+B2<> 7 B1+B2<> 7 C1+C2<> =120*A1+6	2 ,C O 10:FOR B1=0 1:C2=18-A2-B2 10 GOTO 110 8 GOTO 110 30 GOTO 110 6*B1+72*C1+58*	TO 8:FOR A2=0 *	TO 10:FOR B2=0 TO 8
100 I 100 I 110 F 120 F	PRINT Al; NEXT B2:N END	BI;CI;A2;B2;C2 EXT A2:NEXT BI Prog	ram listing 2.	WORDPRODUCTION
10 ' PROGRA 20 DIM X(5) 30 PM=0 35 FOR J=1 40 FOR I=1 50 IF X(1)+ 60 IF X(1)+ 60 IF X(1)+ 90 P=X(1)*X 3*X(3)-X(4) 100 IF P>=P 110 PRINT " 200 NEXT J 210 END	M 3 TO 10000 TO 5:X(I X(2)+X(3) 2*X(2)+2))+X(2)+6 X(4)+5*X X(4)+5*X X(1)+X(2) -2*X(5) M THEN P (";X(1);	00 =RND(100)-1:N +X(4)+X(5)>40 *X(3)+X(4)+6*X *X(3)>200 GOTO (5)>200 GOTO 2 *X(2)+3*X(3)*X M=P ELSE 200 ",";X(2);",";X	EXT I Ø GOTO 200 (5)>800 GOTO 20 200 ØØ (3)+4*X(4)*X(4) (3);",";X(4);",	10 +2*X(5)*X(5)-8*X(1)-2*X(2)- ";X(5);") ";PM

Use the information in a North Star diskette file directory as data. Here's how to access it from BASIC.

Treat Your File Directory As Data

By Stephen Lewis

Irun North Star BASIC on my Altair, and use it to keep track of stock prices, interest rates and other data. Several of the programs I've written require me to input the name of a disk file for the program to operate on. But two problems may arise.

First, a typing or file name error, or a failure to remember which drive holds the data disk ends program execution. Second, I may not know the complete file name, only the first one or two characters.

Also, I may wish to get a partial printout of the file directory (e.g., those with file names starting with NV), not the complete directory.

Thus, I need to be able to treat the file directory as data. I could use the

WORDPRO DISK ADDR 73

IT IS 48 BLOCKS LONG SINGLE DENSITY ITS FILE TYPE IS 7 TYPE DEPENDENT INFORMATION 24 45 32 SEPT DISK ADDR 145 IT IS 6 BLOCKS LONG ITS FILE TYPE IS 3 TYPE DEPENDENT INFORMATION 8 32 32 BASIC DISK ADDR 10 IT IS 52 BLOCKS LONG ITS FILE TYPE IS 1 GO ADDRESS IS 11520 TYPE DEPENDENT INFORMATION 0 45 32

Sample output.

Address correspondence to Stephen Lewis, 8005 30th St. S.E., Everett, WA 98205. ERRSET statement to catch the FILE ERROR IN LINE XXXX message without ending program execution, but this still leaves me guessing what the correct file name is. It also does not help me get my partial printout. I could keep a separate data file on the disk, duplicating the file directory, and update it every time I create or destroy a file. I don't like that method because most of my data files are created by programs and are not in the command mode. these problems. I use the statement READ#F,&N as part of the program. F is the number of a file with the name of the disk (the identifier for the four sectors, eight in quad density systems) starting at track 0, sector 0, on the disk. For the diskette supplied by North Star, this is MDQ-R5.1. N is a variable name. The & in front of the N signifies that the file is to be read one byte at a time. This method is necessary because the disk directory is not in the form of BASIC strings or numbers.

This program, called Quest, solves

```
10 REM * * * PROGRAM NAME IS QUEST * * *
 15INPUT "DESIRED OUTPUT DEVICE", P
 20 INPUT "DISK NAME ",A$
30 INPUT "NAME OF FILE TO LOOK FOR ",A1$
40 IF LEN (AL$)=8 THEN 80
50 IF LEN (AL$)=8 THEN 30 \ REM * * FILE NAMES ARE 8 CHARACTERS MAXIMUM
60 AL$ = AL$ + " * \REM ADD SPACES TO MAKE UP 8 CHARACTERS
    IF LEN (A1$) <8 THEN 60
OPLN #1*0, A$ \REM THIS OPENS DISK DIRECTORY FILE
FOR J = 1 TO 128 \REM * * 128 FOR A DOUBLE DENSITY DISK
 70
 80
 90
100 FOR I = 1 TO 8
110 READ#1,\&X(I) \REM THIS READS THE FILENAME FROM THE DIRECTORY
 120 NEXT I
130FOR I=1 TO 8\READ#1,&Y(I)\NEXT I
140A2$="" \REM * * * THE NULL STRING
 150 FOR I = 1 TO 8
160 A2$=A2$+ CHR$(X(I)) \ REM * * * THIS REASSEMBLES FILENAME
170 NEXT I
180 IF A2$ = "
                                   " THEN 280 \REM 8 SPACES BETWEEN THE QUOTE MARKS
190 IF A1$ = A2$ THEN 210
200 GOTO 280
210 PRINT#P,A2$," DISK ADDRESS ",\1#P,(Y(1)+256*Y(2))
210 PRINT#P,A2$," DISK ADDRESS ",\1#P,(Y(1)+256*Y(2))

PRESS RETURN TO CONTINUE

220 PRINT#P,"IT IS ",(2*(256*Y(4)+Y(3))),"BLOCKS LONG "

230 IF Y(5)<128 THEN !#P,"SINGLE DENSITY " ELSE Y(5)=Y(5)-128

240 PRINT#P,"ITS FILE TYPE IS ",Y(5)

250 IF Y(5)=1 THEN !#P,"GO ADDRESS IS ",(256*Y(7)+Y(6))

260 1#P,"TYPE DEPENDENT INFORMATION IS ",Y(6),Y(7),Y(8)
 270 GOTO 300
280 NEXT J
290 PRINT#P, "FILE NOT ON THIS DISK "
300 CLOSE#1\GOTO 10
READY
                                              Quest program listing.
```

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EXAMPLES FROM MTU-BASIC

ENTER "TRANSFER3"

Reads in an ASCII text file as program statements.

- SYSTEM "ASSIGN 1 BASICIN"
- Redirects input from keyboard to disk file named BASICIN. LEGEND 1, "First," "Second"
 - Relegends function keys 1 and 2 to read "First" and "Second".

LTPEN F, X, Y

Sets F = 1 and X, Y to coordinates when lightpen picks a point.

GRIN NW\$, X, Y

Displays crosshair and inputs X, Y location of its final position; NW\$ contains the exit key.

DRAW .0645, 3*Y

Draw a vector from current location of graphic cursor to specified coordinates.

LIB "VGL," "IGL"

Select library extensions to be linked to BASIC.

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Thank you and enjoy your subscription
Here are a couple of tips that take the aggravation out of computing.

Little Bits

Bag It By Kenneth Reid

Many computer hobbyists and professionals have been made painfully aware of the disastrous effects of spilled liquids—coffee and soft drinks, in particular—on computer keyboards. Once the gunk gets in around the keys it is nearly impossible to remove, and the sticky keys are a continual aggravation.

The best remedy is prevention. A thin sheet of transparent plastic, secured over the keyboard, will ward off spills without affecting keyboard operation. If your keyboard is separated from your video screen, as mine is, you can simply place the entire keyboard in a large clear plastic bag. If you have an all-in-one system, a sheet of Saran Wrap or similar clear plastic material will provide nearly the same level of protection if well secured with masking tape.

So before you eat, drink or make merry at your keyboard, bag it! The temper you save will be your own.

Kenneth Reid, 1935 Trevilian Way, Louisville, KY 40205.

Hex Table By F. LaPointe

0	1	2	3	4	5	6	7	8	9	A	В	С	D	Е	F
1	2	3	4	5	6	7	8	9	Α	В	С	D	Е	F	10
2	3	4	5	6	7	8	9	A	В	С	D	Е	F	10	11
3	4	5	6	7	8	9	Α	В	С	D	Е	F	10	11	12
4	5	6	7	8	9	A	В	С	D	E	F	10	11	12	13
5	6	7	8	9	Α	В	С	D	E	F	10	11	12	13	14
6	7	8	9	А	В	С	D	E	F	10	11	12	13	14	15
7	8	9	A	В	С	D	E	F	10	11	12	13	14	15	16
8	9	A	В	С	D	E	F	10	11	12	13	14	15	16	17
9	A	В	С	D	Е	F	10	11	12	13	14	15	16	17	18
Α	В	С	D	Е	F	10	11	12	13	14	15	16	17	18	19
В	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A
С	D	Е	F	10	11	12	13	14	15	16	17	18	19	1A	1B
D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C
E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D
F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E
	1				He	k addi	tion/s	ubtrac	tion to	able.					

Remember those math tables from grade school? Here's a little hex table to keep handy when you're writing that relative addressing instruction in assembly language.

F. LaPointe, 33 Windsor Court, Lansdale, PA 19446. Are you suffering from bad memory? Find out for sure with this Cook's memory test adapted for the PET.

Putting PET To the Test

By Garold R. Stone

Here is an adaptation for the PET computer of Fred Monsour's rigorous machine-language RAM test program ("Cook's Memory Test for the 6502," *Microcomputing*, June 1980, p. 178). It can be loaded and run on new ROM (3.0) and old ROM (2.0) PETs, with or without the machine-language monitor.

The Test

The program (Listing 1) repeatedly tests a specified range of RAM, printing an asterisk (*) as it completes each pass. If a bad byte is found, an error code (A,B,C; or D) will be printed, followed by the faulty address in hexadecimal. It takes about three seconds to test each eight kilobytes of RAM.

According to Monsour's article, error code ''A indicates a byte that can't have all 0's stored in it. Error B usually is due to shorted or open address lines, while error C is due to shorted or open data lines. Error D signifies a byte that can't store all 1's.''

For example, if an error C is found, the location of the bad bit (1-8) is printed first, followed by the error

Programs werded 10				
Memory size in hex	SL	SH	EL	EH
8K (0400-2000)	0	4	0	32
16K (0400-4000)	0	4	0	64
24K (0400-6000)	0	4	0	96
32K (0400-8000)	0	4	0	128
32K plus video	0	4	0	132
(0400-8400)				
Video only	0	128	0	132
(8000-8400)				
	Table 2. Test rang	e values in decimal	ins suite an	

code and the hexadecimal address 4C1000.

From KIM to PET

Monsour's KIM program is selfcontained, except for the use of one KIM ROM routine, OUTCHR, to output the results of the test. I substituted a PET ROM routine, WRT, which prints the contents of the 6502 accumulator as a character on the screen. It also updates the cursor position to be

Old ROM	New ROM	
POKE 539,137	POKE146,137	(low byte)
POKE 540,195	POKE 147,195	(high byte)
Set test range fr	rom BASIC:	
POKE 60, SL	(STARTL)	
POKE 61, SH	(STARTH)	
POKE 62, EL	(ENDL)	
POKE 63, EH	(ENDH)	
(See Table	e 2 for decimal v	alues.)
Run test:		SYS 826
Table 1. R	lunning under BA	SIC.

ready for the next character. No 6502 registers are changed by WRT.

Relocating the program to PET's second cassette buffer area was straightforward. None of the branch instructions had to be changed—just the jump and jump subroutine instructions. I changed the variables to locations which would not conflict with the operation of the BASIC interpreter in either the old or new ROM. I put the test in the second cassette buffer so that all of the PET's absolute RAM (0400 hex up) could be tested in one pass.

Unlike the KIM, the PET has no key that will trigger a hardware interrupt to stop a machine-language program, so I added a software interrupt routine. Where Monsour's program calls subroutine INC to increment the pointer, POINTL,H, to the next byte to be tested, I substituted a call to my subroutine, STOP (03ED hex), which tests for any depressed key (except shift). If no key is down, the PET ROM routine GET returns with the zero status flag set.

The branch if equal (BEQ) test is satisfied and the program branches to the instruction JUMP INC. INC increments the test pointer, POINTL,H, and returns to the address just below where STOP was called. If a key is down, the branch test fails and the software break instruction (BRK) is executed.

BRK loads the 6502 program counter with the address specified in the

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contents of the break interrupt vector. In new ROM PETs the break interrupt vector (0092,0093 hex) is set at power on (or reset) to contain the address of the warm start entry point for the machine-language monitor in ROM (FD17 hex). Commodore calls this monitor TIM for terminal interface monitor. In old ROM PETs the break interrupt vector is set to TIM's warm start address when TIM is loaded and run from tape. Users of old ROM may wish to use the program in Listing 2 to load the test, but they will have to set the break interrupt vector to the warm start point for BASIC, so that the test will return to BASIC when a key is pressed. Table 1 shows how to set up and run the test from BASIC, for old and new ROMs.

Running under TIM

Enter TIM and set the range of RAM to be tested in the variables START and END. Put the low-order byte of the starting address (in hex) into STARTL and the high-order byte in STARTH. The variable END

should be set to one byte higher than the last byte to be tested. ENDL is the low-order byte and ENDH is the highorder byte. Execute the program from the monitor with G 033A. Pressing any key during the test will cause a break back to the machine-language monitor.

General Considerations

Remember that the first kilobyte of RAM (0000-03FF hex) cannot be tested because it holds the pointers for the PET operating system. Testing this area would cause the PET to go out of control. To test the two RAM

. 077	A 20	97	50	TSP	\$9797								
, 033	0 89	AA	00	1DA	#\$00			0780	48			PHA	
033	F AS			TRY				ASAS.	38			TXA	
. 034	Ø 91	54		STR	(\$54).	Y		Ø384	20	CA	5.0	ISP	\$030A
. A34	2 81	54		IDA	(\$54).	ý		0787	45	55	00	IDA	455
074	4 FA	145		REG	\$074R		-	9769	20	23	67	TCD	\$970E
, 03- 07/	6 80	44		LDV	#444		'	0300	20	54	0.5	100	454
03-	0 73	DO	07	TCD	40700		'	0300	20	50	137	TCD	#070C
/ 034	0 20	50	67	TCD	40750		'	0304	20	DE	62	JOR	##303
, 03-	E 20	00	00	TCD	#03EU			0301	20	20	137	TCD	##20 #0200
/ 034	4 00	50	612	JOR DOD	₽0300		,	0300	20	2.11	80	ACL	\$0SUN
1 830	2 00	En 07	07	JCD	\$030U		'	0300	00			TOU	
/ 000	0 20	21	00	ACL	40071		'	0001	00			OLD	
/ 830	0 01	04		LUH	(\$04/)	Ť	'	0300	60			FLH	
, 030	8 10	00		DEW	\$030F		,	0383	00			KIS	+= +
, 033	H HE	42		LUX	#\$42		,	0.3BH	HO	54		LUH	\$04
1 033	6 20	HU	83	JSK	\$0.5H0		,	USEL	60	SE		CPIF	\$SE
, 033	F HZ	50		LUX	#\$98		,	USBE	HO	55		LDH	\$55
, Ust	1 43	101		LUH	#\$01		,	USLU	20	St		SBU	\$31
, USE	3 91	54		SIH	(\$54),	Y	,	MSC2	60			RIS	RIDGE N
, 1936	5 01	54		CMP	(\$54),	Ŷ	,	030.3	E6	54		INC	\$54
, 036	FØ	90		BEQ	\$0376		,	0305	DØ	05		BNE	\$0309
, 036	9 9A			TXS			,	0307	E6	55		INC	\$55
, 036	A 48			PHA			,	03C9	60			RTS	
, 036	B SA			TXA			1	03CR	20	02	FF	JSR	\$FFD2
, 036	C 20	CE	92	JSR	\$03CE		,	03CD	60			RTS	
, 036	F 68			PLA			. ,	03CE	85	56		STR	\$56
, 037	0 A2	43		LDX	#\$43		. ,	0300	48			LSR	
, 037	2 20	HØ	83	JSR	\$83A0			0301	4A			LSR	
, 037	5 8A			TSX				0302	48			LSR	
, 037	6 ØA			ASL			. ,	0303	48			LSR	
, 037	7 CA			DEX			. ,	0304	20	DF	03	JSR	\$030F
, 037	\$ 00	E9		BNE	\$0363		. ,	0307	A5	56		LDA	\$56
, 037	A A9	FF		LDA	#\$FF		. ,	0309	20	DF	03	JSR	\$03DF
, 037	C 91	54		STR	(\$54).	Y		Ø3DC	85	56		LDA	\$56
, 037	E 01	54		CMP	(\$54).	ý		M3DE	69			RTS	
, 038	A FA	05		REA	\$0387	the second		030F	29	ØF		AND	#\$0F
, M3F	2 82	44		IDX	#144			03F1	69	AR		CMP	#\$08
, M38	4 20	AA	03	ISR	\$0.700			MRFR	18			CIC	
, 038	7 20	FD	100	JSR	\$93FD			M3F4	30	A2		BMT	\$0358
, 939	6 20	EA	55	TSP	40320			MILL	69	87		208	#\$97
. 075	n 90	67	00	RCC	\$03011		1	03EQ	69	20		anc	#470
. 000	FAG	õA		LDA	#\$28		1	ASEA	40	63	17	TMP	49309
. 970	1 20	CA	07	TCD	\$9700			ASED	20	E4	FE	TCP	\$FFFA
. 035 070	4 40	20	82	TMD	\$030H			0320	53	L4	TT	030	\$9757
. 035	7 45	35	00	100	\$20		ci 1	0350	10	OT		DCU:	+0353
. 035 070	9 25	54		STO	454		ende	0352	40	53	07	TMO	\$0202
. 035 070	00 00	20		100	#20			0355	40	65	02	DDV	*0363
037		50		CTC	455			0300	90		8	DRA	
0000	0 00	00		DIC	400			0350	00			DKK	
037	00 40			PU0			. '	0350	00			DRK	
970	4 90			TUO			. '5	OSF3	00			DKK	
000	1 20			ITT									

BEGINA	033A
NEXTA	033D
INCA	034B
BEGINB	0356
WALK	035F
NEXTB	0363
SHIFT	0376
INCB	0387
INIT	0397
ERR	03A0
COMP	03BA
INC	03C3
RET	03C9
PRNT	03CA
PRBYT	03CE
HEXASC	03DF
HEXASD	03E8
STOP	03ED
GOINC	03F3
Table 3. Statemer	nt labels for Listing 1.
	and the second
DATA32, 151, 3, 163 0, 5, 162, 65, 32, 160 DATA144, 234, 32, 3 6, 32, 160, 3, 162, 8, DATA240, 13, 154, 7 67, 32, 160, 3, 186, 3	9, 0, 168, 145, 84, 177, 84, 9, 3, 32, 237, 3, 32, 186, 3 151, 3, 177, 84, 240, 5, 162 169, 1, 145, 84, 299, 84 72, 138, 32, 206, 3, 104, 16 10, 202, 208, 233, 169, 255
DATA145, 84, 289, 8 , 32, 237, 3, 32, 186, DATA202, 3, 76, 58, 133, 85, 96, 72, 152,	34, 240, 5, 162, 68, 32, 160 3, 144, 199, 169, 42, 32 3, 165, 60, 133, 84, 165, 6 72, 138, 32, 202, 3, 165, 8
DATA32, 206, 3, 165 202, 3, 104, 168, 104	5, 84, 32, 2 86 , 3, 169, 32, 3 4, 96, 165, 84, 197, 62, 165

7 DATA85, 229, 63, 96, 230, 84, 208, 2, 230, 85, 96, 32, 210, 255, 96, 133, 86, 74, 74, 74, 74, 74, 32, 2 23 8 DATA3, 165, 86, 32, 223, 3, 165, 86, 96, 41, 15

, 201, 10, 24, 48, 2, 105, 7, 105, 48, 76, 202, 3, 32

9 DATA228, 255, 240, 1, 0, 76, 195, 3

10 Y=0 20 FORI=826T01013

30 READX: POKEL, X

22263 2, 4 ,3 1,5 6 2,

40 Y=Y+X: NEXT

45 PRINT DATA CHECK SUM SHOULD BE 19554 ": PRINT 50 IFY<>19554THENPRINT"DATA CHECK SUM E RROR: "Y : END CONTRIDUCT: CHECK SUM OK: "Y: END

READY

Listing 2. Poker/Loader.

chips that store these pointers, swap them with chips at a higher address. When testing the video range, the screen will fill with at signs (@) and the checkerboard character (code 255), thus obscuring the asterisk until an error code is printed.

Old ROM users should note that testing RAM from 0400–076A hex will overwrite the machine-language monitor. The test itself will run, but if a key is pressed to stop the test, the PET will break to the now nonexistent monitor and it will crash.

Those with the Programmer's Tool

									RERS
	0338	20	97	2.0	89	RA	88	91	54
	0342	81	54	FØ	195	82	41	20	RØ
	034A	03	20	ED	03	20	BA	03	90
. : 0	0352	EA	20	97	03	61	54	FØ	05
1:12	035A	R2	42	20	AØ	03	H2	08	A9
. : 0	0362	61	91	54	01	54	FØ	00	9A
. :	036A	48	8A	20	CE	03	68	Ĥ2	43
.:	0372	20	A0	03	BA	ØA	CA	00	E9
. 1	037A	A9	FF	91	54	01	54	FØ	05
. :	0382	A5	44	20	AB	03	20	ED	03
. : 6	038A	20	BH	03	90	C7	A 9	28	20
. :	0392	CA	03	40	38	03	A 5	30	85
.:	039A	54	H 5	30	85	55	60	48	98
. :	03A2	48	8A	20	CR	03	A5	55	20
51:15	Ø3AA	CE	03	H5	54	20	CE	03	A9
	03B2	20	20	CA	03	68	H8	68	60
ovin	M 3BH	HO	54	15	SE	HS	55	ED	St
	0302	60	26	54	00	62	E6	55	60
STOR	USCH	20	02	Pr-	50	85	36	44	41
	0302	44	41	20	UF	03	CH	36	20
• :	03DH	UF	10	HD	06	60	29	OF CO	20
	03EZ	AC	10	30	20	67	50	50	30
	03EA	40	dr.	63	20	64	603	ENG.	01
	0372	00	40	63	0.5	00	00	00	00
:016									Jac
		Tab	le 4.	He	c du	mp.			19

Kit or disk units or any other programs which use the second cassette buffer will want to make sure they are not running. Otherwise they may overwrite the test program. For the same reason, some users may not be able to copy the test program intact to disk.

References

"It's Here: Cook's Memory Test" (8080 version), Rod Hallen, *Microcomputing*, July 1978, p. 70.

"Memory Trouble Shooting Tech-

niques," Charles Cook, Microcomputing, Oct. 1977, p. 58.

Pet Machine Language Guide, Abacus Software, Grand Rapids, MI, 1979, routines WRT, GET.

PET/CBM Personal Computer Guide, Donahue and Enger, Osborne/Mc-Graw-Hill, Berkely, CA, 1980, Memory maps—NEW, p. 334; OLD, p. 414. PET/CBM User's Manual (NEW ROM), routines WRT, GET & TIM, BRK, p. 116.

PET User's Manual, PET 2001-8 (OLD ROM), Oct. 1978, TIM, BRK, WRT, GET, pp. 97-111.

Variable	Hex	Decimal	Function in New ROM
STARTL	003C	60	Current DATA line number (low-order byte)
STARTH	003D	61	Current DATA line number (high-order byte)
ENDL	003E	62	Current DATA line pointer (low-order byte)
ENDH	003F	63	Current DATA line pointer (high-order byte)
POINTL	0054	84	Floating point accumulator #3
POINTH	0055	85	Floating point accumulator #3
TEMP	0056	86	Floating point accumulator #3

Table 5. All variables are within the old ROM BASIC input buffer.

Routine	New ROM	Old ROM	Function in both ROMs
WRT	FFD2	FFD2	Write a character to the screen
GET	FFE4	FFE4	Get a character from keyboard; set status
READY	C389	C389	BASIC warm start
TIM	FD17	0427	Warm entry point for TIM
BRK	0092	021B	BRK interrupt vector location (low byte)
	0093	021C	BRK interrupt vector location (high byte)







Dot Matrix Printer Interfaces with Apple II Featuring an Apple II®-compatible parallel interface, Addmaster Corporation has produced a new dot matrix printer, Model 170. The interface includes a Centronics-type handshake and DB-25 interface connector, Baudot, and day and time clock, The Model 170 provides 18 or 21 characters per line, 6 lines per inch print density, on standard 2½²¹ adding machine tape. Designed to use with personal computers, Model 170 will produce hard and carboiless cipies of programs, data or results. Write Addmaster Corporation, 416 Junipero Serra Dr., San Gabriel, CA 91776 or call 213/285-1121. Give your printouts that up-to-date look with these Benton Harbor BASIC programs.

Heath's Hidden Time-Saver

By Charles E. Cohn

Many applications require that the current date be shown on the printout. The program can, of course, have you enter the date. But if the operating system has already called for the date to be entered, it is much more convenient to extract the information internally, and save you the bother of entering the date a second time.

If you use a Heath H8 or H-89 with Benton Harbor BASIC and HDOS, it is easy to extract that information. HDOS stores the date in two different forms. First, and most straightforward, the nine bytes starting at location 8383 contain the date in alphanumeric in the form in which it was en-

00010 D D = '' ''
00020 FOR I = 1 TO 9:D\$ = D\$ + CHR\$(PEEK(8382 + I)):NEXT I
00030 PRINT D\$
00040 END
Listing 1.

tered; e.g., 30-Oct-80. Even though the month may have been entered either in upper- or lowercase, the first letter of the month as stored is always capitalized, and the remaining two letters are stored as lowercase.

This information can be extracted as shown in Listing 1, which prints out the date just as stored. Variations are possible; you can, for example, drop off the hyphens or change the order of the month and the day.

If you wish to do something fancier, such as print the full name of the month, you might want to use the date in the other form in which it is stored, i.e., in binary at locations 8392 and 8393. The low-order five bits of the byte at 8392 give the day, while the high-order three bits are the low-order part of the four-bit month. The low-order bit of the byte at 8393 is the high-order part of the month, while the remaining bits of that byte give the year minus 1970. This information can be used as shown in Listing 2, which prints the date in the form October 30, 1980.

00010 N1 = PEEK(8392):N2 = PEEK(8393):N3 = INT(N1/32):N4 = INT(N2/2) 00020 D = N1 - N3 * 32 00030 M = N3 + N2 * 8 - N4 * 16 00040 Y = N4 + 1970 00050 FOR I = 1 TO M:READ M\$:NEXT I 00060 DATA January,February,March,April,May,June,July 00070 DATA August,September,October,November,December 00080 D\$ = STR\$(D) 00090 PRINT M\$ + LEFT\$(D\$,LEN(D\$) - 1) + '','';Y 00100 END Listing 2.

Address correspondence to Charles E. Cohn, 445 Ridge Ave., Clarendon Hills, IL 60514.



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Power Jump For the 1802

By Brian McCorkle

This feature for 1802-based systems lets you jump to the monitor when you turn the power on. It eliminates the reset/load/reset/run sequence necessary to bootstrap the address of your monitor. An added switch contact lets you jump to the monitor from a running (crashing)

Parts List

	C1	1 μF tantalum
	C2	.01 µF ceramic
	C3	10 µF tantalum
	D1,2,3	1N914
	IC1	1802
	IC2	4050 hex buffer
	IC3	555 timer
	IC4	4066 quad switch
	R1,5	47k ohm
	R2,6	22k ohm
	R3	100k ohm
	R4	1 megohm
	all resis	stors 1/4 watt 5 percent
	S1	1 pole, normally open momentary
		contact
	S2	2 pole, normally open momentary
		contact
1	Fig. 1. 7	The hardware required for a power-o
j	ump to r	monitor.

program. You can also add a switch to let you run at address zero. The circuitry required to do this is quite simple.

You need a self-latching monitor in ROM, and the ROM must be entered with register zero as the program counter.

The jump circuit cycles the 1802 through reset and into run. It also temporarily disables RAM at address #0000 and places the monitor at that address. The first memory write pulse resets the circuit and the system returns to normal operation.

IC1 is the 1802 (Fig. 1). Pin 2(wait) is tied to the 5-V supply. Pin 3(clear) is then used to set IC1 in the reset or run mode.

IC2, R1, R2, R3 and C1 is the reset run portion of the circuit. When you turn on the power the output of IC2 remains low for about 60 ms, holding IC1 in reset. IC2 then goes high, placing IC1 in the run mode. S1 is used to start this sequence from a running program. D1 provides for rapid discharge of C1 if power is lost.

The output of IC2 is also sent to IC3, which disables the RAM at #0000 and transfers the monitor to this location. IC3 is a 555 timer in the

ni s	tart Registe	er 0 is at 0000.	
4000) F840	LDI #40	40 is example. This number is determined by ROM location.
4002	2 BO	PHI RO	Register 0 now at 4003.
4003	3 F82FB2	LDI #2F,PHI R2	
4006	5 F8FFA2	LDI #FF, PLO R2	
4009	9 E2	SEX R2	Locate data pointer to free location.
400	A 73	STXD	Memory write to reset timer.
etc.		UTIL	

Listing 1. Example of the requirement of the ROM to latch its own address and reset the timer with a memory write pulse. The addresses given are examples. Actual values will depend on where your ROM is located.

monostable mode, and its period is fairly long; but in practice it is reset by the first memory write pulse.

The output of IC3 is a high level which drives an OR circuit, consisting of D1, D2, and R5, high. This signal is also used to switch IC4, so a low level is placed on the chip enable of the monitor ROM.

S2 is a run at zero switch. S2A does the same thing as S1. S2B times IC3 out before the reset period is done so no memory switching takes place.

As mentioned, the monitor must be self-latching. Listing 1 gives a way to go about this. The Quest monitor V1.1 does work, and the VIP monitor should also work.

The layout of this project is not critical. The prototype was wirewrapped and distributed over several boards.

In case you have trouble, first check for shorts and opens. Then be sure all COME-FROMs and GOTOs match.

If this doesn't correct the problem, temporarily place a $10 \,\mu$ F capacitor in parallel with C1. The output of IC2 should stay low for about one-half second after power on or S1 depression. The output should then go high. The output of IC3 should go high during this period and drop low shortly thereafter. If this output remains high for ten seconds, then IC3 is not being reset by a memory write pulse. Finally, the cathode of D1 should be a high level and pins 3 and 11 of IC4 should be a low level.

This simple circuit will eliminate a great deal of key punching. I have found it a great convenience well worth building into a system.

Address correspondence to Brian McCorkle, 220 Washington Ave., Neenah, WI 54911.

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(from page 22)

Answer: 67

This program finds the index of the rightmost occurrence of the string LS within the string SS.

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For more information contact Dr. Linda Leffel, CEC., VPI and SU, Blacksburg, VA 24061. 703-961-4848.

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The Robots VI Conference and Exposition will be held March 1–4 in Detroit, MI. Contact RI/SME, One SME Drive, PO Box 930, Dearborn, MI 48128. 313-271-1500, ext. 416.

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For more information write Catalyst Conference, H 112, Jersey City State College, 2039 Kennedy Blvd., Jersey City, NJ 07305.

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Software/Expo-West

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For more information write Software/Expo-West, Suite 400, 222 West Adams St., Chicago, IL 60606. 312-263-3131.

Seventh West Coast Computer Faire

The seventh West Coast Computer Faire will be held March 19–21 in San Francisco, CA. Contact Laurie McLean, 333 Swett Road, Woodside, CA 94062. 415-851-7075.

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Videotext '82 will be held April 12–16 in New York City. Contact Steve Weissman, Information Gatekeepers, Inc., 167 Corey Road, Brookline, MA 02146. 617-739-2022.

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Submit for review by Feb. 1, 1982, six copies of your paper or panel proposal to Dr. Peter Neumann, SRI International EL301, 333 Ravenswood Ave., Menlo Park, CA 94025.

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Deadline for abstracts is March 26, 1982. Abstracts, including author's name, title, company, address, phone and telex, should be submitted as soon as possible to William D. Ashman, Program Coordinator—Peripheral '82, Cahners Exposition Group, 222 W. Adams St., Chicago, IL 60606.

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A workshop on the automotive applications of microprocessors sponsored by the Industrial Electronics Society of IEEE will be held Oct. 7 and 8, 1982, at the Hyatt Regency Hotel, Dearborn, MI.

The workshop will focus on applications of microprocessors to automobiles, trucks, vans and allied automotive products.

Papers are being solicited for presentations at the workshop. Those interested in presenting a paper at the workshop should submit two copies of a 300–500 word summary (double-spaced) to John G. Neuman, Technical Program Chairman, General Motors Research Labs, Electrical Engineering Dept., GM Technical Center, Warren, MI 48090, by Feb. 15.

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The sixth Western Educational Computing Conference will be held in San Diego, CA, on Nov. 18 and 19, 1982, under the sponsorship of the California Educational Computing Consortium.

Original papers dealing with computers and computer applications in any area that might be of intrest to instructors and administrators who use computers at the college or university level should be sent no later than March 1, 1982, to Professor Grant, Center for Information and Communications Study, California State University, Chico, CA 95929. They should be typed, double-spaced and approximately 1500 words in length. The title page of each paper must contain the author's name, complete mailing address and telephone number. A brief abstract should precede the text.

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Athana, BASF, Control Data, Dysan, IBM, Maxell, Nashua, Scotch, Shugart, Syncom, 3M, Verbatim or Wabash

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Product Family	Product Description	Memorex Part Number (3201-)	CE quant. 100 price perdisc(\$)	Athana	BASF	Dysan	IBM	Maxell	Nashua	Scotch 3M	Shugart	Syncom	Verbatim	Wabash	Control Data
Cated Street	IBM Compatible (128 B/S, 26 Sectors)	3060	1.99	473071	53428	800506	2305830	FD1-128	FD-1	740-0	S/A 100	15002	FD34-9000	FIIIIIX	421602
Flexible Disc 1s	IBM Compatible (128 B/S. 26 Sectors) w/ W P N	3062	2.04	1+6.30	- 194	and failers to	-17912	1220	191-10-1	740-0	1000	13.000	FD34-9000		- A.
Single Headed Drives	IBM Compatible (128 B/S, 26 Sectors) w/ W P N & Hub Ring	3064	2.39	3+0.10	in the	- 10 C		100-2	1.198		1000000000	12121000	FD34-9000		
Single-Density Media	IBM Compatible (128 B/S, 26 Sectors) REVERSIBLE	1729	3.19	473072	54431		rach- c.P.	110-00	FD-2	740/2-0	1.000	15150	FF34-9000	F171111X	- 7
	IBM System 6 Compatible	3066	2.04	473077	54561	800509	1669959			740-0 056		15003	FD60-9000	F116111X	-
	IBM Compatible (256 B/S, 15 Sectors)	3109	1.99	473073		800584	2305845	1 - 3 -	-	740-3600	-212	15005	FD36-9000	F112111X	
	IBM Compatible (512 B/S. 8 Sectors)	3110	1.99	473074	100-500	800585	1669954			- 11	-28	15004	FD60-9000	F113111X	- 3
	Shugart Compatible, 32 Hard Sector	3015	1.99	470901	53802	101/1	1.1.1	FH1-32	FD-132	740-32	S/A-101	15025	FD32-9000	10 - 3	421322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3067	2.49	Contrario	54491					740-32RH	No. No. C	1. 411		F37A411X	
	CPT 8000 Compatible	3045	2.69	1015144		Let.Lo		120	100 -101		o the	15226	119 - 2014	100 -	
Flexible Disc 1d	IBM Compatible (128 B/S, 26 Sectors)	3090	2.69	474071	54568	3740/10	-	FD1-128/M2100	FD-1D	741-0		-	FD34-8000	F131111X	423002
Single Headed Drives	Soft Sector (128 B/S. 26 Sectors) REVERSIBLE	3093	3.69			19970	100-10	- 1	1100 -1110		-		-	-	
Double Density Media	Shugart Compatible, 32 Hard Sector	3091	2.69	470801	54596	101/1D	1 Acres	FH1-32D	12903 14 44	741-32	S/A-103	15075	F 332-8000	F33A411X	423322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3088	3.09	0814-5280		1 -	1206	2	COM LINE		- 1	15 - 19	R	-	-
Flexible Disc 2s	Soft Sector (128 B/S, 26 Sectors)	3113	3.09	50/+ 900	54428	800814	1766870		Non President		S/A-150	15153	FD10-4026	F121111X	14-11
Double-Headed Drives Single-Density Media	Soft Sector (256 B/S, 15 Sectors)	3106	3.09	473477	54226	800815	2736700	FD2-2560	NOR O	742-0	-	15154	FD10-4015	F122111X	424612
Flexible Disc 2d	Soft Sector (Unformatted)	3102	3.09	473485	-	DY150		FD2-XDM	FD-2D	743-0		15103	DD34-4001	-	425002
Double-Headed Drives	Soft Sector (128 B/S, 26 Sectors)	3115	3.09				1.				S/A-150	_			-
Double-Density Media	Soft Sector (256 B/S, 26 Sectors)	3103	3.09	473471	54325	800817	1766872	ED2.2560	1000	743-0/256	_	15101	DD34-4026	F144111X	425602
	Soft Sector (512 B/S, 15 Sectors)	3114	3.09	473472	54479	800818	1669044			743-0/512		15100	DD34-4015	F145111X	425612
	Soft Sector (1024 B/S B Sectors)	3104	3.09	473473	54485	800819	1669045	1 986	A COMPANY	743-0/1024	1000	15102	DD34-4008	F147111X	425622
	32 Hard Sector	3105	3.00	470851	51105	101/20	1000010	EH2.220		743.32	S/A-151	15125	DD32.4000	F34A411X	425322
	Burroughs B.80 Compatible 32 Hard Sector	3003	3.09	470001	1 000 TO 1	101110		PH2-320		140-02	0.14.101	-		F34A611X	-
	Soll Sector (1024 B/S B Sectora) w/ Mub Rise	3092	3.09			23	and the first			100	000.00	100000	1.1		
	Shugart Compatible, 32 Hard Sector	3181	3.49	- 15	1921	Ra		1.	2.1			12-1	DD32-4000		1 -1
Flexible Disc FD	Contract of the Contract of th	19.4			1000				1.1.		5.66	12.11		1. TO 1	
Memorex 651 or Equiv. Drive Compatible	FD VI (Vinyl Jacket)	30712003	2.69	470651	-	FDIV	C. C	-1.0	FD-165	511-0	-12	15026	FD65-1000	F61A111X	-
Mini Flexible Disc 1s	Soft Sector (Unformatted)	3401	1.94	475001	54256	104/1	10-07	MD1	MD 1	744-0	S/A-104	15300	MD525-01	M11A211X	441002
5%" Single-Headed	10 Hard Sector	3403	1.94	475010	54257	107/1	-	-	MD 110	744-10	S/A-107	15325	MD525-10	M41A211X	441102
Drives	16 Hard Sector	3405	1.94	475016	54258	105/1	11110	MH1	MD 116	744-16	S/A-105	15326	MD525-16	M51A211X	441162
Single-Density Media	Soft Sector (Unformatte 1) w/Hub Ring	3431	2.14	-	-	13-10		-	-	- 34	- 11	-	MD525-01	-	
	10 Hard Sector, w/Hub Ring	3433	2.14		-		-				-	-	MD525-10	-	-
Presidente i com	16 Hard Sector, w/Hub Ring	3435	2.14	-	-		-			5, 5		New Trav	MD525-16	- 5 B	
Mini Flexible Disc 1d	Soft Sector (Unformatted)	3417	2.14	-	54646	104/1D	-	-					MD525-01	100 - 00 - 00 - 00 - 00 - 00 - 00 - 00	
5%" Single-Headed	10 Hard Sector	3418	2.14	10 11-1 (C)	54649	107/1D		-		-	-	-	MD525-10	- 10	-
Drives	16 Hard Sector	3419	2.14		54652	105/1D			and the second		-	- 23	MD525-16		-
Double-Density Media	Soft Sector (Unformatted) w/Hub Ring	3481	2.34	2.040.8	-	1/-	-	-	-	-	-		MD525-01	-	-
	10 Hard Sector w/Hub Ring	3483	2.34	10 miles 200	-	-	-	-	-	-	-	-	MD525-10		-
and and	16 Hard Sector w/Hub Ring	3485	2.34		-		-	-	TON	-	-	-	MD525-16	-	-
Mini Flexible Disc 2d	Soft Sector (Unformatted)	3421	2.59	-	54624	104/20	-	-	4.4		S/A-154	-	MD550-01	-	-
5%" Double-Headed	10 Hard Sector	3423	2.59	-	54627	107/20	-	-	-		S/A-157	-	MD550-10		Value Trans
Double Density Media	16 Hard Sector	3425	2.59	-	54630	105/20	-	-	-	5 -2.6	S/A-155		MD550-16	1 . To . C	1.01
source venany media	Soft Sector (Unformatted) w/Hub Ring	3491	2.79	-	-	-	-	-	-		-	-	MD550-01		10010
	10 Hard Sector w/Hub Ring	3493	2.79		-				-		-		MD550-10	1 - 1 -	
	16 Hard Sector w/Hub Ring	3495	2.79	1. 170 M	-	-	-	-		0	-	-	MD550-16	24 - 5	-

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The Super Elf includes a ROM monitor for program loading, editing and execution with SINGLE STEP for program debugging which is not in-cluded in others at the same price. With SINGLE STEP you can see the microprocessor chip operating with the unique Quest address and data bus displays before, during and after executing in-structions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 video graphics chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key HEX keyboard includes 16 HEX keys plus load, reset, run, wait, input, memory protect, monitor select and single step. Large, on board displays provide output and optional high and low address. There is a 44 pin standard connector slot

Super Expansion Board with Cassette Interface \$89.95

This is truly an astounding value! This board has been designed to allow you to decide how you want it optioned. The Super Expansion Board comes with 4K of low power RAM fully address-able anywhere in 64K with built-in memory pro-tect and a cassette interface. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the Super Elf. The board includes slots for up to 6K of EPROM (2708, 2758, 2716 or TI 2716) and is **fully socketed**. EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor \$19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate pro-

Bockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer 20 char alphanu-meric display ROM monitor., fully expandable. \$419.00. 4K version \$449.00. 4K Assembler \$35.00. 8K Basic Interpreter \$65.00

Special small power supply 5V 2A 24V .5A assem. in frame \$59.00. Molded plastic enclosure to fit both AIM 65 and power supply \$52.50. AIM 65 1K in cabinet with power supply. switch fuse cord assem \$559.00, 4K \$579.00. A65/40-5000 AIM 65/40 w/16K RAM and monitor \$1295.00. RAM Board Kit (16K, \$195) (32K, \$215). VD640 Video Interface Kit \$119.00. A&T \$149.00. Complete AIM 65 in thin briefcase with wer supply \$518.00. Special Package Price: 4K AIM, 8K Basic, power supply, cabinet \$629.00 AIM 65/KIM/SYM/Super Elf 44 pin expansion

board board with 3 connectors \$22.95.

Elf II Adapter Kit \$24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional \$18.00.

Quest Super Basic V5.0

new enhanced version of Super Basic now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic** by **Ron Cenker** including floating point capability with scientific notation (number range $\pm .17E^{38}$), 32 bit integer ±2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs; and over 75 statements, functions and operations. New improved faster version including re-number and essentially unlimited variables. Also, an exclusive user expandable command

library Serial and Parallel I/O routines included

Super Basic on Cassette \$55.00.

for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for all IC's are included plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music pro-gram and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D

Remember, other computers only offer Super Elf features at additional cost or not at all. Compare before you buy. Super Elf Kit \$106.95, High address option \$8.95, Low address option \$9.95. Custom Cabinet with drilled and labelled plexiglass front panel \$24.95. All metal Expansion Cabinet, painted and silk screened, with room for 55-100 boards and power supply **557.00. NiCad Battery Memory Saver Kit \$6.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for \$12.00 per 12 issues. Single issues \$1.50. Issues 1-12 bound \$16.50.

Moews Video Graphics \$3.50, Games and Music \$3.00, Chip 8 Interpreter \$5.50, Starship 4K cas-sette \$14.95.

Free 14 page brochure of complete Super Elf system.

gram bugs quickly, then follow with single step. If you have the Super Expansion Board and Super Monitor the monitor is up and running at the push of a button.

Other on board options include Parallel Input and Output Ports with full handshake. They allow easy connection of an ASCII keyboard to the input port. RS 232 and 20 ma Current Loop for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. Parallel I/O Ports \$9.85, RS 232 \$4.50, TTY 20 ma I/F \$1.95, S-100 \$4.50. A 50 pin connector set with ribbon cable is available at \$18.95 for easy connection between the Super Elf and the Super **Expansion Board**.

Power Supply Kit for the complete system (see Multi-volt Power Supply below).



Super Color S-100 Video Kit \$129.95 Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expand-able to 6K. S-100 bus 1802, 8080, 8085, Z80, etc. Dealers: Send for excellent pricing/margin program.

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Softwar

164 Microcomputing, January 1982

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VAK-7 8" FLOPPY DISK SYSTEM FOR AIM-65, SYM-1



The VAK-7 Disk System was specifically designed for use with AIM-65 and SYM-1 Microcomputer Systems. The VAK-7 is a complete full size (8") Floppy Disk System. This system will Read, Write and Format IBM Single and Dual Density diskettes. The VAK-7 is available with both Single and Dual Sided Disk Drives. Each Disk Drive comes with its own cabinet and Power Supply. The VAK-7 can handle up to 4 disk drives, totaling more than 4.98 Megabytes of storage.

The VAK-7 Disk System incorporates both advanced hardware and innovative software designs. The addition of the VAK-7 produces a very powerful and useful computer system. Unlike most other disk systems, there is no requirement for the user to provide RAM to hold the Disk Operating System software. No valuable time is wasted loading in the DOS from cassette

tape, because the VAK-7 DOS software is in onboard ROM. The VAK-7 is located above the 32K boundary (8000 HEX), leaving the user with a full 32K bytes of contiguous address space for his own use.

AIM-65—Allows the user to save and load object code thru the AIM Monitor; to load, save, and append Text thru the AIM Editor; to load, save, and append Basic Programs thru the BASIC INTERPRETER; to assemble directly from disk single or multiple file programs.

SYM-1—Allows the user to save and load Files for use with the SYM Monitor, SYM Basic, and RAE-1.

ADDITIONAL COMMANDS:

ACTIVATE A DELETED FILE COMPRESS A DISK RENAME A DISK FILE COPY A DISK

SPECIFICATIONS:

- · Completely assembled, tested, and burned in.
- Occupies address 8000–8FFF for AIM-65, \$9000–9FFF for SYM-1, or \$E000–EFFF for KIM-1.
- IBM Format; Single Density (128 bytes/sector); Dual Density (256,512, or 1024 bytes/sector).
- All ICs are in sockets.
- · Fully buffered address and data bus.
- Standard KIM-4* BUS (both electrical pin-out and card size).
- Designed for use with a regulated power supply, but has provisions for adding regulators for use with an unregulated power supply.
- Dimensions: Board—10" wide x 7" high (including cardedge). Cabinet—9.25" wide x 10" high x 16" deep.
- Power Requirements: + 5v DC @ 2 Amps.
 - 117 AC 60Hz @ 2 Amps.
- Shipping Weight: 25 lbs.

*KIM-4 is a product of MOS Technology/C.B.M.



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Versafloppy II Double density controller with CP/M 2.2



• S-100 bus compatible • IBM 3740 compatible soft sectored format • Controls single and doublesided drives, single or double density, 5¹/₄" and 8" drives in any combination of four simultaneously • Drive select and side select circuitry • Analog phase-locked loop data seperator • Vectored interrupt operation optional • CP/M 2.2 disk and manual set included • Control/diagnostic

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SBC-200

2 or 4 MHz single board computer



• S-100 bus compatible • Powerful 4MHz Z-80A CPU • Synchronous/asynchronous serial I/O port with RS-232 interface and software programmable baud rates up to 9600 baud • Parallel input and parallel output port • Four channel counter/timer • Four maskable, vectored interrupt inputs and a non-maskable interrupt • 1K of on-board RAM • Up to 32K of on-board ROM • System monitor PROM included

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CPU-30200A A & T with monitor . \$299.95

ExpandoRAM II

16K to 64K expandable RAM board



• S-100 bus compatible • Up to 4MHz operation • Expandable from 16K to 64K • Uses 16 x 1 4116 memory chips • Page mode operation allows up to 8 memory boards on the bus • Phantom output disable • Invisible on-board refresh

The ExpandoRAM II is compatible with most S-100 CPUs. When other SD System' series II boards are combined with the ExpandoRAM II, they create a microcomputer system with exceptional capabilities and features.

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Multi-user operating system

• Multi-user disk operating system • Allows up to 8 users to run independent jobs concurrently • Each user has a seperate file directory

COMOS supports all the file structures of CP/M 2.2, and is compatible at the applications program level with CP/M 2.2, so that most programs written to run under CP/M 2.2 or SDOS will also run under COSMOS.

SFC-55009039F COSMOS on 8" disk \$395.00

Multi-User System SBC-200, 256K ExpandoRAM III, Versafloppy II, MPC-4

COSMOS Multi-User Operating System, C BASIC II

Two Z-80A CPUs (4 MHz), 256K RAM, 5 serial I/O ports with independently programmable baud rates and vectored interrupts, parallel input port, parallel output port, 8 counter/timer channels, real time clock, single and double sided/single or double density disk controller for 5¼" and 8" drives, up to 36K of on-board ROM, CP/M 2.2 compatible COSMOS interrupt driven multi-user disk operating system, allows up to 8 users to run independent jobs concurrently, C BASIC II, control and diagnostic software in PROM included.

-All boards are assembled and tested-MPC-4



• Four buffered serial I/O ports • On-board Z-80A processor • Four CTC channels • Independently programmable baud rates • Vectored interrupt capability • Up to 4K of onboard PROM • Up to 2K of on-board RAM • Onboard firmware

This is not just another four-port serial I/O board! The on-board processor and firmware provide sufficient intelligence to allow the MPC-4 to handle time consuming I/O tasks, rather than loading down your CPU. To increase overall efficiency, each serial channel has an 80 character input buffer and a 128 character output buffer. The on-board firmware can be modified to make the board SDLC or BISYNC compatible. In combination with SD's COSMOS operating system (which is included with the MPC-4), this board makes a perfect building block for a multi-user system.

IOI-1504A A & T with COSMOS .. \$495.00



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Computer Products

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Three cards in one!	Real time clock/calendar, seri	al interface,
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IOI-2050K	Par & Ser kit \$139.95
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Through the use of the Intel 8275 CRT controller with an onboard 8085 processor and 4k memory, the VIO-X interface operates independently of the host system and communicates via two ports, thus eliminating the need for host memory space. The screen display rate is effectively 80,000 baud.

The VIO-X1 provides an 80 character by 25 line format (24 lines plus status line) using a 5 \times 7 character set in a 7 \times 10 dot matrix to display the full upper and lower case ASCII alphanumeric 96 printable character set (including true descenders) with 32 special characters for escape and control characters. An optional 2732 character generator is available which allows an alternate 7×10 contiguous graphics character set.



The VIO-X2 also offers an 80 character by 25 line format but uses a 7×7 character set in a 9 × 10 dot matrix allowing highresolution characters to be used. This model also includes expanded firmware for block mode editing and light pen location. Contiguous graphics characters are not supported.

Both models support a full set of control characters and escape sequences, including controls for video attributes, cursor location and positioning, cursor toggle, and scroll speed. An onboard Real Time Clock (RTC) is displayed in the status line and may be read or set from the host system. A checksum test is performed on power-up on the firmware EPROM.

Video attributes provided by the 8275 in the VIO-X include:

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- INVERSE CHARACTER
- UNDERLINE CHARACTER or
- ALT. CHARACTER SET
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The above functions may be toggled together or separately.

The board may be addressed at any port pair in the IEEE 696 (S-100) host system. Status and data ports may be swapped if necessary. Inputs are provided for parallel keyboard and for light pen as well as an output for audio signalling. The interrupt structure is completely compatible with Digital Research's MP/M ®.

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LETTERS TO THE EDITOR

NTS Molasses

I found J.C. Hassall's article in the Oct. 1981 issue of *Microcomputing* ("Become a Troubleshooter—In 34 Easy Lessons," p. 182) most interesting, and, in a sense, comforting because I am also caught in the grip of the National Technical Schools molasses-like administration. My experience so far with NTS seems to be no better, and in one respect worse, than Mr. Hassall's. (I am enrolled for VA educational assistance reimbursement the GI Bill—and NTS seems unable to properly handle the few additional bits of paperwork required by the VA!)

There is one bit of confusion in Mr. Hassall's article. NTS actually has (at least they did when I enrolled in April 1981) three microcomputer courses which eventually result in the student getting a Heath HN-89A computer. Course No. 1 is the long course (28 months to complete) without advanced standing; the cost is \$2875 at the \$75/month payment rate, \$2632 at the \$100/month rate. Course No. 1B (with advanced standing) has an estimated completion time of 25 months and costs \$2576/\$2381 at the payment rates mentioned. Course No. 1D (with advanced standing) has an estimated completion time of 18 months and costs \$2278/ \$2130 at the foregoing payment rates. The difference between 1D and 1B is partly that 1D gets only the HN-89A computer, while 1B also gets the NTS "Compu-Trainer" and a digital logic probe.

In my view, the NTS 1D course is worth the money—provided the student is prepared to be patient with the slowness and confusion of NTS administration, and is not expecting to depend on NTS advisors for special help. Frankly, they don't seem to know what they're doing, at least in respect to microcomputers. The NTS advertisements are still saying that the Heath All-In-One Computer can have up to 32K bytes of memory!

I am especially disturbed by the "examination" system used by NTS. As Mr. Hassall said, almost all of the questions are really quoted statements from the text. Often they are used completely out of context in that the quotation is from discussion of a specific example in the text, but its use in an examination implies a general applicability that is false. The examination technique using quotations forces the student only to scan the text for the key words, but requires him/her to actually understand or learn nothing.

So far, I have pointed out to NTS eight

outright errors in their grading of examination questions, or in the wording of questions that resulted in more than one correct answer. In one case, a question quoted an error in the text (which misstated the meaning of the letters ASCII) indicating to me that the staff preparing and reviewing the examination questions know little or nothing about their subject!

My conclusion is that it is entirely up to the student to get his money's worth of learning from the NTS microcomputer course. He cannot even rely on the examinations, which should normally be a major part of the educational process.

> Elmer A. Goetsch Three Lakes, WI

I have received mail every day since the October issue came out with the National Technical Schools review "Become a Troubleshooter—In 34 Easy Lessons," p. 182. Every writer experienced the same problems which I described. Most indicated that, while the treatment described in the article is inexcusable, there is solace in the knowledge that others have been given the treatment.

I sent a courtesy copy of the article to Mr. R. Hessler, the manager of student services, inviting his comments. Three months later he responded that my "...comments are being studied and we will use them in making adjustments to the microcomputer course." New students who wrote indicate that no improvements have resulted from the article, so apparently I failed in my attempt to improve the situation through the "power of the pen."

Therefore, I suggest all students who are having trouble to send a letter to the National Home Study Council, 1601 18th Street N.W., Washington, D.C. 20009. I understand that these people certify home study schools. Include in the letter as much substantiating documentation as possible. Angry diatribes with no corroboration will have little effect. A word to G.I. Bill students: send a letter to the VA with the same information, also. They may reconsider the school's certification.

Beyond that, all I can say to presently enrolled students is either make a lot of phone calls to Mr. Hessler, or expect to wait. Eventually the kits will arrive. Good luck.

> J.C. Hassall Blacksburg, VA



Fig. 1. Power supply modification.

Still Won't Burn

I have just read your reply to Ron Hassinger on p. 16 of the March 1981 issue. I wish to remind him that his 2 A fuse still won't burn.

He must be aware that a fuse rating at 2 A means it is specified to carry 2 A safely. The fusing current for a 2 A fuse is 4 A. Please note that fusing current is always double the rating current.

Further, the 2 A fuse he uses draws too much voltage and will upset his computer. (A 2 A fuse usually measures 0.2 or 0.3 ohms.) That's why OSI supplied him with a 5 A fuse.

To blow his 5 A fuse from a 3 A power supply, he must add a large value capacitor to the output point of his power supply as shown in Fig. 1. The extra capacitor will supply the current to blow the 5 A fuse when his crowbar works.

Charn-Leung Kong Hong Kong

Lazy Writer Rave

I completely sympathize with the complaints in your October *Microcomputing* editorial: as a businessman I know what it's like trying to use a computer at a work station that wasn't designed for somebody who has more to do than enter data all day. But I think you're shortchanging your system with the remark, "I find (a typewriter) better for most of my writing than the slower word processing systems."

I'm a fast typist, too. I used to write news for a TV station and I frequently write advertising copy for pocket money now. When I was in college I had a job as a secretary; at one time I was clocked at 65 words a minute. Most typewriters are too slow for my fingers.

About a year ago I purchased Lazy Writer, a word processing program by David Welsh, for my TRS-80 Model I. It's wonderful. Even though my machine has the old style (mechanical contact) keyboard, the processor keeps up with my fastest bursts of inspiration. Words wrap around the screen before I can say them in my head. Changes and revisions are easy in the text entry mode, and almost automatic in the editing mode. In fact, the only software I've ever owned that I was this happy with was the stuff I wrote myself.

The publisher is also good about documentation (my Lazy Writer manual is almost half an inch thick) and terrific with support. When an upgrade was issued six months after I bought the program, they mailed me a copy—without my asking. When the package was returned by the post office as undeliverable, they sent it UPS. I suspect if UPS hadn't gotten through, they would have strapped it to a Saint Bernard.

In fact, the only problem I've had with the system (other than hardware problems; it's an old TRS-80) was with the upgrade. I like to use NEWDOS; the upgrade was released on TRSDOS, and I had some problems transferring one of the files. When I explained my problem to Therese Welsh (and sent her a few bucks to cover media and mailing), she mailed me a NEWDOS disk and a spare TRSDOS disk, just in case.

Lazy Writer offers straight and formatted disk saves, complete printer support, full editing, and even a module that'll process text in and out of an RS-232 board for communications. The publishers run their business as well as I try to run mine. If you're still convinced that you can write faster on your IBM, get a copy from them.

Jay Rose Boston, MA

Plotting Data Revised

In the March 1980 issue of *Microcomputing* the article "Plotting Data or Functions" by Dr. Gordon W. Wolfe (page 167) contained a program for plotting a graph (in SWTP 8K BASIC) which we have revised and use almost every day in our engineering work.

The TRS-80 version that we use is shown in the Program listing. A sample problem printout is also shown.

This program combines Listings 1 and 3 from Dr. Wolfe's article as our work involves plotting X-Y coordinates rather than functions.

The only difference between Dr. Wolfe's original program and our version (other than changes in format due to the differences in BASIC) is that we have used -1, -1 as the flags to indicate the completion of coordinate entrances. This enables the plotting of (0,0), the origin of the X-Y coordinate axis, where desired (as in the sample problem).

The only difference between our TRS-80 version and an OSI MicroSoft BASIC version that we also use is that line 9870 (TAB(3)) in the TRS-80 version becomes TAB (5) in the OSI version.

> Bernard L. Golding, PE Orlando, FL

Program listing.

5 DIM T1(60,2) 10 T2=0 20 INPUT"X,Y COORDINATE";X,Y 3Ø T2=T2+1 31 T1(T2,1)=X 32 T1(T2,2)=Y 40 IF X<>-1 THEN 20 50 IF Y<>-1 THEN 20 51 T2=T2-1 55 PRINT: PRINT 56 FOR I=1 TO T2 60 PRINT T1(1,1),T1(1,2) 65 NEXT I 70 PRINT: PRINT 80 INPUT "X TITLE";X\$ 90 INPUT "Y TITLE";Y\$ 95 PRINT: PRINT 9520 PRINT TAB(10);Y\$ 953Ø T3=9E-9:T5=T3 954Ø T4=9E+9:T6=T4 9550 FOR I1=1 TO T2 9560 IF T1(11,2)>T3 THEN T3=T1(11,2) 9570 IF T1(11,1)>T5 THEN T5=T1(11,1) 9580 IF T1(I1,2)<T4 THEN T4=T1(I1,2) 9590 IF T1(I1,1)<T6 THEN T6=T1(I1,1) 9600 NEXT Il 9610 U5=INT(2.3*LOG(ABS(T3))) 9620 PRINT TAB(9); T4; TAB(56); T3 9630 PRINT TAB(10); 9640 FOR I1= 1 TO 53 9650 PRINT "-"; 9660 NEXT Il 9665 PRINT 9685 U8=1 969Ø T8=(T5-T6)/4Ø 9700 T9=(T3-T4)/50 9710 FOR I1=1 TO 40 9720 U9=ASC(X\$) 9730 IF U9=0 THEN U9=32 974Ø X\$=MID\$(X\$,2) 9741 IF X\$="" THEN X\$=" " 9745 U7=T6+(I1-1)*T8 9760 PRINT CHR\$(U9); CHR\$(32); 9762 PRINT USING"###.##";U7; 9763 PRINT CHR\$(33); 9764 IF U8+1>=T2 THEN 9766 9765 IF U7>T1(U8+1,1) THEN U8=U8+1 9766 IF I1=40 THEN 9780 9770 IF U7<T1(U8,1) THEN9840 9780 U6=INT((T1(U8,2)-T4)/T9-.01) 9785 IF U6<=Ø THEN 9820 9790 FOR 12=1 TO U6 9800 PRINT CHR\$(32); 9810 NEXT 12 9820 PRINT CHR\$(42) 9825 U8=U8+1 9830 GOTO 9860 9840 PRINT CHR\$(32) 9860 NEXT I1 9870 PRINT TAB(3); T5 988Ø END

Sample run.

X,Y	COORDINATE?	0,0
X,Y	COORDINATE?	10,40
X,Y	COORDINATE?	20,100
X,Y	COORDINATE?	30,80
X,Y	COORDINATE?	40,60
X,Y	COORDINATE?	50,40
X,Y	COORDINATE?	60,20
X,Y	COORDINATE?	70,10

(More
service with it. However, this summer a
piece broke in the PerSci disk drive and I
have been unable to get it fixed. I have
written PerSci, Cromemco, an advertiser
in the Cromemco User's Group Newslet-
ter, as well as having a local dealer try to
get the part for me.
The second

Cromemco did answer my letter after about six weeks, but offered no help. PerSci has yet to be heard from. The advertiser answered promptly, but did not sell parts. The local dealer drew a blank with PerSci, also.

So I limp along with a single drive, not knowing where to turn. Cromemco is doing well, probably best of the S-100 companies, and I see that PerSci has a new prestigious ad out. But can they compete with IBM without spare parts support?

> Malcolm Gillis, president MEGA Corporation Toney, AL

Literature Appreciation

After reading the review of Stan Kelly-Bootle's *The Devil's DP Dictionary* by John Edwards (*Microcomputing*, Oct. 1981, p. 260), it is my studied opinion that the review should have never been allowed to reach print. It is obvious that Mr. Edwards did not (or more likely was unable to) understand the context within which, and the viewpoint from which, the *Devil's DP Dictionary* was written.

One's earliest training in literature appreciation concerns the idea of reading the introduction or preamble (if one is provided). If Mr. Edwards had done this, he would have learned that the book was intended to be sort of an appendix of technical terms to Ambrose Bierce's Devil's Dictionary. Bierce's book expounds on words common to all human experience, therefore its humor is accessible to everyone. Kelly-Bootle's concerns itself with those terms in the common experience of the mainframe computer world not those in the world of the micro "baby boom." In both cases, the humor is witty and subtle. Not of the type that clubs one over the head as Mr. Edwards seems to require. If the reader is not intimately familiar with the words and phrases and their real meanings, much of the humor could fly right over their heads. It is easy to get some help from a knowledgeable friend as I did (and, apparently, as Mr. Edwards did not). About the only point on which I concur is that the price is a bit high. But the group to which the book is directed (long-time dp professionals) is still rather small compared to the prospective audience for a Harold Robbins novel. The economics of scale apply.

> Welbrey A. Hill, Jr. Tallahassee, FL

Dealer's Fault?

Sample run continued.

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10

20

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5Ø

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70

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S

X TITLE? X-AXIS

Y TITLE? Y-AXIS

0.001*

2.001

4.00!

6.001

8.001

10.001 12.001 14.001

16.001

20.001

22.001

24.001 26.001

28.001

30.00!

32.001

34.001

38.001

40.001

42.001

44.001

48.001

50.001

52.001

54.001

58.001

60.001

62.001

64.001

68.001

70.001

72.001

74.001

78.00!*

80

Y-AXIS

X,Y COORDINATE? 80,0 X,Y COORDINATE? -1,-1

Ø

40

100

80

60

40

20

10

Ø

I was surprised to see the letter by Duncan Moyer in your November issue (p. 211). I too have bought an Osborne. The problem Mr. Moyer had (additonal charge for setup) must have been just a problem he had with his local dealer. I bought mine through Computer Center in Rochester, NY. The dealer was helpful from the time I first inquired about the Osborne until the final delivery. The only extra costs I encountered were the New York state sales tax. There was no setup or any other extra charges. I have not had

the opportunity to test his warranty repair, as the machine has functioned perfectly since I have had it. The problem Mr. Moyer has is not with Osborne Computer Corp. but rather with a dealer attempting to make a few extra bucks.

> William L. Roberts Brooktondale, NY

100

Where to Turn?

My business uses a Cromemco Z2 computer and I have had three years of good

BOOK REVIEWS

Edited by Lise Markus

Beware the New Electronic Media Intro for 6800 Experimenters Stargazer's Guide to Computing

Electronic Nightmare: The New Communications And Freedom

John Wicklein Viking Press, 1981 Hardcover, 282 pp., \$14.95

Is there life after high tech? John Wicklein thinks so—but as the title of this book indicates, he doesn't think it's going to be handed to us on a platter.

Wicklein, a former *New York Times* editor and once a programmer for several TV stations, foresees a wide range of problems arising from what he calls the "multifaceted, integrated communications system" offered by modern electronic communications.

"The new technologies of communication *can* provide great benefits to society—I have no doubt about that," he says. "But unless we plan carefully for their arrival, rather than let them hit us headon, the threats they bring with them may outweigh the benefits we may enjoy."

In particular, Wicklein is afraid that electronic media will lead to serious abuses of our right to privacy. Corporations or the government could compile a highly detailed profile of anyone who uses videotext systems for home banking, shopping and information retrieval. Such a dossier could, for instance, tell any interested party whether you'd bought books that espoused unpopular political views. It could tell to what causes you had made contributions. It could provide details on who you associated with, what products you bought and what magazines you read. Two-way television-such as the Qube system in Columbus, OH-offers other possibilities. The central computer can, for instance, keep careful track of what you watch, or monitor the views you express during interactive programs.

But the potential problems don't end here. Consider, for example, the ease with which this information could be made available. No laws currently prevent corporations from selling such dossiers to anyone with the money. Furthermore, it is a simple matter to tap communications lines without the knowledge of either the citizen or the host computers. And finally, a system could select from its database what Wicklein calls "guidance" items "to apply a corrective to the subscriber's mindset" if that subscriber is deemed to have objectionable political opinions.

Such a scenario seems, on the surface, to be absurd. But two prominent names in recent American history prove different—Joseph McCarthy and Richard Nixon. It was McCarthy who used seemingly innocent facts to persecute innocent citizens, and it was Richard Nixon who tried to systematically undermine our right to freedom of expression and belief through illegal wiretaps and surveillance.

Even Wicklein's proposal that information could be prescreened to correct a citizen's opinions doesn't seem so ridiculous when one considers the extent to which the Moral Majority and other conservative groups are trying to control what Americans see, hear and read. (Wicklein points to a case in which five dictionaries were pulled from the shelves of a Texas school because they contained too many objectionable words. What would the Moral Majority think about an electronic encyclopedia that included details about the human reproductive system?)

Privacy is not the only issue Wicklein tackles. He also discusses, for example, the question of who will provide and control information that will be transmitted to American homes. Does videotext fall within the regulative boundaries of the Federal Communications Commission? If so, will newspapers that transfer to new electronic media slowly lose their First Amendment right to freedom of the press? If a monolithic communications system develops in the hands of a megacorporation like AT&T, how can we be sure that the news will not be censored to support that corporation's self-serving vision of the world?

Also, who will have access to such a system? Will citizen's organizations and individuals be able to use it for a reasonable price? Will people with questionable political opinions be given a fair chance to use the medium?

Wicklein is committed to the idea that AT&T should not be allowed to operate as both a carrier and information-provider. He points to enormous problems in calling to account "the world's largest private corporation with an annual budget and revenues greater than most countries of the world."

Wicklein continues: "The temptation of such a powerful entity to influence, to interfere with, or subtly or openly to try to control the content of the nation's news and information lifeline over which it had been given exclusive jurisdiction would be very great indeed."

If Wicklein had stopped with these major questions, he would have had himself a substantial book. Unfortunately, he tries to cover a number of other issues: the impact of modern telecommunications on social relationships, whether governments and corporations will tend to centralize or decentralize, whether rich countries and multinational corporations will use information extracted from less-developed countries for national and commercial gain, and the impact of satellite technology. While Wicklein intended his book to be an overview of the potential dangers of electronic media, he tries to cover far too much. By the end of the book, the reader is following far too many threads of thought, and Wicklein fails to tie them up satisfactorily.

Nevertheless, *Electronic Nightmare* offers some important insights into the potential ramifications of the new electronic media. We would do well to remember Wicklein's concluding sentence:

"None of the potential benefits of the new communications will come about unless we shape the technology to human ends and not let it shape us in a commercial or authoritarian mold."

> Eric Maloney Microcomputing staff

Microcomputer Experimentation with the Motorola MEK 6800D2

Lance A. Leventhal Prentice-Hall, Inc., 1981 Softcover, 438 pp.

Microcomputer Experimentation with the MEK 6800D2 is a good introductory text on microcomputers and also offers material for the more advanced student or hobbyist. The book is set up so that the reader can carry out the problems and examples on an MEK 6800D2 microcomputer, a 6800-based machine-language computer with a keyboard and sevensegment LED displays. This computer has a well-thought-out monitor program and doesn't require a CRT terminal, making it a good low-cost tool for individual or class study.

The text is clearly written and well organized. Each chapter covers a particular topic and introduces terms and 6800 instructions as required. Many of the examples and problems involve running programs on the MEK 6800D2 as is; others require a small amount of additional hardware such as LEDs, TTL ICs and switches. The hardware additions are minor in nature and are well documented so they should pose little problem, even for the novice. The author often presents both hardware and software approaches to the same problem and discusses the trade-offs in cost, development time and performance. The examples in the book which I ran on the computer were bug free, which supports the statement on the back cover that the examples are fully tested.

The first five chapters cover use of the MEK 6800D2 JBUG monitor commands as well as simple input and output using switches and LEDs. Switch debouncing as well as output to seven-segment displays are discussed using both hardware and software methods. Later chapters cover how to handle tables of data using 6800 machine or assembly language, flowcharting and debugging, the use of breakpoints and single stepping, and binary and BCD arithmetic. Chapters A-F treat slightly more advanced topics including subroutines and stack, I/O (using handshaking), interrupts, timing methods, serial I/O and microcomputer timing and control. Topics are covered clearly from the ground up with examples and problems to be carried out on the MEK 6800D2.

Of particular interest to me were discussions of the proper use of the stack, the JBUG monitor subroutines, subtleties of various instructions, changing of parameters on the stack using indexed addressing and the use of timing loops to determine the rate of incoming serial data. The chapter on serial I/O was particularly good because the examples used the on-board UART hooked up in a loopback mode allowing you to send and receive serial data and get a feel for the process.

This book is set up to teach microcomputer techniques by having the reader try the problems and examples on his own system. Although it doesn't include any full blown projects, you should be well prepared to use a microcomputer in your own application after you finish the book.

The only shortcoming I can find with the book is that its dedication to one microcomputer may discourage its use by other 6800 microcomputer users. I recommend it as a text for an introductory structure from the start. Every function performed by Erlewine's programs, from planetary calculations to keyboard input, is contained in discrete subroutines. These routines may be chosen and combined by students to custom tailor their own programs with whatever features they desire.

While the features described above make this book useful to any beginning BASIC programmer, the manual is especially valuable to those who are interested in astrological, or even straight astronomical, calculations.

A few years ago I wanted to write a pro-

The manual is especially valuable to those who are interested in astrological, or even straight astronomical, calculations.

microcomputer lab course. Owners of other 6800-based systems will also find the book of interest if they plan to use it for reference only, or don't mind modifying the examples and problems to run on their particular machine.

Peter W. Marcus Miami, FL

Manual of Computer Programming for Astrologers

Michael Erlewine The American Federation of Astrologers Tempe, AZ, 1981 Paperback, 218 pp., \$13.95

This book is valuable for two groups of people: astrology buffs and students of BASIC programming.

The opening sections deal with all the fundamentals one would expect to be covered in a good primer: direct versus programming (or deferred) modes, variables, arrays, operators, hierarchy of operations, error messages, editing, etc. Erlewine's treatment of these basic concepts is lucid and concise.

A valuable feature of the book is its reference section of BASIC keywords. This is like an extremely abridged edition of Lien's BASIC Handbook. It contains a rundown of the Microsoft keywords, and describes how different dialects accomplish similar functions. For example, both the TRS-80's INKEYS and the PET's and Apple's GET statements are covered. The information is also summarized in a BASIC language reference list.

Erlewine's section on compacting is one of the best treatments I've seen on the venerable art of squeezing that last byte of programming into your dwindling memory reserves.

After covering the basics, Erlewine goes on to deal with program planning and flow. One of the advantages of his approach is that the student learns modular gram to draw astrological charts. My search for the algorithms for calculating planetary motions proved frustrating. Before dropping the project, I checked city and college libraries. I also made a trip to NYC's Hayden Planetarium to use their special astronomical reference section. I could find no material to even help me get a handle on the raw mathematics involved, let alone predigested computer algorithms.

This book provides three different routines and databases for calculating planetary motions. The three methods differ in precision, memory-use, speed and date range. One accepts any dates from 4713 B. C. forward and is accurate to within one degree. Another may be used only for dates between A.D. 1900 and A.D. 2000, but is accurate to within several minutes of arc, is quite fast and easily fits into 8K. The third is accurate to within one minute of arc. Routines are also given for the moon and its nodes, asteroids and the Uranian planets.

Some of the other topics covered are progressions, returns, relocations, aspects, midpoints and sorts. House systems supported are Regiomontanus, Porphyry, Equal, Morinus, Koch, Topocentric, Campanus and Placidus. Attention is given to formatting the output and representing a chart on a video monitor.

One warning note: The book states that all its routines are copyrighted and that while they may be freely used by the student in his own programs, they must not be sold. So if you are planning to use this book to create your own commercial astrological software, be prepared to comprehend the ideas involved and write your own programs from the algorithms up.

The Manual of Computer programming may be purchased for \$13.95 from Matrix Software, 315 Marion Ave., Big Rapids, MI 49307.

Paul Weiner

NEW PRODUCTS

Edited by Linda Stephenson

Get It Together with Apple Sound Synthesis for Heath New Sinclair, North Star Micros

Apple Organizer

The Apple-Center from Doss Enameling Company, 1224 Mariposa St., San Francisco, CA 94107, was designed to house an Apple computer, a 9-inch monitor and two disk drives. The circuitry protects your Apple from voltage surges, and a cooling fan prevents overheating. A key-locking on/off switch prevents unwanted use. The monitor is angled for comfortable viewing, and the organizer's flat top provides a handy place for an extra monitor or a printer. The price will be approx. \$300. Reader Service number 482.

Heath/Zenith Sound Effects

Create sound effects for games or play music from your keyboard. Multiple programmable sound generators using the General Instruments AY3-8910 psg chip are available for Heath/Zenith computers. This chip can produce a wide variety of complex sounds under software control. The psgx2 for the Z/H-89 has two psg chips, plugs into P504 or P505 of the H-89 bus and uses any decoded port address. The psgx4 contains four of these chips and plugs directly into the H8 bus. Each board comes with a

speaker and features a built-in audio monitor amplifier and crystal time base. Multiple chips give multiple complex sounds, and each chip offers two eight-bit parallel I/O ports, which have been pinned out on the board. The psgx2 costs \$125 and the psgx4 costs \$225, plus \$5 for shipping and handling.

Mako Data Products, 1441-B N. Red Gum, Anaheim, CA 92806. Reader Service number 486.

Portable Computer From Sinclair

Sinclair Research Ltd., 2 Sinclair Plaza, Nashua, NH

03061, has introduced the ZX81 microcomputer. The Sinclair ZX81 is based upon an innovative four-chip design, and it measures just $6 \times 6.5 \times 1.5$ inches and weighs 12 ounces. It has an 8K-byte BASIC ROM, enabling it to operate in decimal arithmetic with full scientific functions. A 40-key touch-sensitive membrane keyboard gives the equivalent of 91 keys using function mode and single-press keyword system. Graphics mode enables an additional 20 graphical and 54 inverse video characters. Programs can be loaded and saved on any home cassette player. A 16K RAM attaches to the



The Apple-Center from Doss Enameling Company. 184 Microcomputing, January 1982



The Sinclair ZX81 microcomputer.



JUDGE THE REST, THEN BUY THE BEST

Only GIMIX offers you **SOFTWARE SWITCHING** between **MICROWARE's OS-9** and **TSC's FLEX**. Plus you get the power of the GMXBUG system monitor with its advanced debugging utility, and memory manipulation routines. A wide variety of languages and other software is available for these two predominant 6809 Disk Operating Systems.

You can order a system to meet your needs, or select from the 6809 Systems featured below.

JUDGE THE FEATURES AND QUALITY OF GIMIX 6809 SYSTEMS

GIMIX' CLASSY CHASSIS™ is a heavyweight aluminum mainframe cabinet with back panel cutouts to conveniently connect your terminals, printers, drives, monitors, etc. A 3 position keyswitch lets you lock out the reset switch. The power supply features a ferro-resonant constant voltage transformer that supplies 8V at 30 amps, + 15V at 5 amps, and - 15V at 5 amps to insure against problems caused by adverse power input conditions. It supplies power for all the boards in a fully loaded system plus two 5 ¼1' drives (yes! even a Winchester) that can be installed in the cabinet. The Mother board has fifteen 50 pin and eight 30 pin slots to give you the most room for expansion of any SS50 system available. 11 standard baud rates from 75 to 38.4K are provided and the I / 0 section has its own extended addressing to permit the maximum memory address space to be used. The 2 Mhz 6809 CPU card has both a time of day clock with battery back-up and a 6840 programmable timer. It also contains 1K RAM, 4 PROM/ROM/RAM sockets, and provides for an optional 9511A or 9512 Arithmetic Processor. The RAM boards use high speed, low power STATIC memory that is fully compatible with any DMA technique. STATIC RAM requires no refresh timing, no wait states or clock stretching, and allows fast, reliable operation. The system includes a 2 port RS232 serial interface and cables. All GIMIX boards use glod plated bus connectors and are fully socketed. GIMIX designs, manufactures, and tests in-house its complete liability and freedom from infant mortality of component parts. All systems are assembled and the retested as a system after being configured to your specific order.

56KB 2MHZ 6809 SYSTEMS WITH GMXBUX/FLEX/OS-9 SOFTWARE SELECTABLE

With #58 single density disk controller	\$2988.59
With #68 DMA double density disk controller	\$3248.49
to substitute Non-volatile CMOS RAM with battery back-up, add	300.00
for 50 Hz export power supply models, add	30.00
Either controller can be used with any combination of 5" and/or 9" drives, up to 4 drives total, have data recovery	

Either controller can be used with any combination of 5" and/or 8" drives, up to 4 drives total, have data recovery circuits (data separators), and are designed to fully meet the timing requirements of the controller I.C.s.

5 1/4" DRIVES INSTALLED IN THE ABOVE with all necessary cables

	SINGLE	SINGLE DENSITY		DOUBLE DENSITY		
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40 track (48TPI) single sided	199,680	250,000	341,424	500,000	2 for \$700.00	Chart shows total
40 track (48TPI) double sided	399,360	500,000	718,848	1,000,000	2 for 900.00	capacity in Bytes for
80 track (96TPI) single	404,480	500,000	728,064	1,000,000	2 for 900.00	2 drives.
80 track (96TPI) double	808,960	1,000,000	1,456,128	2,000,000	2 for 1300.00	

Contact GIMIX for price and availability of 8" floppy disk drives and cabinets; and 5" and 8" Winchester hard disk system.

128KB 2Mhz 6809 DMA Systems for use with TSC's UNIFLEX or MICROWARES's OS-9 Level 2

(Software and drives not included)	3798.39
to substitute 128KB CMOS RAM with battery back-up, add	600.00
for each additional 64KB NMOS STATIC RAM board, add	639.67
for each additional 64KB CMOS STATIC RAM board, add	988.64
for 50 Hz export power supply, add	30.00

NOTE: UNIFLEX can not be used with 5" minifloppy drives.

GIMIX has a wide variety of RAM, ROM, Serial and Parallel I/O, Video, Graphics, and other SS50 bus cards that can be added now or in the future. Phone or write for more complete information and brochure.

THE SUN NEVER SETS ON GIMIX USERS

GIMIX Systems are found on every continent, except Antarctica. (Any users there? If so, please contact GIMIX so we can change this.) A representative group of GIMIX users includes: **Government Research and Scientific Organizations** in Australia, Canada, U.K., and in the U.S.; NASA, Oak Ridge, White Plains, Fermilab, Argonne, Scripps, Sloan Kettering, Los Alamos National Labs, AURA. **Universities:** Carleton, Waterloo, Royal Military College, in Canada; Trier in Germany; and in the U.S.; Stanford, SUNY, Harvard, UCSD, Mississippi, Georgia Tech. **Industrial users** in Hong Kong, Malaysia, South Africa, Germany, Sweden, and in the U.S.; GTE, Becton Dickinson, American Hoechst, Monsanto, Allied, Honeywell, Perkin Elmer, Johnson Controls, Associated Press, Aydin, Newkirk Electric, Revere Sugar, HI-G/AMS Controls, Chevron. **Computer mainframe and peripheral manufacturers**, IBM, OKI, Computer Peripherals Inc., Qume, Floating Point Systems. **Software houses**; Microware, T.S.C., Lucidata, Norpak, Talbot, Stylo Systems, AAA, HHH, Frank Hogg Labs, Epstein Associates, Softwest, Dynasoft, Research Resources U.K., Microworks, Analog Systems, Computerized Business Systems.



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Microcomputing, January 1982 185

back of the ZX81 to expand the size of the computer's memory. Assembled price is \$149.95; kit is \$99.95. Reader Service number 483.

It's About Time

Hayes Microcomputer Products, Inc., 5835 Peachtree Corners East, Norcross, GA 30092, has introduced the Hayes Stack Chronograph, an RS-232-compatible calender/ clock for microcomputers. The Chronograph quartzcrystal control adds precise timekeeping to computer sys-

tems. With the Chronograph and user-developed software, your computer can log programs and reports by day, date and time. The Chronograph can also provide information to control lights, burglar alarms and sprinkler systems. To cut the cost of electronic mail, the user can develop programs to batch messages during the day and send them at night when telephone rates are lowest. The system, including Chronograph unit, power pack, three AA batteries and owner's manual, costs \$249. Reader Service number 484.



Axiom Corporation's Model EX-1650 printer.

Electronic Notepad

Axiom's Model EX-1650 printer produces full-sized hard copy directly from a video input device, such as a video computer terminal, graphics terminal, video monitor or TV set. Any displayed data, including complex graphics, alphanumeric data in any size or font, foreign symbols or even hieroglyphics can be quickly reproduced on electrosensitive paper. The printer operates from the composite video information displayed on the screen, and requires only a single connection to a standard video jack. No external hardware or software is required. Price is \$3495.

Axiom Corporation, 5932 San Fernando Road, Glendale, CA 91202.

Business Computing

The MicroMaster from Barreto and Associates, Inc., 507 West 16, Sedalia, MO 65301, is a self-contained desktop computer. It operates under a

modified CP/M, and is designed for use in small and intermediate businesses. The system is IEEE S-100 based. and contains both a 51/4-inch 5 megabyte Winchester drive and a floppy drive. Standard 64K-byte random access memory is expandable to 16 megabytes. The system can be configured for single or multiple users. The 12-inch monitor has an 80 character by 24 line format. The unit's multiprocessor architecture and special operating system speed operation. The Micro-Master sells for \$12,500. Reader Service number 488.

Publications of Note

A helpful publication on school use of microcomputers is available from the Project Planning Centre, Ministry of Education, Legislative Buildings, Victoria, BC V8V 1X4. The discussion paper, "Instructional Use of Microcomputers: A Report on BC's Pilot Project," is an 80-page document which outlines the results of an innovative test project in British Columbia's schools. Reader Service number 492.

The Turtle News is offered, free, to subscribers under 18 years of age. The monthly newsletter is published by the Young People's Logo Association, 1208 Hillsdale Drive, Richardson, TX 75081, to bring together young programmers using Logo and other languages. It will promote educational and recreational use of microcomputers,



The MicroMaster business microcomputer from Barreto and Associates.



The Hayes Stack Chronograph from Hayes Products, Inc.

Heath/Zenith SOURCEBOOK

A directory to Heath/Zenith compatible products, The Information Center Sourcebook features over 200 pages of abstracts and listings, including:

HARDWARE PRINTED MATTER LOCAL DEALERS

SOFTWARE **USER'S GROUPS** SERVICE CENTERS **BUSINESS APPLICATIONS**

Three quarterly updates are mailed free to all owners of the Sourcebook.

The Information Center Sourcebook is available at Heathkit Electronic Centers* and computer stores nationwide, or for \$20.00 from:

> The Information Center 223 642-AW. Rhapsody San Antonio, Texas 78216 512/340-1561

Dealer inquiries invited.

*Heathkit is a registered trademark of Heath Company

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CONVERT YOUR SERIAL PRINTER TO PARALLEL

NEW MODEL UPI-3 SERIAL PRINTER INTERFACE MAKES IT POSSIBLE TO CONNECT AN ASCII SERIAL PRINTER TO THE PARALLEL PRINTER PORT ON THE TRS-80.

Software compatibility problems are totally eliminated because the TRS-80 "THINKS" that it has a parallel printer attached. NO MACHINE LANGUAGE DRIVER NEEDS TO BE LOADED INTO HIGH MEMORY BECAUSE THE DRIVER ROUTINE FOR THE UPI-3 IS ALREADY IN THE TRS80 ROM! SCRIPSIT, PENCIL, RSM 2, ST80D, NEWDOS, FORTRAN, BASIC etc. all work as if a parallel printer was in use.

The UPI-3 is completely self contained and ready to use. A 34 conductor edge card connector plugs onto the parallel printer port of the model I Expansion Interface or onto the parallel printer port on the TRS-80 III. A DB25 socket mates with the cable from your serial printer. The UPI-3 converts the parallel output of the TRS-80 printer port into serial data in both the RS232-C and 20 MA. loop formats.



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	7 or 9 Data Rits par word

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ODD or EVEN Parity

UPI-2 for TRS80 Model II	\$149.95
UPI-3 for TRS80 Model I or 3	\$149.95
UPI-4 for use with Model 1 and RS Printer	
Interface Cable (no expansion interface required)	\$159.95
Manual only (may be applied to order)	\$ 5.00
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and provide a catalog for exchange of software written by YPLA members. The use of microcomputers in the education of the learning disabled and handicapped will also be encouraged by the exchange of information and software. Annual subscription price for parents, teachers and other grown-up people is \$15. Reader Service number 493.

Programmer, a new publication from Media21, offers programming and marketing tips to writers of microcomputer software. It provides information on contracts, agents and royalties, as well as specific help with programming techniques. Programmer gives the small, independent software producer a chance to express market needs, and fields as many questions from readers as possible. The newsletter is not currently accepting advertising. Subscription cost is \$13 for the first six issues.

Programmer, PO Box 3210, Manchester, NH 03105. Reader Service number 494.

Dual-Processor Micro

North Star's Advantage microcomputer uses two processors: the Z80A as the main CPU and an Intel 8035 as the keyboard and disk controller. The full system has 64K bytes of random-access memory with parity as the main memory, 20K of dedicated randomaccess memory for the display and a 2K bootstrap programmable read-only memory for the display and floppy disks. The standard screen format is 24 lines by 80 characters, with a graphics resolution of 240 pixels high by 640 pixels wide.



The Lynx-300 disk alignment tool.

The Advantage is supported by one of three different operating systems: the Application Support Program (ASP), Graphics CP/M or North Star's Graphics BASIC/Graphics DOS. Priced under \$4000.

North Star Computers, Inc., 14440 Catalina St., San Leandro, CA 94577. Reader Service number 487.

Quick Alignment Tool

The Lynx-300 is a portable, compact and low-cost solution to the problem of verifying and adjusting the alignment of floppy-disk drives. This instrument lets technical support personnel make all the necessary adjustments without the need for an oscilloscope. Any technician can quickly and easily verify and adjust the alignment of any floppy drive encountered. The Lynx-300 uses a series of LEDs to indicate the proper setting for radial and index/ sector adjustments. If the proper LED is not illuminated. the drive adjustment is not within specifications. The Lynx is powered by the disk drive being adjusted. It comes with a set of color-coded probes that are attached simultaneously to the drive PCB, reducing the possibility of error in hookup and speed-



North Star's Advantage offers sophisticated microcomputer araphics.

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- 1980 by MICRO-SPARC., INC. Lincoln, Mass. 01773. All rights reserved Apple II is a registered trademark of Apple Computer Company.

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ing the alignment process. The Lynx-300 comes in a plastic case, priced at \$379 U.S., \$459 Canadian.

Lynx Design & Technology, Inc., 3880 Chesswood Drive, Downsview, Ontario, Canada M3J 2W6. Reader Service number 491.

Flood Alarm

An electronic protection

device that sounds an alarm at the first trace of water in the double floor and other locations in computer rooms is available from KF Industries, Inc., 2310 North American St., Philadelphia, PA 19133. Flood Alarm sounds a loud buzzer when it detects water in unwanted places, so that action can be taken to prevent cable and other damage. The power unit contains the power supply and buzzer as-



Vector Graphic's 3105 computer system in the laboratory.

sembly, and the two-probe sensor unit contains solid state circuitry. As many sensors as necessary can be added to a single power unit to protect several areas at once. The Model 200 power unit costs \$30; each sensor unit is also \$30. Reader Service number 499.

Industrial and Scientific System

The Vector Graphic 3105 technical computer system includes a Vector 3 Z-80based processor and terminal. an 18-board card cage for S-100 bus interface cards and a five-inch Winchester disk with five megabytes of storage backed by a single 630Kbyte floppy disk. Available peripheral boards include a fast scan video digitizer, a highresolution graphics module, precision 12-bit digital-toanalog converter, high-speed multichannel ADC, clock/calendar, PROM/RAM board, IEEE-488 interface, relay driver and stepper motor interface board. The system can

be tailored for pilot process control, non-destructive and other testing, biophysics, medical electronics, food technology and a wide range of electronics, physics, optical and electromechanical experiments. The basic 3105 system price is \$8495.

Vector Graphic, Inc., 500 N. Ventu Park Road, Thousand Oaks, CA 91320. Reader Service number 490.

A Guieter Printer

A new dot matrix printer has been added to the Heath/ Zenith line of microcomputer peripherals. The bidirectional H-25 prints 150 cps; all 95 ASCII characters, upper/lowercase, and 33 graphics characters are included. Pitch can be varied from 10-16.5 cpi. Standard edge-punched or fanfold paper feeds easily. Paper exits from the rear of the printer and the cabinet is totally enclosed, thus reducing noise. LEDs light up to indicate when the printer is on, on-line with the computer, out of paper, jammed or has

RACET SORTS - RACET UTILITIES - RACET computes - RACET SORTS - RACET UTILITIES - RACET computes - RACET SORTS - RACET UTILITIES - RACET computes -RACET **FIELD PROVEN!!** Mod I, III \$50.00 DISCAT (32K 1-drive Min) 10 MEGABYTES and MORE for the TRS-80* Model II SORTS This comprehensive Diskette Cataloguing/Indexing utility allows the user to keep track of thousands of programs in a categorized library. Machine language program plus SHARED ACCESS to HARD DISK DRIVE works with all TRSDOS and NEWDOS versions. Files include program names and Hard/Soft Disk System (HSDS) Software allows access as single drive. You can mo extensions, program length, diskette numbers, front and back, and diskette free space. have that 10 Megabyte continuous file - that 50,000 name maillist or inventory! Or CET UTILI RACET Mod I, III \$100.00; Mod II \$175.00 a directory with 1000 entries! All completely compatible with TRSDOS 2.0 BASIC KFS-80 (1-drive 32K Min - Mod II 64K) You can mix floppy and hard disk drives. Includes special utilities including HPURGE, DCS Directory Catalog System, HZAP Hard Disk Superzap, and many special formatting options. Three to eight times faster than floppy! RACET quality. The keyed file system provides keyed and sequential access to multiple files. Provides the programmer with a powerful disk handling facility for development of data base applications. Binary tree index system provides rapid access to file records. UTILITIES E HARD DISK DRIVE & CONTROLLER \$5995. Second User \$595 MAILLIST (1-drive 32K Min - Mod II 64K) Mod I, III \$75.00; Mod II \$150.00 HSDS Software \$400. (Note: HSDS now also available for CORVUS drives!!) This ISAM-based maillist minimizes disk access times. Four keys — no separate sorting. Supports 9-digit zip code and 3-digit state code. Up to 30 attributes. Mask RACET RACET Mod I \$50.00, Mod III \$60.00 INFINITE BASIC (Mod | & III Tape or Disk) and query selection. Record access times under 4 seconds!! Extends Level II BASIC with complete MATRIX functions and 50 more string functions. Includes RACET machine language sorts! Sort 1000 elements in 9 seconds!! Select only functions you want to optimize memory usage. COMPROC (Mod I & Mod III --- Disk only) Mod I \$20; Mod III \$30 SORTS Command Processor. Auto your disk to perform any sequence of instructions that you can give from the keyboard. DIR, FREE, pause, wait for user input, BASIC, No. of FILES and MEM SIZE, RUN program, respond to input statements, BREAK. Mod I & III \$30.00 **INFINITE BUSINESS (Requires Infinite BASIC)** Complete printer pagination controls — auto headers, tooters, page numbers. Packed decimal aritmetic — 127 digit accuracy +, -, *, /. Binary search of sorted and unsorted arrays. Hash codes. RACET return to DOS, etc. Includes lowercase driver software, debounce and screenprint! UTILITY PACKAGE (Mod II 64K) \$150.00 Important enhancements to the Mod II. The file recovery capabilities alone will pay for the package in even one application! Fully documented in 124 page manual! XHIT, XGAT, XCOPY and SUPERZAP are used to reconstruct or recover date from bad diskettes! XCOPY provides multi-file copies, 'Wild-card' mask select, absolute sector mode and other features. SUPERZAP allows examine/change any sector on diskette include track-0, and absolute disk backup/copy with I/O recovery. DCS builds consolidated directories from multiple diskettes into a single display or listing sorted by disk name or file name plus more. Change Disk ID with DISKID. XCREATE preallocates files and sets 'LOF' to end to speed disk accesses. DEBUGII adds single step, trace, subroutine calling, program looping, dynamic disassembly \$150.00 UTILITY PACKAGE (Mod II 64K) BASIC CROSS REFERENCE UTILITY (Mod II 64K) \$50.00 compr SEEK and FIND functions for Variables, Line Numbers, Strings, Keywords. 'All' options available for line numbers and variables. Load from BASIC — Call with 'CTRL'R. Output to screen or printer! RACET Mod I \$75.00, Mod II \$150.00, Mod III \$90.00 DSM DSM Mod 1375.00, Mod 1373.00, Mod 11 310.00, Mod 11 350.00 Disk Sort/Merge for RANDOM files. All machine language stand-alone package for sorting speed. Establish sort specification in simple BASIC command File. Execute from DOS. Only operator action to sort is to change diskettes when requested! Handles multiple diskette files! Super fast sort times — improved disk I/O times make this the fastest Disk Sort/Merge available on your TRS. (Mod I Min 32K 2-drive system. Mod II 64K 1-drive. Mod III 32K 1-drive) UTILITIES TIL ITIES adds single step, trace, subroutine calling, program looping, dynamic disassembly and more!! ACET \$125.00 DEVELOPMENT PACKAGE (Mod II 64K) RACET Includes RACET machine language SUPERZAP, Apparat Disassembler, and Model II interface to the Microsoft 'Editor Assembler Plus' software package including GSF (Mod | & III Tape or Disk - Specify Memory Size) Mod I \$25; Mod II \$50; Mod III \$30 uploading services and patches for Disk I/O. Generalized Subroutine Facilities. The STANDARD against which all other sorts are SORTS RACET COMPUTES CHECK, VISA, M/C, C.O.D., PURCHASE ORDER compared! And then compare prices! Machine language — fast and powerful! Multi-key multi-variable and multi-key character string. Zero and move arrays. Mod II includes USR PEEKS and POKES. Includes sample programs. **TELEPHONE ORDERS ACCEPTED (714) 997-4950** 1330 N. GLASSELL, SUITE M. *TRS-80 IS A REGISTERED TRADEMARK OF TANDY CORPORATION RA ORANGE, CA 92667 101 RACET SORTS - RACET UTILITIES - RACET computes - RACET SORTS - RACET UTILITIES - RACET computes - RACET SORTS - RACET UTILITIES - RACET computes



The Heath H-25 dot matrix printer.

the cover open. Automatic test printing and status lights are built in. Price is \$1095.

Heath Company, Dept. 350-315, Benton Harbor, MI 49022. Reader Service number 498.

Software-Based Keyboard Design

The Maxi-Switch Universal Keyboard is based on the physical design of one of the first microprocessor-based keyboards, with a standard keyboard typing layout plus numeric blocks at either end. The basic unit is equipped with 103 keyswitch positions, and can be expanded at minimum cost up to 128 positions, using a prepunched panel and a circuit board with traces already in place. Simple preparation of a control EPROM, using existing routines, can equip the board to meet virtually any keyboard specifications. Performance options are selected by keyboard input or jumper and diode options. Price is \$210.

Maxi-Switch Co., 9697 E. River Road, Minneapolis, MN 55433. Reader Service number 496.

Single Board for Multi-User Systems

Complete networking capa-

bility for S-100 users, including bank-switched memory and parity checking, is available on a single board from MuSYS Corporation, 1451 Irvine Blvd., Suite 11, Tustin, CA 92680. NET/82 features a Z80A CPU, two serial ports, optional floating point processor, interrupt controller, shadow EPROM, real-time clock and S-100 parallel port for communication with the master CPU. NET/82 is compatible with MuDOS, CP/M, MP/M and CP/NET. Parity checking permits easy detection of memory malfunctions. The 128K-byte bank-switched memory option allows the program to select 48-63K of user RAM, controlled through an I/O port. Each serial port can also be customized for other applications, including interface with a serial printer. Price is \$1395; \$1995 with 128K and floating point processor. Reader Service number 497.

Data Acquisition

The Analog Peripheral is a self-contained eight-bit analog-to-digital converter with its own power supply. Its RS-232C output line is switch selectable from 110 to 9600 bits per second, and can be connected to virtually any computer, from Apple to IBM.



Maxi's Universal Keyboard.



PERSONAL INCOME TAX INTERVIEW PROGRAM written in BASIC by a tax attorney as he would conduct a personal interview to organize taxpayer's data into Federal income tax categories for 1981 tax returns. Program leads the user through an extensive checklist of personal events which can have income tax consequences, giving numerous examples and explanation of tax law for each YES answer.

Covers events such as marriage, divorce, birth, death, employment, lay-offs, retirement, travel, change of residence, accidents, illness or injuries, business ventures, self-employment, education, investments of money or time, prizes, scholarships, insurance recoveries, tax-exempt income, bad debts, etc., as well as the commonly known income items and deductible expenses.

OTHER POS PRODUCTS ...

- POS-100 NRZ1 Tape Drive Controller/Formatter \$795.00
 POS 800/1600 Universal Tape Drive Controller \$1495.00
- (4K/16K buffer, RS-232 or Parallel Ports to CPU)
 POS I/O Conversion Kit for IBM Office Selectric . . . \$150.00
- POS ASCII Printer Interface for IBM Unce Selectric . . . \$150.00
 POS ASCII Printer Interface for IBM I/O Selectric . . . \$249.95
- POS IBM ASCII Selectric Printer (Parallel Interface) . \$895.00
- GTE IS Model 560 ASCII Selectric I/O Terminal \$995.00
- POS Daisy-Wheel Printer Interface for TRS-80 Model I . \$249.95
 Variable Width FORMS TRACTOR for 15" Selectrics . . \$95.00

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2265 Old Middlefield Way • Mt. View, CA 94043 • (415) 493-7455





The NET/82 single board computer from MuSYS Corporation.

There is also a 26-pin parallel output for faster data transfer rates. Plug-in sensors for temperature, light, pH and other analog signals eliminate the need for building transducer circuits. Four input channels permit logging of several variables at once. Fast conversion speed of 100 μ s is sufficient for most teaching applications.

Cambridge Development



The Analog Peripheral from Cambridge Development Laboratory. Laboratory, 36 Pleasant St., Watertown, MA 02172. Reader Service number 495.

Dual Thermometer For Apple II

Strawberry Tree Computers, 949 Cascade Drive, Sunnyvale, CA 94087, is offering an Apple II interface card with two complete thermometers and software. The system turns an Apple into a laboratory tool that measures, logs and analyzes temperature. It will display time, temperature, maximum and minimum temperatures and temperature difference between probes. An alarm will sound at any preset temperature. Just plug in the two tenfoot probes to measure temperatures from - 55 to 125 degrees Celsius. The Dual Thermometer package costs \$260. Reader Service number 489.



This Dual Thermometer package from Strawberry Tree Computers converts an Apple II into a precision measurement tool.

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OSI

GALAXIAN - 4K - One of the fastest and finest arcade games ever written for the OSI, this one features rows of hard-hitting evasive dogfighting aliens thirsty for your blood. For those who loved (and tired of) Alien Invaders. Specify system – A bargain at \$9.95 OSI

LABYRINTH - 8K - This has a display back-ground similar to MINOS as the action takes place in a realistic maze seen from ground level. This is, however, a real time monster hunt as you track down and shoot mobile monsters on foot. Checking out and testing this one was the most fun I've had in years! - \$13.95. OSI

THE AARDVARK JOURNAL

FOR OSI USERS - This is a bi-monthly tutorial journal running only articles about OSI systems. Every issue contains programs customized for OSI, tutorials on how to use and modify the system, and reviews of OSI related products. In the last two years we have run articles like these!

1) A tutorial on Machine Code for BASIC programmers.

2) Complete listings of two word processors for BASIC IN ROM machines.

3) Moving the Directory off track 12.4) Listings for 20 game programs for the OSI. 5) How to write high speed BASIC - and

lots more -

Vol. 1 (1980) 6 back issues - \$9.00

Vol. 2 (1981) 4 back issues and subscription for 2 additional issues - \$9.00.

ADVENTURES!!!

For OSI, TRS-80, and COLOR-80. These Adventures are written in BASIC, are full featured, fast action, full plotted adventures that take 30-50 hours to play. (Adventures are inter-active fantasies. It's like reading a book except that you are the main character as you give the computer commands like "Look in the Coffin' and "Light the torch".)

Adventures require 8K on an OSI and 16K on COLOR-80 and TRS-80. They sell for \$14.95 each.

ESCAPE FROM MARS (by Rodger Olsen)

This ADVENTURE takes place on the RED PLANT. You'll have to explore a Martian city and deal with possibly hostile aliens to survive this one. A good first adventure.

PYRAMID (by Rodger Olsen)

This is our most challenging ADVENTURE. It is a treasure hunt in a pyramid full of problems. Exciting and tough!

TREK ADVENTURE (by Bob Retelle) This one takes place aboard a familiar starship. The crew has left for good reasons - but they forgot to take you, and now you are in deep trouble.

DEATH SHIP (by Rodger Olsen) Our first and original ADVENTURE, this one takes place aboard a cruise ship - but it ain't the Love Boat.

VAMPIRE CASTLE (by Mike Bassman) This is a contest between you and old Drac and it's getting a little dark outside. \$14.95 each.

OSI

TRS-80

NEW-NEW-NEW **TINY COMPILER**

The easy way to speed in your programs. The tiny compiler lets you write and debug your pro-gram in Basic and then automatically compiles a Machine Code version that runs from 50-150 times faster. The tiny compiler generates relocatable, native, transportable machine code that can be run on any 6502 system.

It does have some limitations. It is memory hungry - 8K is the minimum sized system that can run the Compiler. It also handles only a limited subset of Basic – about 20 keywords in-cluding FOR, NEXT, IF THEN, GOSUB, GOTO, RETURN, END, STOP, USR(X), PEEK, POKE, -, =, *, /, , , , , Variable names A-Z, and Integer Numbers from 0-64K.

TINY COMPILER is written in Basic. It can be modified and augmented by the user. It comes with a 20 page manual.

TINY COMPILER - \$19.95 on tape or disk OSI

SUPERDISK II

This disk contains a new BEXEC* that boots up with a numbered directory and which allows creation, deletion and renaming of files without calling other programs. It also contains a slight modification to BASIC to allow 14 character file names.

The disk contains a disk manager that contains a disk packer, a hex/dec calculator and several other utilities.

It also has a full screen editor (in machine code on C2P/C4)) that makes corrections a snap. We'll also toss in renumbering and program search programs - and sell the whole thing for -SUPERDISK II \$29.95 (51/4") OSI

BARE BOARDS FOR OSI C1P

MEMORY BOARDS!!! - for the C1P - and they contain parallel ports!

Aardvarks new memory board supports 8K of 2114's and has provision for a PIA to give a parallel ports! It sells as a bare board for \$29.95. When assembled, the board plugs into the expansion connector on the 600 board. Available now!

PROM BURNER FOR THE C1P - Burns single supply 2716's. Bare board - \$24.95.

MOTHER BOARD - Expand your expansion connector from one to five connectors or use it to adapt our C1P boards to your C4/8P. - \$14.95.

16K RAM BOARD FOR C1P This one does not have a parallel port, but it does support 16K of 2114's. Bare Board \$39.95.



COLOR-80 OSI

WORD PROCESSING THE EASY WAY-WITH MAXI-PROS

This is a line-oriented word processor designed for the office that doesn't want to send every new girl out for training in how to type a letter.

It has automatic right and left margin justification and lets you vary the width and margins during printing. It has automatic pagination and automatic page numbering. It will print any text single, double or triple spaced and has text centering commands. It will make any number of multiple copies or chain files together to print an entire disk of data at one time.

MAXI-PROS has both global and line edit capability and the polled keyboard versions contain a corrected keyboard routine that make the OSI keyboard decode as a standard typewriter keyboard.

MAXI-PROS also has sophisticated file capabibilities. It can access a file for names and addresses, stop for inputs, and print form letters. It has file merging capabilities so that it can store and combine paragraphs and pages in any order.

Best of all, it is in BASIC (0S65D 51/4" or 8" disk) so that it can be easily adapted to any printer or printing job and so that it can be sold for a measly price.

MAXI-PROS - \$39.95. Specify 51/4 or 8" disk.

SUPPORT ROMS FOR BASIC IN ROM MA-CHINES - C1S/C2S. This ROM adds line edit functions, software selectable scroll windows, bell support, choice of OSI or standard keyboard routines, two callable screen clears, and software support for 32-64 characters per line video. Has one character command to switch model 2 C1P from 24 to 48 character line. When installed in C2 or C4 (C2S) requires installation of additional chip. C1P requires only a jumper change. - \$39.95

C1E/C2E similar to above but with extended machine code monitor. – \$59.95 OSI

ARCADE GAMES FOR OSI, COLOR-80 AND TRS-80 (8K OSI, 16K TRS-80 AND COLOR-80)

TIMETREK - A REAL TIME, REAL GRAPHICS STARTRECK. See your torpedoes hit and watch your instruments work in real time. No more unrealistic scrolling displays! \$14.95.

STARFIGHTER - This one man space war game pits you against spacecruisers, battlewagons, and one man fighters, you have the view from your cockpit window, a real time working instrument panel, and your wits. Another real time goody. \$9.95

BATTLEFLEET - This grown up version of Battleship is the toughest thinking game available on OSI or 80 computers. There is no luck involved as you seek out the computers hidden fleet. A topographical toughie. \$9.95

QUEST - A NEW IDEA IN ADVENTURE GAMES! Different from all the others, Quest is played on a computer generated mape of Alesia. Your job is to gather men and supplies by combbat, bargaining, exploration of ruins and temples and outright banditry. When your force is strong enough, you attack the Citadel of Moorlock in a life or death battle to the finish. Playable in 2 to 5 hours, this one is different every time. 16K COLOR-80 OR TRS-80 ONLY, \$14.95

Please specify system on all orders

This is only a partial listing of what we have to offer. We offer over 120 games, ROMS, and data sheets for OSI systems and many games and utilities for COLOR-80 and TRS-80. Send \$1.00 for our catalog.



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NEW SOFTWARE

Edited by Linda Stephenson

Byte Your Way to Good Nutrition Apple Statistics Make Music with VIC Understanding Asian Languages

Diet Analysis

Nutri-Calc is a nutritional analysis program designed to rapidly and accurately assess individual nutrient intake. Eighteen of the nutrients found in 730 common foods are included. Nutrient values have been taken from standard USDA listings. The user can modify the food and nutrient database as needed. Comparisons of input data to the recommended daily allowances for specific subgroups is provided; calculations are based on age and sex, and for infants, body weight. Nutri-Calc lets the user build new food items (over 200) by combining components already in the foods database. Standard menus and special recipes can also be stored. The program can be used with Apple II+, TRS-80 Models II and III, and any CP/M or UCSD p-System microcomputers with 64K-byte memory and eight-inch single-density disk drives. Price is \$350.

PCD Systems, Inc., PO Box 143, Penn Yan, NY 14527. Reader Service number 464.

Statistics For the Apple

Rainbow Computing, 19517 Business Center Dr., Northridge, CA 91324, offers a comprehensive statistics package for the Apple II with Applesoft and DOS 3.3. Statistics with Daisy offers a full range of statistical capabilities for business, scientific and social science applications. It features Help and Info

functions to simplify operation. The system does math and time-series transforms, hi-resolution plots, basic statistics, correlations, multiple regression (six different procedures), model testing and evaluation, nonparametric statistics, hypothesis testing and analysis of variance. Users can add their own programs as new Daisy commands. Data is entered through a window view into the data table. Statistics with Daisy is priced at \$79.95. Reader Service number 465.

Music Composer

Turn your VIC microcomputer into a music machine with VIC Piper. This program lets you compose, save, recall and play back music, using a standard VIC without additional hardware. You enter notes by using alpha notation: A. F#, C. G. D; rests and note duration are also entered at the keyboard. You can vary the volume and tempo, play harmony, print pictures of text to accompany your music and automatically load and run additional compositions from cassette or disk. Price is \$25, including manual and sample compositions.

Abacus Software, PO Box 7211, Grand Rapids, MI 49510. Reader Service number 466.

Professional Tax Preparation

The Income Tax Preparation system by Micro-Tax, Microcomputer Taxsystems, Inc., 22713 Ventura Blvd., Suite F. Woodland Hills, CA 91364, is designed to computerize the tax professional's office. The system accepts the data, summarizes needed information, computes tax and prints the required IRS and state forms. The tax specialist can provide clients with immediate results. Micro-Tax offers the system in three levels, priced from \$250-\$1000. Reader Service number 467.

Asian Languages Program

Asiagraphics software enables people using Asian languages, with their many thousands of ideographic characters, to use computer technology for word processing, data processing, telex and other applications. A specific character is selected by typing a unique code (descriptor) on a standard keyboard; the character is displayed on the video screen. Both traditional and simplified characters are available. The descriptor consists of the phonetic representation of the character's pronunciation and a phonetic rendering of the radical family to which the character belongs. The operator must beliterate in the language used and know the phonetic syson which the descriptors are based. Using touch typing, speeds comparable to western language typing speeds can be achieved. Descriptors for more than 6600 charactors currently exist in memory: new characters can be entered at any time by drawing the needed character on a grid with the character generator program.

China Institute in America, Inc., 125 East 65th St., New York, NY 10021. Reader Service number 469.

Spelling Help for Your 6809

A misspelled word that slips by your secretary but is noticed by a potential customer will cost you sales; spelling errors in a manuscript almost guarantee a rejection slip. Spell-Test will help you find those deadly spelling errors. Spell-Test, for Flex-based 6809 microcomputers, is completely menu-driven. The program stops and points to all invalid words, so you can Accept the word as it is, Accept and Save it for use in an optional dictionary later or Replace it. You can do a quick check of your prose with the basic 11,000-word dictionary or a thorough check against a comprehensive 21,000-word dictionary. Spell-Test on a standard Flex disk costs \$195.

Frank Hogg Laboratory, 130 Midtown Plaza, 700 East

謹订于十月二十三日, 星期 五,上午十一时假华美协进 社二楼图书室举行中文电脑 打字程式系统示范表演, 尾 时恭请光临。

华美协进社謹订

The China Institute in America has introduced the Asiagraphics Software System. Water St., Syracuse, NY 13210. Reader Service number 471.

Computerized Ratings

Media Service Concepts. 1713 N. North Park Ave., Chicago, IL 60614, has introduced Recall, a radio ratings analysis package for use on the Apple II. Recall lets a radio station quickly organize and interpret data furnished by Arbitron, the major radio ratings service. Recall can analyze up to four radio stations or four rating books simultaneously. The different sections provide in-depth understanding of radio audience flow dynamics and market positioning. Recall can help a radio station find its strengths and weaknesses, and those of competitors. Recall is priced at \$750. Reader Service number 468.

Apple Graphics

The Superplotter is a pro-

fessionally-oriented graphics package for business, engineering, education and math applications. The program features pie graphs, standard bar charts, point and line graphs, a mathematical function plotter, a least squares polynomial curve-fit generator, automatic graphics disk storage and recall, a data file editor, overlay modes, a user tutorial and keyboard image shapes that can be mixed with the user's own graphics displays. The program runs on Apple computers with Applesoft. Price is \$59.95.

Dickens Data Systems, 433 Greenwood Drive, LaPlace, LA 70068. Reader Service number 472.

Econometric Software

WITS World Information and Technology Systems Corp., 235 Yorkland Blvd., Suite 901, Willowdale, Ontario M2J 4W9, has announced WITS/Economist, a software package that helps businesspeople develop financial and

marketing strategies. WITS/ Economist is used for profitability and break-even analysis; capital budgeting, investment, pricing and marketing/ advertising decisions; and competitive and risk analysis. To model a business the user types in the key business parameters that describe anticipated economic, financial and marketing conditions. WITS/Economist presents the resulting business scenario and guides the user interactively through price-sale optimization and risk analysis. WITS/Economist is available on Heath/Zenith systems under CP/M and HDOS. It requires 48K bytes of memory and one disk drive. Price is \$495 (Canadian). Reader Service number 470.

Hi-Res Graphics For Atari

Versa Computing, Inc., 3541 Old Conejo Road, Suite 104, Newbury Park, CA 91320, has a complete joystick/paddle graphics software package for 32K Atari 400/800 computers. With Graphics Composer you can use paddles or joystick to draw a picture outline on hires screen Mode 8 or 7. Then use color fill-in, color brushes and Add Text to complete your graphics designs. Graphics Composer lets you create player/missile shapes to use in other programs. The geometric figures program lets you define circles, triangles, polygons, parallelograms and even trigonometric curves. Loading routines are provided so that pictures can be used in other programs or traded with friends. Price is \$39.95, on disk or cassette. Reader Service number 474.

Two Investment Broker Systems

Kate's Komputers offers investment programs for North Star, Apple and CP/M users. The AnalySt is a comprehensive stock market graphics system. It features graphics plotting using seven different techniques on a screen that can be triple split. The Ad-



vi\$or is a stocks and bonds portfolio management system featuring immediate access to all options, stocks, bonds and commodities held, and detailed information about each. Both programs have access to four on-line quote services, with software to automatically update. The AnalySt is \$425: Advi\$or is \$375: the price for both is \$750. Add \$95 for CP/M versions.

Kate's Komputers, PO Box 1675, Sausalito, CA 94965. Reader Service number 475.

Multi-Tasking Kernel

The Multi-Tasking Kernel from U.S. Software, 5470 NW Innisbrook Place, Portland, OR 97229, is a tool for integrating multiple real-time software tasks. It is burned into read-only memory, and oversees the selection and execution of each task. The kernel is small, fast and easy to use. The Multi-Tasking Kernel is documented, tested and available in source assembly form for the 8085, Z-80, 6502, 6800 and 6809 microprocessors. The package provides source code for a basic multitasking organization (tasks self-schedule in a round-robin ordering). The user is guided through a series of enhancements for implementing sophisticated interrupt-initiated, preemptive priority, dynamic task scheduling. Also included are descriptions of dedicated and shared-resource scheduling, time-slice scheduling and intertask communication schemes. Price is \$195 for full internal use rights and unlimited rights to distribute kernelbased products in machine form. Reader Service number 476.

\$\$\$

Level 10 offers a \$5000 reward for the return of the Alkemstone. Their new computer adventure challenges you to recover the missing Alkemstone from the underground lair in which it has been concealed. Unusual messages, fragments of words, sketches and other clues written on the cave walls will lead you to the treasure. And the first player to describe its exact location to Level 10's designated judge wins \$5000. The game features hi-resolution graphics, three-dimensional animation, sound effects and an illustrated short story. It runs on an Apple with 48K and one 16-sector disk drive.

Level 10 Division, Dakin5 Corp., 7475 Dakin St., Suite 507, Denver, CO 80221. Reader Service number 477.

Software Development

Genesis is a professional program generator that accepts commands in conversational English, has ample memory capacity to code difficult algorithms and generates efficient code faster than four lines per second. Genesis runs on all CP/M 2.XX systems and uses compiled PL/1-80, although PL/1-80 is not required to run the program. Code is generated in CBASIC. The program comes with on-



Genesis program generator from Time Management Software.

line documentation and a complete manual. Price is \$500.

Time Management Software, 123 E. Broadway, PO Box 727, Cushing, OK 74023. Reader Service number 478.

Language Hybrid

Starside Engineering, PO Box 8306, Rochester, NY 14618, offers the RUNIC 1.0 threaded interpreted language, on CP/M disk, in various popular microcomputer formats. RUNIC has its roots



flexibility seen in the minicomputer world has not been available on micros. **RACOMOL** now allows transfer of such software with a minimum of fuss. We have participated in such a mini-to-micro transfer We have participated in such a minit-to-micro transfer of a major set of general business software. using **RM**. **CORON**, as the transfer mechanism, of course. Running on literally thousands of minicomputers, these refined, enhanced, and proven software packages cover A/R, A/P, G/L, P/R, Order Entry (with Invoicing and Inventory Control) as well as Sales Analysis. The packages define a new level of achievement for features and flexibility in micro applications software and offer top quality at a reasonable price.

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and Cybernetics' unique TRS-80 $^3,\,Model\,II\,CP/M$ offering high performance, hard disk support, and CP/M compatibility.

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196 Microcomputing, January 1982

(714)848-1922

in FORTH, but is more easily read and maintained than FORTH code. RUNIC implements higher-level data structures than FORTH, including integers, floats and character strings. RUNIC uses RPN to evaluate its expressions, but its control structures are closer to those of Pascal, BASIC and other algebraic languages. Price is \$52.95. Reader Service number 479.

VisiPeek

Micro-Sparc, Box 325, Lincoln, MA 01773, has released a utility for users of Personal Software's VisiCalc on the Apple II. Apple VIP (VisiCalc Info Printer) reads VisiCalc files and produces listings of the formats, formulas, variables and other VisiCalc grid elements. Labels and formulas appear in their complete, untruncated form. VIP lets you examine individual elements, selected areas of the grid or the entire VisiCalc sheet. Files can be listed in either row or column sequence, sorted alphabetically by column. Apple VIP requires Applesoft; specify DOS 3.2 or 3.3 version. Price is \$23.45. Reader Service number 480.

Space Waste Race

Storybooks of the Future, 527-41st Ave., San Francisco, CA 94121, has announced Space Waste Race, a computerized storybook for young children. This program for the TRS-80 includes animated graphics, music, sound effects and contextual learning activities. The learning games involve the story's graphics or ideas. The story tells about the moon getting jealous when a giant rocket ship brings all the earth's wastes into space to form a new garbage "moon." A silly moon race ensues that ends in collision-and the fallout can go either way. Space Waste Race is available on cassette or disk for Models I and III. The 32K program costs \$24.95; the slimmer 16K version (storybook with three games only) is \$19.95. Reader Service number 481.

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KILOBAUD MICROCOMPUTING, as thick as it is, is more like a floppy when it comes to standing on the bookshelf. Try the KILOBAUD MICROCOMPUTING Library Shelf Boxes . . . sturdy corrugated white dirt-resistant cardboard boxes which will keep them from flopping around. We have self-sticking labels for the boxes, too, not only for **KILOBAUD MICROCOMPUTING, but** also for 73 Magazine, 80 MICRO-COMPUTING . . . and for CQ, QST,



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CONVERSIONS "I"

Fifteen Puzzle

This program is a conversion of William L. Colsher's Fifteen Puzzle (*Kilobaud Microcomputing*, February 1981, p. 114) from TRS-80 Level I to Level II. It is contributed by E. L. Green, 890 Montego Bay Drive, Merritt Island, FL 32952.

Kilobaud Microcomputing welcomes and encourages such conversions of programs that appear in the magazine.

Program listing.

REM*** FIFTEEN FUZZLE FROM MICROCOMPUTING FEB 81 PG 114 10 REM*** BY WILLIAM L.COLSHER - LISLE, ILL 60532 20 REM*** MODIFIED BY E.L.'LANK'GREEN - B90 MONTEGO BAY DR. M ERRITT ISLAND.FL 32952 - TO RUN AS A LEVEL II PROGRAM FOR TRS 8 25 DIMA(16) 25 DIMA(16) 30 CLS:INPUT'DD YOU NEED INSTRUCTIONS (Y=1, N=2)";A:IF A=1 THEN GOSUB 10000 40 CLS:M=0;PRINT"GENERATING THE PUZZLE TAKES A WHILE. PLEASE WAIT." 50 FOR I=1 TO 16; A(I)=0;NEXT I 60 FOR I=1 TO 16; 70 R=RND(16) 80 IF A(R)<>0 THEN 70 90 A(R)=I 100 NEXT 1 110 GOSUB 5000 120 IF F=1 THEN 50 130 GOSUB 6000 140 PRINT" ":INPUT"YOUR MOVE":X 145 GOSUB 4000 150 GOSUB 7000 160 IF F < >0 THEN 180 170 PRINT"ILLEGAL MOVE, RE-ENTER": FOR I=1 TO 500:NEXTI:GOTO130 180 A(X+F)=A(X):A(X)=16 190 GOTO 8000 200 M=M+1: GOTO 130 999 END 4000 REM*** CONVERT NL 4010 FOR I=1 TO 16 4020 IF A(I)=X THEN 4040 REM*** CONVERT NUMBER TO LOCATION IN ARRAY 4030 NEXT I 4040 X=I 4050 RETURN REM*** VERIFY SOLUTION POSSIBLE 5000 5000 RE 5005 F=1 5010 S=0 5020 FOR I=1 TO 15 5030 FDR J=I+1 TD 16 5040 IF A(I)>A(J) THEN S=S+1 5050 NEXT J: NEXT I 5060 FOR I=1 TO 8 5070 READ X 5080 IF A(X)=0 THEN S=S+1 5090 NEXT I 5095 RESTORE 5100 A=INT (5/2) 5110 IF A*2=S THEN F=0 5120 RETURN 5120 RETURN 5130 DATA 2, 4, 5, 7, 10, 12, 13, 15 6000 REM*** DISPLAY GAME BOARD 6005 CLS: L=339:PRINT0217,"MOVE ";M 6010 FDR I=1 TO 4 6015 PRINT0L," "; 6020 FDR J=1 TO 4 6025 N=A((I-1)*4+J) 6028 IF N=16 THEN N=0 6030 IF N<10 THENPRINT" ";N;:60T0 6040 6038 IF (N=10) DR (N<16) THEN PRINTN; 6040 NEXTJ 6050 L=L+64 6060 NEXT 6070 RETURN 7000 REM*** CHECK FOR LEGAL MOVE 7010 F=0 7015 IF X+1>16 THEN 7025 7020 IF A(X+1)=16 THEN F=1 7025 IF X-1<=0 THEN 7035 7030 IF A(X-1)=16 THEN F=-1 7030 IF A(x-1)=16 IHEN F=-1 7035 IF X+4>16 THEN 7045 7040 IF A(X+4)=16 THEN F=4 7045 IF X-4<=0 THEN 7060 7050 IF A(X-4)=16 THEN F=-4 7060 RETURN REM*** CHECK FOR A WIN 8000 8010 FOR I=1 TO 16 8020 IF A(I)<> I THEN200 8030 NEXT I 8040 GDSUB 6000 8050 PRINT" ": ":PRINT" " 8060 PRINT"CONGRATULATIONS'!! YOU DID IT IN ONLY";M;"MOVES!!" 8070 PRINT" ":INPUT"TO PLAY AGAIN, HIT 'ENTER'.":A\$ 8080 GOTD 10 More

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Listing continued.

10000 REM*** INSTRUCTIONS 10010 CLS:PRINT@18,"F I F T E E N P U Z Z L E" 10020 PRINT@128,"THE OBJECT OF THE FIFTEEN PUZZLE IS TO MOVE THE" 10030 PRINT"NUMBERS AROUND SO THAT THEY ARE IN ORDER FROM 1 TO 15." 10040 PRINT"A MOVE IS MADE BY TYPING IN THE NUMBER (WHICH MUST BE " 10050 PRINT"ADJACENT TO THE ZERO) YOU WISH TO MOVE. THAT NUMBER IS" 10050 PRINT"ADJACENT TO THE ZERO) YOU WISH TO MOVE. THAT NUMBER IS" 10060 PRINT"THEN EXCHANGED WITH THE ZERO. YOU WIN WHEN THE BOARD" 10065 PRINT"LOOKS LIKE THIS:" 10070 PRINT" ":PRINT" 12 3 4":PRINT"5 6 7 8":PRINT"9 10 11 12" 10080 PRINT"13 14 15 0" 10090 PRINT" ": INPUT"HIT 'ENTER' TO PLAY";A\$ 10100 RETURN

DNVERSIONS "II"

A "Personable" Calendar

This conversion of G.R. Boynton's Personable Calendar program for the PET (Aug. 1980, p. 168) is written in Applesoft BASIC. The author has added one-key inputs and a printer prompt for a printed calendar of appointments. The printed sheet can list for a specific day or for a full month. To print out a monthly calendar when prompted to enter the date, simply enter the month only. (Contributed by Kenneth M. Jenkins, 915 S. 12th St., Gadsden, AL 35901.)

Program listing.

5 H	OME : VTAB 5			
10	PRINT "PLEASE TYPE IN YOUR GREETING !>>>>"			
20	VTAB 20			
21	INPUT "HERE >>:";G\$			
30	FOR $I = 1$ TO LEN (G\$)	9 011 5		
40	IF MID\$ (G\$, I, LEN ("KEN")) = "KEN" THEN NA\$ = "KE	N"		
50	NEXT I			
80	IF MAN = "NEN" IMEN GUTU 1010			
10	HURE : INPUT AT RAME IS ISAAC . WHAT IS TUUK NAME	T PNAD		
02	DOUD IIIV			
05	HOME ! UTAB 12			
97	PRINT "ENTER DATE AS (EX. AUCUST 01)"! PRINT			
100	INPUT "WHAT IS THE DATE TODAY? ":D\$			
120	GOTO 2010			
890	HOME			
900	PRINT "THE PROGRAM IS MADE UP OF THE FOLLOWING"			
902	PRINT "COMPONENTS:"			
903	PRINT : PRINT : PRINT			
904	PRINT TAB(5)"1 - CONTROL FOR HELLO"			
906	PRINT TAB(5)"10-120"			
908	PRINT TAB(5)"2 - GREETINGS KEN"			
910	PRINT TAB(5)"1000-1099"			
912	PRINT TAB(5)"3 - GREETINGS OTHER"			
914	PRINT TAB(5)"1100-1199"			
916	PRINT TAB(5)"4 - READ DATA FOR CALENDAR"			
918	PRINT TAB(5)"2000-2140"			
920	PRINT TABE 5)"5 - KOUTE FOR CALANDAR SUBR'S"			
922	PRINT TABLE D'2140-2299"			
924	PRINT TABLE DI O - TUDAT'S EVENIS			
020	PRINT + PRINT "HIT 'PETHON' TO CET THE PERT"			
030	CET AS! HOME ! IF AS = "" THEN 930			
932	UTAR 10			
936	PRINT TAB(5)"7 - OTHER DATES"			
938	PRINT TAB(5)"2400-2450"			
940	PRINT TAB(5)"8 - UNFINISHED ITEMS"			
942	PRINT TAB(5)*2500-2599*			
944	PRINT TAB(5)"9 - CHANGE STATUS OF ITEMS"			
946	PRINT TAB(5)" 2600-2699"			
948	PRINT TAB(5)"10- ADD ITEMS TO CALENDAR"			
950	PRINT TAB(5)"2700-2799"			
956	PRINT TAB(5)"11- WRITE TO DISK"			
958	PRINT TAB(5)"2800-2898"			
960	PRINT TABLE 5)"12- SEAKCH BY DATE"			
902	PRINT PRINT PRINT (PETUDNI FOR CALENDAR S			
970	CET AS! HOME ! TE AS - "" THEN 970			
079	COTO 2190			
980	IF FRE (0) > 200 THEN 987			
981	HOME			
982	VTAB 12: PRINT "THERE IS VERY LITTLE SPACE LEFT IN	MEMORY"		
983	PRINT : INPUT "DO YOU WANT TO DELETE ALL OF THE IT	TENS THAT	ARE FINI	(S
	HED?" ;A\$		-	-
			(Mo	ore





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Listing continued.

IF A\$ = "Y" THEN E = 1: GOSUB 2510 GOTO 996 HOME : IF CH < = WR THEN 995 VTAB 12: PRINT "THERE ARE ONE OR MORE CHANGES THAT HAVE NOT BEEN REC ORDED." INPUT "DO YOU WANT TO WRITE THEM TO DISK?" #A\$ IF A\$ = "Y" THEN GOSUB 2810 HOME VTAB 12: PRINT TAB(20)"GOODBYE!"" "NA\$ PRINT TAB(20)"GLAD I COULD HELP YOU." FOR I = 1 TO 3000: NEXT I: HOME : PRINT CHR\$ (4);"RUN DISK \$21" REM HELLO KEN LET N = INT ((RND (1) * 10) / 2.5) + 1 ON N GOSUB 1035,1045,1055,1065 FOR K = 1 TO 1500: NEXT K GOTO 92 HOME : VTAB 12: HTAB 30 PRINT "HELLO DESIGNER": RETURN HOME : VTAB 12: HTAB 30 PRINT "BACK TO WORK, EH?": RETURN HOME : VTAB 12: HTAB 30 PRINT "HI, KEN": RETURN HOME : VTAB 12: HTAB 30 PRINT "HOWDY, KEN": RETURN REM OTHERS HOME : VTAB 12: PRINT NAS" ..I AM A CALENDAR OF THINGS" PRINT "TO BE DONE." FRINT TO BE DUME." FRINT TO BE DUME." FOR K = 1 TO 1500: NEXT K FOR K = 1 TO 1500: NEXT K FRINT "HE TELLS ME WHAT HE HAS TO DO ON EACH" FRINT "FOR TODAY, AND WHAT HE HAS NOT FINISHED," FOR K = 1 TO 6500: NEXT RETURN REM CALENDAR ROUTINE FOR I = 1 TO 2000: NEXT I HOME : VTAB 12 FRINT "FIRST I HAVE TO READ THE CALENDAR---"NA\$ PRINT HTAB 25 PRINT "CAN YOU WAIT? ";: GET A\$ HOME IF A\$ = "Y" THEN GOTO 2045 HOME : VTAB 12 HUNE : VIAB 12 IF LEFTS (AS,1) < > "Y" THEN PRINT "NOTHING HAPPENS "NAS" WITHOU T READING THE DISK-FILE FIRST !": GOTO 2000 HOME : VTAB 12 L = 1:D = 1:C = 0:FS = "MEMOS" PRINT CHRS (4);"READ ";FS PRINT CHRS (4);"READ ";FS INPUT N 2080 J = N + 10DIM DA\$(J), IT\$(J), ST\$(J) FOR K = 1 TO N : INPUT DA\$(K), IT\$(K), ST\$(K) NEXT K PRINT CHR\$ (4);"CLOSE ";F\$ HOME : VTAB 12 PRINT "WOULD YOU LIKE TO SEE WHAT IS ON FOR "; PRINT "TODAY? ";; GET A\$ HOME : VTAB 12 IF A\$ = "Y" THEN GOSUB 2310 PRINT "WHAT'S NEXT ";NA\$"? (TYPE FIRST WORD OF SELECTION)." PRINT : PRINT TAB(10)"OTHER DATES" TAB(10)"PAST ITEMS NOT COMPLETE" PRINT PRINT TAB(10)"STATUS UPDATE" TAB(10)"ADDITIONS" TAB(10)"TODAY" PRINT PRINT PRINT PRINT TAB(10)"COMPONENTS OF PROGRAM" PRINT TAB(10)"DONE WITH CALENDAR" PRINT : PRINT : PRINT "WHICH? >>:";; GET A\$ PRINT : PRINT : PRINT *WHICH? >>:";: GET IF A\$ = "0" THEN R0 = 1 IF A\$ = "P" THEN R0 = 2: REM 2510 IF A\$ = "S" THEN R0 = 3: REM 2605 IF A\$ = "A" THEN R0 = 4: REM 2705 IF A\$ = "A" THEN R0 = 5: REM 2310 IF A\$ = "C" THEN COSUB 890 IF A\$ = "D" THEN 980 ON R0 GOSUB 2400,2500,2600,2700,2300,900 COTO 2120 2290 GOTO 2190 2300 REM TODAY 2310 SE\$ = D\$ **GOSUB 2900** RETURN HOME : VTAB 12 PRINT "FOR SPECIFIC DATE..TYPE MONTH & DAY (EX.JUNE 23)" PRINT "FOR FULL MONTH'S SCHEDULE..TYPE MONTH ONLY (EX.JUNE)": PRINT INPUT "WHICH DATE ARE YOU LOOKING FOR?" ; DB\$ 2440 HOME :SE\$ = DB\$ GOSUB 2900 RETURN HOME : VTAB 12 PRINT "HERE IS WHAT'S HANGING OVER YOUR HEAD!" PRINT FOR K = 1 TO N (More IF E = 1 AND ST\$(K) = "NOT FINISHED" THEN NN = NN + 1

Listing continued.

```
IF ST$(K) = "FINISHED" THEN GOTO 2540
2530
            IF ST$(K) = "NOT FINISHED" THEN GOTO 2560
 2535
2540
          NEXT K
IF E = 1 THEN 2810
 2545
 2550
           RETURN
 2560
           PRINT MID$ (DA$(K),1, LEN (DA$(K)) - 2)
PRINT "ITEM # " RIGHT$ (DA$(K),2)
 2565
2570
2575
           PRINT ITS(K)
           PRINT
 2580
           FOR Z = 1 TO 1500: NEXT Z
2590
2600
           GOTO 2540
HOME : VTAB 12
PRINT "WHAT IS THE DATE OF THE ITEM YOU WANT"
2605
           INPUT "TO CHANGE?";DB$
PRINT : PRINT "DO YOU WANT TO LOOK AT THE ITEMS FOR"
PRINT "THAT DATE FIRST?";: GET A$
2610
2620
2630
           HOME: VTAB 12

IF A$ = "Y" THEN GOSUB 2430

INPUT "WHAT IS DATE AND ITEM NUMBER TO BE CHANGED?";DI$

PRINT : PRINT 'IS THE NEW STATUS TO BE 'FINISHED' OR"

INPUT "'NOT FINISHED' ?";ST$
2633
2640
2650
2660
           FOR K = 1 TO N
2665
          IF DI$ = DA$(K) THEN ST$(K) = ST$
NEXT K
HOME : VTAB 12
2670 2675
2677
2680 CH = CH + 1: PRINT "OK, THE CHANGE IS MADE. DO YOU WANT TO MAKE ANOT
         HER CHANGE?" #: GET A$
2685
         HOME
IF A$ = "Y" THEN 2605
 2690
2695
           RETURN
          RETURN

REM ADDITIONS

HOME: VTAB 12

INPUT "WHAT IS THE DATE OF NEW ENTRY?";DB$

HOME: VTAB 10

PRINT "SINCE YOU HAVE TO GIVE AN ITEM NUMBER"

PRINT "AS WELL AS THE DATE DO YOU WANT TO"

PRINT "LOOK AT THE ITEMS FOR THAT DATE?";: GET A$

HOME: VTAB 12

IF A$ = "Y" THEN GOSUB 2430

INPUT "WHAT IS THE DATE AND ITEM NUMBER?";DA$(N + 1)

HOME: WITAP 10
 2705
2710
2715
 2717
2720 2725
 2727
2730
2735
           HOME : VTAB 10
INPUT "WHAT IS THE ITEM TO BE ENTERED?";IT$(N + 1)
HOME : VTAB 10
 2737
2740 2742
            INPUT "WHAT IS THE STATUS; FINISHED OR NOT FINISHED?"; ST$(N + 1)
 2745
2750 N = N + 1:CH = CH + 1
2755 PRINT "DO YOU WANT TO ADD ANOTHER ITEM?";: GET A$
           HOME : VTAB 10
IF A$ = "Y" THEN 2705
PRINT "ARE YOU READY TO WRITE ALL THIS TO DISK?";: GET A$
 2757
2760
2765
           HOME : VTAB 10
IF A$ = "Y" THEN GOSUB 2810
 2767
2770 2775
           RETURN
2800 REM WRITE TO DISK

2810 L = 1:D = 1:C = 1:F$ = "MEMOS"

2820 PRINT CHR$ (4);"OPEN ";F$

2822 PRINT CHR$ (4);"WRITE ";F$

2825 IF E = 1 THEN PRINT NN: GOTO 2840
          PRINT N
FOR K = 1 TO N
2830
 2840
           IF E = 1 AND ST$(K) = "FINISHED" THEN 2880
PRINT DA$(K): PRINT IT$(K): PRINT ST$(K)
2845
2850
2880
           NEXT K
           PRINT CHR$ (4);*CLOSE*F$:WR = WR + 1:CH = WR
PRINT : PRINT : RETURN
2890
2898
2899 REM SEARCH FOR DATE AND PRINT
2900 CO = 0
2905 W = LEN (SE$)
           GOSUB 3000
FOR K = 1 TO N
IF LEFT$ (DA$(K),W) = SE$ THEN 2960
2906
2910
2920
           NEXT K
HOME : VTAB 12: IF CO = O THEN PRINT "NOTHING FOR "SES: PRINT : PRINT
HOME : VTAB 12: IF CO = O THEN PRINT "NOTHING FOR "SES: PRINT : PRINT
 2930
2940
2945
           PRINT " PR#0": PRINT
          RETURN

IF CO > 0 THEN 2969

HOME : HTAB 25

PRINT "APPOINTMENTS FOR ** "SE$", 1980 **"

FOR I = 1 TO 80: PRINT "=";: NEXT I

PRINT "THE ITEMS ON THE CALENDAR ARE:"

PRINT "THE ITEMS ON THE CALENDAR ARE:"

PRINT 'PRINT

PRINT MID$ (DA$(K),1, LEN (DA$(K)) - 2)

PRINT "ITEM * "RIGHT$ (DA$(K),2)

PRINT TAB( 20)IT$(K)

IF ST$(K) = "FINISHED" THEN PRINT "COMPLETED"

IF ST$(K) = "NOT FINISHED" THEN PRINT "NOT COMPLETED"

PRINT : PRINT
2950
           RETURN
2960
 2961
2962
2963
 2965
 2967
2969
 2970
 2975
2980
 2982
 2984
            PRINT : PRINT
 2985 CO = CO + 1
2990 FOR Z = 1 TO 3000: NEXT Z
2995 PRINT : GOTO 2930
           REM PRINTER
HOME : VTAB 12
PRINT "PRINTER ? (Y/N) ";: GET P$
 3000
3010
3020
 3030
            HOME
            IF P$ = "Y" THEN PRINT " PR#1"
 3040
           RETURN
 3050
             PRINT "ITEM # " RIGHTS (DAS(K),2)
 22570
```

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bered d. Default values are 10 for a and b, and the beginning and end of the program for c and d.

TRACE [xx[.print list]]. Traces the logic flow of a program. After each statement is executed, its line number is printed in square brackets. The run begins at line xx if the parameter is included. The print list may be anything normally found after a PRINT command, so that variable values may be traced as the program executes. I find it helpful in some cases to include a CHR\$(17) (i.e., HOME) in the print list so that the changing values stay in a fixed position at the top of the screen rather than scrolling.

HELP xx. This command is used to find a non-obvious error in a line. The line is executed in command mode until the error is found, and then the line displayed in EDIT mode with the cursor over or near the error. Note that there are some errors HELP can't detect, and also that any GOTO encountered will be executed. Still, I have found this to work, though I can envisage situations where it could be tricked by changed variable values, etc.

FIND [''] string. Lists all program lines containing the string. If it is anticipated within PRINT or REM statements, the quote should be included. A wildcard character \pounds can be used within the string to represent any single character.

DEF x. Defines a function key, where x is any single-digit number. Enter any function (series of commands to be executed) from one to 1000 characters long. Up to ten functions may be defined or redefined. Graphics RAM is used as the buffer, starting at FFFF and going down. To terminate a definition input, CTRL-C is used. To use the defined function x, just use CTRL-x. A special input character i may be used in the definition to pause for keyboard input, similar to the BASIC input statement.

VAR. Lists the values of any scalar numeric or string variables currently defined. This is helpful to find out why an error has occurred. No array variables are listed, and the list is in order of creation as the program is executed.

LIST [xx[,yy]]. Lists the program—the usual graphic shortform can be used. The listing is from line xx to yy. If the parameters are omitted, they default to program start and end, and if yy is omitted, it defaults to xx (i.e., LIST 100 lists line 100).

DEL [xx[.yy]]. Deletes lines from the program. Parameter defaults are as for LIST.

CLOSE. Eliminates all blanks other than those in REM statements or within quotes. This is used to reduce the amount of memory required to store the program.

OLD. May recover your program after a goof—accidental RESET, DEL or NEW, or a failure in CLOAD. If RESET was hit, System 3 must be restarted first by exiting to the Monitor and typing GO F070.

CTRL-P. Starts or stops output to the printer. It does not work while a program is running, but you can temporarily halt the program with the RUN/STOP key to allow CRTL-P to be used. It works in BASIC or the Monitor. The system is set up to drive the Centronics output, but it can be changed to another driver by inserting its address in locations F074 and F075.

CLOAD?. Verifies a program on tape by reading it to check for CRC errors, similar to the Monitor Files command. This ensures that there is no corruption of memory if a CRC error does occur. This command is handy if you want to be sure that the program you just saved can be reread.

MERGE. Merges a tape program onto the end of the current one. All the line numbers in the second program must be larger than the last line number in the first program. Care must be taken that no duplication or overlap of line numbers occurs. Any failure to observe this will lead to unpredictable results. The program will only be merged if the tape read is successful.

Evaluation

As you can see, quite an impressive array of commands is available with this program. System Software guarantees that it will cut programming and debugging time by half, and offers total satisfaction or your money back. Is their faith in their product justified? I think it is.

Some of the facilities offered are worth the price on their own, even without all the extra commands. Two CTRL-Ps and a LIST will get me a listing of a program. Furthermore, since unwanted control codes are filtered from the input buffer, you can input ?CHR\$(12); :LIST <CTRL-P><CR> and the printer does not output the command line, since it was echoed before the printer was enabled. The purpose of the CHR\$(12) or formfeed is to feed my printer to the start of the next page.

Of course, there are always more facilities you would like in any program. System Software offers a customizing service, so if you have a real need for further or modified commands, they're at your service.

System Software, 1 Kent St., Bicton, 6157, Western Australia, Australia (09-339-3842).

> Dr. Ivan D. Reid North Adelaide South Australia

Touch Typist

Newline Software Littleton, MA System: Heath

I used to type about the same way I

chopped firewood: with a great deal of gusto, but not much finesse.

I do a lot of writing in my job, mostly at the keyboard of my company's H-89. Thanks to our Heath AutoScribe word processor software, typing mistakes were readily corrected. Since I could muster better than 40 words per minute with my eyes (scanning the keyboard as I typed), I felt no compelling need to learn to touch type.

But I invariably had trouble transcribing material. In such cases I had the secretary do the work, rationalizing that I had something more pressing to do right then.

I think that my colleagues saw through that ruse, however, because one day a disk was anonymously left in my office with a note attached which told me to use the disk immediately. I discovered to my initial chagrin that it was a computeraided instruction course called Touch Typist, from Newline Software. I say chagrin because I still (after all these years) have vivid memories of my high school typing class, and the horrors of learning to touch type.

My curiosity got the better of me, though, and I tried the software. While nothing can completely ameliorate the drudgery of learning to touch type, Newline Software has come up with a program to make it interesting and a challenge. The program not only helps the student learn to touch type, but also to finely hone the skills necessary to be able to type accurately and quickly. Interspersed throughout the lessons are tips on typing techniques, such as leaving two spaces after a period before the first character of the next sentence. While tips of this nature may be common knowledge to the experienced typist, they are new information for the new student. And for those who already know how to type, there are practice lessons to help improve speed and accuracy.

Each lesson begins with text which describes what new techniques will be learned in that lesson. The student is then given drill patterns to practice, followed by a review at the end of the lesson. The software uses good teaching practice by telling the student what will be taught, teaching that material, then reviewing (with speed drills usually) the material.

Touch Typist will run on any Heath H-89. H8/H19/H17 or Zenith Z89 system with 24K memory and HDOS version 1.6 or higher. The typing tutor package consists of three series of lessons:

• The T series of lessons, in which the student learns to touch type on the standard keyboard. The student is introduced to each letter on the keyboard, one letter at a time. After completion of this series of lessons, the student is able to touch type the entire alphabet and some of the standard symbols by touch.

• The N series of lessons teaches touch

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typing on the numeric keypad (the numeric keys on the right side of the keyboard). This feature is particularly useful for data entry applications (and using a push-button telephone).

• The S series reinforces the T series with speed and accuracy drills. This series of lessons consists primarily of paragraphs for the student to type. There are also valuable hints and rules of style.

Each lesson contains practice drills to improve speed and accuracy. Touch Typist displays a line of text in the middle of the screen, and instructions, if appropriate, at the top of the screen. The student then types the line as shown. The program checks each character as it is entered. If the character is correct, nothing happens. If the character is incorrect, then a large X is displayed under the erroneous character and the terminal bell beeps (you soon learn to hate that bell).

If an error is made, nothing can be done about it during that drill because the backspace key is not operative (indeed, the backspace key isn't even taught until about halfway through the T lessons). The student finishes that drill, after which the same drill is presented again. The program checks each drill for the number of errors made. If the number of errors on any given drill is not excessive (it seems to vary from drill to drill), then My typing speed went from 40 wpm with my eyes keeping my fingers honest to 40 wpm without looking.

the next drill is presented. If the number of errors is excessive, the same drill is continuously presented to the student. If, after a few futile attempts, the student has not mastered the drill, the program offers a graceful way out of the drill: simply hit the escape key to move on to the next lesson.

The program is not totally forgiving, however. If the student takes the easy way out of a particularly difficult drill, the tally at the end of the lesson tells the student that the lesson was completed but a number of lessons were skipped (it tells how many).

Most lessons end with a speed test. This is where a personal computer really comes into its own for tutorial lessons. The challenge is there to better one's previous typing speed and accuracy, and the speed drill is there whenever the student wants to try it, whether it is immediately after completing a previous lesson or three o'clock in the morning.

Touch Typist will display a paragraph on the screen. The student should then type the entire paragraph as quickly and as accurately as possible. As each character is entered, it is checked for accuracy. If it is correct, again nothing happens. If it is incorrect, Touch Typist will beep the terminal bell again and write the errant character in reverse video (a black character on a white background). Now, however, the backspace key is operational. The student may correct any typing errors by using the backspace key, but the character will still be counted as an error. To add further challenge, a timer is started as soon as the first key is struck and does not stop until the paragraph is completed.

For those with a low frustration threshold, it is possible to "fool" the computer into thinking that the paragraph has been finished by holding down any key, along with the repeat key, until the end of the paragraph is reached. At that time simply hit the carriage return and watch your blistering speed of 224 wpm (words per minute) flash on the screen. Of course, the number of errors is also displayed, which in that case will be considerable.

The important thing to note is that at the end of each speed drill, the number of errors and the typing speed in words per



minute (wpm) is displayed, thereby giving the student immediate feedback.

The nonbootable, write-protected disk comes with two sheets of instructions, for either single-drive or multidrive systems. An owner with absolutely no experience with using system programs such as Onecopy should have no trouble whatsoever following the instructions. I wish that all software houses would pay as much attention to documentation as Newline Software has.

But does it work? Absolutely. The user's success will certainly depend upon how well the lessons are followed, and how well the user applies him- or herself. No computer-aided instruction program can assure that the student will have perfect mastery of the material at the end of the lessons. But the student's success is in part a measure of the program. In my case, my typing speed went from 40 wpm with my eyes keeping my fingers honest to 40 wpm without looking. I now have not only the ability to transcribe material without resorting to my old typing method, but I also have the skills necessary to improve my typing speed and accuracy. After all, the name of the game is accuracy.

Newline Software, PO Box 402, Littleton, MA 01460.

> J.C. Hassall Blacksburg, VA

CRAE

Highlands Computer Services Renton, WA System: Apple II \$15

Writers of BASIC programs have many tedious housekeeping chores. They have to number the lines of their programs. They have to keep these line numbers consistent during such procedures as GOTO and GOSUB, particularly as the programs are being revised. They have to keep the spelling of variable names consistent; and if they need to change the spelling of a variable name, they must change every occurrence of that variable.

BASIC program writers also sometimes have to patch one program into another; or repeat virtually the same sequence of commands in different parts of the same program; or, in debugging, locate every occurrence of a given string.

These are boring tasks. Programmers like to have utility programs which do these chores. One such program, designed for the 48K Apple II, is CRAE (Co-Resident-Apple-Editor) sold by Highlands Computer Services, Renton, WA.

At \$15, CRAE is a good buy, a useful tool for those users who are more than casual programmers. It will join two BASIC programs together; it will find and change strings within a program; it will list a program or provide a hexadecimal dump of a range of memory; it will "quote" one section of a program in another section; it will automatically number and renumber program lines. And it does all this with just nine short commands.

The Program

You first boot the system with the CRAE disk, or use the PR#6 command. CRAE is then automatically loaded in the 12K of memory below 48K, and you are asked, "Do you want instructions?" If you say, "No," the machine returns to Applesoft II BASIC, and CRAE becomes "invisible."

When you need CRAE, you must first type an ampersand (&) as the first character in a line on the CRT. CRAE will then drop down to the next line and display a left bracket (ASCII character 219 decimal, DB hex). This contrasts with the Applesoft right bracket prompt (ASCII 221 decimal, DD hex).

One serious flaw at this point: apparently the only practical way for users to return to Applesoft (and, for example, run their programs) is to hit the reset key. This isn't fatal though; you're returned to BASIC rather than to the machine monitor, and both CRAE and the user program are intact. Still, it does seem reasonable to ask that CRAE have a graceful exit procedure, and/or a facility for running BASIC programs within CRAE's umbrella.

The commands are simple. Each begins with a single letter; then, depending on the command, you can have from zero to four parameters which specify the string to be located or changed, or the range of lines to act upon. Each parameter (except, in some cases, the first) is separated from the others by either a slash or a comma. The commands would be even simpler, of course, if the delimiter were consistently either a slash or a comma, and if the delimiter were consistently required (or not required) for the first parameter as well as the others; but these inconsistencies are a nuisance, not a serious flaw.

The Append command joins two BA-SIC programs together. The first program is brought into memory; the Append command is issued, and you're prompted for the name of the second program, which should be on disk. Be sure the line numbers of the second program are larger than those of the first.

The Change and Verify commands both alter a given string. Both can be limited to a specific line range. The difference is that Verify, in spite of its name, does not verify—i.e., echo—the change. The Find command will locate a given string, but will not change it. Like the Change and Verify commands, it can be set to operate within a specified line range.

The Quote command repeats a given range of lines in a different section of the program without deleting the original set of lines. The same sequence of commands can therefore be used in two different parts of the program; and there are some situations where this procedure is preferable to the use of the GOSUB command—where, for example, the programmer wants to avoid jumping out of or into a FOR...NEXT loop.

The Auto Line Number command (which uses the letter N) automatically provides line numbers for a program. You can specify the starting line number and the increment. The Dump command gives a hexadecimal dump for a specified range of memory, a function duplicated in the Applesoft ROM.

The Renumber command is also duplicated in Applesoft; in fact, the Applesoft version is somewhat better because it can handle longer programs. And finally, the List command essentially duplicates the Applesoft List command, but does not produce as readable a listing because it eliminates "extraneous" spaces.

As far as I can tell, the error-trapping routines are flawless—although the error messages are sometimes cryptic ("err<0," for example). Still, experienced programmers should have few problems deciphering the error messages; often they simply mean that the user has entered a BASIC command or line number instead of a CRAE command.

The Most Serious Problem

The most serious problem with CRAE, as with so many programs, is the user documentation. The user's manual has 17 double-spaced pages, including the cover, and not all of these are full pages. Most of the commands are explained in less than one page. This one page will explain the purpose of the command and present the format for the command. In many cases it will also present a few examples of the command format. But there are very few examples of the results (i.e., printouts showing what happens when you use the commands.)

Also, no tutorial is included to lead users step-by-step through the program. Tutorials are probably the most effective device available for showing users how a program works, and I believe that every user's manual should contain one. In CRAE's case, it would have been easy to include a tutorial on the disk.

If we assume that CRAE is intended only for experienced programmers, we can to some extent excuse its poor documentation (although I have to wonder why people who hope to make money from their programs would exclude less experienced programmers from their market). CRAE is simple enough that experienced programmers can figure out for themselves just how the commands operate. Still, while I get satisfaction from solving the puzzle of what the commands do, it is only grim satisfaction, tempered by resentment that the authors have presented me with this unnecessary puzzle.

But in spite of its poor documentation

and its lack of a graceful exit routine, I am satisfied with CRAE. It probably does no more than many other programmer aides (such as Applesoft's DOS Toolkit), and perhaps it does not do them as well. But I am content. I was weary of eyeball editing, and I'm delighted with the help that CRAE gives me. Especially when I look at that \$15 price tag. You'll have a hard time beating that.

Highland Computer Services, Renton,

Brownlee Elliott Bloomfield Hills, MI

Flash Attack

Mach 2 Software Danbury, CT System: PET \$15

Flash Attack is a multimachine game that provides infinitely more challenge than do the you-against-the-computer games.

The 40 \times 60 playing field shows a terrain of mountains, consisting of cross hatched squares, or forest, represented by groups of trees. Both players have a command post, five tanks (to be used one at a time), walls to build dummy command posts, land mines, missiles and tank and command post guns. The object is to destroy your opponent's command post (actually a wall of the command post).

The game is challenging because you can't see the entire playing field, only a small window around your command post and the current position of your tank. The numeric keypad moves your tank, using one unit of fuel for each square moved. In the heat of battle, it's easy to forget this and end up stuck far away from your base.

Tanks may not move over the mountains, nor can shells destroy mountains. Tanks may pass through forests, and any kind of a shell will destroy them. Mines laid by your tank are visible to you, but not your opponent. A square containing a tree cannot contain a mine.

CB2 sound effects indicate firing a gun, hitting a mine and launching an ICBM.

If your tank is hit by a shell from another tank, it will go from condition green to amber, or from amber to red, or from red to destroyed. Running over a mine is equivalent to being hit by two tank shells. If a tank is hit by either a command post gun or an ICBM, it will be destroyed no matter what its condition was. A tank in condition red will move only about half the time a direction key is pressed. Returning to the command post will completely repair and reequip the tank. As good as this program is, it has a few drawbacks. The most obvious is that it is much easier to come up with two people to play the game than two PETs to play it on. Also, the program is uncopyable; I worry a little about what happens when my tape wears out. Hopefully, it will soon be available on disk.

Occasionally random patterns of mountains box in a command post, making that game unplayable. Both tanks are represented as diamonds. It would be easier if they could be distinguished from one another. Occasional keystrokes cause the program to jump back to BA-SIC for no apparent reason.

My user group has spent the better part of its last three meetings playing Flash Attack, making it the most popular game we've ever tried. The authors have indicated they are working on other games of this type. We hope so, because we'd like to encourage them to continue to produce what would be best described as a new class of games.

Mach 2 Software, 96 Hammersmith Apts., Danbury, CT 06810.

> Daniel M. Kapsch Miamisburg, OH

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SOFTWARE REVIEWS

Edited by Eric Maloney

A Cure for Sorcerer Blues Learn to Type on Your Heath Apple Editor War Games on the PET

System 3

System Software Bicton, Western Australia System: Exidy Sorcerer \$29.95, \$2 extra for air mail

Exidy's Sorcerer is a fine machine, with one of the quickest BASICs around. However, this speed is achieved at the expense of some complexity and numerical accuracy. For most applications, the accuracy is unimportant, but there are times when you wish that the ROMPAC supported a few more features (see, for example, "A Sure Cure for Those "?SN ERROR' Blues" by Randy L. Henne, May 1981, p. 142). Now there is a simple and relatively inexpensive method to add editing, renumbering, and several other facilities to your Sorcerer.

Richard Swannell, a young Perth programmer, has set up a small software house in Western Australia dealing exclusively in Sorcerer software. One of his offerings is a programmer's aid which can cure most of the blues a Sorcerer programmer may have. For your \$29.95 (plus \$2.00 for airmail—recommended because of the slow surface mail to and from Australia) Richard will send you a cassette containing the program, and a small printed sheet explaining the facilities that are offered. The tape is recorded with three copies of the program, two on the first side at 1200 baud and one on the reverse at 300 baud. The tape is protected against unauthorized copying, but Richard offered to let me know how to defeat that if it turned out to be a problem. I believe future copies will not be protected. I have had no problems loading the tape at the higher speed, though I always record my own programs at 300 baud for extra security.

The program must be loaded before you start entering your BASIC program, as it first loads into low memory normally occupied by BASIC source code. It is recommended that the LOG command be used. But I've successfully operated it by using the GO command after a normal load. When loading, the Monitor message is indicating a program 1050 bytes long starting at OFOO and an auto-execution address of OFOO as well. Once loaded and execution has commenced, the program relocates itself into the top of RAM and resets the BASIC top-of-RAM indicator to prevent it from being overwritten. In this way, the program can be used with any memory size, operating just as well on my 48K machine as it would on an 8K Sorcerer.

After the program signs on, the aid is transparent to the user until he wants to use some of its facilities. It works by intercepting input and output to check if any

Keypad right-arrow Keypad left-arrow Keypad X Keypad '=' or CLEAR Keypad divide RUB TAB REPEAT CTRL-C RETURN Keypad down-arrow Keypad up-arrow Move cursor right Move cursor left Scan cursor Delete character under cursor Truncate line Toggle mode (X or R) Backspace (RUB in command mode). Now tabs Repeats last key Quit without editing Enter edited line Enter current line and edit next Enter current line and edit previous Table 1. action has to be taken by System 3, allowing all other I/O to pass through to the ROMPAC or Monitor programs.

Facilities

In the following descriptions, an item enclosed in square brackets [] is optional.

EDIT xx[,yy]. Edit line xx. The graphic shortform for EDIT is GRAPHIC-E. The keypad is used to control the editor, and no shift is required to activate the cursor-control keys. A special buffer is used to ensure that longer lines can be entered without problems. The line being edited is displayed on the screen between two delimiting characters with an inverse cursor over the first statement.

The commands are shown in Table 1. The two modes, replace (R) and expand (X), are indicated by a single character at the top of the screen. In R mode, typing a character will replace the character under the cursor with the one typed, and move the cursor to the next position. In X mode the cursor and the rest of the line shift along and the typed character is inserted before the cursor. In R mode, typing up to the end-of-line delimiter will expand the delimiter across the screen and onto the next line if necessary.

If the down-arrow command is given when the current line is the last line in the program, a new line number is displayed with value yy greater than the last.

AUTO [xx[,yy]]. Enters AUTO mode. The next line number is displayed on the screen ready for a new line. If the line number is duplicated in the program, a full colon is displayed under the cursor. If a new line is not to be entered, LINE-FEED skips to the next line.

All edit commands are available, but once you have gone into EDIT mode (e.g., used cursor-up to edit a mistake in a previous line) then RETURN will put you back to command mode. Parameter xx is the initial line number, and yy is the increment.

REN [*a*[,*b*],*c*[,*d*]]]]. Renumber BASIC program with first new line number a, increment b, first line of original program to be renumbered c, and last to be renum-

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