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NOTE: See page 113 before typing in programs.

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Editor's Notes

It's always a pleasure here to launch a new magazine. It is something we pride ourselves on doing well, and our family of publications, both books and magazines, represents a significant and ongoing commitment to quality of product. We are a fluid group, at least internally, and have been fortunate in that we managed, as an editorial group, to avoid most of the pitfalls of overexpansion that befell many of our publishing colleagues in this industry's jarring setbacks of 1984 and 1985. Tom Halfhill, most recently editor of COMPUTE!, has now taken the reins of our newest publication, COMPUTE's Atari ST Disk & Magazine. It's our most massive disk-based undertaking to date, and no publishing house in the history of this industry has ever dared place tens of thousands of bound-in disks into general newsstand distribution. Lance Elko, long our editor of COMPUTE's GAZETTE, is expanding his duties to encompass COMPUTE!. We are confident this move will strengthen COMPUTE!, and help us in our continuing efforts to provide you with a constantly growing, and improving, publication. We welcome Lance to his new responsibilities, and can assure him, from long experience, that you out there will be the first to let him know how things are going.

A Software Product Note

While on the subject of COMPUTE!'s Atari ST Disk & Magazine, we'd like to mention an important concern. This is a truly integrated product—the magazine documents, nurtures, and tutors the disk. The programs, likewise, appear only on the disk. In short, you need the two parts to make the whole. One of our vendors' biggest concerns for this magazine was that of removal of the disk. After all, they argued, this is an expensive item, and so on. It is of major concern to us that you, as potential readers, be able to handle the magazine and browse the printed pages. For this reason, you will find that the newest magazine we publish has a bound-in disk. And pages that open for previewing. We're relying on you to prove us right. And, as always, COMPUTE! disk products are produced so that you can immediately, and easily, create your own backup. We do not engage in copy-protection. We expect you to refuse to engage in copying.

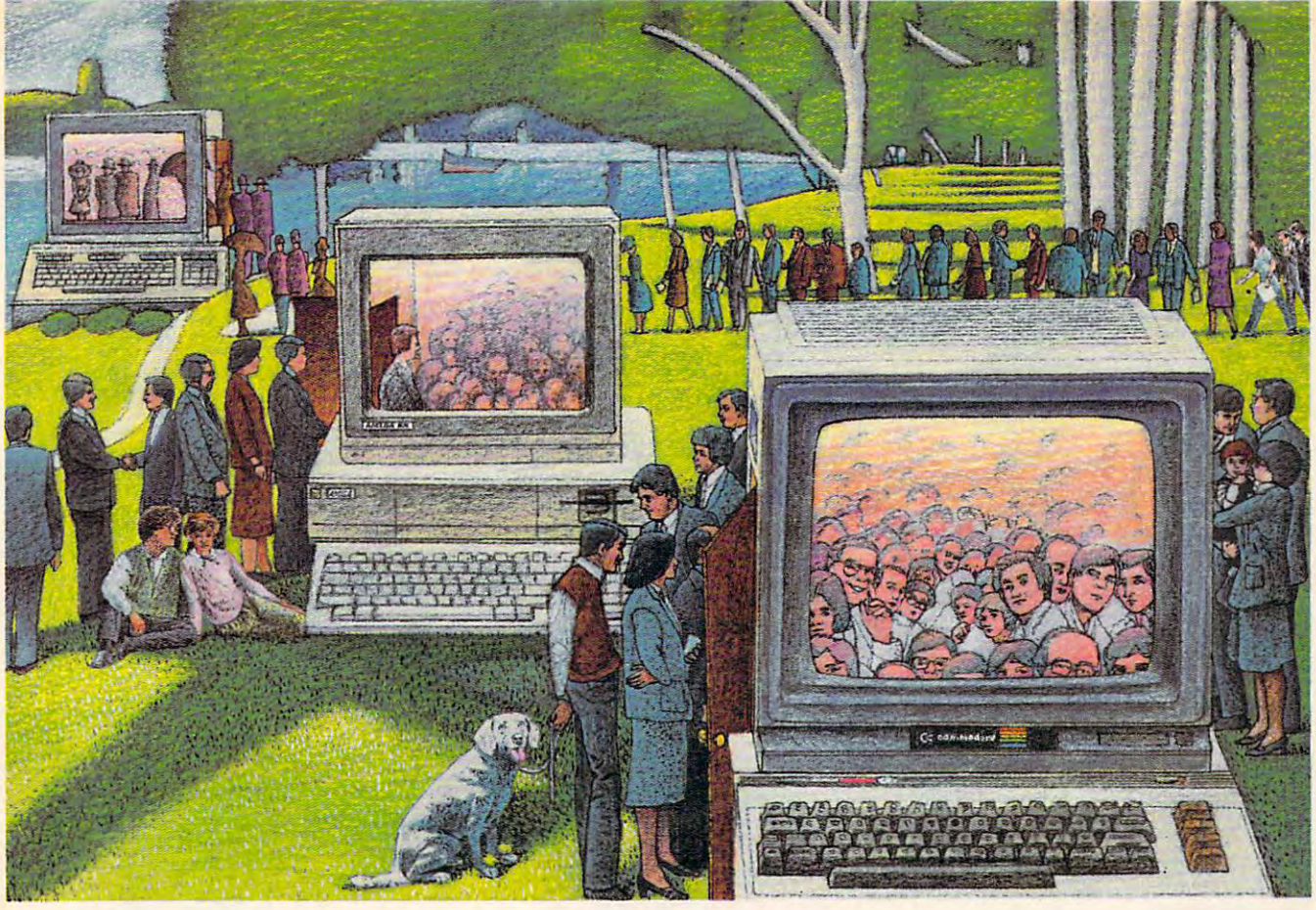
A Rare Exception

We do not frequently participate, in these pages, in a hand wringing regarding the ebbs and flows of our staff page. This is not, after all, afternoon television.

Our rare exception usually regards the move hither or yon of an editor or two as mentioned earlier in this piece. This month we must make a far more notable exception. Mr. Charles Brannon, of our resident staff, has accepted new employment, and we want not only to wish him well, but to devote to him a few sentences on this page. Charles, known by many of you as the author of *SpeedScript*, an incredibly sophisticated piece of COMPUTE!'s "giftware," came to work for us in 1980 as a high school student, doing program listings after school. Over the years Charles grew and evolved into a very senior young member of our staff, achieving the position of program editor, and the person behind many, many of the significant programs we have developed and published here. We have many talented people, and would not wish these accolades for Charles to diminish that collective excellence. But there is, after all, only one *SpeedScript* and *Superfont*, and well, Charles, we'll miss you, and we appreciate all the tremendous service you have provided to the readers and users of these publications over the last few years. We wish you well in your new venture.

Until next time, enjoy your issue. And watch for COMPUTE's Atari ST Disk & Magazine, appearing on your local newsstand in early September. ©

Robert C. Lock
Editor in Chief



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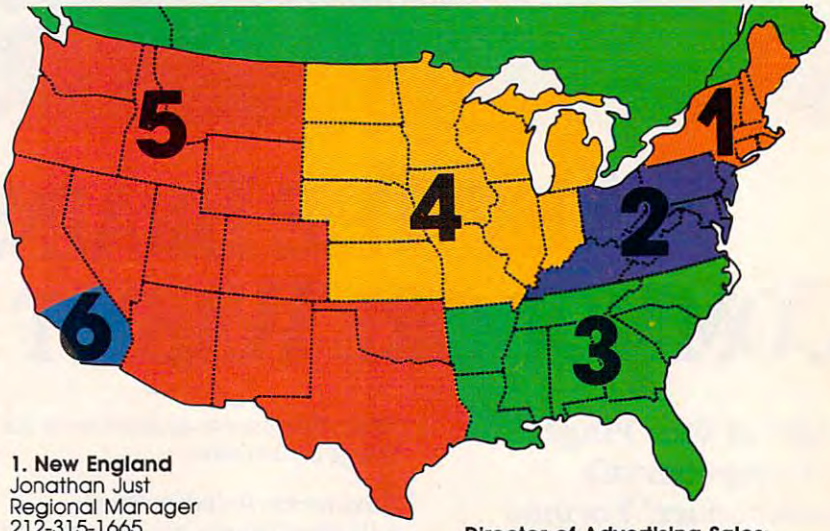

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The Editors and Readers of COMPUTE!

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STRING$, SPACE$, And CHR$

I have a suggestion for people who submit or translate IBM PC/PCjr programs for publication in your magazine. Whenever a BASIC program line requires that I type a long series of spaces, I find it difficult to tell exactly how many spaces are needed. This can be frustrating, because the "Automatic Proofreader" keeps signaling an error until I finally get the right number by trial and error. The STRING$ function can easily eliminate this problem. For instance, the statement PRINT STRING$(15,32) has exactly the same effect as PRINT " " and is much easier to type in. STRING$ can be used where any long series of identical characters is needed. For instance, PRINT STRING$(40,46) prints a line consisting of 40 dots.

Richard J. Patton

This is an excellent suggestion, and the same general advice applies to every version of BASIC. Some versions include STRING$, which works exactly as in IBM BASIC; Amiga BASIC even includes a specialized SPACE$ function for creating a string of spaces. For BASICs that don't support either function, you can do the same job through concatenation. To create a string consisting of 30 spaces, for instance, use SP$=" ":FOR J=1 TO 30: SP$=SP$+CHR$(32): NEXT. This construction is easy to type and requires only a few more characters than printing the string in literal form.

For similar reasons, it's often preferable to express graphic characters or unusual symbols as CHR$ values rather than as string literals. Here are two different versions of a typical Commodore BASIC line:

```
10 IF X$="■" THEN GOSUB 100
10 IF X$=CHR$(135) THEN GOSUB 100
```

The first version of line 10 uses a literal graphics character to test whether the f1 function key has been pressed. The second version performs the same test with CHR$. To alleviate the "mysterious character" problem, our listing conventions (see "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue) replace any unusual Commodore or Atari character with a sequence that's easier to read. Here's what the same line would look like in a COMPUTE! listing:

```
10 IF X$="{ f1 }" THEN GOSUB 100
```

That's an improvement over listing an indecipherable graphics symbol, but it still requires that you remember the listing convention or look it up when the time comes. Of these three alternatives, the line with CHR$ is preferred in many cases, since it's easy to read and type, and doesn't require reference to anything but the listing. Of course, where large numbers of characters are involved, CHR$ may not be practical.

Spaced Out Operators

I enjoyed Bill Boegelein's "Amiga Puzzle" article in the May 1986 issue of COMPUTE!. I did have one problem, however, that may be of interest to your readers. The mistake was mine, not yours or the author's, but the solution might help everyone type in programs more accurately. The Play subroutine of Amiga Puzzle contains a complex IF statement that begins like this:

```
IF (mouseX>rat(x,y,0) AND ...
```

I mistakenly entered that portion of the statement like this:

```
IF (mouseX.rat(x,y,0) AND ...
```

Notice my inadvertent use of a period in place of the greater-than operator (>). Clearly, I forgot to hold down the SHIFT key when typing the > character. The problem arises because Amiga BASIC lets you include a period as part of a variable name. Instead of performing the logical comparison triggered by >, BASIC saw *mouseX.rat* as the name of an array. Of course, there is no such array or variable in the program, so its value was set to zero, like all other uninitialized variables. As a result, this part of the IF test is always false and the program's CheckCheat routine can never be called.

Although I was lucky enough to find this error without much searching, similar mistakes could be very difficult to detect in other situations. As a precautionary measure, I suggest that programmers always place a blank space on either side of a logical operator, as shown here:

```
IF (mouseX > rat(x,y,0) AND ...
```

If the original line had been written in this way, my typing error would have been much easier to spot. More to the point, BASIC itself would have detected the mistake and signaled a syntax error immediately. Again, the problem was mine, not Mr. Boegelein's or yours. But it could easily be prevented by following this simple rule.

Jack Purdum

Thanks for the suggestion.

SpeedScript File Resurrected?

I recently experienced an odd thing when using *SpeedScript* on my Commodore 128 in 64 mode. After writing a document, I pressed the RESET switch to go back to 128 mode. Then I decided to go back to 64 mode to finish up the document. When I reloaded and ran *SpeedScript*, I saw the same document that was in memory before I reset the computer. Shouldn't the memory have been cleared during this process? Does this mean that my 128 running in 64 mode isn't fully compatible with a normal 64?

Chris Hicks

To answer your last question first, this experience does not signal any sort of incompatibility. Your computer behaved exactly as a normal 64 with a RESET switch would under the same circumstances. The 64's reset routine does not *erase or scramble everything in the computer's memory; that happens only when you turn the computer off and on again. (For more details, see "64 RAM Report" in the June 1986 installment of this column.)*

SpeedScript *erases all of its text storage space when you first run the program, but not if you rerun it during the same session. When you run* SpeedScript, *it checks to see whether a special memory*

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location contains the "I was here before" flag. If this flag is present, SpeedScript concludes that it was used previously in this session and sets up without erasing any text. Resetting the computer doesn't disturb either the memory area where text is stored or the location that holds the flag. So when you reran SpeedScript, the text was still there.

This feature of SpeedScript permits you to exit to BASIC if necessary, then reactivate the word processor without losing all of your work. As long as you don't load a different program or perform operations that change the contents of BASIC program space (or the memory location where SpeedScript stores the flag), any previous text should remain intact. To play it safe, of course, you shouldn't exit to BASIC more often than necessary. SpeedScript permits you to view the disk directory and send commands to the disk drive without leaving the program.

1541 Disk Drive Rattle

I have seen a BASIC command that prevents the Commodore 1541 disk drive from knocking when protected software is loaded. Is there any way to prevent the knocking sound when you format a new disk? I am worried that too much knocking will force my drive out of alignment.

Tom Smith

While it's true that head-knocking isn't particularly good for the drive, there's no easy way to prevent it during the format process. The 1541 drive is often called an "intelligent" peripheral because it contains its own microprocessor, free RAM, and operating system in ROM. The knocking sound heard when you format a disk is deliberate. It's caused by the format routine itself, which is permanently recorded in the drive's ROM.

A Commodore 1541 disk contains 35 tracks, numbered 1–35. Track 35 is nearest the center hub, and track 1 is the outermost. The drive always begins formatting with track 1 and proceeds inward, formatting one track at a time. To locate the read/write head accurately for the beginning of this process, the drive steps the head outward a total of 46 tracks. Since the drive is designed to access only 35 tracks in normal use, this maneuver is guaranteed to cause a read/write error regardless of the read/write head's initial position. The rattle is caused when the read/write head pounds against a mechanical metal stopper. The stopper physically prevents the head from moving past the outer edge of the disk.

As you've seen, the command that prevents the head from knocking in other cases doesn't work when formatting. That method works by storing a smaller than usual number in location $6A in the drive's RAM. This location is a zero-page counter used to control how many times the drive should try to access a requested sector before giving up and signaling a read/write error.

The reason this trick doesn't work is that the ROM formatting routine, the relevant portion of which begins at $FAC7 in ROM, pays no attention to what's in location $6A. After stepping the head out 46 tracks, the ROM routine does set up a counter (at location $0620), but that's used to keep track of the number of errors encountered after the head-knock takes place.

It is possible to format a disk without rattling the head, but the alternatives are fairly involved and may be less reliable than the usual method. The first catch is that you need the ability to write a machine language routine for the drive to execute, download that code into one of the drive's RAM buffers, then cause the drive's microprocessor to execute it in place of the ROM format routine.

For those who are up to that challenge, here's one possibility: If your drive is correctly aligned, then, rather than locating the read/write head in the usual way, why not use a commercially formatted disk for calibration? Mass-produced commercial disks such as the 1541 Test/Demo disk are usually created on industrial equipment, not 1541 disk drives, and software companies have a strong incentive to keep such equipment in good alignment. So any commercial disk that doesn't contain deliberately implanted errors should be very close to the standard.

The idea is to insert the calibration disk, move the drive's read/write head to track 1 by reading track 1, sector 0, leave the read/write head stationary at that point, perform the other setup tasks required, then enter the ROM format routine at a point that bypasses the head-knocking section. That's a fairly tall order for most programmers and requires a much longer program than we can include in this space. This scheme could also increase the risk of inconsistent results, since it relies on two critical assumptions—that your drive is correctly aligned and that the calibration disk was accurately formatted in the first place—which may not be true in every case.

Loading Touch Tablet Screens In Atari BASIC

How can I write a BASIC program to display pictures drawn with the Touch Tablet and *Atari Artist* cartridge?

Peter Hinz

Loading Touch Tablet pictures in Atari BASIC is quite possible, and by calling an operating system routine, your BASIC program can load the images at machine language speed. But first, there are a few important points to cover.

To begin with, the Atari Artist cartridge that comes with the Touch Tablet saves pictures in a special compacted format to conserve disk space. That's why, if you examine a disk directory of Atari Artist pictures, you'll notice that the files are usually of different lengths. Before you can load these pictures with a BASIC program, you have to convert them to uncompacted format.

Although some people have written conversion utilities for this purpose, there's an even simpler method. It's not mentioned anywhere in the Atari Artist manual, but if you hold down SHIFT and press the greater-than key (>), Atari Artist saves the current screen onto disk with the filename PICTURE. (Be aware that this replaces any existing file named PICTURE on the disk.) The file PICTURE is uncompacted and always takes up 62 disk sectors. This trick is useful in a couple of ways. It makes it possible to load Atari Artist pictures into other drawing programs for the Atari that use this format, including the Atari Light Pen's Atari Graphics cartridge and Datasoft's Micropainter. And it also makes it possible to load Atari Artist pictures into your own programs.

But first, another point: Before loading the picture with a BASIC program, you have to set up the proper graphics mode. Atari Artist (and most other drawing programs for the Atari) uses a special mode often known as GRAPHICS 7½. Of course, there's really no such thing as GRAPHICS 7½, but the term refers to the fact that this mode has the same horizontal resolution as GRAPHICS 7 (160 pixels) and the same vertical resolution as GRAPHICS 8 (192 pixels, without a text window). Yet, it also offers the same number of simultaneous screen colors as GRAPHICS 7 (four), while GRAPHICS 8 is limited to only two colors. Because it combines the best of both modes, GRAPHICS 7½ has been the most popular mode for drawing programs.

GRAPHICS 7½ has always been supported by the Atari operating system. However, until the XL and XE series computers came out, it was not available from Atari BASIC without making some special POKEs to modify the display list. (The display list is an area of memory that tells the computer which graphics mode to display on the screen.) On an XL or XE, GRAPHICS 7½ is called GRAPHICS 15.

The following BASIC program shows how to load a 62-sector screen file named PICTURE at machine language speed. It should work with any uncompacted screen files, including those created with Atari Artist, the Atari Light Pen, and Micropainter. This program is actually a slightly modified version of the program named MENU on the Atari COMPUTE!

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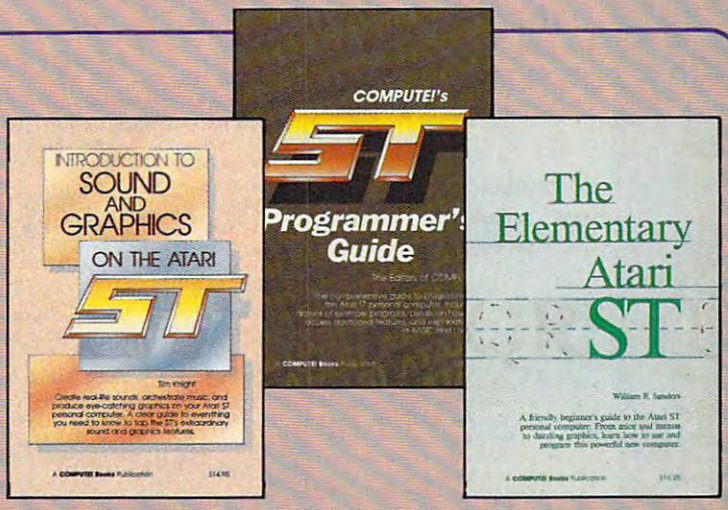

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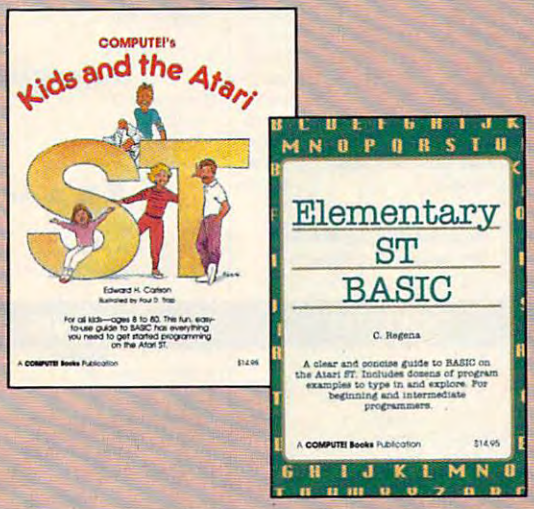

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DISK. *It's easily adapted to your own BASIC programs. Briefly, here's how it works.*

Lines 10 and 160 create a very short machine language routine that is used later to call a high-speed loading routine in the operating system. Lines 170–177 set up graphics mode 7½ on any Atari computer. If your program is intended only for XL and XE models, you can replace these lines with a single statement such as 170 GRAPHICS 15+16. Line 190 opens the file PICTURE on disk and jumps to the subroutine at line 980. This subroutine, in turn, calls an operating system routine which loads the screen into memory at full speed. Line 200 simply loops endlessly so the picture stays on the screen. Press BREAK or SYSTEM RESET to end the program.

```
MC 10 DIM CIO$(7)
AC 160 CIO$="hhh":CIO$(4)=CH
       R$(170):CIO$(5)="LV":
       CIO$(7)=CHR$(228)
CO 170 GRAPHICS 8+16:DL=PEEK
       (560)+256*PEEK(561)+4
AJ 172 SETCOLOR 4,0,12:SETCO
       LOR 0,2,10:SETCOLOR 1
       ,2,6:SETCOLOR 2,0,0
ND 175 POKE DL-1,14+64:FOR I
       =2 TO 194:IF PEEK(DL+
       I)=15 THEN POKE DL+I,
       14
BH 176 IF PEEK(DL+I)=15+64 T
       HEN POKE DL+I,14+64
CH 177 NEXT I
II 190 OPEN #1,4,0,"D:PICTUR
       E":ADL=PEEK(88):ADH=P
       EEK(89):LN=7936:GOSUB
        980:CLOSE #1
FN 200 GOTO 200
EC 980 X=16:REM Fil@#2,$20
EF 990 ICCOM=834:ICBADR=836:
       ICBLEN=840:ICSTAT=835
PL 1000 POKE ICBADR+X,ADL:PO
       KE ICBADR+X+1,ADH
LN 1010 L=LN:H=INT(L/256):L=
       L-H*256:POKE ICBLEN+
       X,L:POKE ICBLEN+X+1,
       H
PB 1020 POKE ICCOM+X,7:A=USR
       (ADR(CIO$),X)
KI 1025 RETURN
```

When the picture appears, chances are the screen colors won't be right. You'll have to recreate the picture's original colors with four SETCOLOR statements inserted somewhere between lines 170 and 190. You can figure out what these SETCOLOR statements should be by looking at the Color Menu screen in Atari Artist. *The four color register numbers along the bottom of the Color Menu screen—0, 1, 2, and 3—correspond to the first parameter in the SETCOLOR statement. Color 0 = SETCOLOR 4, color 1 = SETCOLOR 0, color 2 = SETCOLOR 1, and color 3 = SETCOLOR 2. The second parameter in SETCOLOR matches the color numbers along the vertical color bar on the Color Menu screen (0 to 15). And the third parameter in SETCOLOR is derived from the vertical luminance bar on the Color Menu screen (also 0 to 15, but use the even numbers only). For example, if color 0 in* Atari Artist *is set to black, your program would need a statement such as SETCOLOR 4,0,0.*

Incidentally, another undocumented trick makes it possible to load *uncompacted-format pictures into* Atari Artist, *too. Simply hold down SHIFT and press the less-than key (<). This way, you can take 62-sector pictures created with the Atari Light Pen,* Micropainter, *and other drawing programs and modify them with the Touch Tablet. If you then save this screen with* Atari Artist *in the usual way, it's converted to compacted format.*

Commodore SHIFT–SPACE

Sometimes when typing in programs from your magazine on my 64, I've come across a SHIFT–SPACE. When I press SHIFT and the space bar, it doesn't appear any different on my screen from the normal space. What does the SHIFT–SPACE character do?

Warren Frederick

There is a difference between the normal space character and shifted space. Although they appear the same on your screen, they are actually two separate ASCII characters. The normal space is CHR$(32) while the shifted space is CHR$(160). This distinction is probably not significant in every Commodore program where a {SHIFT–SPACE} appears. Many times, the programmer happens to be working in lowercase and types in an entire message with SHIFT LOCK down. When this happens, a shifted space appears in the listing, but an unshifted space would work just as well.

However, sometimes SHIFT–SPACE serves a special purpose. Certain programs use SHIFT–SPACE to mark a position on the screen that's invisible to the user. By PEEKing into screen memory, the program can distinguish between shifted and unshifted spaces even though both look identical on the screen.

You can also use SHIFT–SPACE to add short comments to disk filenames. If you include a shifted space as part of the filename, the disk drive treats that character as the end of the name and ignores any characters that come after it. But the extra characters are visible when you list the disk directory. For instance, you might want to save the current date to indicate when a program was last revised. This statement saves a program as FILE, followed by the date 9/22/86:

```
SAVE "FILE"+CHR$(160)+"/9/22/86",8
```

After you execute this statement, you can still load the program normally, with LOAD "FILE",8. But when you list the directory, the filename appears as FILE/9/22/86. This trick is frequently used when saving machine language programs, to indicate the SYS address used to start the program. Of course you are limited to a total of 16 characters, just as with any other disk filename.

IBM PrtSc Problems

When using the PrtSc function with my PCjr in "IBM Pie Chart Maker" (COMPUTE!, January 1985), my Gemini 10X prints the chart, but with thin blank lines between each row of the chart, as if the printer were displaying text lines. I have tried resetting the line space command to the printer and tested it in immediate mode to verify that the line space has been changed. But as soon as I type the PrtSc command, it seems that this command initializes the printer.

Rich Camaish

We've experienced the same problem when using PrtSc with anything except an Epson printer. Normally, pressing SHIFT–PrtSc just prints a text dump. In order to dump graphics with PrtSc, you need to enter the GRAPHICS command at the DOS command line to load the graphics print-screen driver. This driver was written specifically for the IBM Graphics Printer, a relabeled version of the Epson MX-80.

Apparently, the driver resets the printer completely before starting the graphics dump, as if the printer were turned off and on. (The Epson code for this is ESC-@.) It then sets the lines-per-inch to 8, corresponding to seamless eight-wire graphics printing. The code used for this function is different on the Gemini 10X and many other printers that are otherwise Epson compatible. Your printer accepts the reset sequence, though, throwing it back to nine lines per inch before starting the graphics dump. We've had the same problem with the IBM Color Printer.

The only way around this would be to modify the GRAPHICS driver. If you know something about 8088 machine language and have a working acquaintance with the DEBUG utility, you could search for the ESC-@ sequence (hex $1F $40) and replace it with two zeros to null it out. However, there are programs on the market and in the public domain that support graphics printing with PrtSc for many different printers. Check with your local IBM user group or nearest dealer to see if they've heard of these.

Apple HTAB In 80 Columns

I have an Apple IIe with an extended 80-column card. I found out recently that the Applesoft BASIC HTAB command does not work properly. When I type the following line in 80-column mode, I get an incorrect result:

```
HTAB 20:PRINT "THIS IS A TEST";:
  HTAB 1:PRINT "A"
```

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The computer prints this line preceded by 19 spaces:

THIS IS A TEST.A

Memory location 36 is supposed to contain the horizontal cursor position, but in 80-column mode, it always contains 0. The BASIC function POS(0) doesn't work either. How can I determine the current cursor position?

William Liao

Many older Apple II programs, especially those written in machine language, print to the screen by adding the horizontal cursor position (CH, location 36) to the address of the first character in the current row (BASL and BASH, locations 40 and 41), then storing a character at the address that results. When 80-column hardware is in use, this technique could scramble the Apple's memory, since the organization of 80-column screen memory is different.

As a precaution, whenever the Apple's I/O software accesses the 80-column screen to move the cursor or print, it resets CH to 0. This is why PEEK(36) and POS(0) no longer work. In IIe and IIc computers, the 80-column cursor position is kept in location 1403, called OURCH. (If you're familiar with the Apple II's memory arrangement, you'll remember that addresses between 1024 and 2047 are reserved for screen display memory. Since the 40-column screen is 40 × 24, that's a total of 960 bytes that are actually used. The 64 unused bytes are called screen holes and are used to store I/O variables. OURCH is one of these.)

The HTAB command changes the cursor's position by storing a new value in location 36. To keep this command operational, the enhanced I/O routines keep a copy of CH in another screen hole, location 1147 (OLDCH). Before each screen access, CH and OLDCH are compared. If they are different, CH must have been changed, so its value is made the current position by storing it in OURCH. The only time this doesn't work is when 80-column mode is active. Since CH and OLDCH are both set to zero at each screen access, an HTAB 1 command stores zero in CH, and there's no way to tell that anything happened. Since CH and OLDCH still contain the same value, OURCH is not altered.

One simple way to move the current screen position to the first column is to use a lone PRINT statement. All it does is move the cursor to the first column of the next line without disturbing the display at all. Another way to be certain of the cursor's position in any display mode is to POKE the new column value (0–79) into both CH and OURCH. In standard display mode (40 columns, checkerboard cursor), OURCH is not used; POKEing a value there doesn't seem to have any undesirable side effects.

When the enhanced I/O firmware is active (block cursor in 40 or 80 columns), you can find the current cursor column with PEEK(1403). To find the current column regardless of display mode, PEEK the value in CH. Then, if it has a value of zero, PEEK at 1403. This should always give the correct position.

EduCalc Clarification

A statement concerning disk initialization in the review of Grolier's *EduCalc* spreadsheet (March 1986) requires clarification. When using an uninitialized data disk, the program will automatically ask if you wish to initialize the disk and then lead you through an initialization routine. When using a disk that's already initialized, *EduCalc* recognizes that and skips the routine.

HOTWARE: Software Best Sellers

This Month	Last Month	Title	Publisher	Remarks	Systems: Apple	Atari	Commodore	IBM	Macintosh
Entertainment									
1.		*Elite*	Firebird Licensees, Inc.	Action/adventure	•		•		
2.	4.	*The Bard's Tale*	Electronic Arts	Adventure/role-playing game	•		•		
3.	2.	*Ultima IV*	Origin Systems, Inc.	Fantasy game	•	•	•		
4.		*Hardball*	Accolade	Baseball game	•		•		
5.		*Karate Champ*	Data East	Martial arts game	•		•		
Education									
1.		*Homework Helper: Math Word Problems*	Spinnaker	Math tutorial, high school level	•		•		
2.	1.	*Math Blaster!*	Davidson	Introductory math program, ages 6-12	•	•	•	•	
3.		*Spanish*	American Educational Computer	Spanish vocabulary skills	•	•	•	•	
4.	2.	*Music Construction Set*	Electronic Arts	Music composition program	•	•	•		
5.	3.	*Color Me:The Computer Coloring Kit*	Mindscape	Children's artistic tool	•		•		
Home Management									
1.	3.	*Better Working Spreadsheet*	Spinnaker	Spreadsheet	•		•		
2.	4.	*The Newsroom*	Springboard	Do-it-yourself newspaper	•		•	•	•
3.	1.	*Print Shop*	Brøderbund	Do-it-yourself print shop	•	•	•		
4.	5.	*The Newsroom: Clip Art Collection, Vol. 1*	Springboard	Additional graphics	•		•	•	•
5.		*Print Shop Companion*	Brøderbund		•	•	•		

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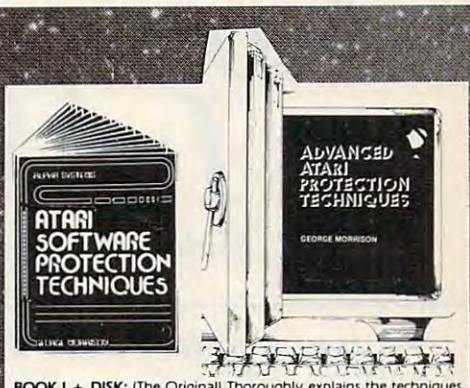

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Promoting Computers In School

Kathy Yakal, Assistant Features Editor

Via free or discounted hardware and software, along with special teacher training, computer hardware manufacturers continue to promote their microcomputers in schools at every level. Here's an overview of recent efforts to increase the already impressive penetration of this technology into classrooms across the land.

Microcomputers now play a significant role in many areas of education. But getting computers into the classroom and deciding how they are best used continue to be subjects of much debate. A combination of factors has slowed the process even further: the problems of implementing a new, evolving technology; the chaotic atmosphere of the computer industry itself; the computer education of teachers and administrators; and the relatively tight budgets of educational institutions.

Nevertheless, tremendous changes have occurred in teachers' attitudes toward microcomputers over the last couple of years. There are several reasons. First, software publishers have increasingly attempted to provide the kind of programs that teachers feel comfortable with—quantifiable, curriculum-based software. At the same time, innovative, nontraditional kinds of learning aids have gained a wider acceptance. Second, the hardware and software shakeouts that have moved the computer industry toward maturity and greater stability have made educators feel more confident about making a financial commitment to microcomputers. Finally, teachers are generally less anxious about computers and more experienced at applying them, with a growing number of classroom success stories fueling increased computer use. It's not just the students and a few computer-wise teachers who are driving the movement anymore.

Each of the major computer manufacturers has made unique contributions to trigger the integration of computers into classrooms. Some offer educational discounts. Others provide special grants and develop efficient ways to exploit the hardware, such as networking. In addition to easing the financial burden, hardware manufacturers promote the general health of the educational computing industry by fostering quality software development and encouraging nontraditional applications of hardware to traditional curricula. Inservice training of teachers and special workshops sponsored by hardware companies have also been significant in creating a more upbeat attitude toward classroom computing in recent years.

Here's a company-by-company look at the variety of approaches.

Apple Computer

Officials at Apple Computer realized early on that a good software base was central to getting their hardware into schools. Apple made major efforts in the early 1980s to convince software developers to support its machines, offering them shared advertising, discounts on development machines, and technical support.

Currently, Apple has two educational discount programs. *Step pricing* gives buyers lower prices on larger orders, encouraging educators to buy in quantity whenever possible. And with the *Volume Purchase Agreement*, a school can elect to pay for its computers over a three-year time period. If a school involved in such an agreement finds that the hardware does not

meet its needs, it may return the equipment without making the remaining payments.

Support after the sale is also a key to Apple's success in the school market. Apple relies heavily on its local dealers to provide on-site support to educators. Ten days before an order of computers is scheduled to reach a school, Apple notifies a local dealer who is then responsible for installing the equipment and providing orientation and training for teachers and administrators. The dealer is also responsible for any follow-up repair and maintenance.

Apple has developed a fairly high profile on many college campuses across the country, thanks to the Apple University Consortium (AUC). A couple of years ago, 24 U.S. colleges and universities formed an organization whose purpose was to develop tools and resources for the Macintosh. Because of that, many campuses today maintain busy Macintosh labs and workstations. At least one institution, Drexel University, *requires* its freshmen to purchase Macintoshes.

Atari Corporation

Atari Corporation's change of ownership and revamped management have resulted in few formal educational programs currently in operation. Considering Atari's growing strength, however, that may soon change. Low-cost 8-bit Ataris have already been the first kind of computer many students ever encountered in a class; their current availability and strong software base may even amplify this trend. And the low price of the powerful ST computers, as well as their strong graphics and music capabilities, may cause some educators to look twice, especially for use in creative applications.

Atari recently announced a marketing agreement with Montreal-based Arrakis, publisher of the *Advantage* series of educational software. ST versions of these programs, which have in the past been available for Apple, Commodore, and IBM, should be ready by the end of the year. The Arrakis series is known for its impressive graphics and cartoonlike animation, as well as a sophisticated parser which incorporates principles of artificial intelligence and provides direct answers to students' questions.

Computer Curriculum Corporation (Palo Alto, CA) has announced a commitment to Atari equipment. CCC is packaging STs along with their minicomputers and a series of courses; that is, they bundle hardware and software and install the complete systems in schools.

Finally, a 10-percent discount is available to colleges and universities, with follow-up service and support provided by local dealers.

Commodore

Commodore's big draw for schools lies in its inexpensive hardware and broad base of third-party educational software. Many teachers, unable to get funds allocated for major hardware purchases, started out by buying a few Commodore 64s (or even bringing their own in from home). In many settings, this was all that was necessary to get students familiar with the fundamentals of microcomputers, while also providing workstations for word-processing, database management, and computer-aided learning. In other cases, some school administrators have been willing to make a financial commitment to microcomputers in the classroom, based on the excitement they've seen generated by a few hundred dollars' worth of hardware and software.

Every major educational software publisher supports Commodore machines, so hundreds of titles have been developed for the Commodore 64 over the last few years. Though some are more appropriate for the less structured atmosphere of the home, many have been adopted for classroom use. A complete list of the more than 1500 packages will be available through distributors this fall.

Commodore has recognized that computer-aided education does not necessarily have to happen in a schoolroom, and has supported some unique opportunities for learning. Two of these involve telecommunications. QuantumLink, a year-old service that Commodore has backed with technical and marketing assistance, is an online forum for sharing information of all kinds. Though much of the earliest activity that went on there was computer-oriented, a variety of other special interests are now supported there. Education is one of them. The Resource Center, a relatively new forum in the Learning Center area of Q-Link, is composed of three sections. The Library includes curriculum guides, teaching strategies, software reviews, and articles about home and community education. In the Media Room, users can download software written

Each of the major computer manufacturers has made unique contributions to trigger the integration of computers into classrooms.

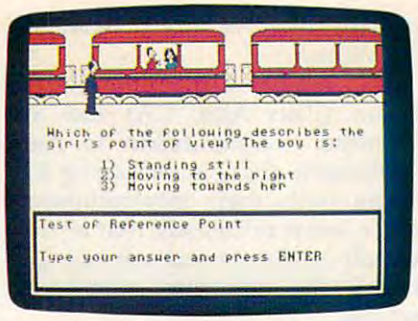
by teachers. The Lounge is an online conference area, a meeting place for teachers and parents to gather and discuss educational issues and plans. And the Resource Center's Message Boards keep everyone posted on what's happening in educational computing. (Quantum Computer Services, 8620 Westwood Center Dr., Vienna, VA 22180.)

Commodore is involved with another online educational venture: the Electronic University Network, operated by TeleLearning Systems, Inc., of San Francisco. By purchasing the $195 enrollment package, you have access to online courses offered by 25 colleges and universities. You may either take selected courses or, if you have met the school's prerequisites, work toward an M.B.A. or undergraduate degree. Degrees are issued by the schools involved, not by the Electronic University Network. The system software also gives you access to online databases—libraries of information for research purposes—as well as counseling and online seminars. (Software allowing IBM and Apple owners to use the network is also available. For more information, write to TeleLearning Systems, Inc., 505 Beach St., San Francisco, CA 94133, or call (800)22LEARN; in California, call (800)44LEARN.)

Commodore has, in the past, participated in more traditional outreach efforts to schools. Recent financial problems at the company have apparently forced cutbacks in ongoing educational support. That, too, may change if Commodore is able to weather remaining financial hurdles. The company has a strong history of major support to Canadian schools, and continues to maintain that presence.

IBM

IBM has made a major commitment to the basic skills of reading and writing with its Writing To Read program in the school market. Developed by educator Dr. John Henry Martin, Writing To Read was tested among 22,000 students and was evaluated in an independent two-year study by the Educational Testing Service before being introduced in the fall of 1984. The program has grown in use from 200 schools at the end of 1984 to 1100



Atari recently announced that 17 titles from the acclaimed Arrakis series will be available for the ST.

schools at the end of 1985. More than 125,000 students have participated in the program. The computer-based program allows students to advance at their own pace and offers positive reinforcement during a student's interaction with the computer.

Through Writing To Read, children learn the 42 *phonemes* (letter and sound combinations) that make up the English language. Using these phonemes, students are able to read and write everything they can say. Typically, students spend an assigned hour each day in a Writing To Read center or lab, a specially designed room made up of five learning stations. Work sessions in the lab are generally an hour long. Students alternate around the five stations: at the computer, with a work journal, at a listening library using specially

The Tandy 1000 computer is becoming an increasingly popular choice for educators.

taped lessons, and playing two phoneme-based games at the "make word" station.

IBM has made a significant commitment to developing curriculum-based software in many subject areas for elementary and secondary schools, programs that come bundled with several student disks and a teacher's guide for easy use in classrooms with multiple computer workstations. Many of the programs are also available individually. In addition, IBM has founded the National Disability Resource Center, a national technology resource that supports the needs of the disabled.

Tandy Corporation/ Radio Shack

The Tandy Corporation has had a longstanding commitment to computer use in the schools. In 1979, Tandy introduced the first low-cost classroom network system—Network 1. In 1980, the Radio Shack Education Division was formed to produce a line of educational courseware. In the years since, Tandy has offered free computer literacy training to teachers, provided formal support for educational software publishers, donated more than $1 million in hardware and software products to support research and development activities, and sponsored conferences and associations to promote the further integration of computers into classrooms.

Currently, three major programs are in place in addition to these areas of ongoing support. In conjunction with Education Systems Technology Corporation (ESTC), Tandy offers an integrated learning system for elementary schools, consisting of three major components: a comprehensive 1500-lesson reading and mathematics curriculum for grades K-6; a computer laboratory composed of 1 Tandy 3000 host computer and up to 40 Tandy 1000 personal computer workstations, allowing an entire class to use the system at once; and an on-site facility management service, which includes an ESTC lab attendant and a complete computer-controlled student management and performance reporting system.

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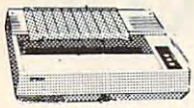

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Tandy offers special pricing on educational network systems. Educational customers purchasing two Model 4 computer/Network 4 Student Stations at the regular price of $1,099 each will receive a third station free. Other network configurations are available at substantial discount. Network 4 is Tandy's newest and most powerful classroom network. Students at individual stations can sign on to teacher-created network accounts to share software stored on the hard disk drives at a central disk server. The system supports multiple disk and printer servers, which saves money by eliminating the need for peripherals at each workstation. (This promotion is good through September 30, 1986; interested customers may contact a Regional Education Coordinator by calling 800/433-5628.)

Finally, topics for the third and fourth quarter Grants Program have been announced. All nonprofit educational institutions and professional educators are eligible to submit proposals for these project grants. Proposals for "Creative Uses of Microcomputers in Education" should be submitted by September 30, 1986, and proposals for "Using Computers for Instructional Management" should be submitted by December 31, 1986. (Information packets required for use in order to submit proposals can be obtained by writing to Tandy Educational Grants Program, 1400 One Tandy Center, Fort Worth, TX 76102.)

For further information on any of the products or programs mentioned here, please contact:

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THE REFERENCE *Library* OF THE FUTURE

Kathy Yakal, Assistant Features Editor

Traditional classroom education has already undergone some major changes with the continuing integration of microcomputers into schools. But there's a relatively new technological development with far-reaching educational implications—CD-ROM (Compact Disc–Read Only Memory). By connecting a personal computer to a compact disc containing digital information, you can easily store and cross-reference an entire encyclopedia, with plenty of room to spare. Similar to the laser-driven audio compact discs that now hold an hour or so of recorded music, these new computer peripherals will surely alter many of our current approaches to education. Here's a look at what this might mean for the classroom of the future.

Your grandchild's sixth-grade history homework assignment: Turn in a report on the first manned space flight to the moon. Though the topic may sound typical, the research won't involve trudging to the school library or home encyclopedia to haul down 15 different books and stare at reams of text and a static photo of the moon.

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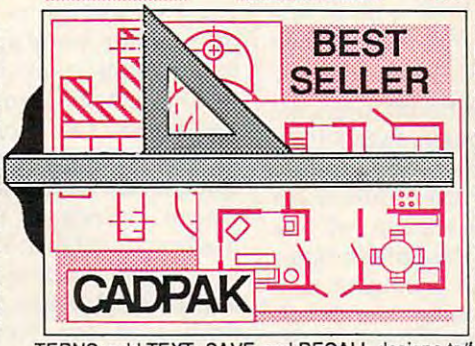

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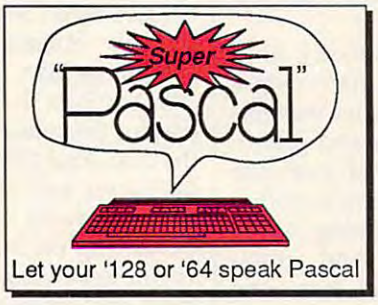

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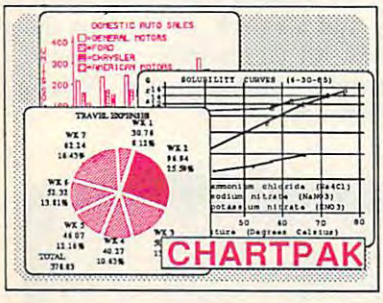

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capabilities—reveal the early attempts at space flight, including a revolving three-dimensional overview of Sputnik; the voice of rocket expert Werner Von Braun; a cross-section of a typical rocket system, revealing how the physical configurations have changed over time; and a brief explanation of early V-1 and V-2 rockets during World War II.

Dozens of additional topics offer themselves almost magically to the young researcher—from Andy Williams singing *Moon River* to an animated demonstration of the moon's effects on the Earth's tides.

Although such examples may sound farfetched today, the development of this technology is already under way. The *interactive* nature of research in tomorrow's schools will be a far cry from the traditional approach.

For schoolchildren today, finding information is, in many ways, similar to the process that was followed by their parents and grandparents. The millions of available books can be a fascinating but often frightening and frustrating world for young students. And cross-referencing information from one source to another is even more daunting. The search process itself can sometimes be discouraging enough to thwart many students' early efforts at learning.

In the next few years, however, laser technology in the form of compact disc players interfaced with personal computers are expected to have a major impact on how students research. Called CD-ROM, this configuration of digital technology embodies three elements that offer tremendous power for educational research. First, speed: Using a CD-ROM system, a student can find the most trivial fact contained in a multivolume reference work in the time it would take to remove a book from the shelf and flip it open to the index. Second, durability: Because the search functions of CD-ROM are driven by a laser beam reading a disc, the hardware and software, given reasonable care, could last hundreds of years. And third, tremendous storage capability: A compact disc can hold over 550 *megabytes* of data. That's roughly a quarter of a million pages of text on a disc smaller than a 45 rpm record.

A Long Time Coming

The power of lasers was harnessed over twenty years ago and has potential applications in many industries. Engineers at many consumer electronics companies worldwide have been experimenting with consumer and business applications for almost as long as the technology has been available. We saw some of the first results of this experimentation in 1980, when Sony and N.V. Philips of the Netherlands announced specifications for a new kind of home stereo system: *compact disc–audio*. Compact disc players use laser beams to read music digitally encoded in microscopic pits on the disc. Since nothing actually touches the disc itself in the playing process, there is no wear on the disc. And the recording is free of the hisses and pops and other distortions we've grown accustomed to hearing on albums. CD players began appearing on the market in 1983 and, thanks to market acceptance, are now a very reasonably priced alternative to traditional stereo systems.

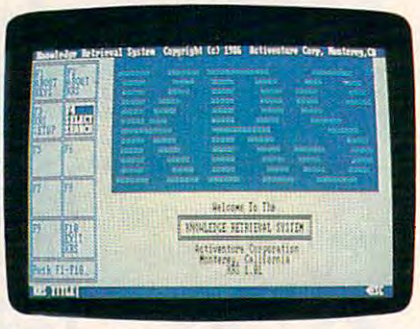
In that same year, Sony and Philips announced specifications for another way to use CD technology: Compact Disc–Read Only Memory (CD-ROM). Slightly modified CD players interfaced with personal computers are capable of holding the data that would require hundreds of the floppy disks that we've grown accustomed to using for data storage. And with the right search software, access to that data is almost instantaneous.

Reference material is an obvious first application for CD-ROM. Consequently, the first hardware/software configuration actually available for the consumer market was a joint venture between Philips, which provided the player, and Grolier Electronic Publishing, which offered its online *Academic American Encyclopedia* on a compact disc. The package, sold in limited outlets across the country, retails for $1,495.

Amazing Searches

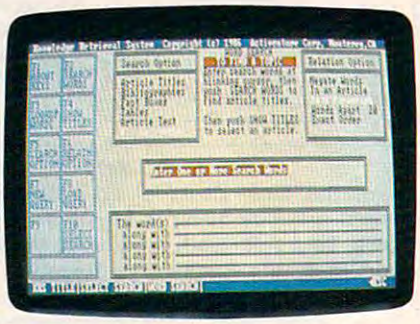
Many now claim that the CD-ROM is superior to any previous reference tool. To see why, let's take a brief walk through a search using the Philips/Grolier package.

Installation of the system involves plugging a board into the IBM-PC, connecting the CD player cable to the PC, and turning everything on. Once you've loaded the search software (*Knowledge Retrieval System*, by Knowledge Set) from a floppy disk, put the CD into the drive and turned it on, you're ready to go.



Here is the opening screen of the CD-ROM search software developed by Knowledge Set (formerly Activenture).

The opening screen offers you the options of finding out more about the system itself, moving directly into a search, or entering the system. All commands are issued by simply pressing the desired function key.



Step 1: Set your search and relation parameters and enter the words or phrases you want to explore.

The first working screen of the system presents two sets of options. Search options let you look for desired words or phrases within article titles, bibliographies, fact boxes, article text itself—or anywhere in

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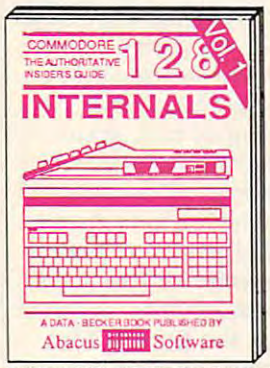

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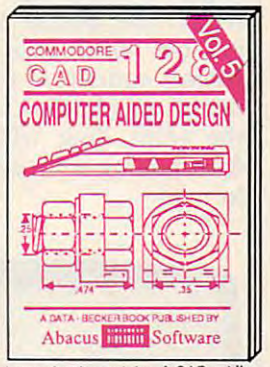

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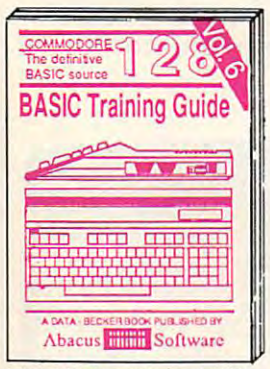

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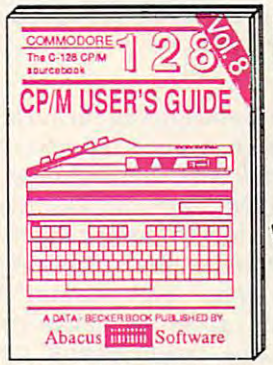

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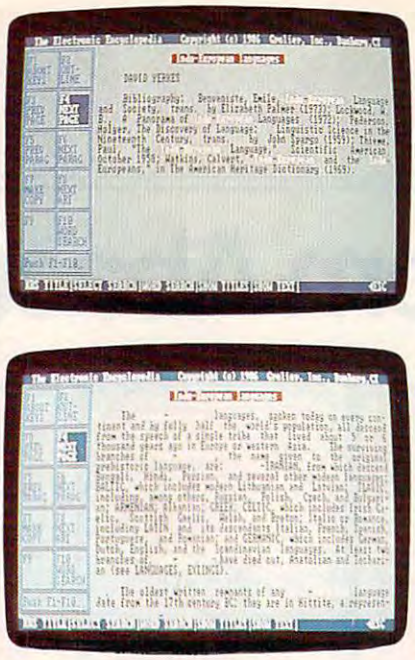
the encyclopedia. If you're cross-referencing two words or phrases to see if they have any relationship to each other, you can choose from several Relation options. For instance, you can find out if your selected words or phrases appear in the same article, the same paragraph, within a certain number of words of each other, or in the exact order. The fifth option here, which can save you some time, lets you negate a word that might appear within the phrase you're looking for, but which is actually another subject entirely. If you are doing a report on Martin Luther, negating the word King will prevent you from pulling articles you don't need to read.

Step 2: After getting a list of entries, decide which you'd like to look at.

Let's say you're doing a research project on Indo-European culture. Upon entering that phrase, you'll find that there are 162 occurrences of that phrase in 65 articles. After asking to see a list of the articles, you can choose to read and even print out any of them. Moving around from article to article and in and out of searches is made quite simple by the function key menu that remains along the left side of the screen (and changes depending on what area of the software you're using).

To save you some time, if you don't want to skim through entire articles, every time your selected search word or phrase appears in an article or bibliography, it shows up as highlighted print.

The system's real power is quite evident the first time you sit down to conduct a search. The incredibly fast search capabilities were made possible by the software developers at Knowledge Set (formerly Activenture). In order to make referencing accurate and thorough, every unique word in the *Academic American Encyclopedia* was identified. Then the VAX minicomputer which compiled the list created an index that cross-referenced every entry. This accounts for the system's speed, as well as its ability to make connections between seemingly unrelated items that might never occur to the user, but which might make for some very interesting research.



The top screen shows (in highlighted text) where your selected phrase appears within a bibliography; the bottom screen shows it within an actual article about the topic. From here, you can print out a copy, continue your search, or begin a new search.

Graphics And Sound, Too

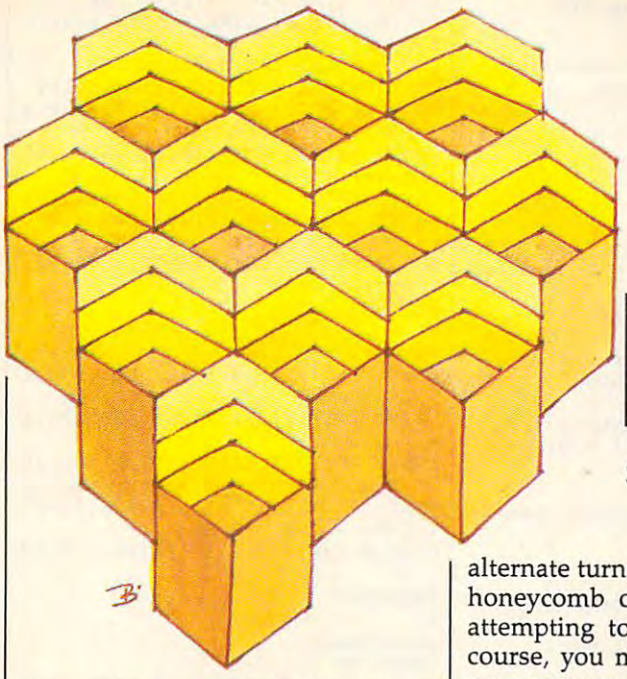
Libraries and other institutions that have major information storage and retrieval needs have, understandably, shown a great deal of interest in CD-ROM. But there are still a few things that need to be worked out before CD-ROM becomes as commonplace as microfiche. First, compatibility: Ideally, CD-ROM should be a market similar to that of CD-audio; that is, any CD you buy will run on any manufacturer's CD-ROM player. Negotiations over standards are currently under way.

Second, where will the software come from? Many software publishers are very interested in developing for CD-ROM, though few have publicly committed to it. Part of the problem here stems from the old chicken-and-egg problem. Businesses are hesitant to buy a system unless there is a lot of software available, but software publishers are hesitant to put a lot of development money into a product unless there is a solid installed base of the hardware.

Sony and Philips recently announced specifications for a specialized kind of CD-ROM perhaps better suited to the home market. *CD-I (Compact Disc–Interactive)* suggests an environment that will allow the mixing of text, graphics, sound, and limited animation. It's described as a system, as opposed to CD-ROM, which is considered a peripheral. CD-I hardware may be available in several different configurations from several different companies, but the general idea is to get away from the need for any extensive technical knowledge to operate it. Several companies in the entertainment field have announced intentions to develop home entertainment products for the system.

Microsoft recently showed a prototype of the Multimedia Encyclopedia, *a CD-I product.*

Of course, better research tools won't necessarily mean better, smarter students. Motivation and the desire to learn are always key factors. But this new generation of electronic equipment will do much more than simply make it easier to find facts. Just as the computer age has so far sparked previously undreamed-of applications, so also may CD-ROM and CD-I technology lead to uses that we, at this early stage, can hardly imagine. ©



BEEHIVE

Steve Michel

To avoid getting stung in this delightful strategy game, you'll need to plan ahead. The original version of "Beehive" was written for the 512K Amiga. We've added fresh translations for the Commodore 64 (and 128 in 64 mode), Apple II series, IBM PC/PCjr, and Atari 400, 800, XL, and XE. The IBM PC/PCjr game requires a color/graphics card and BASICA for the PC, and Cartridge BASIC for the PCjr. The Atari version requires at least 32K of memory and a joystick. The Commodore version requires a joystick. The Apple II version requires a joystick and color monitor, and runs on any Apple II-series computer with either ProDOS or DOS 3.3.

"Beehive" is a two-player strategy game that requires you to concentrate fully and develop long-range planning skills. The game board consists of 121 hexagons arranged in a sloping 11 × 11 matrix. The name derives from the playing field's resemblance to the geometric precision of a honeycomb. The first player is assigned the left and right borders of the honeycomb, while the second player is assigned the top and bottom edges.

The object of the game is deceptively simple. Each player tries to connect a continuous line from one of his or her borders to the other. If you are player 1, for instance, you need to connect the left border with the right. The players alternate turns, filling in cells of the honeycomb one at a time. While attempting to complete your own course, you must also try to block your opponent's way, and this requires strategic thinking. The first player to connect both borders wins the game. As a reward, tiny bee faces appear along the line of connection, clearly marking the path to victory.

Entering The Game

Type in the program listing for your computer, referring to the special notes below. When you have saved a copy of the game, type RUN and press RETURN. Beehive begins by asking for the name of each player. After both players have entered their names, the beehive grid is drawn and play begins. In the Amiga and IBM PC/PCjr versions, the computer determines randomly which player should take the first turn; in other versions, player 1 always goes first. In the Amiga version, each player takes a turn by moving the mouse pointer to the desired cell and pressing the left mouse button once. Other versions substitute joystick or keyboard controls for the mouse (see below).

When you choose a cell, it is filled with a solid circle and your turn ends. While connecting your own borders, you should also be trying to prevent the other player from making a connection. Play continues until one player or the other completes a continuous line from one border to the other. At this point a victor is declared, and bee faces replace the circles along the entire winning route.

Winning Strategies

Like most two-player games, Beehive adjusts itself to the skill of the players. The basic concept is simple enough that even small children can enjoy playing. But when two knowledgeable players are matched, play proceeds at a much higher level. The flexibility of the game allows many different strategies.

Here are some important points for beginners to keep in mind. To begin with, your first move does *not* have to occur in one of your border rows. In fact, you can often establish a better strategic position by starting somewhere near the middle of the playing field. In a typical game you will have to swing back and forth between an expanding, offensive posture and a defensive, blocking posture. The middle areas accommodate both strategies well.

Second, it is not necessary that all of your cells be connected. That is, a new cell doesn't necessarily have to touch one of your existing cells. Any empty cell in the hive is fair game for either player, and it's often advantageous to space out your cells to allow multiple paths between borders. Starting multiple pathways makes it harder for an opponent to block your progress completely.

Finally, keep in mind that the hexagonal shape of each cell permits you to move in six different directions. Try not to get locked into a strict, straight-line strategy too often. Any pathway that connects both borders is legal, and in many cases the winning path will be quite roundabout.

Amiga Version

Before you begin typing in the Amiga version (Program 1), notice the small arrows marking the end of the line. They are not intended to be typed (in fact, we deliberately chose a character that's not available from the Amiga's keyboard). Instead, wherever you see an arrow in the listing, press RETURN or move the cursor off the line to enter it into memory.

The Amiga version of Beehive includes synthesized speech. Either player can toggle the speech effects on or off at any time. Press the left button once: A small box appears, indicating the current speech status. If speech was turned on, it is now turned off, and vice versa. Press the left button again to erase the speech box and resume the game.

Commodore 64/128 Version

The Commodore version (Program 2) runs on a Commodore 64 or Commodore 128 in 64 mode; it requires a joystick. Plug the joystick into port 1 and use it to move the bee-shaped pointer onto the desired cell. To select a cell, press the fire button.

Atari Version

Atari Beehive (Program 3) requires a joystick and runs on any Atari 400, 800, XL, or XE computer with at least 32K of memory. Plug the joystick into port 1. Move the pointer over the cell you wish to occupy, then press the fire button to select it.

Apple II Version

The Apple II version of Beehive (Program 4) runs on any Apple II-series computer, under DOS 3.3 or ProDOS. A color monitor and joystick are required. To select a cell, move the pointer onto it, then press the button.

IBM PC/PCjr Version

IBM Beehive (Program 5) requires a color/graphics card and BASICA for the IBM PC, and Cartridge BASIC for the PCjr. Keyboard controls are used to move the bee-shaped pointer around the playing field and to select a cell. Use the arrow keys to move left, right, up, or down. When the pointer is above the desired cell, press the space bar to select it.

Program 1: Beehive For Amiga

Please refer to the typing instructions in the article before entering this listing.

```
◄
CLS◄
talk$="": GOSUB talk◄
GOSUB init◄
GOSUB getnames ◄
start:◄
CLS: RANDOMIZE TIMER◄
markers = 0: winner = 0: prev.pl
ayer = 0◄
player = INT(2*RND(1)+1)◄
FOR j = 1 TO 11: FOR k=1 TO 31:
hive%(j,k)=0: NEXT k: NEXT j ◄
FOR j = 1 TO 20: pathlen(j) = 0:
NEXT j◄
FOR j = 1 TO 65: path%(j) = 0: u
sed%(j) = 0: node%(j) = 0: NEXT
j◄
GOSUB drawscreen◄
BREAK ON: ON BREAK GOSUB closeup
◄
◄
main:◄
IF prev.player <> player THEN◄
COLOR 4◄
LOCATE 1,2: PRINT "Player:
"◄
LOCATE 1,2: PRINT "Player: ";◄
COLOR colr(player): PRINT LEFT$(
player$(player),15)     ◄
talk$=player$(player): GOSUB tal
k◄
prev.player = player◄
END IF◄
WHILE MOUSE(0) = 0◄
x = MOUSE(0)◄
a$=INKEY$:IF a$=" " THEN GOSUB r
eadkey◄
WEND◄
GOSUB checkmouse◄
IF used THEN main◄
GOSUB checkline◄
IF possible = 1 THEN GOSUB check
winner◄
LOCATE 3,2: PRINT "                "
◄
IF winner = 1 THEN drawpath◄
IF player = 1 THEN ◄
player = 2     ◄
ELSE    ◄
player = 1      ◄
END IF◄
GOTO main◄
◄
init:◄
CLS: colr(1) = 2: colr(2) = 3◄
DIM colcor%(11): FOR j = 1 TO 11
: READ colcor%(j): NEXT j◄
DATA 5,4,4,3,3,2,2,1,1,0,0◄
DIM row.inc%(6), col.inc%(6)◄
FOR j = 1 TO 6: READ row.inc%(j)
, col.inc%(j): NEXT j◄
DATA -1,-1,0,1,1,1,1,0,0,-1,-1,-
1◄
DIM hive%(11,31)◄
DIM used%(65), node%(65), path%(
65), pathlen(20)◄
SCREEN 1,640,200,3,2◄
WINDOW 1,"BEE HIVE",,16,1◄
GOSUB setcolor◄
DIM hexa(100),ball1(100),ball2(1
00),eyes1(100),eyes2(100)◄
LINE (30,10)-(12,15),7: LINE - S
TEP (0,10),7: LINE - STEP (18,5)
,7◄
LINE - STEP (18,-5),7: LINE - ST
EP (0,-10),7: LINE - STEP (-18,-
5),7◄
LINE (30,11)-(13,15),6: LINE - S
TEP (0,9),6: LINE - STEP (17,5),
6◄
LINE - STEP (16,-4),6: LINE - ST
EP (0,-10),6: LINE - STEP (-17,-
4),6◄
GET (12,10)-(48,30),hexa ◄
CLS: CIRCLE (30,20),11,colr(1):
PAINT (30,20),colr(1): GET (20,9
)-(40,31),ball1◄
GOSUB parts: GET (18,12)-(42,30)
, eyes1 ◄
CLS: CIRCLE (30,20),11,colr(2):
PAINT (30,20),colr(2): GET (20,9
)-(40,31),ball2◄
GOSUB parts: GET (18,12)-(42,30)
, eyes2: CLS◄
RETURN◄
◄
parts:  ◄
CIRCLE (25,19),4,1: CIRCLE (35,1
9),4,1◄
PAINT (25,19),1: PAINT (35,19),1
◄
PSET (29,17): LINE - STEP (-5,-5
): LINE - STEP (-5,3)◄
PSET (31,17): LINE - STEP (5,-5)
: LINE - STEP (5,3)◄
CIRCLE (30,24),2,1: PAINT (30,24
),1◄
RETURN◄
◄
getnames:◄
COLOR 4◄
CLS: talk$="WELCOME TO BEEE HIVE
": GOSUB talk◄
a$ = " What is the name of playe
r 1 ": PRINT ◄
PRINT a$;: talk$=a$: GOSUB talk:
INPUT player$(1)◄
a$ = " What is the name of playe
r 2 ": PRINT ◄
PRINT a$;: talk$=a$: GOSUB talk:
INPUT player$(2)◄
talk$="Press space bar to turn s
peech off or on during game."◄
LOCATE 15,14:PRINT talk$◄
GOSUB talk:CLS: RETURN◄
◄
drawscreen:◄
CLS: y = 7◄
FOR r = 1 TO 11◄
x = 180 - r * 18◄
FOR c = 1 TO 11◄
x = x + 36◄
PUT (x,y),hexa,OR◄
NEXT c ◄
y = y + 15 ◄
NEXT r    ◄
PSET (595,12),2: GOSUB upndown:
LINE -STEP (0,10),2◄
PSET (596,12),2: GOSUB upndown:
LINE -STEP (0,10),2◄
PSET (597,12),2: GOSUB upndown:
LINE -STEP (0,10),2◄
PSET (194,12),2: GOSUB upndown:
LINE -STEP (0,10),2◄
PSET (195,12),2: GOSUB upndown:
LINE -STEP (0,10),2◄
PSET (196,12),2: GOSUB upndown:
LINE -STEP (0,10),2◄
y1=-5: y2=5: PSET (198,9),3: GOS
UB across◄
PSET (198,10),3: GOSUB across◄
PSET (199,11),3: GOSUB across◄
y1=5: y2=-5: PSET (19,173),3: GO
SUB across◄
PSET (19,174),3: GOSUB across◄
PSET (19,175),3: GOSUB across◄
RETURN◄
◄
upndown:◄
FOR j = 1 TO 10◄
LINE -STEP (0,10),colr(1)◄
LINE -STEP (-18,5),colr(1)◄
NEXT j◄
RETURN◄
◄
```

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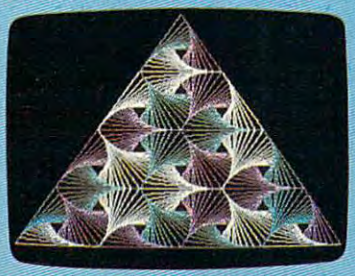

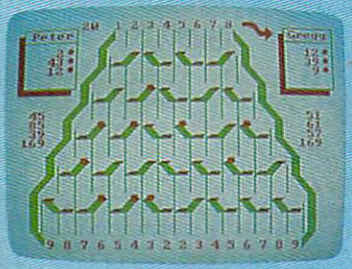

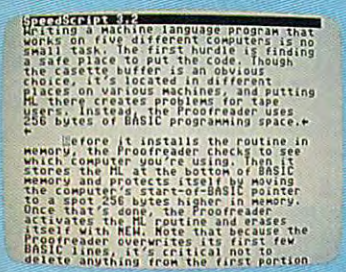

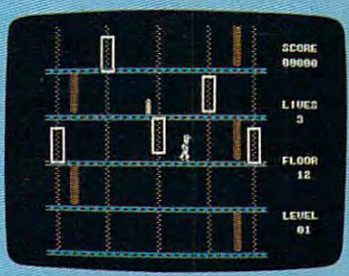

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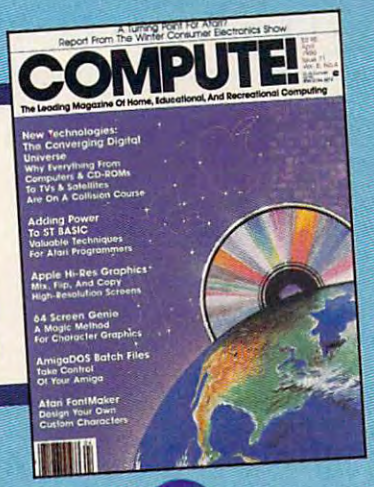

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```
across:
FOR j = 1 TO 11
LINE -STEP (18,y1),colr(2)
LINE -STEP (18,y2),colr(2)
NEXT j
RETURN

checkmouse:
x = MOUSE(3): y = MOUSE(4)
offset = 0: used = 0
yr = INT (y/15+.5): row = yr: yr = yr * 15
IF INT (yr/2) = yr/2 THEN offset = 18
xr = INT ((x-offset)/36+.5): col = xr: xr = xr * 36 + offset
IF row < 1 OR row > 11 THEN
used = 1
RETURN
END IF
col = col - colcor%(row)
IF  col < 1 OR col > 11 THEN
used = 1
RETURN
END IF
rowhive = row: colhive = 10+2*col-row
IF hive%(row,colhive) <> 0 THEN
used = 1
RETURN
END IF
markers = markers + 1
hive%(row,colhive) = player
IF player = 1 THEN
PUT (xr-10,yr-9),ball1,OR
ELSE
PUT (xr-10,yr-9),ball2,OR
END IF
RETURN

checkline:
possible=1
IF player = 2 THEN
FOR row = 1 TO 6: ff=0: fb=0
FOR col = 1 TO 11: colhive=10+2*col-row
IF hive%(row,colhive)=player THEN ff=1
colhive = 10+2*(col)-(12-row)
IF hive%(12-row,colhive)=player THEN fb=1
NEXT col
IF ff=0 OR fb=0 THEN
possible = 0
row = 1E+09
END IF
NEXT row
ELSE
FOR col = 1 TO 6: ff=0: fb=0
FOR row = 1 TO 11: colhive=10+2*col-row
IF hive%(row,colhive)=player THEN ff=1
colhive = 10+2*(12-col)-row
IF hive%(row,colhive)=player THEN fb=1
NEXT row
IF ff=0 OR fb=0 THEN
possible = 0
col = 1E+09
END IF
NEXT col
END IF
RETURN

checkwinner:
LOCATE 3,2: COLOR 4: PRINT "Checking..."
used.cntr = 0: winner = 0: node.cntr = 0: node.total = 0: counter = 0
IF player = 1 THEN check1
FOR col = 1 TO 11: row = 1
IF hive%(row,10+2*col-row) <> player THEN skip2
noderow = row: nodecol = col: GOSUB usedlookup
IF used.flag = 1 THEN skip2
node.total = 1: path.total = 1:counter = 1
path%(1) = 100 * noderow + nodecol
GOSUB checkpath
IF winner = 1 THEN col = 1E+09
skip2:
NEXT col
RETURN

check1:
FOR row = 1 TO 11: col = 1
IF hive%(row,10+2*col-row) <> player THEN skip1
noderow = row: nodecol = col: GOSUB usedlookup
IF used.flag = 1 THEN skip1
node.total = 1: path.total = 1: counter = 1
path%(1) = 100 * noderow + nodecol
GOSUB checkpath
IF winner = 1 THEN row = 1E+09
skip1:
NEXT row
RETURN

usedlookup:
used.flag = 0: search = 100 * noderow + nodecol
lk = 0: IF used.cntr = 0 THEN skipsearch
FOR lk = 1 TO used.cntr
IF search = used%(lk) THEN
used.flag = 1
lk = 1E+09
END IF
NEXT lk
skipsearch:
IF used.flag = 0 THEN
used.cntr = used.cntr + 1
used%(used.cntr) = search
END IF
RETURN

checkpath:
node.cntr = 0
FOR nc = 1 TO 6
noderow = noderow + row.inc%(nc): nodecol = nodecol + col.inc%(nc)
IF noderow < 1 OR noderow > 11 OR nodecol < 1 OR nodecol > 11 THEN skipnode

IF hive%(noderow,10+2*nodecol-noderow) <> player THEN skipnode
GOSUB usedlookup: IF used.flag = 1 THEN skipnode
node.cntr = node.cntr + 1
node.total = node.total + 1: node%(node.total) = 100 * noderow + nodecol
IF (player = 2 AND noderow = 11) OR (player = 1 AND nodecol = 11) THEN
winner = 1
path.total = path.total + 1
path%(path.total) = 100 * noderow + nodecol
nc = 1E+09
END IF
skipnode:
NEXT nc
IF winner = 1 THEN RETURN
IF node.cntr = 0  AND node.total = 0 THEN RETURN
IF node.cntr = 0 THEN
path.total = path.total - pathlen(counter)
pathlen(counter) = 0
counter = counter - 1
END IF
IF node.cntr > 1 THEN counter = counter + node.cntr - 1
noderow = INT(node%(node.total)/100)
nodecol = node%(node.total) - 100 * noderow
path.total = path.total + 1
pathlen(counter) = pathlen(counter) + 1
path%(path.total) = node%(node.total)
node.total = node.total - 1
GOTO checkpath

drawpath:
LOCATE 1,1: PRINT "
": COLOR 4
LOCATE 1,1: PRINT "THE WINNER: ";:COLOR colr(player): PRINT player$(player);
a$ = "THE WINNER IS " + player$(player): talk$=a$: GOSUB talk
FOR j = 1 TO path.total: offset = 0
row = INT(path%(j)/100): col = path%(j) - 100*row + colcor%(row)
IF row/2 = INT(row/2) THEN offset = 18
xr = col * 36 + offset: yr = row * 15
IF player = 1 THEN
PUT (xr-10,yr-9), ball1, XOR
PUT (xr-12,yr-5), eyes1, OR
ELSE
PUT (xr-10,yr-9), ball2, XOR
PUT (xr-12,yr-5), eyes2, OR
END IF
NEXT j

goagain:
LINE (419,139)-(625,186),7,b: LINE (420,140)-(624,185),7,b
LINE (421,141)-(623,184),4,bf: COLOR 6
LOCATE 19,55: a$ = " WANT TO PLAY AGAIN ? ": PRINT  a$;
LINE (431,162)-(487,180),7,bf: LOCATE 22,56: PRINT " YES ";
LINE (567,162)-(615,180),7,bf: LOCATE 22,73: PRINT " NO ";
talk$=a$: GOSUB talk

waiter:
WHILE MOUSE(0) <> 1
WEND
x = MOUSE(3): y = MOUSE(4)
IF y < 162 OR y > 180 THEN waiter
IF x > 430 AND x < 488 THEN start
IF x > 566 AND x < 616 THEN closeup
GOTO waiter

setcolor:
PALETTE 0,.3,.3,.3    'grey
PALETTE 1,0,0,0       'black
PALETTE 2,0,1,0       'green
PALETTE 3,0,0,1       'blue
PALETTE 4,1,1,1       'white
PALETTE 5,0,1,1       'aqua
PALETTE 6,1,1,0       'yellow
PALETTE 7,.8,.2,0     'red
RETURN

closeup:
PALETTE 0,.1,.1,1     'blue
PALETTE 1,1,1,1       'white
PALETTE 2,0,0,0       'black
PALETTE 3,.85,.2,0    'red
WINDOW CLOSE 1
SCREEN CLOSE 1
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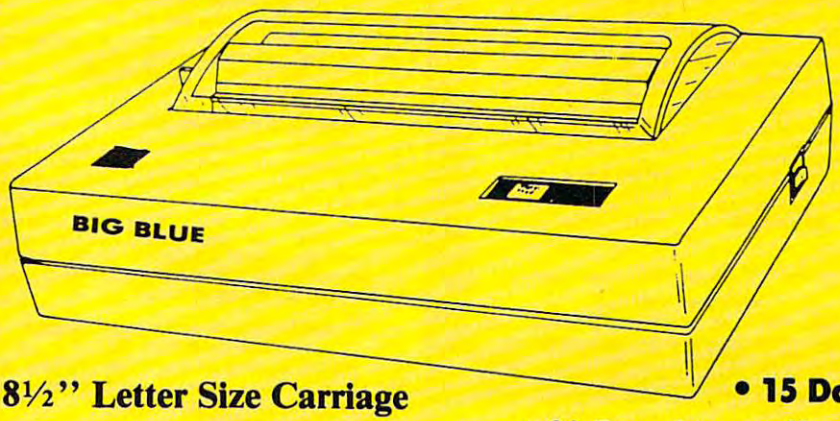

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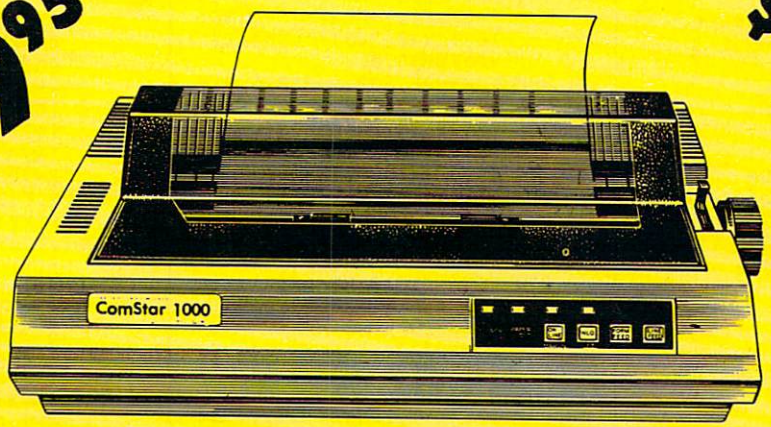

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"Beehive" for the 512K Amiga, a challenging strategy game.

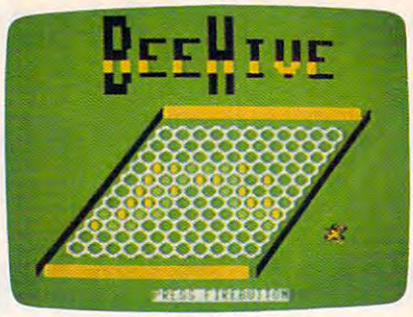
```
STOP↵
↵
↵
readkey:↵
WINDOW 4,"Speech",(250,70)-(390,
110),16,1↵
IF TalkFlag=1 THEN↵
talk$="Now I can talk."↵
PRINT talk$↵
TalkFlag=1-TalkFlag↵
GOSUB talk↵
GOTO clearmouse↵
END IF↵
IF TalkFlag=0 THEN↵
talk$="OK, I'll be quiet."↵
PRINT talk$↵
GOSUB talk↵
TalkFlag=1-TalkFlag↵
END IF↵
↵
clearmouse:↵
WHILE MOUSE(0)<>0:WEND↵
PRINT "Press button once"↵
PRINT "to continue..."↵
WHILE MOUSE(0)<>1:WEND↵
WHILE INKEY$<>"":WEND↵
WINDOW CLOSE 4↵
RETURN↵
↵
talk:↵
IF TalkFlag=0 THEN SAY TRANSLATE
$(talk$)↵
RETURN↵
↵
```

Program 2: Commodore 64/128 Beehive

Version by Kevin Mykytyn, Editorial Programmer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
EF 10 POKE56,48:CLR:GOTO80
RK 20 GOSUB560
QK 30 JV=15-(PEEK(56321)AND15)
      -128*((PEEK(56321)AND16)
      <>16):IFJV>127THENRETURN
AX 40 IFJV=0THEN30
FF 50 TX=X:TY=Y:TX=TX+X(JV):TY
      =TY+Y(JV)
HK 60 IFTX<1ORTX>11ORTY<1ORTY>
      11THEN30
BQ 70 X=TX:Y=TY:GOSUB560:GOTO3
      0
XQ 80 GOSUB170:GOSUB530
RM 90 POKE53280,5:POKE53281,5:
      PRINT"{CLR}{6 DOWN}
      {6 RIGHT}";:GOSUB470:POK
      E53269,1
SC 100 INPUT"{BLK}{3 DOWN}
       {2 RIGHT}ENTER YOUR NAM
       E PLAYER ONE";PN$(1)
SR 110 INPUT"{DOWN}{2 RIGHT}EN
       TER YOUR NAME PLAYER TW
       O";PN$(2):POKE53269,0
```



The Commodore 64/128 version of "Beehive" features a bee-shaped pointer.

```
QC 120 GOSUB400:FORA=1TO2:PN$(
       A)=LEFT$(PN$(A),15):NEX
       T:X=1:P=1:UN=1:Y=1
HM 130 B$="YOUR TURN ":GOSUB11
       60
RM 140 GOSUB20:SP=1397+40*Y+X*
       2-Y
MM 150 IFPEEK(SP)<>32THENF=10:
       GOSUB580:GOTO140
AK 160 BD(X,Y)=UN:POKESP,81:PO
       KESP+54272,7*(P-1):GOSU
       B590:GOSUB610:P=3-P:GOT
       O130
KF 170 ML$="{I}"+CHR$(8)+"{X}<
       "+CHR$(3)+"{2}XJ"+CHR$(
       16)+CHR$(248)+"L{B}{T}"
       :POKE835,0
SK 180 POKE836,208:POKE830,0:P
       OKE831,216:POKE828,0:PO
       KE829,56:POKE56334,0
SP 190 POKE1,51:ML$=ML$:SYS(PE
       EK(51)+256*PEEK(52)):PO
       KE1,55:POKE56334,1
GF 200 FORI=12568TO12631:READJ
       :POKEI,J:NEXT:POKE53272
       ,28
AP 210 FORA=0TO10:READX(A),Y(A
       ):NEXTA:FORA=832TO895:R
       EADB:POKEA,B:NEXT
JE 220 POKE53276,1:POKE2040,13
       :POKE53287,7:POKE53285,
       0:RETURN
ER 230 DATA231,126,24,24,24,24
       ,126,231
RC 240 DATA0,0,0,0,0,0,126,231
SC 250 DATA231,126,0,0,0,0,0,0
HR 260 DATA7,30,24,24,24,24,12
       6,231
DA 270 DATA7,30,24,24,24,24,30
       ,7
MF 280 DATA224,120,24,24,24,24
       ,120,224
RA 290 DATA231,126,24,24,24,24
       ,120,224
JA 300 DATA195,36,126,219,255,
       126,36,24
PH 310 DATA 0,0,0,-1,0,1,0,0,-
       1,0,0,0,0,0,0,0,1,0,0,0
       ,0,0
CQ 320 DATA0,0,0,0,0,0,0,16
CS 330 DATA0,0,65,80,0,65,164,
       20
JR 340 DATA70,100,1,150,100,1,
       165,144
JM 350 DATA0,106,64,5,105,0,26
       ,170
GB 360 DATA64,21,153,144,26,86
       ,80,5
SE 370 DATA5,144,0,2,96,0,1,16
       0
SH 380 DATA0,0,0,0,0,0,0,0
JG 390 DATA0,0,0,0,0,0,0,53
GH 400 PRINT"{CLR}{8 DOWN}"SPC
       (13)"{RVS}{BLK}£{YEL}
       {J}{23 SPACES}{BLK}£"
CB 410 PRINTSPC(12)"{BLK}{RVS}
       £{OFF}£";:FORA=1TO11:
       PRINT"{WHT}$ ";:NEXTA:P
       RINT" {BLK}{RVS}£{OFF}
       £"
BC 420 FORA=1TO11
QA 430 PRINTSPC(12-A)"{BLK}
       {RVS}£{OFF}£{WHT}& ";
       :FORB=1TO10:PRINT"# ";:
       NEXT:PRINT"){RVS}{BLK}
       £{OFF}£":NEXTA
GP 440 PRINT"{BLK}{RVS}£{OFF}
       £{2 SPACES}";:FORA=1TO
       11:PRINT"{WHT}% ";:NEXT
       :PRINT"{LEFT}{BLK}{RVS}
       £{OFF}£"
FM 450 PRINT"{BLK}£{YEL}{RVS}
       {23 SPACES}{OFF}{H}
       {BLK}£":PRINT"{HOME}
       {7 SPACES}";
XJ 460 POKE1827,39:POKE56099,1
       :POKE1459,40:POKE55731,
       1
GH 470 PRINT"{BLK}{RVS}{K}
       {2 SPACES}{OFF}
       {9 SPACES}{RVS}{K}{OFF}
       {K}{RVS}{K}{OFF}{K}
       {BLK}"SPC(24)"{RVS}{K}
       {OFF}{K}{RVS}{K}{OFF}
       {K}"SPC(8)"{RVS}{K}
       {OFF}{K}{RVS}{K}{OFF}
       {K}"SPC(24);
MJ 480 PRINT"{RVS}{K}{OFF}{K}
       {RVS}{K}{OFF}{K}{RVS}
       {K}{D}{I}{OFF}{V}{RVS}
       {K}{D}{I}{OFF}{V}{RVS}
       {K}{OFF}{K}{RVS}{K}
       {OFF}{K} {RVS}{F}{D}
       {OFF} {RVS}{K}{OFF}{K}
       {RVS}{K}{OFF}{K}{RVS}
       {K}{D}{I}{OFF}{V}"SPC(1
       2)"{RVS}{K}{2 SPACES}
       {OFF} {RVS}{K}{C}";
PP 490 PRINT"{OFF}{F} {RVS}{K}
       {C}{OFF}{F} {RVS}{K}
       {2 SPACES}{OFF}{K}
       {RVS}{K}{OFF}{K} {RVS}
       {K}{OFF}{K}{RVS}{K}
       {OFF}{K}{RVS}{K}{C}
       {OFF}{F}{YEL}"SPC(13)"
       {RVS}{K}{OFF}{K}{RVS}
       {K}{OFF}{K}{RVS}{K}
       {OFF}{K}{2 SPACES}{RVS}
       {K}{OFF}{K}{2 SPACES}
       {RVS}{K}";
HD 500 PRINT"{OFF}{K}{RVS}{K}
       {OFF}{K} {RVS}{K}{OFF}
       {K} {C}{RVS}{C}{V}{OFF}
       {V}{RVS}{K}{OFF}{K}
       {BLK}"SPC(14)"{RVS}{K}
       {OFF}{K}{RVS}{K}{OFF}
       {K}{C}{RVS}{2 I}{OFF}
       {V}{C}{RVS}{2 I}{OFF}
       {V}{RVS}{K}{OFF}{K}
       {RVS}{K}{OFF}{K} {RVS}
       {2 I}{OFF} ";
FC 510 PRINT" {C}{V} {C}{RVS}
       {2 I}{OFF}{V}"SPC(12)"
       {RVS}{K}{2 SPACES}{OFF}
       "SPC(9)"{RVS}{K}{OFF}
       {K}{RVS}{K}{OFF}{K}":
SH 520 POKE53248,30:POKE53264,
       1:POKE53249,150:RETURN
JF 530 FORA=54272TO54295:POKEA
       ,0:NEXT:POKE54296,15:PO
       KE54277,25
MX 540 DIMTA(11,11,2),EH(61),E
       V(61)
SE 550 DIMBD(11,11),SH(50),SV(
       50):SP$="{RVS}":FORA=1T
       O20:SP$=SP$+" ":NEXT:RE
       TURN
KM 560 POKE53249,0:TX=X*16+(11
       -Y)*8+36:POKE53248,TXAN
       D255
```

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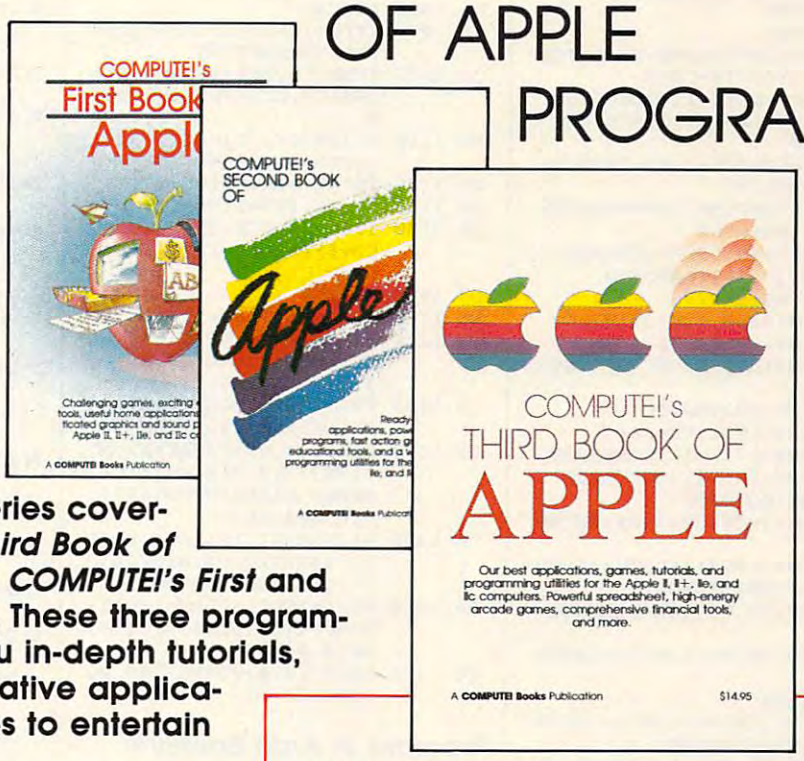

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```
PS 570 POKE53264,-(TX>255):POK
       E53249,Y*8+120:POKE5326
       9,1:RETURN
BM 580 POKE54273,F:POKE54276,1
       6:POKE54276,17:RETURN
XQ 590 POKE54273,10:POKE54276,
       64:POKE54276,65:FORZZ=1
       5TO1STEP-.3:POKE54275,Z
       Z:NEXT
HP 600 RETURN
PG 610 CH=X:CV=Y:LC=0:RC=0:FOR
       X=-1TO1:TH=CH+X
JK 620 TV=CV-1-(X=1):GOSUB780
JG 630 TV=CV-(X>-1):GOSUB780
BK 640 NEXT
PM 650 IFP=1ANDCH=10RP=2ANDCV=
       1THENLC=1
EK 660 IFP=1ANDCH=11ORP=2ANDCV
       =11THENRC=2
QJ 670 CC=LC+RC:IFCC=3THENBD(C
       H,CV)=UN+1:GOTO850
JA 680 IFCC=0THEN770
BS 690 SP=0:SH(0)=CH:SV(0)=CV
AM 700 IFSP=-1THEN770
RC 710 DH=SH(SP):DV=SV(SP):SP=
       SP-1
CH 720 BD(DH,DV)=UN+CC
EP 730 FORX=-1TO1:TH=DH+X
FJ 740 TV=DV-1-(X=1):GOSUB820
JH 750 TV=DV-(X>-1):GOSUB820
MC 760 NEXT:GOTO700
ED 770 X=CH:Y=CV:UN=5-UN:RETUR
       N
DD 780 IFTH<10RTH>11ORTV<10RTV
       >11THENRETURN
DP 790 IFBD(TH,TV)=UN+1THENLC=
       1
PS 800 IFBD(TH,TV)=UN+2THENRC=
       2
SK 810 RETURN
SA 820 IFTH<10RTH>11ORTV<10RTV
       >11THENRETURN
FP 830 IFBD(TH,TV)=UNTHENSP=SP
       +1:SH(SP)=TH:SV(SP)=TV
CM 840 RETURN
PM 850 POKE53248,33:POKE53264,
       1:POKE53249,195
PS 860 FORZZ=1TO20:POKE646,ZZ:
       B$=" YOU WIN ":GOSUB117
       0:NEXT:GOSUB1160
CQ 870 FORCC=1TO2:FE=1:LE=1:EH
       (1)=CH:EV(1)=CV:EF=0:L=
       1
HA 880 CD=CH:IFP=2THENCD=CV
KF 890 IFCC=1ANDCD=10RCC=2ANDC
       D=11THENHH(CC)=0:GOTO99
       0
HB 900 NE=LE:E=FE
RA 910 DH=EH(E):DV=EV(E)
JQ 920 FORX=-1TO1:TH=DH+X:TV=D
       V-1-(X=1):GOSUB1090:TV=
       DV-(X>-1):GOSUB1090:NEX
       T
GM 930 IFEF=1THEN990
XS 940 IF(E=LE)THEN970
EK 950 E=E+1:IFE=61THENE=1
XA 960 GOTO910
CM 970 FE=LE+1:LE=NE:IFFE=61TH
       ENFE=1
EC 980 L=L+1:GOTO900
AE 990 NEXT:FORCC=1TO2:DH=HH(C
       C):DV=VV(CC):L=TA(DH,DV
       ,CC):IFDH=0THEN1040
BF 1000 POKE781,DV+9:POKE782,D
       H*2-DV+13:POKE783,0:SY
       S65520:PRINT"{OFF}[6]*
       ":GOSUB590
ED 1010 IFL=1THEN1040
QQ 1020 FORX=-1TO1:TH=DH+X:TV=
       DV-1-(X=1):GOSUB1060:T
       V=DV-(X>-1):GOSUB1060:
       NEXT
KM 1030 L=L-1:DH=AH:DV=AV:GOTO
       1000
EA 1040 NEXT:POKE781,CV+9:POKE
       782,CH*2-CV+13:POKE783
       ,0:SYS65520:PRINT"[6]*
       ":GOSUB590
HH 1050 GOTO1190
AC 1060 IFTH<10RTH>11ORTV<10RT
       V>11THENRETURN
MF 1070 IFTA(TH,TV,CC)=L-1THEN
       AH=TH:AV=TV
XF 1080 RETURN
KB 1090 IFTH<10RTH>11ORTV<10RT
       V>11THENRETURN
QJ 1100 IFBD(TH,TV)<>UN+CCORTA
       (TH,TV,CC)<>0THENRETUR
       N
FB 1110 TA(TH,TV,CC)=L:NE=NE+1
       :IFNE=61THENNE=1
FF 1120 EH(NE)=TH:EV(NE)=TV
SD 1130 CD=TH:IFP=2THENCD=TV
DP 1140 IFCC=1ANDCD=10RCC=2AND
       CD=11THENEF=1:HH(CC)=T
       H:VV(CC)=TV
SK 1150 RETURN
KH 1160 POKE646,7*(P-1)
FR 1170 POKE214,23:PRINT:A$=LE
       FT$(SP$,(16-LEN(PN$(P)
       )/2))+B$+PN$(P)
JA 1180 PRINT" "A$;LEFT$(SP$,4
       0-LEN(A$));:RETURN
CQ 1190 POKE214,23:PRINT:PRINT
       "{WHT}{13 SPACES}{RVS}
       PRESS FIREBUTTON{OFF}
       {10 SPACES}";
PE 1200 WAIT56321,16,16:POKE21
       4,23:PRINT:PRINTSPC(12
       )"{OFF}{20 SPACES}";
AR 1210 FORA=1TO11:FORB=1TO11:
       FORC=1TO2:TA(A,B,C)=0:
       BD(A,B)=0
XA 1220 NEXTC,B,A:POKE53269,0:
       GOTO120
```

Program 3: Atari Beehive

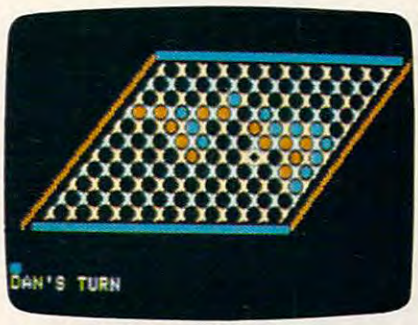
Version by Kevin Mykytyn, Editorial Programmer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
BJ 10 POKE 106,96:GOSUB 2000
      :GOTO 80
LG 20 FL=0:GOSUB 560
NK 30 JV=15-STICK(0)+128*(ST
      RIG(0)=0):IF JV>127 TH
      EN RETURN
JC 40 IF JV=0 THEN 30
NP 50 POKE 77,0:TX=X:TY=Y:TX
      =TX+X(JV):TY=TY+Y(JV)
DB 60 IF TX<1 OR TX>11 OR TY
      <1 OR TY>11 THEN 30
IJ 70 X=TX:Y=TY:FL=0:GOSUB 5
      60:GOTO 30
FK 80 GOSUB 530:GOSUB 170:PR
      INT "{CLEAR}"
OC 90 DIM T$(30),TM$(30),NAM
      E$(40),LENGTH(2):FOR A
      =1 TO 40:NAME$(A,A)="
      ":NEXT A:POSITION 17,1
      0:PRINT "BEEHIVE"
HE 100 FOR A=1 TO 2:PRINT "
       {2 DOWN}ENTER YOUR NA
       ME PLAYER ";A;" ";:IN
       PUT T$
EC 101 IF T$="" THEN T$=" "
OB 105 IF LEN(T$)>15 THEN T$
       =T$(1,15)
NA 106 LENGTH(A)=LEN(T$)
EC 110 NAME$((A-1)*15+1,(A-1
       )*15+LEN(T$))=T$:NEXT
       A:OY=1
OL 120 GOSUB 400:X=1:P=1:UN=
       1:Y=1
EB 140 T$="YOUR TURN ":GOSUB
       4000:POKE 712,150-98
       *(P=2)
AB 145 GOSUB 20:LOCATE X*2-Y
       +14,Y+5,SP:POSITION X
       *2-Y+14,Y+5:PRINT CHR
       $(SP)
LO 150 IF SP<>32 THEN SOUND
       1,100,12,15:FOR TD=1
       TO 50:NEXT TD:SOUND 1
       ,0,0,0:GOTO 140
NL 160 BD(X,Y)=UN:POSITION X
       *2-Y+14,Y+5:PRINT CHR
       $(42+P):GOSUB 590
CP 162 GOSUB 610:P=3-P:GOTO
       140
EC 170 FOR A=0 TO 1023:POKE
       24576+A,PEEK(57344+A)
       :NEXT A
BM 175 FOR A=25600 TO 25856:
       POKE A,0:NEXT A
CP 180 FOR I=24600 TO 24703:
       READ J:POKE I,J:NEXT
       I
IN 210 FOR A=0 TO 10:READ X,
       Y:X(A)=X:Y(A)=Y:NEXT
       A
KP 220 POKE 54279,64:POKE 53
       277,3:POKE 559,62:POK
       E 623,1:POKE 704,0:RE
       TURN
WJ 230 DATA 231,126,24,24,24
       ,24,126,231
DD 240 DATA 0,0,0,0,0,0,126,
       231
DE 250 DATA 231,126,0,0,0,0,
       0,0
EH 260 DATA 7,30,24,24,24,24
       ,126,231
LD 270 DATA 7,30,24,24,24,24
       ,30,7
MB 280 DATA 224,120,24,24,24
       ,24,120,224
ML 290 DATA 231,126,24,24,24
       ,24,120,224
CC 300 DATA 195,36,126,219,2
       55,126,36,24
BK 301 DATA 0,40,170,170,170
       ,170,40,0
LL 302 DATA 0,20,85,85,85,85
       ,20,0
LI 303 DATA 2,2,8,8,32,32,12
       8,128
KC 304 DATA 85,0,0,0,0,0,0,0
KD 305 DATA 0,0,0,0,0,0,0,85
MI 310 DATA 0,0,0,-1,0,1,0,0
       ,-1,0,0,0,0,0,0,0,1,0
       ,0,0,0,0
KE 400 GOSUB 2000:POKE 756,9
       6:POKE 752,1:DL=PEEK(
       560)+256*PEEK(561):PO
       KE DL+6,7:POKE DL+3,7
       1
NO 405 POSITION 5,0:PRINT "*
        BEEHIVE *":POSITION
       15,4:PRINT "//////////
       ///////////////"
FF 410 PRINT SPC$(1,12);"-";
       :FOR A=1 TO 11:PRINT
       "$ ";:NEXT A:PRINT "
       -"
DB 420 FOR A=1 TO 11
MO 430 PRINT SPC$(1,12-A);"-
       & ";:FOR B=1 TO 10:PR
       INT "# ";:NEXT B:PRIN
       T ")-":NEXT A
CB 440 PRINT "-  ";:FOR A=1
       TO 11:PRINT "% ";:NEX
       T A:PRINT "{LEFT}-"
CJ 450 PRINT "..............
       ..........":POSITION
       4,16:PRINT "'":POSITI
       ON 36,6:PRINT "(":RET
       URN
DH 530 DIM TA(11,35),EH(61),
       EV(61),BD(11,11),SH(5
       0),SV(50),SP$(20),X(1
```

```
      Ø),Y(1Ø),SPC$(2Ø),HH(
      15),VV(15)
BC 535 POKE 752,1:POSITION 1
      4,1Ø:PRINT "PLEASE WA
      IT"
PH 54Ø GOSUB 3ØØØ:FOR A=1 TO
       2Ø:SP$(A,A)="-":SPC$
      (A,A)=" ":NEXT A:RETU
      RN
EM 56Ø LB=PEEK(88):HB=PEEK(8
      9):POKE 752,1:POKE 89
      ,1ØØ:POKE 88,OY*8+99:
      POSITION Ø,Ø:PRINT "
      {8 SPACES}":IF FL THE
      N 575
ID 57Ø POKE 53248,X*8+(11-Y)
      *4+61:POKE 88,Y*8+99:
      POSITION Ø,Ø:PRINT "■
      {■}P8,&# "
BM 575 POKE 88,LB:POKE 89,HB
      :OY=Y:RETURN
OP 59Ø FOR T=15 TO Ø STEP -Ø
      .4:SOUND 1,1ØØ,1Ø,T:N
      EXT T:RETURN
JL 61Ø CH=X:CV=Y:LC=Ø:RC=Ø:F
      OR X=-1 TO 1:TH=CH+X
BB 62Ø TV=CV-1+(X=1):GOSUB 7
      8Ø
OC 63Ø TV=CV+(X>-1):GOSUB 78
      Ø
DB 64Ø NEXT X
BK 65Ø IF P=1 AND CH=1 OR P=
      2 AND CV=1 THEN LC=1
IE 66Ø IF P=1 AND CH=11 OR P
      =2 AND CV=11 THEN RC=
      2
BA 67Ø CC=LC+RC:IF CC=3 THEN
       BD(CH,CV)=UN+1:GOTO
      85Ø
ON 68Ø IF CC=Ø THEN 77Ø
AH 69Ø SP=Ø:SH(Ø)=CH:SV(Ø)=C
      V
DB 7ØØ IF SP=-1 THEN 77Ø
LJ 71Ø DH=SH(SP):DV=SV(SP):S
      P=SP-1
FD 72Ø BD(DH,DV)=UN+CC
GK 73Ø FOR X=-1 TO 1:TH=DH+X
BA 74Ø TV=DV-1+(X=1):GOSUB 8
      2Ø
OB 75Ø TV=DV+(X>-1):GOSUB 82
      Ø
DO 76Ø NEXT X:GOTO 7ØØ
GA 77Ø X=CH:Y=CV:UN=5-UN:RET
      URN
MG 78Ø IF TH<1 OR TH>11 OR T
      V<1 OR TV>11 THEN RET
      URN
OA 79Ø IF BD(TH,TV)=UN+1 THE
      N LC=1
OA 8ØØ IF BD(TH,TV)=UN+2 THE
      N RC=2
HJ 81Ø RETURN
MB 82Ø IF TH<1 OR TH>11 OR T
      V<1 OR TV>11 THEN RET
      URN
MB 83Ø IF BD(TH,TV)=UN THEN
      SP=SP+1:SH(SP)=TH:SV(
      SP)=TV
HM 84Ø RETURN
GA 85Ø FL=1:GOSUB 56Ø:T$="YO
      U WIN ":GOSUB 4ØØØ:FO
      R A=255 TO Ø STEP -1:
      POKE 712,A:NEXT A
HA 86Ø POSITION Ø,2Ø:PRINT "
      {15 SPACES}SEARCHING
      {13 SPACES}"
BP 87Ø FOR CC=1 TO 2:FE=1:LE
      =1:EH(1)=CH:EV(1)=CV:
      EF=Ø:L=1
AD 88Ø CD=CH:IF P=2 THEN CD=
      CV
JD 89Ø IF CC=1 AND CD=1 OR C
      C=2 AND CD=11 THEN HH
      (CC)=Ø:GOTO 99Ø
EB 9ØØ NE=LE:E=FE
MI 91Ø DH=EH(E):DV=EV(E)
MK 92Ø FOR X=-1 TO 1:TH=DH+X
      :TV=DV-1+(X=1):GOSUB
      1Ø9Ø:TV=DV+(X>-1):GOS
      UB 1Ø9Ø:NEXT X
PF 93Ø IF EF=1 THEN 99Ø
FP 94Ø IF (E=LE) THEN 97Ø
FF 95Ø E=E+1:IF E=61 THEN E=
      1
HC 96Ø GOTO 91Ø
BA 97Ø FE=LE+1:LE=NE:IF FE=6
      1 THEN FE=1
NO 98Ø L=L+1:GOTO 9ØØ
AO 99Ø NEXT CC:FOR CC=1 TO 2
      :DH=HH(CC):DV=VV(CC):
      L=TA(DH,DV*3+CC):IF D
      H=Ø THEN 1Ø4Ø
CI 1ØØØ POSITION DH*2-DV+14,
      DV+5:PRINT "*":GOSUB
       59Ø
PP 1Ø1Ø IF L=1 THEN 1Ø4Ø
OM 1Ø2Ø FOR X=-1 TO 1:TH=DH+
      X:TV=DV-1+(X=1):GOSU
      B 1Ø6Ø:TV=DV+(X>-1):
      GOSUB 1Ø6Ø:NEXT X
FP 1Ø3Ø L=L-1:DH=AH:DV=AV:GO
      TO 1ØØØ
CI 1Ø4Ø NEXT CC:POSITION CH*
      2-CV+14,CV+5:PRINT "
      *":GOSUB 59Ø
MH 1Ø5Ø GOTO 116Ø
OO 1Ø6Ø IF TH<1 OR TH>11 OR
      TV<1 OR TV>11 THEN R
      ETURN
ON 1Ø7Ø IF TA(TH,TV*3+CC)=L-
      1 THEN AH=TH:AV=TV
KJ 1Ø8Ø RETURN
PB 1Ø9Ø IF TH<1 OR TH>11 OR
      TV<1 OR TV>11 THEN R
      ETURN
CI 11ØØ IF BD(TH,TV)<>UN+CC
      OR TA(TH,TV*3+CC)<>Ø
       THEN RETURN
NL 1110 TA(TH,TV*3+CC)=L:NE=
      NE+1:IF NE=61 THEN N
      E=1
KO 112Ø EH(NE)=TH:EV(NE)=TV
EK 113Ø CD=TH:IF P=2 THEN CD
      =TV
OG 114Ø IF CC=1 AND CD=1 OR
      CC=2 AND CD=11 THEN
      EF=1:HH(CC)=TH:VV(CC
      )=TV
KH 115Ø RETURN
JF 116Ø POSITION Ø,2Ø:PRINT
      "{12 SPACES}PRESS FIR
      EBUTTON{8 SPACES}"
AM 1165 IF STRIG(Ø)<>Ø THEN
      1165
IK 117Ø POSITION Ø,2Ø:PRINT
      "{36 SPACES}":GOSUB 3
      ØØØ:GOTO 12Ø
GE 2ØØØ GRAPHICS Ø:POKE 71Ø,
      15:POKE 7Ø9,Ø:POKE 7
      Ø8,45:POKE 54279,96:
      POKE 559,62:POKE 7Ø4
      ,1Ø2:RETURN
DI 3ØØØ FOR A=1 TO 11:FOR B=
      1 TO 35:TA(A,B)=Ø:NE
      XT B:NEXT A:FOR A=1
      TO 11:FOR B=1 TO 11:
      BD(A,B)=Ø:NEXT B:NEX
      T A
KE 3Ø1Ø RETURN
PL 4ØØØ TM$=T$:TM$(LEN(T$)+1
      ,LEN(T$)+LENGTH(P))=
      NAME$((P-1)*15+1,(P-
      1)*15+LENGTH(P))
AJ 4ØØ5 POSITION 2,2Ø:PRINT
      "{33 SPACES}"
FL 4Ø1Ø POSITION 19-LEN(TM$)
      /2,2Ø:PRINT TM$:RETU
      RN
```

"Beehive" for Atari 400, 800, XL, and XE computers.



Apple II version of "Beehive."

Program 4: Apple II Beehive

Version by Tim Victor, Editorial Programmer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
ØD 1ØØ LOMEM: 16384: DIM BD(11,1
      1),SH(5Ø),SV(5Ø),TA(11,11
      ,2),EH(61),EV(61)
6F 11Ø FOR A = 768 TO A + 88: RE
      AD D: POKE A,D: NEXT : RE
      AD D: IF D < > - 1 THEN 1
      Ø7Ø
A6 12Ø FOR A = 35328 TO A + 7: P
      OKE A,Ø: NEXT
38 13Ø FOR A = 35840 TO A + 79:
      READ D: POKE A,D: NEXT :
      READ D: IF D < > - 1 THEN
       1Ø7Ø
44 14Ø TEXT : HOME : FOR I = 1 T
      O 2
3D 15Ø PRINT "PLAYER "I"'S NAME:
      ";: INPUT "";A$:NN$(I) =
      LEFT$ (A$,24): NEXT
87 16Ø POKE 6,Ø: POKE 7,138: IF
      PEEK (19Ø * 256) < > 76 T
      HEN POKE 54,Ø: POKE 55,3:
       CALL 1ØØ2: GOTO 18Ø
B6 17Ø PRINT CHR$ (4);"PR#A$3ØØ"
59 18Ø GOSUB 85Ø
FD 19Ø P = 1:UN = 1:NH = 6:NV =
      6:CH = 6:CV = 6: GOSUB 93
      Ø
7A 2ØØ HTAB 1: VTAB 21: CALL - 8
      68: PRINT NN$(P)"'";:S =
      ASC ( RIGHT$ (NN$(P),1)):
       IF S - 32 * (S > 96) < >
       83 THEN PRINT "S";
C9 21Ø PRINT " TURN": VTAB 2Ø: H
      TAB 1: PRINT CHR$ (96 + P
      )
99 22Ø IF PEEK (49249) > 127 THE
      N 29Ø
A3 23Ø IF PDL (Ø) < 9Ø THEN NH =
       NH - 1: IF NH < 1 THEN N
      H = 1
23 24Ø IF PDL (Ø) > 165 THEN NH
      = NH + 1: IF NH > 11 THEN
       NH = 11
```

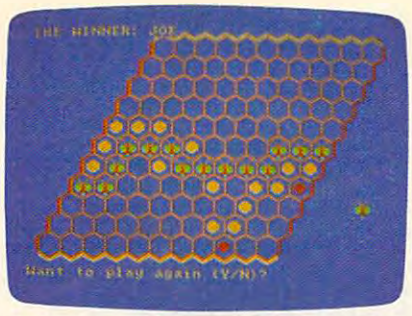
```
21 250 IF PDL (1) < 90 THEN NV =
       NV - 1: IF NV < 1 THEN N
       V = 1
9B 260 IF PDL (1) > 165 THEN NV
       = NV + 1: IF NV > 11 THEN
        NV = 11
EC 270 IF CH < > NH OR CV < > NV
        THEN GOSUB 960:CH = NH:C
       V = NV: GOSUB 930
1E 280 GOTO 220
FE 290 IF BD(CH,CV) < > 0 THEN P
       RINT CHR$ (7);: GOTO 230
CB 300 BD(CH,CV) = UN
07 310 GOSUB 960: GOSUB 930
8D 320 IF PEEK (49249) > 127 THE
       N 320
D7 330 LC = 0:RC = 0: FOR X = -
       1 TO 1:TH = CH + X
E7 340 TV = CV - 1 + (X = 1): GO
       SUB 500
06 350 TV = CV + (X > - 1): GOSU
       B 500
07 360 NEXT
5B 370 IF P = 1 AND CH = 1 OR P
       = 2 AND CV = 1 THEN LC =
       1
9C 380 IF P = 1 AND CH = 11 OR P
        = 2 AND CV = 11 THEN RC
       = 2
7E 390 CC = LC + RC: IF CC = 3 T
       HEN 570
D1 400 IF CC = 0 THEN 490
68 410 SP = 0:SH(0) = CH:SV(0) =
        CV
C0 420 IF SP = - 1 THEN 490
2D 430 DH = SH(SP):DV = SV(SP):S
       P = SP - 1
38 440 BD(DH,DV) = UN + CC
C9 450 FOR X = - 1 TO 1:TH = DH
       + X
2F 460 TV = DV - 1 + (X = 1): GO
       SUB 540
4C 470 TV = DV + (X > - 1): GOSU
       B 540
70 480 NEXT : GOTO 420
1D 490 P = 3 - P:UN = 5 - UN: GO
       TO 200
FE 500 IF TH < 1 OR TH > 11 OR T
       V < 1 OR TV > 11 THEN RET
       URN
2A 510 IF BD(TH,TV) = UN + 1 THE
       N LC = 1
37 520 IF BD(TH,TV) = UN + 2 THE
       N RC = 2
1B 530 RETURN
07 540 IF TH < 1 OR TH > 11 OR T
       V < 1 OR TV > 11 THEN RET
       URN
D5 550 IF BD(TH,TV) = UN THEN SP
        = SP + 1:SH(SP) = TH:SV(
       SP) = TV
21 560 RETURN
80 570 GOSUB 960: VTAB 21: HTAB
       1: CALL - 868: PRINT NN$(
       P)" WINS!": PRINT "CHECKI
       NG BOARD"
1E 580 FOR CC = 1 TO 2:FE = 1:LE
        = 1:EH(1) = CH:EV(1) = C
       V:EF = 0:L = 1
C1 590 CD = CH: IF P = 2 THEN CD
        = CV
CD 600 IF CC = 1 AND CD = 1 OR C
       C = 2 AND CD = 11 THEN HH
       (CC) = 0: GOTO 700
4D 610 NE = LE:E = FE
D5 620 DH = EH(E):DV = EV(E)
D9 630 FOR X = - 1 TO 1:TH = DH
       + X:TV = DV - 1 + (X = 1)
       : GOSUB 780:TV = DV + (X
       > - 1): GOSUB 780: NEXT
FB 640 IF EF = 1 THEN 700
19 650 IF (E = LE) THEN 680
5E 660 E = E + 1: IF E = 61 THEN
        E = 1
22 670 GOTO 620
F1 680 FE = LE + 1:LE = NE: IF F
       E = 61 THEN FE = 1
55 690 L = L + 1: GOTO 610
0B 700 NEXT : FOR CC = 1 TO 2:DH
        = HH(CC):DV = VV(CC):L =
        TA(DH,DV,CC): IF DH = 0
       THEN 740
B0 710 HTAB DH * 2 - DV + 14: VT
       AB DV + 5: PRINT CHR$ (10
       5);: IF L = 1 THEN 740
C9 720 FOR X = - 1 TO 1:TH = DH
       + X:TV = DV - 1 + (X = 1)
       : GOSUB 750:TV = DV + (X
       > - 1): GOSUB 750: NEXT
3C 730 L = L - 1:DH = AH:DV = AV
       : GOTO 710
1C 740 NEXT : HTAB CH * 2 - CV +
        14: VTAB CV + 5: PRINT C
       HR$ (105);: GOSUB 1010: G
       OTO 180
0B 750 IF TH < 1 OR TH > 11 OR T
       V < 1 OR TV > 11 THEN RET
       URN
DD 760 IF TA(TH,TV,CC) = L - 1 T
       HEN AH = TH:AV = TV
25 770 RETURN
11 780 IF TH < 1 OR TH > 11 OR T
       V < 1 OR TV > 11 THEN RET
       URN
9F 790 IF BD(TH,TV) < > UN + CC
       OR TA(TH,TV,CC) < > 0 THE
       N RETURN
76 800 TA(TH,TV,CC) = L:NE = NE
       + 1: IF NE = 61 THEN NE =
        1
89 810 EH(NE) = TH:EV(NE) = TV
1D 820 CD = TH: IF P = 2 THEN CD
        = TV
11 830 IF CC = 1 AND CD = 1 OR C
       C = 2 AND CD = 11 THEN EF
        = 1:HH(CC) = TH:VV(CC) =
       TV
20 840 RETURN
F9 850 HGR : HOME : FOR I = 6 TO
        16: VTAB I: HTAB 20 - I
95 860 FOR J = 1 TO 11: PRINT CH
       R$ (96); CHR$ (32);: NEXT
       : PRINT CHR$ (96);
B0 870 FOR J = 0 TO 1: HTAB 18 -
        I + J: PRINT CHR$ (99 +
       J + 2 * (I < > 2 * INT (I
        / 2)));: HTAB 43 - I + J
       : PRINT CHR$ (99 + J + 2
       * (I = 2 * INT (I / 2)));
       : NEXT
6A 880 NEXT : HCOLOR= 4: FOR I =
       0 TO 4: HPLOT 92 + I,38
       TO 14 + I,127: HPLOT 255
       + I,38 TO 177 + I,127: NE
       XT
08 890 VTAB 5: HTAB 13: PRINT CH
       R$ (101);
E6 900 FOR J = 1 TO 12: PRINT CH
       R$ (103); CHR$ (104);: NE
       XT : PRINT CHR$ (99);
22 910 VTAB 17: HTAB 2: PRINT CH
       R$ (102);
0E 920 FOR J = 1 TO 12: PRINT CH
       R$ (104); CHR$ (103);: NE
       XT : PRINT CHR$ (100);: R
       ETURN
A8 930 HCOLOR= 7
F4 940 GV = CV * 8 + 32:GH = 92
       + 7 * (CH * 2 - CV)
8F 950 HPLOT GH,GV TO GH + 4,GV
       TO GH + 7,GV + 4 TO GH +
       4,GV + 7 TO GH,GV + 7 TO
       GH - 3,GV + 3 TO GH,GV: R
       ETURN
5D 960 HCOLOR= 4: GOSUB 940
5A 970 VTAB CV + 5: HTAB 14 + CH
       * 2 - CV:A$ = CHR$ (32)
F2 980 IF BD(CH,CV) > 3 THEN A$
       = CHR$ (97 + (CV < > 2 *
       INT (CV / 2))): GOTO 1000
E2 990 IF BD(CH,CV) > 0 THEN A$
       = CHR$ (98 - (CV < > 2 *
       INT (CV / 2)))
FD 1000 PRINT A$;: RETURN
B5 1010 VTAB 22: HTAB 1: PRINT "
       PRESS KEY TO QUIT, BUTTO
       N TO PLAY AGAIN"
ED 1020 IF PEEK (49249) > 127 TH
       EN 1050
B2 1030 IF PEEK (49152) < 128 TH
       EN 1020
3F 1040 POKE 49168,0: NORMAL : E
       ND
EA 1050 HGR : FOR I = 1 TO 11: F
       OR J = 1 TO 11:BD(I,J) =
        0:TA(I,J,1) = 0:TA(I,J,
       2) = 0: NEXT : NEXT
E9 1060 RETURN
2F 1070 PRINT "ERROR IN DATA STA
       TEMENTS": END
B2 1080 DATA 216,120,133,69,134,
       70,132,71,166,7,10
FA 1090 DATA 10,176,4,16,62,48,4
       ,16,1,232,232
F6 1100 DATA 10,134,27,24,101,6,
       133,26,144,2,230
93 1110 DATA 27,165,40,133,8,165
       ,41,41,3,5,230
BA 1120 DATA 133,9,162,8,160,0,1
       77,26,36,50,48
31 1130 DATA 2,73,127,164,36,145
       ,8,230,26,208,2
C2 1140 DATA 230,27,165,9,24,105
       ,4,133,9,202,208
69 1150 DATA 226,165,69,166,70,1
       64,71,88,76,240,253
05 1160 DATA 255
25 1170 DATA -1
CE 1180 DATA 193,182,156,156,156
       ,156,182,193,128,136,170
0A 1190 DATA 170,170,170,136,128
       ,128,148,213,213,213,213
FC 1200 DATA 148,128,128,128,192
       ,192,192,208,208,148,138
44 1210 DATA 138,130,130,128,128
       ,128,128,128,128,128,128
EA 1220 DATA 160,160,168,168,148
       ,133,133,129,129,129,128
BB 1230 DATA 128,128,128,170,170
       ,170,170,128,128,128,128
C7 1240 DATA 213,213,213,213,128
       ,128,193,162,156,201,201
25 1250 DATA 190,156,136
23 1260 DATA -1
```

Program 5: IBM PC/PCjr Beehive

Version by Patrick Parrish, Programming Supervisor

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
MI 10 KEY OFF:DEF SEG=0:POKE 104
      7,PEEK(1047) OR 64:GOTO 20
JD 20 GOSUB 350
LC 30 GOSUB 650
NP 40 REM START
QL 50 RANDOMIZE TIMER
HB 60 WINNER=0:PREV.PLAYER=0:ROW
      =6:COL=6:CB=146:RB=89
MC 70 PLAYER=INT(2*RND+1)
JB 80 LOCATE 12,11:PRINT "Please
       wait a moment"
KJ 90 FOR J=1 TO 11:FOR K=1 TO 1
      1:HIVE%(J,K)=0:NEXT K:NEXT
      J
HG 100 FOR J=1 TO 20:PATHLEN(J)=
      0:NEXT J
AA 110 FOR J=1 TO 65:PATH%(J)=0:
      USED%(J)=0:NODE%(J)=0:NEX
      T J
II 120 GOSUB 700:LOCATE 24,1:PRI
      NT "Player:";
```



Keyboard controls are used in the IBM PC/PCjr version of "Beehive."

```
AE 130 REM MAIN
PC 140 IF PREV.PLAYER=PLAYER THE
       N 170
EP 150 LOCATE 24,8:PRINT "
                 ";:LOCATE 24,8:P
       RINT PLAYER$(PLAYER);:IF
       PLAYER=1 THEN PUT (270,13
       0),EYES1,PSET ELSE PUT (2
       70,130),EYES2,PSET
NH 160 PREV.PLAYER=PLAYER
MN 170 PUT (CB,RB),BEE
DN 180 DEF SEG=0:POKE 1050,PEEK(
       1052)
OK 190 A$=RIGHT$(INKEY$,1):IF LE
       N(A$)=0 THEN 190
PO 200 PUT (CB,RB),BEE:OCOL=COL:
       OROW=ROW
MN 210 IF A$=CHR$(77) THEN ROW=R
       OW+1:COL=COL+1:IF ROW>11
       OR COL>11 THEN ROW=OROW:C
       OL=OCOL ELSE RB=RB+15:CB=
       CB+9
CB 220 IF A$=CHR$(75) THEN ROW=R
       OW-1:COL=COL-1:IF ROW<1 O
       R COL<1 THEN ROW=OROW:COL
       =OCOL ELSE RB=RB-15:CB=CB
       -9
CH 230 IF A$=CHR$(72) THEN ROW=R
       OW-1-(ROW=1):IF ROW<>OROW
        THEN CB=CB+9:RB=RB-15
HD 240 IF A$=CHR$(80) THEN ROW=R
       OW+1+(ROW=11):IF ROW<>ORO
       W THEN CB=CB-9:RB=RB+15
MK 250 PUT (CB,RB),BEE
PA 260 IF A$=" " THEN GOSUB 1050
        ELSE 180
BB 270 IF USED THEN PUT (CB,RB),
       BEE:GOTO 140
OG 280 OROW=ROW:OCOL=COL:GOSUB 1
       110
NG 290 IF POSSIBLE=1 THEN GOSUB
       1290
IH 300 IF WINNER=1 THEN 1880
PD 310 LOCATE 24,1:PRINT "Player
       :";
CC 320 IF PLAYER=1 THEN PLAYER=2
        ELSE PLAYER=1
BC 330 ROW=OROW:COL=OCOL:GOTO 14
       0
LO 340 REM INIT
AC 350 CLS:COLR(1)=2:COLR(2)=3
EA 360 DIM ROW.INC%(6),COL.INC%(
       6)
DH 370 FOR J=1 TO 6:READ ROW.INC
       %(J),COL.INC%(J):NEXT J
NK 380 DATA -1,-1,0,1,1,1,1,0,0,
       -1,-1,-1
GP 390 DIM HIVE%(11,11)
EA 400 DIM USED%(65),NODE%(65),P
       ATH%(65),PATHLEN(200)
HK 410 SCREEN 1:COLOR 1,2:DEFINT
       B
IN 420 DIM HEXA(100),BALL1(100),
       BALL2(100),EYES1(100),EYE
       S2(100)
NH 430 LINE (30,10)-(21,15),3:LI
       NE-STEP (0,10),3:LINE-STE
       P (9,5),3
PB 440 LINE-STEP (9,-5),3:LINE-S
       TEP (0,-10),3:LINE-STEP (
       -9,-5),3
NI 450 LINE (30,11)-(22,16),2:LI
       NE-STEP (0,9),2:LINE-STEP
        (8,4),2
JB 460 LINE-STEP (7,-4),6:LINE-S
       TEP (0,-10),6:LINE-STEP (
       -7,-4),6
FP 470 GET (21,10)-(39,30),HEXA
HE 480 CLS:CIRCLE (30,20),5,COLR
       (1):PAINT (30,20),COLR(1)
       :GET (25,16)-(35,24),BALL
       1
HB 490 GOSUB 580:GET (23,12)-(37
       ,25),EYES1
BJ 500 CLS:CIRCLE (30,20),5,COLR
       (2):PAINT (30,20),COLR(2)
       :GET (25,16)-(35,24),BALL
       2
MC 510 GOSUB 580:GET (23,12)-(37
       ,25),EYES2:CLS
OA 520 READ X,Y:E=(4+INT((X+7)/8
       )*Y)/2:DIM BEE(E):BEE(0)=
       X:BEE(1)=Y:FOR I=2 TO E:R
       EAD A$:BEE(I)=VAL("&H"+A$
       ):NEXT
JL 530 DATA 26,8,828,A,5AA,802A,
       95AA,80AA
HK 540 DATA 952A,AA,8002,A0,1500
       ,0,0,0
NP 550 DATA 500,0,0
NL 560 RETURN
BN 570 REM PARTS
KF 580 CIRCLE (26,19),2,1:CIRCLE
        (34,19),2,1
EF 590 PAINT (26,19),1:PAINT (34
       ,19),1
IE 600 PSET (29,17):LINE-STEP (-
       2.5,-5):LINE-STEP (-2.5,3
       )
OC 610 PSET (31,17):LINE-STEP (2
       .5,-5):LINE-STEP (2.5,3)
AA 620 CIRCLE (30,24),1,1:PAINT
       (30,24),1
MG 630 RETURN
DE 640 REM GETNAMES
GB 650 LOCATE 12,16:PRINT "BeeHi
       ve":PUT (84,84),EYES1:PUT
        (192,86),EYES2
HC 660 FOR I=1 TO 2:LOCATE 19+I*
       2-1,6:PRINT "Player"I"'s
       name";
MI 670 INPUT PLAYER$(I):PLAYER$(
       I)=LEFT$(PLAYER$(I),15):N
       EXT I
IM 680 CLS:RETURN
JC 690 REM DRAWSCREEN
LD 700 CLS:Y=7
MF 710 FOR R=1 TO 11
CD 720 X=90-R*9
EC 730 FOR C=1 TO 11
IO 740 X=X+18
BM 750 PUT (X,Y),HEXA,OR
KN 760 NEXT C
HC 770 Y=Y+15
DH 780 NEXT R
GL 790 PSET (297,12),2:GOSUB 930
       :LINE-STEP (0,10),2
FH 800 PSET (298,12),2:GOSUB 930
       :LINE-STEP (0,10),2
GG 810 PSET (299,12),2:GOSUB 930
       :LINE-STEP (0,10),2
NJ 820 PSET (96,12),2:GOSUB 930:
       LINE-STEP (0,10),2
NH 830 PSET (97,12),2:GOSUB 930:
       LINE-STEP (0,10),2
OF 840 PSET (98,12),2:GOSUB 930:
       LINE-STEP (0,10),2
CB 850 Y1=-5:Y2=5:PSET (99,9),3:
       GOSUB 990
NL 860 PSET (99,10),3:GOSUB 990
CK 870 PSET (100,11),3:GOSUB 990
CO 880 Y1=5:Y2=-5:PSET (9,173),3
       :GOSUB 990
AG 890 PSET (9,174),3:GOSUB 990
AE 900 PSET (9,175),3:GOSUB 990
MF 910 RETURN
QO 920 REM UPNDOWN
HC 930 FOR J=1 TO 10
HC 940 LINE-STEP (0,10),COLR(1)
CG 950 LINE-STEP (-9,5),COLR(1)
OF 960 NEXT J
NB 970 RETURN
PO 980 REM ACROSS
GF 990 FOR J= 1 TO 11
KA 1000 LINE-STEP (9,Y1),COLR(2)
LH 1010 LINE-STEP (9,Y2),COLR(2)
GA 1020 NEXT J
IE 1030 RETURN
PN 1040 REM SET PIECE
NB 1050 USED=0
LF 1060 IF HIVE%(ROW,COL)<>0 THE
       N USED=1:RETURN
LL 1070 HIVE%(ROW,COL)=PLAYER
FA 1080 PUT (CB,RB),BEE:IF PLAYE
       R=1 THEN PUT(CB+1,RB-1),
       BALL1 ELSE PUT(CB+1,RB-1
       ),BALL2
JB 1090 RETURN
GJ 1100 REM CHECKLINE
BI 1110 POSSIBLE=1
CJ 1120 IF PLAYER=1 THEN 1200
EL 1130 FOR ROW=1 TO 6:FF=0:FB=0
IM 1140 FOR COL=1 TO 11
GJ 1150 IF HIVE%(ROW,COL)=PLAYER
        THEN FF=1
JC 1160 IF HIVE%(12-ROW,COL)=PLA
       YER THEN FB=1
LE 1170 NEXT COL
HM 1180 IF FF=0 OR FB=0 THEN POS
       SIBLE=0:ROW=6
PE 1190 NEXT ROW:RETURN
CK 1200 FOR COL=1 TO 6:FF=0:FB=0
JP 1210 FOR ROW=1 TO 11
FC 1220 IF HIVE%(ROW,COL)=PLAYER
        THEN FF=1
GP 1230 IF HIVE%(ROW,12-COL)=PLA
       YER THEN FB=1
OB 1240 NEXT ROW
HD 1250 IF FF=0 OR FB=0 THEN POS
       SIBLE=0:COL=6
LD 1260 NEXT COL
JE 1270 RETURN
EB 1280 REM CHECKWINNER
OA 1290 LOCATE 24,1:PRINT "Check
       ing...          ";
ED 1300 USED.CNTR=0:WINNER=0:NOD
       E.CNTR=0:NODE.TOTAL=0:CO
       UNTER=0
LO 1310 IF PLAYER=1 THEN 1440
II 1320 FOR COL=1 TO 11:ROW=1
JF 1330 IF HIVE%(ROW,COL)<>PLAYE
       R THEN 1410
NO 1340 NODEROW=ROW:NODECOL=COL:
       GOSUB 1560
GD 1350 IF USED.FLAG=1 THEN 1410
EB 1360 NODE.TOTAL=1:PATH.TOTAL=
       1:COUNTER=1
OL 1370 PATH%(1)=100*NODEROW+NOD
       ECOL
ML 1380 GOSUB 1650
FJ 1390 IF WINNER=1 THEN COL=11
JP 1400 REM SKIP2
LI 1410 NEXT COL
JJ 1420 RETURN
EL 1430 REM CHECK1
FI 1440 FOR ROW=1 TO 11:COL=1
BB 1450 IF HIVE%(ROW,COL)<>PLAYE
       R THEN 1530
NG 1460 NODEROW=ROW:NODECOL=COL:
       GOSUB 1560
MO 1470 IF USED.FLAG=1 THEN 1530
FO 1480 NODE.TOTAL=1:PATH.TOTAL=
       1:COUNTER=1
OD 1490 PATH%(1)=100*NODEROW+NOD
       ECOL
KH 1500 GOSUB 1650
```

```
KB 1510 IF WINNER=1 THEN ROW=11
JJ 1520 REM SKIP1
DE 1530 NEXT ROW
JB 1540 RETURN
CC 1550 REM USEDLOOKUP
QK 1560 USED.FLAG=0:SEARCH=100*N
        ODEROW+NODECOL
NO 1570 LK=0:IF USED.CNTR=0 THEN
         1620
FC 1580 FOR LK=1 TO USED.CNTR
KL 1590 IF SEARCH=USED%(LK) THEN
         USED.FLAG=1:LK=USED.CNT
        R
AA 1600 NEXT LK
QP 1610 REM SKIPSEARCH
OA 1620 IF USED.FLAG=0 THEN USED
        .CNTR=USED.CNTR+1:USED%(
        USED.CNTR)=SEARCH
JA 1630 RETURN
MH 1640 REM CHECKPATH
NO 1650 NODE.CNTR=0
PK 1660 FOR NC=1 TO 6
AD 1670 NODEROW=NODEROW+ROW.INC%
        (NC):NODECOL=NODECOL+COL
        .INC%(NC)
PI 1680 IF NODEROW<1 OR NODEROW>
        11 OR NODECOL<1 OR NODEC
        OL>11 THEN 1750
JL 1690 IF HIVE%(NODEROW,NODECOL
        )<>PLAYER THEN 1750
OA 1700 GOSUB 1560:IF USED.FLAG=
        1 THEN 1750
QO 1710 NODE.CNTR=NODE.CNTR+1
OM 1720 NODE.TOTAL=NODE.TOTAL+1:
        NODE%(NODE.TOTAL)=100*NO
        DEROW+NODECOL
JA 1730 IF (PLAYER=2 AND NODEROW
        =11) OR (PLAYER=1 AND NO
        DECOL=11) THEN WINNER=1:
        PATH.TOTAL=PATH.TOTAL+1:
        PATH%(PATH.TOTAL)=100*NO
        DEROW+NODECOL:NC=6
KP 1740 REM SKIPNODE
MH 1750 NEXT NC
JA 1760 IF WINNER=1 THEN RETURN
QO 1770 IF NODE.CNTR=0 AND NODE.
        TOTAL=0 THEN RETURN
MK 1780 IF NODE.CNTR=0 THEN PATH
        .TOTAL=PATH.TOTAL-PATHLE
        N(COUNTER):PATHLEN(COUNT
        ER)=0:COUNTER=COUNTER-1
AG 1790 IF NODE.CNTR>1 THEN COUN
        TER=COUNTER+NODE.CNTR-1
KP 1800 NODEROW=INT(NODE%(NODE.T
        OTAL)/100)
EM 1810 NODECOL=NODE%(NODE.TOTAL
        )-100*NODEROW
ED 1820 PATH.TOTAL=PATH.TOTAL+1
GA 1830 PATHLEN(COUNTER)=PATHLEN
        (COUNTER)+1
GA 1840 PATH%(PATH.TOTAL)=NODE%(
        NODE.TOTAL)
LL 1850 NODE.TOTAL=NODE.TOTAL-1
BB 1860 GOTO 1650
OJ 1870 REM DRAWPATH
HF 1880 LOCATE 1,1:PRINT "THE WI
        NNER: ";:PRINT PLAYER$(P
        LAYER);
JH 1890 FOR J=1 TO PATH.TOTAL
HF 1900 ROW=INT(PATH%(J)/100):CO
        L=PATH%(J)-100*ROW:CB=CO
        L*18+38+(6-ROW)*9:RB=ROW
        *15-1
FI 1910 IF PLAYER=1 THEN PUT(CB+
        1,RB-1),BALL1,XOR:PUT (C
        B,RB-3),EYES1,OR ELSE PU
        T(CB+1,RB-1),BALL2,XOR:P
        UT (CB,RB-3),EYES2,OR
HC 1920 NEXT J
IK 1930 REM GOAGAIN
JM 1940 LOCATE 24,1:PRINT "Want
        to play again (Y/N)?";
NE 1950 A$=INKEY$:IF A$<>"Y" AND
         A$<>"N" THEN 1950
LO 1960 IF A$="N" THEN SCREEN 0,
        0,0:WIDTH 80:END ELSE CL
        S:GOTO 50
```

Analyze! For Amiga

David Powell

Analyze!, unlike some other spreadsheets for the Amiga, is a true Amiga software product, making full use of windows, drop-down menus, icons, color, and the Amiga mouse. You insert the *Analyze!* disk when the Amiga asks for the Workbench. When you select the disk icon, a window appears containing icons for an Empty Drawer, a Trashcan, and the *Analyze!* program itself. By using the Empty Drawer and Trashcan, you can organize a spreadsheet into directories and subdirectories, and "clean house" easily when the disk gets too full.

When you select the spreadsheet icon, *Analyze!* opens a dialog window through which you can partition off memory for your spreadsheet. The default partition is 128K. If you enter a larger value (one that's reasonable for your configuration, of course), the computer reserves that amount of memory, then displays the spreadsheet screen itself. The memory partitioning scheme lets you use most, but not quite all, of the system's free memory. On my 512K system, there were 400K bytes of memory available after *Analyze!* was loaded. However, I couldn't partition off more than about 300K.

Compression Yields Extra Room

I was curious to see how big a spreadsheet I could cram into the 128K default partition. Theoretically, at one byte per cell, a square 128K spreadsheet would have about 362 cells per side (or one could just fit a one-column spreadsheet 128K cells long.) However, *Analyze!* employs the *sparse-matrix technique* to permit much bigger spreadsheets than would otherwise be possible. Only cells holding text, data, or formulae are actually stored in memory. Empty cells, such as spaces added to improve readability, are not.

So, 128K of memory holds 128K of actual data, text, and formulae—no matter how large the spreadsheet's geography grows. For example, a one-column, 128K spreadsheet could actually be 256K cells long if data cells alternated with empty cells. This permits you to arrange the spreadsheet in an attractive manner without worrying about wasted memory.

Intuitive Operation

From within the spreadsheet screen, you reveal *Analyze!*'s main menu bar by holding down the right mouse button. The menu bar contains five menus: Project, Range, Worksheet, Print, and Recalculate. While holding the right button down, move the mouse pointer to one of these options; a menu of its commands drops into view. You select a command by sliding the mouse cursor to it and releasing the mouse button. In short, *Analyze!* handles menus and other program options in the usual Amiga fashion, which will seem natural to Amiga owners. It's easy to take these intuitive, easy-to-use features for granted until you try operating an Amiga program that lacks them. (It's still possible to buy an Amiga program that doesn't look or act like Amiga software at all. Amiga programs that ignore the mouse and visual icons, operating chiefly through keyboard controls, are usually quick translations of software written for an older machine such as the IBM PC.)

Commands within the Project menu display a Worksheet's current formatting parameters and allow you to load, store, delete, and update spreadsheets stored on internal or external disk drives. (Spreadsheets can be stored on disks used by other programs, because *Analyze!* only looks for files with the extension .SHT.)

The Range menu offers commands that name, format, label, copy, move, erase, and write-protect individual cells or groups of cells. People building spreadsheets will use these functions frequently, and it's nice to have them all in one place.

Moving And Copying Cells

An example will show you how easy the Range command—and Amiga's mouse—make the task of moving or copying a block of cells to a new location. This requires only three steps:

1. Select the Range option's Move (or Copy) command. A prompt appears on the screen asking for the range of cells you want to move.
2. Position the mouse cursor at the upper-left cell of this range, press the left mouse button, and drag the cursor to the lower-right cell. Release the mouse button; a prompt appears on the screen asking for the move destination.
3. Move the mouse pointer to the upper-left cell of this destination; then click the left button. *Analyze!* repositions the entire block of cells so that its upper-left corner coincides with the destination cell.

I like the fact that such operations can be done without touching the keyboard. However, you can't use the mouse to define ranges that go beyond the visible screen. So *Analyze!* also offers simple keyboard procedures for selecting ranges and jumping to different places in a spreadsheet.

When you copy cells to a new location, *Analyze!* can copy formulae in the cells in *absolute* form (with row and column references transferred verbatim), in *relative* form (with references adjusted for the new location), or in a combination of both. (However, all cell references are kept verbatim when you transfer formulae to a new location with a Move command.)

A Variety Of Formats

The main menu's Worksheet option includes commands that insert or delete blank rows and columns, erase a spreadsheet, enter titles, format all cells, set column widths, justify labels, and write-protect the entire spreadsheet. Of special interest is the Worksheet option's Format command, which differs from the Range option's Format command in scope. Worksheet formatting applies to every cell in the entire sheet, not to a specific block of cells.

Through Range-Format and Worksheet-Format, you can display data in the following formats:

- fixed-point decimal
- scientific (exponential) notation
- dollars and cents

- percentages
- dates
- with commas (for instance, 2,123 instead of 2123)

Negative numbers are automatically displayed in red to distinguish them from positive numbers, which appear black on the paper-white background of the spreadsheet.

Another Worksheet-Format option (labeled as +/−) can convert positive and negative integers into crude bar charts. This option is designed to work only with integers (whole numbers), so it doesn't work as well with noninteger values.

Following Worksheet in the main menu is the Print command, which enables you to format a spreadsheet and send it to a printer. (However, you must still use Preferences to select the correct settings for your particular printer.) The Print feature allows you to set top-of-form, define page lengths, transmit linefeeds, print part or all of a spreadsheet, set all four page margins, define page headers and footers, pick rows or columns to use as page borders, and print calculated formula results or the formulae themselves. If you don't want to print directly to a printer, you may send the same output to an ASCII disk file for further formatting by a word processing program.

The last option in the main menu (Recalculate) lets you set your spreadsheet's calculation order. You can make recalculations automatic (after each cell change) or manual (as requested). The calculation order can be top-to-bottom or right-to-left. Or, it can be natural, in which case the system performs multiple passes to pull together complex data relationships the way a person would.

This offers more calculation flexibility than many spreadsheets I've seen, but there's even more. *Analyze!* also lets you create a spreadsheet that runs through as many as 50 iterations, or recalculations, before displaying its results. As a former mathematician, I value this feature highly.

Special Functions

Advanced users will also welcome the program's library of special functions. These include, but are not limited to, the following:

- comparisons and logical operators
- trigonometric functions
- statistical averages, standard deviations, and variances
- table lookups within a spreadsheet
- logarithms and exponentials
- present/future values of cash flows
- loan and annuity payments
- maxima/minima of values in a block
- modulus arithmetic
- random numbers

Analyze! is an effective, efficient spreadsheet, with very few apparent bugs. However, I do have some small complaints. It does not, for instance, offer a macro capability for writing spreadsheet-template programs (power users, take note). It could also handle formula input better. Some spreadsheets use a parser that looks at what you type and decides on its own whether you have entered data, text, or a formula. *Analyze!*, on the other hand, makes you begin every formula with a plus sign (+). This is a bit awkward.

The *Analyze!* user manual, like others of its type, suffers from too much text and too few illustrations. You should follow along with the computer as you read the manual. However, it does include very useful summaries of all system menus and special functions. However, since *Analyze!* is so well integrated with the Amiga's Workbench metaphor, you can learn to use the program almost without opening the manual.

Analyze!
Micro Systems Software
4301-18 Oak Circle
Boca Raton, FL 33431
$99.95

The American Challenge: A Sailing Simulation

Tony Roberts

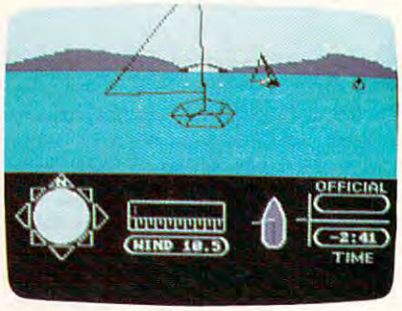
Requirements: Apple II-series computer with at least 64K RAM. IBM PC or PCjr with 128K RAM and DOS 2.0 or above. Graphics card required for use with PC. Commodore 64 (available early fall).

The pleasures of sailboat racing are effectively recreated in *The American Challenge: A Sailing Simulation* from Mindscape and Tom Snyder Productions. Fashioned after the America's Cup races, the goal of the game is to win all the preliminary heats. This, in turn, gains you the right to challenge the Australians in an attempt to regain the Cup for the United States. Should you manage to beat Australia in the program's Cup Race, you become eligible for a contest that could win you a trip to Australia to watch the 1987 America's Cup races in person (the contest closes on October 30, 1986).

Taking The Challenge

To play the game, you choose a course; the computer displays an overhead view of the course and shows you a suggested route around it. Sailing against a boat piloted by the computer, you jockey for position and attempt to cross the starting line just as the horn sounds.

The computer sails a pretty good race. It's possible, but not easy, to beat it, and there's little room for error if you hope to win. You control your boat's direction, sail trim, and centerboard position. At any time during the race, you can press the space bar to return to the overhead view, which shows the paths



The American Challenge: A Sailing Simulation *recreates the challenge of competing in the America's Cup races.*

both boats have taken. Press the space bar again and the race resumes. Other controls allow you to look right and left off your board and to zoom in on the competition or zoom back for a wider angle view.

Seven of the eight courses are based on the courses used in actual sailboat races. Each race becomes progressively more difficult as the currents become stronger and your compass is taken away.

You're not to sail the Cup Race until your boat has beaten the computer at all seven of the preliminary races. Even for someone familiar with sailboat racing, it will take quite a while to become that proficient.

Racing against the computer is a challenge, but also becomes predictable. The computer maintains a record of the best time for each course and sails a course the same way each time until it is beaten.

Two-Computer Version

One way to eliminate this predictability is to choose the two-player option. However, this choice requires that you have two computers connected by modem or a null modem cable, and both computers must be running the program. With this option, you can send messages to the other captain. This

communication becomes necessary to settle disputes regarding collisions or possible rules violations.

Sailing against another human adds to the enjoyment of the game, but it also slows things down a bit. If you are using 300 bit-per-second modems, the races take from five to twenty minutes each.

One other option allows you to race a high-speed motorboat around the courses. This can be fun, but don't expect to take on the Australians with anything but wind power.

While explaining the program, the manual also imparts quite a bit of information about sailing itself, including sailing basics, racing strategy, and right-of-way rules. The package even includes a 45 r.p.m. phono record with a sailing tutorial for novices.

The American Challenge: A Sailing Simulation
Mindscape
3444 Dundee Road
Northbrook, IL 60062
Apple II series/IBM flippy version
$39.95
Commodore version (available early fall)
$29.95

Vorpal Utility Kit

N. Randall

Requirements: Commodore 1541 disk drive.

It has never been any secret that a major problem with a Commodore 64 system is the speed of the disk drive. It's slow. Several companies, understanding the impatience of the regular 1541 user, have released products that speed it up. One of the most popular has been Epyx's *Fast Load* cartridge, which many owners now swear they could scarcely do without. Following the success of *Fast Load*, Epyx has now released the *Vorpal Utility Kit*. For anyone who needs to manipulate files, copy disks, or make use of extremely fast loads and saves, the *Vorpal* package could quickly become indispensable.

The *Vorpal Utility Kit* is actually several utilities in one. With *VFiler*, you can load and save user-created programs at about 25 times the normal 1541 speed. Note that this does not apply to commercial software; the *Fast Load* cartridge takes care of those. What the *Vorpal* kit does is add a fifth file type to the 64's normal four (program, sequential, user, and relative). These files make use of the kit's greatly increased speed.

As a nonprogrammer, I must confess to a thorough disinterest in these super-fast files, simply because I never create programs that could use them. They can be used, though, with any BASIC program (and some ML programs) which you receive from user groups or type in from a book or magazine, in addition to those you create yourself. Epyx makes it clear on the package that the high speed applies only to user-created software and BASIC programs.

20-Second Formatting

More exciting, for nonprogrammers at least, are the disk and file utilities. With the *Vorpal Utility Kit*, you can format a disk in 20 seconds rather than the usual two minutes. And you can copy an entire disk—including formatting—in less than three minutes. For those with two or more disk drives, the software allows you to renumber both the origin and the destination drives as needed.

File commands include Delete, Undelete, Protect, Unprotect, and Rename, in addition to the following special functions. You can change a file from one type to another. For example, if your old word processor stores documents as USR files, and you buy a new word processor that stores them as PRG files, the *Vorpal Utility Kit* lets you change them in seconds, without the tedium of reading a file into memory and writing it back to disk in the new format. You can also copy files and convert them at the same time.

The final utility in the *Vorpal Utility Kit* is a hardware check. The program will check your 1541's head alignment and drive speed, and will even attempt to correct a minor alignment problem. Impressively, all the commands on the *Vorpal* kit respond to the touch of a single key, and the manual, although certainly complete, is practically superfluous. Even if you use only the 20-second formatting or the three-minute disk copying, the *Vorpal Utility Kit* is one package you will not want to pass up.

Vorpal Utility Kit
Epyx
1043 Kiel Court
Sunnyvale, CA 94089
$34.95

Lords Of Conquest

Todd Heimarck

Lords of Conquest from Electronic Arts is a lot like the popular board game Risk, and in some ways, it's even better.

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King Of The World

A game of Risk begins with a world map divided into a number of countries owned by various players. By shaking the dice, you win and lose territories. Some countries are isolated (Eastern Australia, Japan, and Argentina), while others are busy crossroads (the Middle East and the Ukraine, to name a couple). The ultimate goal is to build up your armies and win enough battles to conquer the world.

In *Lords of Conquest*, the basic idea is to take over the world, but you win by building or capturing a certain number of cities—from three to six. Some of your territories produce raw materials such as gold, iron, coal, timber, and horses. When you've acquired certain combinations of materials, you can buy weapons or place a new city on the map.

Before the game starts, you split up the available territories. It's important to choose countries that contain coal mines, gold mines, forests, and the like, so you can start building up your stockpile of raw materials. At the same time, you should pick areas that are near each other, because your defenses will be stronger if you have friendly countries as neighbors.

Up To Four Players

You can play one-on-one against the computer, or you can involve as many as four human players. The disk contains 20 maps, including Europe, Africa, North America, the Middle East, South America, Japan, Australia, and the Mediterranean. If you're not satisfied with the built-in maps, you can ask the computer to generate a random battlefield from parameters you supply. You can also create your own map. It takes some time to build a map, but you can fine-tune it until it looks just the way you want. These new maps can be saved to disk for use in later games.

Select a level of play: beginner, intermediate, advanced, or expert. In the beginner level, there are only pastures (a source of horses) and gold mines; this level is suitable for playing with children. More challenging is the expert level, featuring horses, gold, timber, coal, and iron.

Should you choose to play the computer, you must also select a level of difficulty. Level 1 gives you a big advantage (four extra territories) and level 9 skews the game in favor of the computer.

After you divvy up the territory, the game begins. Each round has several phases. During development, you can use your gold and other commodities to create weapons, boats, or cities. Production comes next; more raw materials are added to your inventory. You then have a chance to move your stockpile to a new country. The stockpile is like an imperial treasury; if another player captures it, he or she will get all your gold, iron, coal, and timber. Finally, there's a combat phase during which each player can send forces against the other players. You're limited to two attacks per round.

To create a city, you have two choices: Spend one unit of iron, coal, timber, and gold, or use four gold units. In the advanced and expert games you can build a boat (a naval force) with three timber units, or buy one with three units of gold. A boat can carry a horse and a weapon, which makes it a valuable offensive force.

Offense Or Defense?

There's a lot to be said for building cities. The ultimate goal is to own three or more cities, so each one you build brings you one step closer to winning. Cities also increase production in the neighboring countries. If you place a city next to a gold mine, its output will double from one unit to two.

But cities are fairly expensive. And if you spend all your resources on cities while your opponents build up their horses, weapons, and boats, you may eventually lose the game. Your opponent will likely attack and conquer your cities. Ownership of a certain number of cities is the goal. It doesn't matter whether you build the cities or capture them.

Each game of *Lords of Conquest* has a definite rhythm. In the first couple of rounds, weak and isolated countries are overrun by invaders, especially if the country produces a valuable commodity. As the territories coalesce in the middle rounds, powerful armies build up along the borders between empires. When boats first appear, the complexion of the game changes. Suddenly, any coastal country is vulnerable to an attack from the sea. It's difficult to defend a coastal country from marauding Vikings.

The mechanics of the game are fairly simple; there are four commodities, three weapons, and the cities. But *Lords of Conquest* requires a good sense of strategy. On your way to the goal of building cities, you have to watch your resources and try to keep them from your opponents. If you own no country with a gold mine, you may have to develop a short-term strategy to capture one. You should spend your money wisely, occasionally forgoing a new weapon to save up for a city.

Geography and distribution of resources are also important factors. The strategy that works best on one map might fail miserably on another. Boats

are valuable when islands are plentiful, but they're relatively unimportant when the map contains mostly land.

The Role Of Diplomacy

The computer plays a tough game; at the higher levels you won't often beat it. And when you play with other people, diplomacy plays a role: "I won't attack you if you won't attack me." The multiplayer game also allows for alliances. When more than two players are near a battle, the uninvolved players can send forces to the attacker or defender, or they can remain neutral. You also have a chance to trade commodities—a gold and an iron for two coal mines, for example.

If you're a Risk player, you'll enjoy *Lords of Conquest*, and if you get tired of conquering one world, you can easily find or build another. A second useful feature is the one-player game: When you want to play, but can't round up a group of opponents, you can test the computer's abilities. The only negative comments I've heard concern the graphics. There's nothing particularly wrong with them; they're just simple. The countries, for example, are made up of colored squares. This doesn't affect the playability of the game, so it's a minor criticism.

Lords of Conquest
Electronic Arts
1820 Gateway Drive
San Mateo, CA 94404
Commodore version $32.95
Apple II and Atari 8-bit versions soon to be released; no prices available.

©

Attention Programmers

COMPUTE! magazine is currently looking for quality articles on Commodore, Atari, Apple, and IBM computers (including the Commodore Amiga and Atari ST). If you have an interesting home application, educational program, programming utility, or game, submit it to COMPUTE!, P.O. Box 5406, Greensboro, NC 27403. Or write for a copy of our "Writer's Guidelines."

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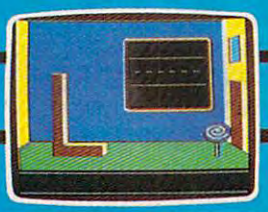

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Lesson Three asks your child to identify the beginning letter of the words presented in Lesson Two. Mistakes are reviewed and correct answers are musically rewarded. Ages 4–8.

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Jacket Lister

Gregory Jackmond

The more disks you have, the more you'll enjoy this novel utility. It prints a disk jacket with an alphabetized directory of all the programs on a disk. The original version of "Jacket Lister" runs on the Commodore 64 and 128 (in 64 mode). We've added new versions for the IBM PC/PCjr, Apple II series (DOS 3.3 and ProDOS), and Atari 400, 800, XL, and XE. A printer is required. The Atari version requires at least 32K of memory.

How many times have you picked up a disk, only to realize that you can't remember which programs are on it? You can always get a disk directory in the usual way—by putting the disk in the drive and listing the directory on the screen—but that's slow and tedious when you're looking for a specific program.

"Jacket Lister" is a unique, time-saving solution to this perennial problem: It not only allows you to create a personalized jacket out of ordinary paper, but also lists an alphabetized directory on the jacket itself. In a glance, you can see which programs are on each of your disks. A date is also included so that you can tell whether the listing is obsolete. The jacket listing may include as many as 88 filenames, using the front and back of the jacket. (Some computers can store more than 88 files on a disk, but the jacket does not have room for more than that number.)

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Type in the appropriate program for your computer, then save a copy before you run it. The variable NS$ in line 420 (NAME$ in line 15 for the Atari version) defines your personalized title for the jacket, which you can change to whatever you like. You may substitute any characters in the definition of NS$, but don't make the string longer than 26 characters.

Jacket Lister is a self-prompting program, so you don't need elaborate instructions. Simply run the program, insert the disk that you want to catalog, then follow the screen prompts to create a custom jacket for that disk. When the jacket has finished printing, all that's left to do is to cut the cover to size, fold it along the printed fold lines, and glue the flaps.

Commodore 64 Version

Commodore Jacket Lister (Program 1) runs on a Commodore 64 or Commodore 128 in 64 mode. The program is written for standard Commodore printers (and for non-Commodore printers that can emulate the standard Commodore graphics characters), but can easily be modified to work on other printers as well. Simply change the graphics symbols to dashes (–) or exclamation points (!) in lines 510, 1100, and 1240. (Horizontal lines are formed from the dashes, and vertical lines from the exclamation points.) The program also uses characters 17 and 145 as control codes to set the printer for lowercase/uppercase or uppercase/graphics printing, respectively. You may need to substitute other control codes for these in lines 100 and 110.

If you have a Commodore Plus/4, 16, PET/CBM, or VIC-20 with expansion memory, you should be able to make Jacket Lister work with only slight modifications. The POKEs that change the screen color and create sound effects are specific to the Commodore 64; if you delete these statements, the program should run on nearly any Commodore computer.

Atari Version

The Atari version (Program 2) runs on any Atari 400, 800, XL, or XE computer with at least 32K of memory, and should work with any standard-width printer. No special instructions are required; simply follow the directions on the screen.

Apple II Version

With the Apple II version of Jacket Lister, all output is in uppercase. If you are using DOS 3.3, type in Program 3 as listed. For ProDOS, start with Program 3, but omit lines 80–200 and add the lines listed as Program 4. In either case, you may have to modify line 450 to suit your particular printer configuration.

IBM PC/PCjr Version

In this version of Jacket Lister (Program 5), all output is in uppercase.

Program 1: Commodore Jacket Lister

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
GD 10 REM ***** PROGRAM SET UP
      ******
RH 20 DIMTB$(144):DIMAB$(144)
KR 30 PRINT"{CLR}{73}":POKE5328
      0,14:POKE53281,6
PS 40 PRINT"{4 DOWN}{9 RIGHT}
      {RVS}{WHT} WHAT IS TODAY
      'S DATE: ":PRINT:
EK 50 PRINT"{5 RIGHT}{RVS}
      {WHT} ENTER MO/DY/YR THE
      N <RETURN> {OFF}"
MD 60 PRINT"{2 DOWN}";SPC(11);
      :INPUT DT$
QA 70 PRINT"{CLR}{4 DOWN}
      {9 RIGHT}{RVS}{CYN} UPPE
      R AND LOWER CASE ? ":PRI
      NT:
RC 80 PRINT"{10 RIGHT}{RVS}
      {CYN} {WHT}Y{CYN} OR
      {WHT}N{CYN} THEN <RETURN
      > {OFF}"
CB 90 PRINT"{2 DOWN}";SPC(11);
      :INPUT CC$
PR 100 IF CC$="Y" THEN CM$=CHR
      $(17):REM LOWER CASE
RC 110 IF CC$<>"Y" THEN CM$=CH
      R$(145):REM UPPER CASE
QF 120 PRINT"{CLR}{73}":POKE532
      80,14:POKE53281,6
SX 130 PRINT"{4 DOWN}{RIGHT}
      {YEL}WHICH DISK DRIVE D
      O YOU WANT TO LIST?"
JC 140 PRINT"{2 DOWN}";SPC(11)
      ;:INPUT DI
MG 150 REM ***** READ DISK MEN
      U ******
XF 160 PRINT"{CLR}{CYN}":POKE5
      3280,2:POKE53281,0
HK 170 PRINT"{6 DOWN}{3 RIGHT}
      {RVS}{2 SPACES}READING
      {2 SPACES}DATA : PLEASE
       STANDBY{2 SPACES}"
ED 180 GOSUB1630
JD 190 OPEN8,DI,0,"$0":FORC=1T
      08:GET#8,A$:NEXT:C=1:DN
      $="":FORC=1TO16
JA 200 GET#8,A$:DN$=DN$+A$:NEX
      T:GET#8,A$:GET#8,A$:DN$
      =DN$+"{2 SPACES}":GET#8
      ,A$
ED 210 DN$=DN$+A$:GET#8,A$:DN$
      =DN$+A$:GET#8,A$:GET#8,
      A$
GE 220 GET#8,A$:GET#8,A$:C=1
FH 230 FORA=1TO4:GET#8,A$:NEXT
      :PN$="":TY$=""
PM 240 GET#8,A$:IFST<>0THEN310
FP 250 IFA$=""THEN310
MC 260 IFASC(A$)<>34THEN240
BA 270 GET#8,A$:IFASC(A$)<>34T
      HENPN$=PN$+A$:GOTO270
FA 280 GET#8,A$:IFASC(A$)=32TH
      EN280
RR 290 TY$=TY$+A$:GET#8,A$:IFA
      $<>""THEN290
RD 300 TB$(C)=PN$:C=C+1:IFST=0
      THEN230
XC 310 CLOSE8
GH 320 IF C>88 THEN GOSUB1310
JE 330 REM *** ALPHABETIZE LIS
      TING ***
CA 340 PRINT"{CLR}{CYN}":POKE5
      3280,4:POKE53281,0
QX 350 PRINT"{6 DOWN}{3 RIGHT}
      {RVS}{2 SPACES}SORTING
      {2 SPACES}DATA : PLEASE
       STANDBY{2 SPACES}"
JS 360 GOSUB1570
HA 370 Z$="ZZZZZZZZZZZZZZZZ":E
      =1
GS 380 FORA=1TOC-1:C$=Z$:FORB=
      1TOC-1:IFC$<TB$(B)THEN4
      00
JB 390 C$=TB$(B):D=B
QF 400 NEXT:AB$(E)=C$:E=E+1:TB
      $(D)=Z$:NEXT
BM 410 REM{2 SPACES}**** JACKE
      T NAME = NS$ ***
MA 420 NS$="*****{3 SPACES}REF
      ERENCE{3 SPACES}*****"
SJ 430 REM ***** PRINT ALPHA L
      IST *****
AA 440 PRINT"{CLR}":POKE 53280
      ,5:POKE53281,0
GR 450 PRINT"{6 DOWN}{2 RIGHT}
      {RVS}{2 SPACES}PRINTING
       JACKET : PLEASE STANDB
      Y{2 SPACES}"
MA 460 GOSUB1510
EP 470 DD=0:CD=INT(C/2):OPEN1,
      4
JS 480 FOR CR=1TO2
FS 490 PRINT#1,CHR$(10):REM LI
      NEFEED
XA 500 NEXT CR
JE 510 TL$="{80}"
FS 520 PRINT#1,TAB(2);:FOR TL=
      1 TO 72:PRINT#1,TL$;:NE
      XTTL:PRINT#1," CUT"
KC 530 GOSUB1130:GOSUB1140
RE 540 GOSUB1130
DC 550 PRINT#1,CHR$(14);NS$;CH
      R$(15);:REM 14 DOUBLE W
      IDTH 15 SINGLE
JG 560 GOSUB1140
PD 570 FOR LE=1TO2
RG 580 GOSUB1130:GOSUB1140
AD 590 NEXT LE
MK 600 GOSUB1130
FX 610 PRINT#1,TAB(15);CM$;DN$
      ;SPC(5);DT$;:GOSUB1140:
      GOSUB1160
CJ 620 IF C>32 THEN790
QA 630 REM ** PRINT : < 32 PRO
      GRAMS **
HC 640 FORDD=1TOCD:GOSUB1130
JE 650 PRINT#1,CHR$(16);CHR$(5
      0);CHR$(48);CM$;AB$(DD)
      ;:REM PRINT HEAD POSITI
      ON
KS 660 PRINT#1,CHR$(16);CHR$(5
      2);CHR$(53);CM$;AB$(CD+
```

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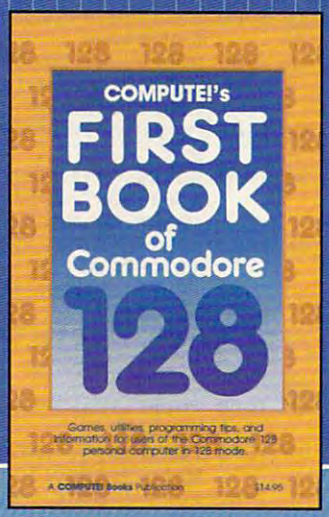

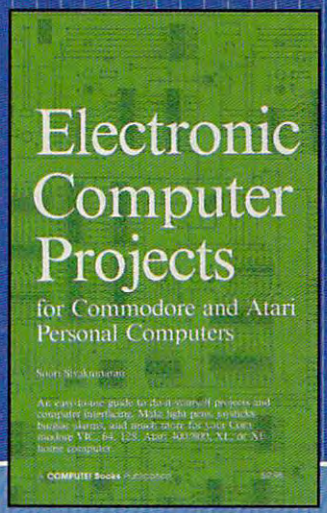

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```
      DD);:GOSUB1140
MC 670 REM PRINT HEAD POSITION
AE 680 NEXT DD
KB 690 GOSUB1130:GOSUB1140:DD=
      DD+1
FR 700 IF DD>17 THEN720
JF 710 GOTO690
XB 720 GOSUB1220
QF 730 FOR SL=1TO29
FK 740 GOSUB1200:GOSUB1210
AE 750 NEXT SL
FE 760 GOSUB1240
HG 770 GOSUB1260
SE 780 REM ** PRINT : > 32 PRO
      GRAMS **
BB 790 FORDD=1TO16:GOSUB1130
RX 800 PRINT#1,CHR$(16);CHR$(5
      0);CHR$(48);CM$;AB$(DD)
      ;:REM PRINT HEAD POSITI
      ON
QM 810 PRINT#1,CHR$(16);CHR$(5
      2);CHR$(53);CM$;AB$(DD+
      16);:GOSUB1140
KF 820 REM PRINT HEAD POSITION
CR 830 NEXT DD
BB 840 GOSUB1130:GOSUB1140
GJ 850 GOSUB1220
HG 860 GOSUB1200:GOSUB1210
FM 870 CX=(C-33)/2:CZ=CX+32
QD 880 FORDD=33TOCZ:GOSUB1200
BE 890 PRINT#1,CHR$(16);CHR$(5
      0);CHR$(48);CM$;AB$(DD)
      ;:REM PRINT HEAD POSITI
      ON
JQ 900 PRINT#1,CHR$(16);CHR$(5
      2);CHR$(48);CM$;AB$(DD+
      CX);:GOSUB1210
AD 910 REM PRINT HEAD POSITION
GC 920 NEXT DD
XH 930 GOSUB1200:GOSUB1210:DD=
      DD+1
JB 940 IF DD>60 THEN960
FD 950 GOTO930
AG 960 GOSUB1240:GOSUB1260
RG 970 REM *** CLOSING REMARKS
       ***
PA 980 PRINT"{CLR}{CYN}":POKE5
      3280,9:POKE53281,0
CC 990 PRINT"{6 DOWN}{2 RIGHT}
      {RVS}{2 SPACES}ALPHABET
      IZED DISK COVER COMPLET
      E{2 SPACES}"
MH 1000 GOSUB1460
QC 1010 PRINT"{5 DOWN}
      {2 RIGHT}{2 SPACES}DO
      {SPACE}YOU WANT ANOTHE
      R DISK COVER :"
RX 1020 INPUT"{6 RIGHT}'Y' OR
      {SPACE}'N' THEN <RETUR
      N>";AG$
FC 1030 FOR DD=0TO144:AB$(DD)=
      "":NEXTDD
BX 1040 IF AG$<>"Y"THEN1070
EP 1050 PRINT"{CLR}{7}":POKE53
      280,14:POKE53281,6:GOT
      O70
FP 1060 REM ** TERMINATE PROGR
      AM **
HC 1070 PRINT"{CLR}{CYN}":POKE
      53280,7:POKE53281,11
BP 1080 PRINT"{8 DOWN}
      {8 RIGHT}{WHT}{RVS}
      {2 SPACES}PROGRAM TERM
      INATED !{2 SPACES}"
FJ 1090 GOSUB1410
EJ 1100 FOR WT=1TO 1000:NEXT W
      T
GE 1110 PRINT"{CLR}{7}":POKE53
      280,14:POKE53281,6:END
RS 1120 REM *** DISK JACKET OU
      TLINE ***
SA 1130 PRINT#1,"{2 SPACES}{J}
      {7 SPACES}{G}*";:RETUR
      N
EM 1140 PRINT#1,CHR$(16);CHR$(
      54);CHR$(52);"*{M}
      {7 SPACES}{L}":RETURN
KE 1150 REM PRINT HEAD POSITIO
      N
JB 1160 PRINT#1,"{2 SPACES}{J}
      {7 SPACES}{G}*";
HQ 1170 PRINT#1,TAB(15);"
      {20 U}";:
JS 1180 PRINT#1,CHR$(16);CHR$(
      54);CHR$(52);"*{M}
      {7 SPACES}{L}":RETURN
FB 1190 REM PRINT HEAD POSITIO
      N
MP 1200 PRINT#1,"{10 SPACES}
      {J}";:RETURN:
CS 1210 PRINT#1,CHR$(16);CHR$(
      54);CHR$(53);"{L}":RET
      URN:REM PRINT HEAD POS
      ITION
GS 1220 CL$="C"
BD 1230 PRINT#1,TAB(2);:FOR CL
      =1 TO 72:PRINT#1,CL$;:
      NEXTCL:PRINT#1," FOLD"
      :RETURN
XR 1240 LL$="{U}"
DS 1250 PRINT#1,TAB(10);:FOR L
      L=1 TO 56:PRINT#1,LL$;
      :NEXTLL:PRINT#1," CUT"
      :RETURN
MR 1260 PRINT#1:FOR CR=1TO3
KM 1270 PRINT#1,CHR$(10)
DG 1280 NEXT CR:CLOSE1:GOTO980
DE 1290 REM ** MENU TOO LONG T
      O LIST **
FS 1300 REM ** CAN ONLY LIST 8
      8 PGMS **
HR 1310 PRINT"{CLR}{CYN}":POKE
      53280,1:POKE53281,7
BJ 1320 PRINT"{5 DOWN}";SPC(10
      );"{CYN}TOO{2 SPACES}M
      ANY{2 SPACES}PROGRAMS"
CA 1330 PRINT SPC(10);"{CYN} T
      O LIST ON JACKET"
DR 1340 GOSUB1460
JG 1350 PRINT"{3 DOWN}";SPC(8)
      ;"{RED}PRINT{2 SPACES}
      THOSE{2 SPACES}THAT
      {2 SPACES}FIT?"
MC 1360 PRINT SPC(9);"({RVS}Y
      {OFF} OR {RVS}N{OFF} T
      HEN <RETURN>)
HE 1370 PRINT"{2 DOWN}";SPC(15
      );:INPUT AW$
FX 1380 IF AW$<>"Y" THEN1070
XR 1390 C=88:RETURN
SG 1400 REM{2 SPACES}**** SOUN
      D SUBROUTINES ***
SA 1410 REM{2 SPACES}##### BUZ
      ZER #####
KR 1420 POKES,240
GF 1430 H=54273:S=54278:W=5427
      6:V=54296
BK 1440 POKEV,15:POKEH,5:POKEW
      ,33:FORT=0TO500:NEXT
CP 1450 FORT=H-1TOV:POKET,0:NE
      XT:RETURN
QM 1460 REM{2 SPACES}##### DON
      G #####
MG 1470 H=54273:S=54278:W=5427
      6:V=54296
QG 1480 POKES-1,9:POKEH,36:POK
      ES+9,16:POKEV,15:FORU=
      1TO4:POKEW,21:FORT=0TO
      500
EM 1490 NEXT:POKEW,20:NEXT
KJ 1500 FORT=H-1TOV:POKET,0:NE
      XT:RETURN
XF 1510 REM{2 SPACES}##### DIN
      G #####
MJ 1520 H=54273:S=54278:W=5427
      6:V=54296
XQ 1530 FOR AA=1TO3
CE 1540 POKEV,15:POKEH,40:POKE
      S-1,9:POKEW,17:FORT=1T
      O500:NEXTT
AK 1550 FORT=H-1TOV:POKET,0:NE
      XT
SX 1560 NEXTAA:RETURN
JD 1570 REM{2 SPACES}##### BIN
      G-BONG #####
JX 1580 H=54273:S=54278:W=5427
      6:V=54296
DE 1590 POKEV,15:POKES-1,88:PO
      KES,89:POKEW-1,1:FORU=
      1TO6:POKEW,65
XR 1600 POKEH,20:FORT=0TO120:N
      EXT
BG 1610 POKEW,64:POKEH,50:POKE
      W,65:FORT=0TO120:NEXT:
      POKEW,64:NEXT
KA 1620 FORT=H-1TOV:POKET,0:NE
      XT:RETURN
JD 1630 REM{2 SPACES}##### BEL
      LS #####
XS 1640 V=54296:W=54276:POKEW+
      1,96
BQ 1650 POKEW+1,9
DM 1660 POKEV,15:FORL=1TO5:POK
      EW,21
PX 1670 POKEW-3,99*RND(1):POKE
      W+11,99*RND(1)
XK 1680 FORT=1TO600:NEXT:POKEW
      ,20:NEXT
XD 1690 FORI=W-4TOV:POKEI,0:NE
      XT:RETURN
```

Program 2: Jacket Lister for Atari 400, 800, XL, and XE

Version by Kevin Mykytyn, Editorial Programmer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
DC 10 DIM DATE$(12),UPPER$(1
      ),K$(1),DN$(10),DIR$(1
      7*88),T$(20),NAME$(26)
      ,SPC$(80)
FB 15 FOR A=1 TO 80:SPC$(A,A
      )=" ":NEXT A:NAME$="**
      *** REFERENCE DISK ***
      **":REM THIS MUST BE 2
      6 CHARACTERS
JM 20 OPEN #4,4,0,"K:"
KD 100 GRAPHICS 0:POKE 710,1
      5:POKE 709,0:POKE 712
      ,55
FO 110 POSITION 10,6:PRINT "
      ■WHAT IS TODAY'S DATE
      ■"
JG 120 POSITION 6,8:PRINT "■
      ENTER MO/DY/YR THEN <
      RETURN>■"
PH 130 POSITION 15,13:INPUT
      DATE$:PRINT "{CLEAR}"
      :POKE 752,1
GA 160 PRINT "{CLEAR}":POSIT
      ION 2,5:PRINT "WHICH
      DISK DRIVE DO YOU WAN
      T TO LIST":POSITION 1
      7,7:PRINT "(1-9)"
FE 170 GOSUB 1000:IF K$<"1"
      OR K$>"9" THEN 170
HO 180 DN$="D1:*.*":DN$(2,2)
      =K$
JP 190 PRINT "{CLEAR}":POSIT
      ION 3,8:PRINT "■READ
```

```
      ING DATA : PLEASE STA
      NDBY ":POKE 712,136
IF 200 TRAP 220:FILE=1:OPEN
      #1,6,0,DN$
FM 210 INPUT #1,T$:DIR$((FIL
      E-1)*17+1,FILE*17)=T$
      :FILE=FILE+1:IF FILE<
      90 THEN 210
MJ 220 FILE=FILE-2:TRAP 6500
      0:CLOSE #1:IF PEEK(19
      5)=136 OR FILE=88 THE
      N 250
LG 230 PRINT "{CLEAR}":POSIT
      ION 12,11:PRINT "DISK
       ERROR #";PEEK(195)
PN 240 POSITION 8,13:PRINT "
      PRESS ANY KEY TO RETR
      Y":GOSUB 1000:GOTO 19
      0
BH 250 POSITION 5,8:PRINT "S
      ORTING":POKE 712,200
NJ 260 G=INT(FILE/2)
GH 265 N=0:FOR I=1 TO FILE-G
CC 270 IF DIR$((I-1)*17+1,I*
      17)<=DIR$((I+G-1)*17+
      1,(I+G)*17) THEN 290
BJ 280 T$=DIR$((I-1)*17+1,I*
      17):DIR$((I-1)*17+1,I
      *17)=DIR$((I+G-1)*17+
      1,(I+G)*17):DIR$((I+G
      -1)*17+1,(I+G)*17)=T$
      :N=1
HE 290 NEXT I:IF N=1 THEN 26
      5
ID 300 G=INT(G/2):IF G>=1 TH
      EN 265
AO 310 POSITION 2,8:PRINT "
      PRINTING JACKET : PL
      EASE STANDBY ":POKE
      712,104:OPEN #1,4,4,"
      P:"
MH 320 FOR A=1 TO 3:PRINT #1
      ;CHR$(13):NEXT A
GG 330 GOSUB 3070:PRINT #1;"
       CUT"
NH 340 GOSUB 3000:GOSUB 3010
      :GOSUB 3020
NO 350 GOSUB 3000:PRINT #1;C
      HR$(14);NAME$;CHR$(20
      );:GOSUB 3020:REM 14
      IS DOUBLE WIDTH, 20 I
      S NORMAL WIDTH
DI 360 FOR A=1 TO 2:GOSUB 30
      00:GOSUB 3010:GOSUB 3
      020:NEXT A
HL 370 GOSUB 3000:PRINT #1;S
      PC$(1,22);DATE$;SPC$(
      1,30-LEN(DATE$));:GOS
      UB 3020
HD 380 CD=INT(FILE/2):IF FIL
      E>32 THEN 480
CA 390 FOR DD=1 TO CD:GOSUB
      3000
JK 400 PRINT #1;SPC$(1,8);DI
      R$((DD-1)*17+1,DD*17-
      3);SPC$(1,9);DIR$((CD
      +DD-1)*17+1,(CD+DD)*1
      7-3);SPC$(1,7);
NL 410 GOSUB 3020:NEXT DD
LJ 420 GOSUB 3000:GOSUB 3010
      :GOSUB 3020:DD=DD+1
BM 430 IF DD>17 THEN 450
GH 440 GOTO 420
KC 450 GOSUB 3070:PRINT #1;"
       FOLD"
CJ 460 FOR SL=1 TO 29:GOSUB
       3050:GOSUB 3060:GOSUB
       3065
LK 470 NEXT SL:GOSUB 3090:PR
      INT #1;" CUT":GOTO 20
      00
AA 480 FOR DD=1 TO 16:GOSUB
      3000
GD 490 PRINT #1;SPC$(1,8);DI
      R$((DD-1)*17+1,DD*17-
      3);SPC$(1,9);DIR$((16
      +DD-1)*17+1,(16+DD)*1
      7-3);SPC$(1,7);
NL 500 GOSUB 3020:NEXT DD
NG 510 GOSUB 3000:GOSUB 3010
      :GOSUB 3020
CN 520 GOSUB 3070:PRINT #1;"
       FOLD":GOSUB 3050:GOS
      UB 3060:GOSUB 3065
FA 530 CX=INT((FILE-33)/2):C
      Z=CX+32
GN 540 FOR DD=33 TO CZ:GOSUB
       3050
FG 550 PRINT #1;SPC$(1,9);DI
      R$((DD-1)*17+1,DD*17-
      3);SPC$(1,6);DIR$((DD
      +CX-1)*17+1,(DD+CX)*1
      7-3);SPC$(1,11);"!"
GC 560 NEXT DD
NC 570 GOSUB 3050:GOSUB 3060
      :GOSUB 3065:DD=DD+1
CC 580 IF DD<61 THEN 570
KF 590 GOSUB 3090:PRINT #1;"
       CUT":GOTO 2000
HA 1000 POKE 752,1:GET #4,K:
      K$=CHR$(K):RETURN
KA 2000 FOR CR=1 TO 3:PRINT
      #1;CHR$(13):NEXT CR:
      CLOSE #1
PL 2010 PRINT "{CLEAR}":POSI
      TION 3,10:PRINT "ALP
      HABETIZED DISK COVER
       COMPLETE"
ML 2020 POSITION 3,13:PRINT
      "DO YOU WANT ANOTHER
       DISK COVER?"
DM 2030 GOSUB 1000:IF K$="Y"
       THEN RUN
ME 2040 IF K$<>"N" THEN 2030
KD 2050 PRINT "{CLEAR}
      {2 DOWN}BYE":POKE 75
      2,0:END
OE 3000 PRINT #1;" !
      {8 SPACES}!*";:RETUR
      N
FE 3010 PRINT #1;SPC$(1,52);
      :RETURN
KL 3020 PRINT #1;"*!
      {8 SPACES}!":RETURN
JO 3050 PRINT #1;"
      {10 SPACES}!";:RETURN

FL 3060 PRINT #1;SPC$(1,54);
      :RETURN
GJ 3065 PRINT #1;"!":RETURN
BH 3070 PRINT #1;"  ";:FOR A
      =1 TO 72:PRINT #1;"-
      ";:NEXT A:RETURN
BJ 3090 PRINT #1;"
      {11 SPACES}";:FOR A=1
       TO 54:PRINT #1;"-";
      :NEXT A:RETURN
```

Program 3: Apple II Jacket Lister

Version by Tim Midkiff, Editorial Programmer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
79 10 REM ***** PROGRAM SET UP *
      ****
6D 20 DIM TB$(144),AB$(144),WS(1
      000)
CA 30 HOME : PRINT : PRINT "WHAT
       IS TODAY'S DATE (MO/DY/YR
      )";: INPUT DT$
5F 40 HOME : PRINT : PRINT "WHIC
      H DRIVE DO YOU WANT TO LIS
      T (1/2)";: INPUT D1
AC 50 IF D1 < 1 OR D1 > 2 THEN 4
      0
2B 60 REM ***** READ DISK MENU *
      ****
37 70 GOSUB 1320: HOME : PRINT "
      READING DATA : PLEASE STAN
      DBY"
78 80 FOR I = 768 TO 779: READ A
      : POKE I,A: NEXT :P1 = 0:P
      2 = 0:A$ = "":C = 0
60 90 P1 = WS(0) - WS(0) + PEEK
      (131):P2 = WS(0) - WS(0) +
       PEEK (132)
34 100 POKE 769,P1: POKE 770,P2
AE 110 POKE 54,0: POKE 55,3: POK
      E 56,11: POKE 57,3: CALL
      1002
9A 120 PRINT CHR$ (4);"CATALOG,D
      ";D1
F8 125 PRINT
15 130 POKE 768,173: POKE 769,P1
      : POKE 770,P2
40 140 POKE 54,11: POKE 55,3: PO
      KE 56,0: POKE 57,3: CALL
      1002
71 150 FOR I = 1 TO 4: INPUT A$:
       NEXT :C = 1
B8 160 INPUT A$: IF A$ = "" THEN
       170
C2 165 IF LEFT$ (A$,1) = "*" THE
      N A$ = RIGHT$ (A$, LEN (A
      $) - 1)
38 167 TB$(C) = MID$ (A$,7,18):C
       = C + 1: GOTO 160
D7 170 POKE 54,240: POKE 55,253:
       POKE 56,27: POKE 57,253:
       CALL 1002
3C 180 FOR I = 1 TO C - 1: PRINT
       TB$(I): NEXT
71 190 DATA 141,0,64,238,1,3,208
      ,3
EA 200 DATA 238,2,3,96
CF 340 IF C > 88 THEN GOSUB 1260
12 350 REM *** ALPHABETIZE LISTI
      NG ***
F9 360 GOSUB 1320: HOME : PRINT
      "SORTING DATA : PLEASE ST
      ANDBY"
4A 370 Z$ = CHR$ (255):E = 1
7D 380 FOR A = 1 TO C - 1:C$ = Z
      $: FOR B = 1 TO C - 1: IF
       C$ < TB$(B) THEN 400
04 390 C$ = TB$(B):D = B
52 400 NEXT :AB$(E) = C$:E = E +
       1:TB$(D) = Z$: NEXT
07 410 REM **** JACKET NAME = NS
      $ ****
6D 420 NS$ = "*****   REFERENCE
       *****"
62 430 REM ***** PRINT ALPHA LIS
      T *****
CB 440 GOSUB 1320: HOME : PRINT
      "PRINTING JACKET : PLEASE
       STANDBY"
A2 450 DD = 0:CD = INT (C / 2):
      PRINT CHR$ (4);"PR#1": PR
      INT CHR$ (9);"80N"
EA 460 FOR CR = 1 TO 2
8B 470 PRINT CHR$ (10): REM LINE
      FEED
0C 480 NEXT
97 510 TL$ = "-"
7A 520 PRINT TAB( 4);: FOR TL =
      1 TO 71: PRINT TL$;: NEXT
      : PRINT " CUT"
2D 530 GOSUB 1100: GOSUB 1110
CB 540 GOSUB 1100
D6 550 POKE 36, INT (40 - LEN (N
      S$) / 2): PRINT NS$;
D3 560 GOSUB 1110
A9 570 FOR LE = 1 TO 2
```

```
37 580 GOSUB 1100: GOSUB 1110
0F 590 NEXT
C4 600 GOSUB 1100
D1 610 POKE 36,36: PRINT DT$;: G
      OSUB 1110: GOSUB 1120
F3 620 IF C > 32 THEN 790
A6 630 REM *** PRINT : < 32 PROG
      RAMS ***
19 640 FOR DD = 1 TO CD: GOSUB 1
      100
96 650 POKE 36,20: PRINT AB$(DD)
      ;
B8 660 POKE 36,45: PRINT AB$(CD
      + DD);
D6 670 GOSUB 1110
0E 680 NEXT
B5 690 GOSUB 1100: GOSUB 1110:DD
       = DD + 1
A8 700 IF DD > 17 THEN 720
1E 710 GOTO 690
E5 720 GOSUB 1170
20 730 FOR SL = 1 TO 29
95 740 GOSUB 1150: GOSUB 1160
09 750 NEXT
F5 760 GOSUB 1190
D9 770 GOSUB 1210
B2 780 REM *** PRINT : > 32 PROG
      RAMS ***
41 790 FOR DD = 1 TO 16: GOSUB 1
      100
8E 800 POKE 36,20: PRINT AB$(DD)
      ;
92 810 POKE 36,45: PRINT AB$(DD
      + 16);
CE 820 GOSUB 1110
06 830 NEXT
32 840 GOSUB 1100: GOSUB 1110
EC 850 GOSUB 1170
9A 860 GOSUB 1150: GOSUB 1160
77 870 CX = (C - 33) / 2:CZ = CX
       + 32
F1 880 FOR DD = 33 TO CZ: GOSUB
      1150
A0 890 POKE 36,20: PRINT AB$(DD)
      ;
16 900 POKE 36,40: PRINT AB$(DD
      + CX);
E1 910 GOSUB 1160
05 920 NEXT
11 930 GOSUB 1150: GOSUB 1160:DD
       = DD + 1
2C 940 IF DD > 60 THEN 960
A3 950 GOTO 930
63 960 GOSUB 1190: GOSUB 1210
1F 970 REM *** CLOSING REMARKS *
      **
34 980 PRINT CHR$ (4);"PR#0"
30 990 GOSUB 1320: HOME : PRINT
      "ALPHABETIZED DISK COVER
      COMPLETE"
13 1000 PRINT : PRINT "DO YOU WA
      NT ANOTHER DISK COVER (Y
      /N)";: INPUT AG$
77 1010 FOR DD = 0 TO 144:AB$(DD
      ) = "": NEXT : RESTORE
0B 1020 IF AG$ < > "Y" THEN 1050
11 1030 GOTO 40
5A 1040 REM ** TERMINATE PROGRAM
       **
2A 1050 HOME : PRINT "PROGRAM TE
      RMINATED"
5F 1060 GOSUB 1320
AB 1070 FOR WT = 1 TO 1000: NEXT
FF 1080 HOME : END
1A 1090 REM *** DISK JACKET OUTL
      INE ***
FE 1100 PRINT "  !          ! *";:
      RETURN
F9 1110 POKE 36,64: PRINT "* !
            !": RETURN
42 1120 PRINT "  !          ! *";
FC 1130 POKE 36,29: PRINT "-----
      ---------------";
#6 1140 POKE 36,64: PRINT "* !
            !": RETURN
55 1150 PRINT "            !";: RE
      TURN
DC 1160 POKE 36,66: PRINT "!": R
      ETURN
DF 1170 CL$ = "-"
6E 1180 PRINT TAB( 4);: FOR CL =
       1 TO 71: PRINT CL$;: NE
      XT : PRINT " FOLD": RETU
      RN
78 1190 LL$ = "-"
D3 1200 PRINT TAB( 12);: FOR LL
      = 1 TO 55: PRINT LL$;: N
      EXT : PRINT " CUT": RETU
      RN
F9 1210 PRINT : FOR CR = 1 TO 3
B0 1220 PRINT CHR$ (10): REM LIN
      EFEED
9C 1230 NEXT : GOTO 980
F2 1240 REM *** MENU TOO LONG TO
       LIST ***
7C 1250 REM *** CAN ONLY LIST 88
       PGMS ***
1F 1260 GOSUB 1320: HOME : PRINT
       "TOO MANY PROGRAMS TO L
      IST ON JACKET"
F6 1270 PRINT : PRINT "PRINT THO
      SE THAT FIT (Y/N)";: INP
      UT AW$
2C 1280 IF AW$ < > "Y" THEN 1050
8B 1290 C = 88: RETURN
47 1300 RE
48 1310 REM ***** SOUND ROUTINE
      *****
AB 1320 FOR I = 1 TO 10:A = PEEK
       ( - 16336): NEXT : RETU
      RN
```

Program 4: ProDOS Modifications for Program 3

Refer to the article for instructions on adding these replacement lines.

```
B3 80 D$ = CHR$ (4): PRINT D$;"P
      REFIX,D";D1: PRINT D$;"PRE
      FIX"
C2 90 INPUT P$
C3 100 PRINT D$;"OPEN ";P$;",TDI
      R"
30 110 PRINT D$;"READ ";P$
63 120 FOR I = 1 TO 3: INPUT A$:
       NEXT :C = 1
DC 130 INPUT A$: IF LEN (A$) > 0
       THEN TB$(C) = MID$ (A$,2
      ,15): PRINT TB$(C):C = C
      + 1: GOTO 130
79 140 PRINT D$;"CLOSE ";P$
```

Program 5: IBM PC/PCjr Jacket Lister

Version by Tim Midkiff, Editorial Programmer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
DF 10 KEY OFF:WIDTH 80:DEF SEG=0
      :POKE 1047,PEEK(1047) OR 6
      4
0B 20 DIM TB$(144):DIM AB$(144)
EJ 30 CLS:PRINT:PRINT "What is t
      oday's date (Mo/Dy/Yr)";:I
      NPUT DT$
GF 40 CLS:PRINT:PRINT "Which dis
      k drive do you want to lis
      t (A/B)";:INPUT DI$:IF DI$
      <>"A" AND DI$<>"B" THEN 40
LG 50 REM *** READ DISK MENU ***
KL 60 BEEP:CLS:PRINT "READING DA
      TA : PLEASE STANDBY"
CP 70 FSPEC$=DI$+":*.*"
EG 80 HEAD=1050:TAIL=1052:BUFFER
      =1054:C=0
LK 90 ON ERROR GOTO 110
OC 100 FILES FSPEC$:ON ERROR GOT
      O 0:GOTO 120
IM 110 BEEP:CLS:PRINT "CANNOT RE
      AD DIRECTORY":ON ERROR GO
      TO 0:END
GK 120 DIM TT$(24):LOCATE 3,1:RO
      WS=0
OH 130 POKE HEAD,30:POKE TAIL,34
      :POKE BUFFER,0:POKE BUFFE
      R+1,79:POKE BUFFER+2,13:P
      OKE BUFFER+3,28
HC 140 LINE INPUT TT$(ROWS):IF T
      T$(ROWS)<>"" THEN ROWS=RO
      WS+1:GOTO 130
EH 150 ROWS=ROWS-1:FOR I=0 TO RO
      WS:FOR J=0 TO 3
GB 160 T$=MID$(TT$(I),J*18+1,12)
KC 170 IF T$<>"" THEN TB$(C)=T$:
      C=C+1
PK 180 NEXT J:NEXT I:ERASE TT$
CD 190 IF C>88 THEN GOSUB 1260
CL 200 REM *** ALPHABETIZE LISTI
      NG ***
EB 210 BEEP:CLS:PRINT "SORTING D
      ATA : PLEASE STANDDY"
FF 220 Z$=CHR$(255):E=1
QK 230 FOR A=0 TO C-1:C$=Z$:FOR
      B=0 TO C-1:IF C$<TB$(B) T
      HEN 250
BF 240 C$=TB$(B):D=B
FE 250 NEXT:AB$(E)=C$:E=E+1:TB$(
      D)=Z$:NEXT
IE 410 REM *** JACKET NAME = NS$
       ***
CN 420 NS$="*****  REFERENCE  **
      ***"
PD 430 REM *** PRINT ALPHA LIST
      ***
GO 440 BEEP:CLS:PRINT "PRINTING
      JACKET : PLEASE STANDBY"
EF 450 DD=0:CD=INT(C/2)
NL 460 FOR CR=1 TO 2
CA 470 LPRINT CHR$(10):REM LINEF
      EED
CE 480 NEXT CR
GB 510 TL$="-"
OC 520 LPRINT TAB(3);:FOR TL=1 T
      O 71:LPRINT TL$;:NEXT TL:
      LPRINT " CUT"
MF 530 GOSUB 1100:GOSUB 1110
OA 540 GOSUB 1100
IA 550 LPRINT TAB(INT(39-LEN(NS$
      )/2));NS$;
PB 560 GOSUB 1110
KN 570 FOR LE=1 TO 2
NP 580 GOSUB 1100:GOSUB 1110
PC 590 NEXT LE
OJ 600 GOSUB 1100
EA 610 LPRINT TAB(36);CM$;DT$;:G
      OSUB 1110:GOSUB 1120
KN 620 IF C>32 THEN 790
BM 630 REM *** PRINT : < 32 PROG
      RAMS ***
HO 640 FOR DD=1 TO CD:GOSUB 1100
FB 650 LPRINT TAB(20);AB$(DD);
NG 660 LPRINT TAB(45);AB$(CD+DD)
      ;
PE 670 GOSUB 1110
JB 680 NEXT DD
CA 690 GOSUB 1100:GOSUB 1110:DD=
      DD+1
FC 700 IF DD>17 THEN 720
KJ 710 GOTO 690
EJ 720 GOSUB 1170
CO 730 FOR SL=1 TO 29
IC 740 GOSUB 1150:GOSUB 1160
```

```
IP 750 NEXT SL
GL 760 GOSUB 1190
AB 770 GOSUB 1210
EB 780 REM *** PRINT : > 32 PROG
       RAMS ***
FL 790 FOR DD=1 TO 16:GOSUB 1100
FJ 800 LPRINT TAB(20);AB$(DD);
GN 810 LPRINT TAB(45);AB$(DD+16)
       ;
PM 820 GOSUB 1110
JO 830 NEXT DD
NK 840 GOSUB 1100:GOSUB 1110
EA 850 GOSUB 1170
IH 860 GOSUB 1150:GOSUB 1160
KA 870 CX=(C-33)/2:CZ=CX+32
GA 880 FOR DD=33 TO CZ:GOSUB 115
       0
GL 890 LPRINT TAB(20);AB$(DD);
QK 900 LPRINT TAB(45);AB$(DD+CX)
       ;
DM 910 GOSUB 1160
JN 920 NEXT DD
NA 930 GOSUB 1150:GOSUB 1160:DD=
       DD+1
LF 940 IF DD>60 THEN 960
IP 950 GOTO 930
GL 960 GOSUB 1190:GOSUB 1210
EA 970 REM *** CLOSING REMARKS *
       **
OM 980 BEEP:CLS:PRINT "ALPHABETI
       ZED DISK COVER COMPLETE"
PI 990 PRINT:PRINT "Do you want
       another disk cover (Y/N)"
       ;:INPUT AG$
IN 1000 FOR DD=0 TO 144:AB$(DD)=
       "":NEXT DD
LN 1010 IF AG$<>"Y" THEN 1040
MJ 1020 CLS:GOTO 40
QK 1030 REM ** TERMINATE PROGRAM
        **
HF 1040 BEEP:CLS:PRINT "PROGRAM
       TERMINATED"
NE 1050 FOR WT=1 TO 1000:NEXT WT
BH 1060 CLS:END
OA 1090 REM *** DISK JACKET OUTL
       INE ***
IP 1100 LPRINT " ¦        ¦ *";:R
       ETURN
DC 1110 LPRINT TAB(64);"* ¦
          ¦";:RETURN
BD 1120 LPRINT " ¦        ¦ *";
QN 1130 LPRINT TAB(29);"--------
       ------------";
EL 1140 LPRINT TAB(64);"* ¦
          ¦";:RETURN
CC 1150 LPRINT "          ¦";:RET
       URN
KJ 1160 LPRINT TAB(66);"¦";:RETUR
       N
GO 1170 CL$="-"
PJ 1180 LPRINT TAB(3);:FOR CL=1
       TO 71:LPRINT CL$;:NEXT C
       L:LPRINT " FOLD":RETURN
KK 1190 LL$="-"
OF 1200 LPRINT TAB(11);:FOR LL=1
        TO 55:LPRINT LL$;:NEXT
       LL:LPRINT" CUT":RETURN
DN 1210 LPRINT:FOR CR=1 TO 3
CP 1220 LPRINT CHR$(10):REM LINE
       FEED
LB 1230 NEXT CR:GOTO 980
DF 1240 REM ** MENU TOO LONG TO
       LIST **
IE 1250 REM ** CAN ONLY LIST 88
       PGMS **
DK 1260 BEEP:CLS:PRINT "TOO MANY
        PROGRAMS TO LIST ON JAC
       KET"
CC 1270 PRINT:PRINT "Print those
        that fit (Y/N)";:INPUT
       AW$
GG 1280 IF AW$<>"Y" THEN 1040
DD 1290 C=88:RETURN
```


64 Encryptor

James Pettus

This BASIC utility will hide your programs from prying eyes. It encrypts a BASIC program in memory so that it can be neither stopped while running nor listed. The program also includes an option for restoring things back to normal if you wish. A secret ID code even prevents people who have the Encryptor program themselves from unlocking your secrets.

Part of the fun of computing is sharing one of your programs with others. At times, however, you may want to keep things confidential. For example, you might have written a finance program which contains DATA statements revealing your entire personal portfolio. You might want to prevent others from looking at this information. The LIST command ordinarily displays the contents of any BASIC program.

However, you can use "64 Encryptor" to encrypt any BASIC program to prevent other people from deciphering it. Though the encrypted program can't be listed or examined, it still runs normally. And since each copy of Encryptor has a unique ID code, your protected program should be safe even from others who have 64 Encryptor themselves.

A Special Random Identifier

Type in and save the BASIC loader program listed below. You may save it with any filename you like, except ENCRYPTOR (that's what the BASIC loader will name the machine language file that it creates). When the program runs, it spends a few seconds creating the Encryptor machine language routine in the memory area starting at 49152, then it saves the machine language to disk. To have the Encryptor file saved to tape instead, change the DV=8 in line 80 to DV=1.

When the loader writes Encryptor into high memory, it embeds an identifier mark within the program. The identifier is randomly selected and will be different each time you run the loader. This feature makes a program encrypted with one copy of Encryptor incompatible with any other copy of Encryptor—even another copy created on the same 64. As a result, you don't have to worry that other people with this program can decrypt your programs.

To encrypt or decrypt a BASIC program, follow these steps:

• Load Encryptor with LOAD"ENCRYPTOR",8,1 for disk or LOAD "ENCRYPTOR",1,1 for tape.

- Type NEW and press RETURN.
- Load the BASIC program you wish to encrypt or decrypt.
- To encrypt a program, type SYS 49152 and press RETURN. When the cursor returns, be sure to immediately save a copy of the encrypted version using a different filename.
- To decrypt a program, type SYS 49155 and press RETURN.

An encrypted program runs normally, but cannot easily be examined by the person using it. When you run an encrypted program, a built-in machine language subroutine is called to decrypt the actual program data and run it. At the same time, Encryptor disables the LIST command and the RUN/STOP–RESTORE key combination. You should make sure that the program being encrypted does not contain any references to the ROM routine at 65505 ($FFE1), which tests to see whether the RUN/STOP key has been pressed. The program to be protected also should not offer the user the option of exiting the program.

Because the BASIC loader program creates a different Encryptor each time it is run, you should take care to make a backup copy of each Encryptor that you create. (You should also keep an unprotected copy of any important programs you encrypt.) If you accidentally erase your only copy of Encryptor, you will not be able to decrypt any programs protected with that version. Of course, to keep your programs secure, you should not give anyone else a copy of your version of Encryptor.

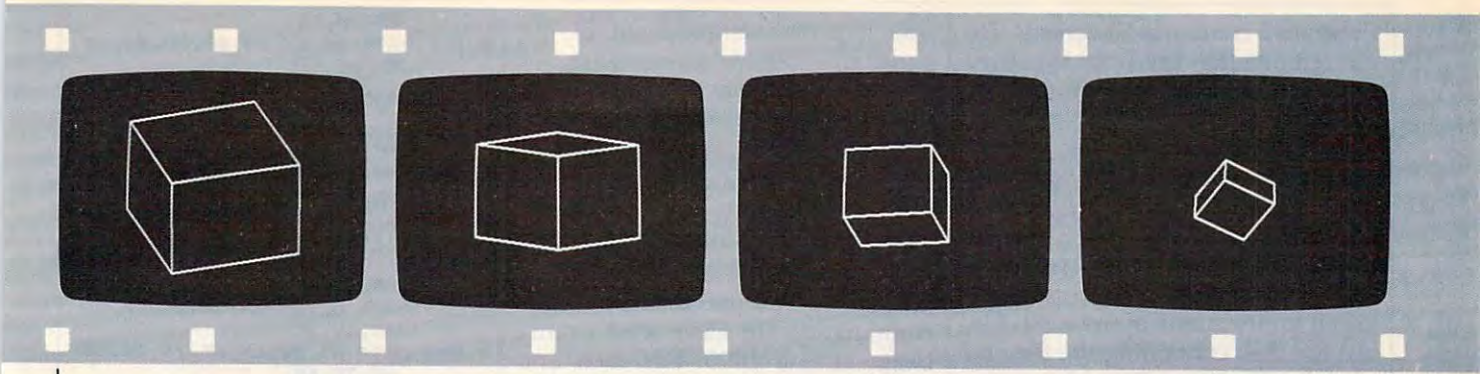
Works With BASIC/ Machine Language Combinations

Some BASIC programs require that you relocate the start of BASIC text before you load and run them, others leave little memory for variables (meaning you should not enlarge the program), and some BASIC programs cannot be relocated because they have ML routines appended to the end of BASIC text. Encryptor has been designed with all these conditions in mind. The ML routine included in an encrypted program contains no absolute addresses, and it moves program data down in memory after it has done its work, so nonrelocating BASIC programs can still be safely encrypted.

64 Encryptor

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
GH 10 PRINTCHR$(147)CHR$(155)"
      PLEASE WAIT":I=49152
HG 20 READA:IFA=256THEN40
HJ 30 POKEI,A:CK=CK+A:I=I+1:GO
      TO20
MC 40 IFCK<>66816THENPRINT"ERR
      OR IN DATA STATEMENTS.":
      STOP
JG 50 POKEI+4574,255
FQ 60 POKEI+4577,128:FORA=I-31
      7TOI-308:POKEA,PEEK(I+45
      86):NEXT:POKEI+4577,0
DB 70 POKEI+4574,0
HB 80 DV=8:SYS57812"ENCRYPTOR"
      ,DV
XG 90 PRINT"SAVING ENCRYPTOR"
JM 100 POKE251,0:POKE252,192:P
      OKE780,251:POKE782,I/25
      6:POKE781,I-PEEK(782)*2
      56
PH 110 SYS65496:PRINT"ENCRYPTO
      R CREATED.":END
EE 120 DATA76,254,192,76,28,19
      3,167,43
RH 130 DATA135,251,135,253,167
      ,44,135,254
EE 140 DATA232,134,252,160,0,1
      77,251,145
AF 150 DATA253,230,251,230,253
      ,208,4,230
KH 160 DATA252,230,254,167,252
      ,197,46,208
SQ 170 DATA236,167,251,197,45,
      208,230,198
RF 180 DATA46,96,167,44,135,17
      5,167,43
AM 190 DATA56,233,1,176,2,198,
      175,133
SF 200 DATA174,167,46,135,252,
      232,134,254
AJ 210 DATA167,45,56,233,1,176
      ,4,198
GC 220 DATA252,198,254,133,251
      ,133,253,160
HC 230 DATA0,177,251,145,253,1
      98,251,198
GA 240 DATA253,167,251,201,255
      ,208,4,198
MB 250 DATA252,198,254,167,252
      ,197,175,208
KC 260 DATA232,167,251,197,174
      ,208,226,230
QH 270 DATA46,96,167,43,135,25
      1,167,44
RJ 280 DATA232,134,252,160,0,1
      62,8,177
FR 290 DATA251,10,102,255,202,
      208,250,167
EQ 300 DATA255,145,251,230,251
      ,208,2,230
EQ 310 DATA252,167,252,197,46,
      208,230,167
CD 320 DATA251,197,45,208,224,
      96,169,0
CX 330 DATA133,255,160,165,191
      ,79,192,69
RC 340 DATA255,133,255,209,43,
      208,6,200
PB 350 DATA192,175,208,240,96,
      169,199,160
QX 360 DATA192,32,30,171,108,2
      ,160,69
KP 370 DATA78,67,82,89,80,84,7
      9,82
DQ 380 DATA32,73,46,68,46,32,7
      7,73
AK 390 DATA83,77,65,84,67,72,0
      ,169
DR 400 DATA0,133,255,160,165,1
      91,79,192
GM 410 DATA69,255,133,255,145,
      43,200,192
CX 420 DATA175,208,242,96,0,0,
      0,0
GC 430 DATA0,0,0,0,0,0,32,50
JC 440 DATA192,32,122,192,160,
      0,191,48
GG 450 DATA193,145,43,200,208,
      248,32,223
QM 460 DATA192,32,89,166,32,51
      ,165,104
FD 470 DATA104,108,2,160,32,16
      6,192,32
EA 480 DATA122,192,32,6,192,32
      ,89,166
AC 490 DATA32,51,165,104,104,1
      08,2,160
RR 500 DATA25,8,0,0,158,194,40
      ,52
MS 510 DATA51,41,170,50,53,54,
      172,194
JA 520 DATA40,52,52,41,170,50,
      54,0
XF 530 DATA0,0,167,43,135,251,
      167,44
BJ 540 DATA232,134,252,160,0,1
      62,8,177
FR 550 DATA251,10,102,255,202,
      208,250,167
PR 560 DATA255,145,251,230,251
      ,208,2,230
HR 570 DATA252,167,252,197,46,
      208,230,167
JR 580 DATA251,197,45,208,224,
      160,84,177
MQ 590 DATA43,153,172,1,200,19
      2,165,208
AH 600 DATA246,76,0,2,167,43,1
      35,251
DP 610 DATA135,253,167,44,135,
      254,232,134
RS 620 DATA252,160,0,177,251,1
      45,253,230
XB 630 DATA251,230,253,208,4,2
      30,252,230
PX 640 DATA254,167,252,197,46,
      208,236,167
DF 650 DATA251,197,45,208,230,
      198,46,32
PB 660 DATA89,166,32,51,165,12
      0,162,255
JJ 670 DATA169,182,143,6,3,169
      ,234,143
AG 680 DATA40,3,169,246,143,41
      ,3,169
FK 690 DATA193,143,24,3,169,25
      4,143,25
PG 700 DATA3,88,76,174,167,0,0
      ,0
RP 710 DATA0,0,0,0,0,0,0,0
KM 720 DATA0,0,0,0,0,0,0,0
FK 730 DATA0,0,0,0,0,0,0,0
BJ 740 DATA0,0,0,0,0,0,0,0
RJ 750 DATA0,0,0,0,0,0,0,0
KX 760 DATA0,0,0,0,0,0,0,0
FS 770 DATA0,0,0,0,0,0,0,0
BR 780 DATA0,0,0,0,0,0,0,0
RR 790 DATA0,0,0,0,0,0,0,0
MR 800 DATA0,0,0,0,0,0,0,0
GQ 810 DATA0,0,0,0,0,0,0,0
HF 820 DATA0,256
```



With ANIMATE you can create rapidly moving 3-D graphics within a BASIC program. This series of photos shows only 4 of the 95 screens used for the CUBE display, which creates a rotating cube that moves toward and away from the viewer.

Easy IBM Full-Screen Animation

Paul W. Carlson

Now you can write BASIC programs with smooth, flicker-free animated displays that move at machine language speeds. For the IBM PC/PCjr. BASICA and a color/graphics card are required to use the program on the PC. Cartridge BASIC is required for the PCjr.

Full-screen animation is achieved by rapidly displaying a series of high-resolution screens on the video display. Producing realistic animation using BASIC is very difficult because of the time required to create the screen images. The creation of a high-resolution screen image usually consists of two processes repeated many times. First, the coordinates of the endpoints of a line segment are computed. Second, the line segment is displayed on the screen.

The method of animation presented here is unusual in that it completely separates the two processes. The computation of the coordinates of every line segment for every screen image is done by a BASIC program which writes the coordinates to disk as a binary (non-ASCII) file. This file of line segment coordinates is then input to a machine language program which displays the screens in rapid succession to produce the animation.

To begin, type in and save Program 1. Before you run this program, make sure you have a disk in the active drive with at least 60,000 bytes of available space. Now run Program 1; it creates a disk file named ANIMATE.OBJ containing the machine language animation routine. The DOS LINK utility must then be used to generate an executable version of this file. To do this, first exit DOS by typing SYSTEM and pressing Enter. Place a DOS system disk containing the file LINK .EXE in the active drive (check the master disk that came with your copy of DOS), type LINK, then press Enter. When you are prompted for the object modules, remove the DOS system disk and replace it with the disk containing ANIMATE .OBJ. At this point you should type **ANIMATE,,NUL,NUL** and press Enter. After a minute or so the DOS prompt will reappear. Your disk now contains a new file named ANIMATE.EXE, the usable version of the machine language program that creates animated displays from the files produced by Programs 2 or 3.

A Rotating Demo

Now you are ready to type in and save Program 2 (this program can be saved on any disk). When you run the program, you will be prompted for an output filename. Enter any legal filename. Program 2 creates images of the word LOVE rotating in three-dimensions. After you press Enter, the program begins computing the line segment coordinates for each screen and writing them to the specified disk file. The display will show which screen is currently being computed.

Program 2 computes 71 screens. Do not remove the disk from the drive until you see the message that the file is complete.

When the BASIC Ok prompt reappears, type SYSTEM and press Enter to exit to DOS. Put the disk containing ANIMATE.EXE in the active drive, then type ANIMATE and press Enter. When you are asked for the name of the input file, put the disk containing the file created by Program 2 in the active drive and enter the name you specified for that file. The disk drive light will go on for a few seconds, and then the animated image should appear on the screen. Press the Q key to terminate the display.

Once you have used Program 2 to create the animation data file, you won't need it again. However, before you delete it, notice that lines 430–520 also occur in Program 3. In fact, you'll find these lines in every program that you write that produces data files for the ANIMATE program. To save yourself a lot of typing, load Program 2 and delete all lines except 430–520; save the shortened program with a name you'll remember—you will probably use it as a template program many times.

To enter Program 3, first load the file containing lines 430–520 of Program 2. Then type in the other lines listed as Program 3 and save the file. At this point you should follow the same procedure as for Program 2. Program 3 computes 95 screens. The computation for each screen takes longer than those in Program 2 because of computations to remove hidden lines from the display. Now run the animate program using this data file as input. You will see a rotating cube repeatedly coming toward and going away from you (see photos).

Make Your Own Art

Writing your own programs with ANIMATE is not difficult. Just follow these steps:

1. Load the template file containing the lines 430–520.

2. All DIM statements and initialization of variables should be performed prior to line 430. If there is not enough room in the program to do this, you can GOSUB to a routine located further down in the program. DATA statements, of course, can be placed anywhere in the program.

3. The variable NUMSCNS should be assigned a value equal to the number of screens to be displayed. This assignment must also be done prior to line 430.

4. The subroutine that does the computation for each screen must begin at line 1000. For each line segment, the program must compute the segment endpoint coordinates (the variables X1, Y1, X2, and Y2) and execute a GOSUB 500.

The ANIMATE program can handle up to 4000 line segments. This means that the number of screens times the number of line segments per screen cannot exceed 4000.

Programs 2 and 3 both produced 3-D images, but this doesn't mean that you need to know 3-D geometry to create impressive displays. Two-dimensional animation, when it's fast and smooth, can be truly spectacular as well.

For instructions on entering these listings, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

Program 1: ANIMATE.OBJ File Maker

```
KN 10 T=0:OPEN "ANIMATE.OBJ" FOR
      OUTPUT AS 1
KL 20 FOR J=1 TO 1076:READ A$:N=
      VAL("&H"+A$)
FA 30 T=T+N:PRINT#1,CHR$(N);:NEX
      T:CLOSE 1
PL 40 IF T=84992! THEN PRINT"FIL
      E SUCCESSFULLY CREATED!":E
      ND
LM 50 PRINT CHR$(7);"***** ERROR
       IN DATA STATEMENTS *****"
      :END
BE 100 DATA 80,03,00,01,41,3B,96
      ,11,00,00
OD 110 DATA 04,43,53,45,47,04,44
      ,53,45,47
BI 120 DATA 04,53,53,45,47,D6,98
      ,07,00,60
OM 130 DATA E1,01,02,01,01,1B,98
      ,07,00,60
NB 140 DATA 9D,BF,03,01,01,A0,98
      ,07,00,74
LM 150 DATA 80,00,04,01,01,67,A0
      ,0C,00,02
AA 160 DATA 00,00,80,40,20,10,08
      ,04,02,01
JL 170 DATA 53,A2,0F,00,02,08,00
      ,00,40,01
EF 180 DATA 00,01,00,00,00,02,00
      ,00,01,A2
BO 190 DATA 0F,00,02,08,80,A0,1F
      ,01,00,01
PB 200 DATA 00,00,00,02,00,00,02
      ,A0,1A,00
BC 210 DATA 02,48,BF,00,00,00,00
      ,00,00,00
BE 220 DATA 00,00,00,00,00,00,00
      ,00,00,00
JH 230 DATA 00,00,00,14,00,29,A2
      ,0E,00,02
NH 240 DATA 5E,BF,14,00,01,00,01
      ,00,00,00
OC 250 DATA 01,20,FA,A0,2F,00,02
      ,72,BF,00
MK 260 DATA 00,45,6E,74,65,72,20
      ,69,6E,70
DF 270 DATA 75,74,20,66,69,6C,65
      ,20,6E,61
MM 280 DATA 6D,65,3A,20,24,0A,0D
      ,46,69,6C
DP 290 DATA 65,20,6E,6F,74,20,66
      ,6F,75,6E
II 300 DATA 64,24,49,A0,01,01,01
      ,00,00,1E
MI 310 DATA 33,C0,50,B8,00,00,8E
      ,D8,B8,00
DB 320 DATA 06,B7,07,B9,00,00,BA
      ,4F,18,CD
DJ 330 DATA 10,33,D2,B7,00,B4,02
      ,CD,10,8D
IO 340 DATA 16,00,00,B4,09,CD,21
      ,8D,16,00
DL 350 DATA 00,B4,0A,CD,21,B7,00
      ,8A,1E,00
BC 360 DATA 00,C6,87,00,00,00,8D
      ,16,00,00
MK 370 DATA B0,00,B4,3D,CD,21,73
      ,09,8D,16
IA 380 DATA 00,00,B4,09,CD,21,CB
      ,A3,00,00
IN 390 DATA 8B,1E,00,00,8D,16,00
      ,00,52,B9
PB 400 DATA 80,00,B4,3F,CD,21,5A
      ,81,C2,80
OB 410 DATA 00,3D,00,00,75,EE,B8
      ,06,00,CD
PI 420 DATA 10,E8,00,00,8D,1E,00
      ,00,8B,07
FJ 430 DATA 3D,9D,FF,74,2F,3D,19
      ,FC,75,05
FI 440 DATA E8,00,00,EB,EB,A3,00
      ,00,83,C3
JK 450 DATA 02,8B,07,A3,00,00,83
      ,C3,02,8B
OO 460 DATA 07,A3,00,00,83,C3,02
      ,8B,07,A3
BK 470 DATA 00,00,83,C3,02,53,E8
      ,00,00,5B
GC 480 DATA EB,CA,E8,00,00,B4,06
      ,B2,FF,CD
NE 490 DATA 21,3C,71,74,04,3C,51
      ,75,1B,32
BB 500 DATA FF,B8,00,06,33,C9,BA
      ,4F,18,CD
LO 510 DATA 10,B8,00,02,33,DB,33
      ,D2,CD,10
ML 520 DATA B8,02,00,CD,10,CB,E8
      ,00,00,83
HP 530 DATA C3,02,EB,96,1E,06,8C
      ,D8,8E,C0
PB 540 DATA 8D,3E,00,00,B8,00,B8
      ,8E,D8,33
DN 550 DATA F6,B9,A0,1F,FC,F3,A5
      ,07,1F,C3
IB 560 DATA 06,B8,45,9C,94,00,C8
      ,05,00,02
BB 570 DATA 02,9D,BF,C4,20,00,02
      ,02,74,BF
EH 580 DATA C4,28,00,02,02,5C,BF
      ,C4,32,00
FL 590 DATA 02,02,5D,BF,C4,36,00
      ,02,02,5E
EI 600 DATA BF,C4,3B,00,02,02,5E
      ,BF,C4,47
LB 610 DATA 00,02,02,8C,BF,C4,4F
      ,00,02,02
OF 620 DATA 72,BF,C4,53,00,02,02
      ,72,BF,C4
```

```
BD 630 DATA 57,00,02,02,08,00,84
       ,71,00,01
KO 640 DATA 01,E1,00,C4,75,00,02
       ,02,08,00
NB 650 DATA 84,84,00,01,01,0F,01
       ,C4,89,00
MB 660 DATA 02,02,48,BF,C4,91,00
       ,02,02,4A
LE 670 DATA BF,C4,99,00,02,02,4C
       ,BF,C4,A1
BF 680 DATA 00,02,02,4E,BF,84,A8
       ,00,01,01
PK 690 DATA 22,01,84,AE,00,01,01
       ,FB,00,84
FA 700 DATA DA,00,01,01,0F,01,C4
       ,E9,00,02
LD 710 DATA 02,08,80,1B,A0,E8,00
       ,01,FD,00
DK 720 DATA 00,B8,8E,C0,B9,A0,1F
       ,33,FF,8D
DB 730 DATA 36,00,00,FC,F3,A5,07
       ,C3,06,8C
PB 740 DATA D8,8E,C0,B9,A0,1F,8D
       ,3E,00,00
JI 750 DATA 33,C0,FC,F3,AB,07,C3
       ,06,8C,D8
JC 760 DATA 8E,C0,BE,01,00,BF,01
       ,00,8B,16
JB 770 DATA 00,00,2B,16,00,00,7D
       ,04,F7,DF
MA 780 DATA F7,DA,89,3E,00,00,8B
       ,0E,00,00
FP 790 DATA 2B,0E,00,00,7D,04,F7
       ,DE,F7,D9
AE 800 DATA 89,36,00,00,3B,CA,7D
       ,08,BE,00
GL 810 DATA 00,87,CA,EB,04,90,BF
       ,00,00,89
QJ 820 DATA 36,00,00,89,3E,00,00
       ,8B,C2,D1
LJ 830 DATA E0,A3,00,00,2B,C1,8B
       ,D8,2B,C1
DC 840 DATA A3,00,00,8B,36,00,00
       ,8B,3E,00
DJ 850 DATA 00,41,56,53,8B,C7,8A
       ,E0,25,FE
GH 860 DATA 01,D1,E0,D1,E0,D1,E0
       ,8B,D8,80
NE 870 DATA E7,07,D1,E0,D1,E0,03
       ,D8,8D,06
GK 880 DATA 00,00,03,D8,8B,C6,D1
       ,F8,D1,F8
DG 890 DATA D1,F8,03,D8,81,E6,07
       ,00,8A,84
QP 900 DATA 00,00,26,0A,07,26,88
       ,07,5B,5E
LI 910 DATA 83,FB,00,7D,11,03,36
       ,00,00,03
KC 920 DATA 3E,00,00,03,1E,00,00
       ,E2,B3,EB
MM 930 DATA 0F,90,03,36,00,00,03
       ,3E,00,00
EJ 940 DATA 03,1E,00,00,E2,A2,07
       ,C3,82,9C
JP 950 DATA 99,00,C4,0B,00,02,02
       ,08,80,C4
EJ 960 DATA 1C,00,02,02,08,80,C4
       ,32,00,02
OD 970 DATA 02,4E,BF,C4,36,00,02
       ,02,4A,BF
KD 980 DATA C4,40,00,02,02,52,BF
       ,C4,44,00
HI 990 DATA 02,02,4C,BF,C4,48,00
       ,02,02,48
OP 1000 DATA BF,C4,52,00,02,02,5
        0,BF,C4,65
NM 1010 DATA 00,02,02,54,BF,C4,6
        9,00,02,02
HN 1020 DATA 56,BF,C4,70,00,02,0
        2,58,BF,C4
BH 1030 DATA 79,00,02,02,5A,BF,C
        4,7D,00,02
CL 1040 DATA 02,48,BF,C4,81,00,0
        2,02,4A,BF
BD 1050 DATA C4,A0,00,02,02,08,8
        0,C4,B4,04
MP 1060 DATA 02,02,C4,C5,00,02,0
        2,54,BF,C4
CP 1070 DATA C9,00,02,02,56,BF,C
        4,CD,00,02
IA 1080 DATA 02,58,BF,C4,D6,00,0
        2,02,50,BF
PM 1090 DATA C4,DA,00,02,02,52,B
        F,C4,DE,00
PB 1100 DATA 02,02,5A,BF,38,90,0
        E,00,00,01
MH 1110 DATA 07,41,52,52,59,53,4
        3,4E,FB,00
BK 1120 DATA 00,3D,90,0C,00,00,0
        1,05,45,52
IN 1130 DATA 41,53,45,0F,01,00,D
        E,90,0E,00
JO 1140 DATA 00,01,07,4D,45,4D,4
        C,49,4E,45
EK 1150 DATA 22,01,00,30,90,0E,0
        0,00,01,07
CH 1160 DATA 53,43,4E,41,52,52,5
        9,E1,00,00
HE 1170 DATA 57,8A,02,00,00,74
```

Program 2: LOVE File Maker

```
DJ 10 DIM BX(11),BY(11),EX(11),E
      Y(11)
PH 20 FOR N=0 TO 11:READ BX(N),B
      Y(N),EX(N),EY(N):NEXT
DC 30 DATA -22,3,-22,-3,-22,-3,-
      14,-3
OA 40 DATA -10,3,-10,-3,-10,-3,-
      2,-3
EL 50 DATA -2,-3,-2,3,-2,3,-10,3
JB 60 DATA 2,3,6,-3,6,-3,10,3
FB 70 DATA 22,3,14,3,14,3,14,-3
OJ 80 DATA 14,-3,22,-3,20,0,14,0
BA 90 CX=320:CY=100:A=6.2831853#
CF 100 NUMSCNS=71
JN 430 INPUT"OUTPUT FILE NAME";F
      $:OPEN F$ FOR OUTPUT AS 1
EE 440 PRINT"COMPUTING SCREEN NU
       MBER: ";
MB 450 FOR SCRN=1 TO NUMSCNS:PRI
       NT SCRN;
MH 460 GOSUB 1000
IE 470 PRINT#1,CHR$(157);CHR$(25
       5);:NEXT SCRN
FO 480 PRINT#1,CHR$(25);CHR$(252
       ):CLOSE 1:PRINT
BJ 490 PRINT"ANIMATION DATA FILE
        ";CHR$(34);F$;CHR$(34);"
        IS COMPLETE":END
CL 500 PRINT#1,CHR$(INT(X1) AND
       255);CHR$(INT(X1/256));CH
       R$(INT(Y1));CHR$(0);
KA 510 PRINT#1,CHR$(INT(X2) AND
       255);CHR$(INT(X2/256));CH
       R$(INT(Y2));CHR$(0);
MD 520 RETURN
HF 1000 FOR N=0 TO 11
KL 1010 ZE=-BX(N)*SIN(A)+30
PO 1020 X1=100*BX(N)*COS(A)/ZE+C
        X:Y1=-100*BY(N)/ZE+CY
MP 1030 ZE=-EX(N)*SIN(A)+30
ML 1040 X2=100*EX(N)*COS(A)/ZE+C
        X:Y2=-100*EY(N)/ZE+CY
II 1050 GOSUB 500
DI 1060 NEXT N:A=A-8.726646E-02
JA 1070 RETURN
```

Program 3: CUBE File Maker

```
BF 1 ' PROGRAM 3
OH 2 '
MH 10 DIM V(8,3),SV(8,2),S(6,5),
      N(6,3),E(12,3)
FE 20 FOR I=1 TO 8:FOR J=1 TO 3:
      READ V(I,J):NEXT J,I
AB 30 FOR I=1 TO 6:FOR J=1 TO 5:
      READ S(I,J):NEXT J,I
KM 40 DATA 40,40,-40,40,40,40,40
      ,-40,40,40,-40,-40
PJ 50 DATA -40,-40,-40,-40,-40,4
      0,-40,40,40,-40,40,-40
LE 60 DATA 1,2,3,4,1,1,8,7,2,1,8
      ,5,6,7,8
NE 70 DATA 5,4,3,6,5,2,7,6,3,2,4
      ,5,8,1,4
KP 90 CX=320:CY=100:TH=.2:PH=.8:
      PPD=2000:DIST=20000
HH 100 NUMSCNS=95
JN 430 INPUT"OUTPUT FILE NAME";F
      $:OPEN F$ FOR OUTPUT AS 1
EE 440 PRINT"COMPUTING SCREEN NU
       MBER: ";
MB 450 FOR SCRN=1 TO NUMSCNS:PRI
       NT SCRN;
MH 460 GOSUB 1000
IE 470 PRINT#1,CHR$(157);CHR$(25
       5);:NEXT SCRN
FO 480 PRINT#1,CHR$(25);CHR$(252
       ):CLOSE 1:PRINT
BJ 490 PRINT"ANIMATION DATA FILE
        ";CHR$(34);F$;CHR$(34);"
        IS COMPLETE":END
CL 500 PRINT#1,CHR$(INT(X1) AND
       255);CHR$(INT(X1/256));CH
       R$(INT(Y1));CHR$(0);
KA 510 PRINT#1,CHR$(INT(X2) AND
       255);CHR$(INT(X2/256));CH
       R$(INT(Y2));CHR$(0);
MD 520 RETURN
KC 1000 S1=SIN(TH):C1=COS(TH):S2
        =SIN(PH):C2=COS(PH)
PP 1010 FOR I=1 TO 8:X=V(I,1):Y=
        V(I,2):Z=V(I,3):SX=-X*S1
        +Y*C1
FL 1020 SY=-X*C1*C2-Y*S1*C2+Z*S2
        :SZ=-X*S2*C1-Y*S2*S1-Z*C
        2+DIST
IB 1030 SV(I,1)=PPD*(2.67*SX/SZ)
        +CX:SV(I,2)=-PPD*(SY/SZ)
        +CY:NEXT
IO 1040 FOR I=1 TO 6:F=S(I,1):G=
        S(I,2):H=S(I,3):U1=V(G,1
        )-V(F,1):U2=V(G,2)-V(F,2
        )
FL 1050 U3=V(G,3)-V(F,3):V1=V(H,
        1)-V(F,1):V2=V(H,2)-V(F,
        2):V3=V(H,3)-V(F,3)
GJ 1060 N(I,1)=U2*V3-V2*U3:N(I,2
        )=U3*V1-V3*U1:N(I,3)=U1*
        V2-V1*U2:NEXT
NI 1070 XE=DIST*S2*C1:YE=DIST*S2
        *S1:ZE=DIST*C2:M=1
JO 1080 FOR I=1 TO 6:E2=S(I,1):W
        X=XE-V(E2,1):WY=YE-V(E2,
        2):WZ=ZE-V(E2,3)
MH 1090 IF (N(I,1)*WX+N(I,2)*WY+
        N(I,3)*WZ)<=0 THEN 1140
DI 1100 E1=S(I,1):FOR J=2 TO 5:E
         2=S(I,J):FOR K=1 TO M
KH 1110 IF E(K,1)=E2 AND E(K,2)=
        E1 THEN E(K,3)=2:GOTO 11
        30
EP 1120 NEXT K:E(M,1)=E1:E(M,2)=
        E2:E(M,3)=1:M=M+1
BH 1130 E1=E2:NEXT J
CB 1140 NEXT I:FOR I=1 TO 12:IF
        E(I,3)=0 THEN 1160
CH 1150 J=E(I,1):K=E(I,2):X1=SV(
        J,1):Y1=SV(J,2):X2=SV(K,
        1):Y2=SV(K,2):GOSUB 500
PC 1160 NEXT:TH=TH+6.544985E-02:
        PH=PH+6.544985E-02:IF SC
        RN<48 THEN PPD=PPD+583.3
        :RETURN
IA 1170 PPD=PPD-583.3:RETURN
```

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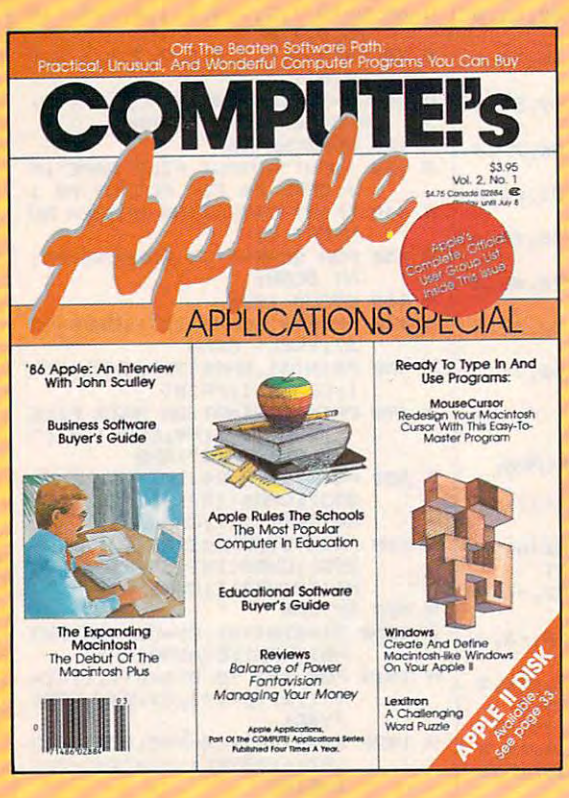

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PowerKey For Apple

Patrick Parrish, Programming Supervisor

This valuable utility puts 52 customized strings or keywords instantly at your fingertips. You can even create several sets of custom commands for use with different applications. For all Apple II series computers with DOS 3.3 or ProDOS.

Using an Apple II computer usually involves a considerable amount of typing, and most of us—good typists or not—would be happy to automate the process of communicating with our machine. Have you ever wished you could just strike one key and produce a directory, run a program, or perform some common task?

"PowerKey" provides a selection of 52 different one-touch keywords which you can customize to your own liking. It lets you access up to 52 keywords or other strings of your own by pressing either the Open Apple or Solid Apple key (or paddle buttons for those who have an Apple II+, which lacks these keys) along with one of the letter keys (A–Z). Although the program relies on a short machine language routine, you can use it without understanding machine language at all.

Entering The Program

This utility is written in three parts. Program 1, POWERKEY.CUSTOM, is a BASIC program that lets you create and save tables of your custom strings or keywords to disk. Program 2, POWERKEY.LOADER, is a BASIC loader which POKEs the machine language driver routine into memory and saves a copy of this code to disk in the form of a binary file. (Since Program 2 uses the name POWERKEY.BINARY for the file it creates, you *must not* use that name for Program 2 itself. If you do, you'll get a FILE TYPE MISMATCH error when Program 2 is run.) Program 3, POWERKEY.SYSTEM, is a short BASIC program which loads both the keyword table and the driver routine, and then activates PowerKey. Before going any further, carefully type in these three programs and save a copy of each to disk.

Creating Customized Keys

After entering Programs 1–3, load and run Program 1, which creates a customized table of keywords and strings. The first prompt asks if you want to load a keyword table from disk. Since this is the first time you've run the program, no tables yet exist, so you should press N for no. In the future, after creating one or more tables, you could also press Y to gain access to a preexisting table. If you press Y, the program displays a directory and asks you to enter the filename of the table to load. If you press RETURN at this prompt without entering a name, PowerKey looks for a default file named TABLE.

If you've specified that no keyword table is to be loaded, Program 1 reads in its 52 default keywords (see lines 910–960). The first 26 keywords can be accessed with the Open Apple key (or the paddle 0 button), and the second 26 keywords by the Solid Apple key (or the paddle 1 button). You can change or rearrange the keywords in the DATA statements if you like, but make sure not to add or delete any keywords. You'll get an OUT OF DATA error if there aren't at least 52 DATA items.

Now PowerKey displays keywords 1–26 on the screen. To the left of each keyword is the letter that will access it. For instance, the keyword AND is represented by *A*. Each keyword or string in the table can be up to 16 characters long, but they can be combined for longer commands. A table can occupy a maximum of 832 bytes and unused characters are signified by dots.

At the bottom of the screen, you are given three options. You can press A to Alter a keyword, the

Solid Apple key (or paddle 1 button) to look at the second 26-keyword set, or W to write the completed table to a disk file. You can switch back and forth between keyword sets by pressing the Solid Apple key (or paddle 1 button) and Open Apple key (or paddle 0 button).

For practice, let's change CATALOG, the current default keyword accessed with Open Apple–C. Select the Open Apple keyword set, then press A and the program prompts you for the letter of the keyword you wish to change. Enter C for the keyword CATALOG. Let's add a carriage return to this keyword so that you'll be able to examine the disk directory from immediate mode with only one keystroke. Type CATALOG followed by a backslash (\ ), then press RETURN. The backslash always stands for a carriage return character.

The screen should now reflect the change you've made. Notice that the backslash is shown as a control character (CTRL-M is equivalent to RETURN). Other keywords or strings in the table can be altered in the same manner. In fact, if you anticipate repeatedly using a phrase longer than 16 characters in your programming, stretch it out over two or more 16-character strings.

Once the table suits you, press W (for Write) to save it to disk. At this point, the 52 strings in your table are converted to their ASCII equivalents and POKEd into memory at 37376. To distinguish a string from the one that follows, the last character of each string has its high bit set (128 is added to its ASCII value). Before the program saves the table, you are allowed once more to look at the directory on the target disk. After this, a filename for your table is requested. Again, if you strike RETURN, the default filename TABLE is chosen for you. Before the program ends, you are given a chance to put a copy of this file on other disks as well.

Installing The Driver

With the keyword table safely on disk as well as in memory, run Program 2. Line 110 of this program POKEs the PowerKey ML driver routine into memory at 768. This area is safe from BASIC, so PowerKey should not interfere with, or be overwritten by, most programs. Line 130 saves a copy to disk using the filename POWERKEY.BINARY.

PowerKey is now ready to be activated. Type CALL −768 and press RETURN. Then, press Open Apple (or paddle button 0) along with the A key. The keyword AND should appear on the screen. Press RETURN and try another one. Hit Open Apple and C for CATALOG. Immediately, a directory of your disk appears on the screen (recall that we added a carriage return to CATALOG).

Try out some more keywords, using the Solid Apple (paddle button 1) set as well. The computer recognizes your keywords and strings from immediate and program mode as well as from the monitor.

Putting It All Together

Because PowerKey is on your disk as a binary file, it can easily be loaded and run by other programs. In fact, this is just what Program 3 does. It sets HIMEM to protect the reserve space for the keyword table, then asks you to specify the name of the table to be loaded from disk (press RETURN alone at the prompt to load the default file TABLE). The POWERKEY.BINARY machine language file created by Program 2 is loaded into memory, and activated with the appropriate CALL. You can even have PowerKey automatically loaded when you boot your disk if you use DOS 3.3. Simply save Program 3 as the HELLO file on the desired disk.

You can also load PowerKey from immediate mode. With DOS 3.3, type in the following line (substitute the appropriate table filename for TABLE):

```
HIMEM:37376:PRINT CHR$(4)"BLOAD
  TABLE,A37376":PRINT CHR$(4)
  "BLOAD POWERKEY.BINARY":CALL
  768
```

If you are using ProDOS, substitute this line:

```
HIMEM:36352:PRINT CHR$(4)"BLOAD
  TABLE,A37376":PRINT CHR$(4)
  "BLOAD POWERKEY.BINARY":CALL
  768
```

How It Works

PowerKey works basically the same whether you are using DOS 3.3 or ProDOS. In either operating system, it relies on a method known as a *wedge*. The input vector that normally points to the keyboard input subroutine (KEYIN) at $FD1B, is rerouted to point instead to the starting location of our machine language code. Once this is done, the program checks a flag to see whether it is already in the process of printing a keyword. If not, it checks the Open and Solid Apple keys. The routine also responds to paddle button presses, since the Open and Solid Apple keys are read by the same circuitry that reads the buttons.

If one of the special keys is pressed, PowerKey begins printing the one-touch keyword. First, the relative number (0–51) of the desired keyword is determined, a flag is set, and the keyword is located in the table. The first character of the word is then put in the accumulator, the table location is updated, and we return to BASIC. The operating system then prints the character in the accumulator and returns to the program for another character. The next time through the program, another character is loaded into the accumulator since the flag is set. This process continues until the last character of the keyword or phrase is detected (this character has the high bit set). The flag is then set to zero and we're returned to BASIC.

Before all this can happen, however, the program must go through a short initialization routine to determine which operating system is installed. This is done by looking at the starting location for ProDOS's global page ($BF). When ProDOS has been booted, the value in location $BF00 is always 76 (representing the JMP command). If this is the case, then the vector that points to KEYIN (CHIN1 at $BE32–$BE33) is loaded in low-byte/high-byte format with the starting address for our routine, and the program returns to BASIC.

If the value at $BF00 is some other value, then the program assumes we are in DOS 3.3. In this case, the input vectors (KSW for KeySWitch) at $38–$39, which normally point to KEYIN, are loaded in a likewise manner with the starting

address of our program. We then jump to a routine at $3EA which updates the input pointers with these new values, reconnects DOS, and returns us to BASIC. Henceforth, with either operating system, our routine gets called so we can print our keywords.

Program 1: Keyword Table Customizer

For instructions on entering these listings, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
97 100 REM OMNIKEY.CUSTOM
C6 110 TEXT :TL = 37376
9A 120 HIMEM: TL: IF PEEK (48896
       ) = 76 THEN HIMEM: TL = 1
       024: REM TL IS TABLE LOCA
       TION; IF PRODOS, HIMEM IS
        MOVED DOWN 1K MORE
2B 130 FOR I = 768 TO 777: READ
       A: POKE I,A: NEXT : DATA
       104,168,104,166,223,154,7
       2,152,72,96: REM ONERR FI
       X
09 140 DIM A$(52):F$ = "........
       ........":R$(0) = "OPEN-A
       PPLE":R$(1) = "SOLID-APPL
       E":P = 0: REM APPLE KEYS
       CORRESPOND TO PADDLE BUTT
       ONS
D5 150 HOME : HTAB 11: VTAB 6: I
       NVERSE : PRINT "KEYWORD C
       USTOMIZER": NORMAL
C1 160 VTAB 10: PRINT "WANT TO L
       OAD A TABLE FROM DISK";:
       GOSUB 790
F9 170 IF X < > 89 THEN 200
55 180 GOSUB 830
E7 190 W = 0:V = 13: GOSUB 480:
       GOTO 210
7F 200 FOR I = 1 TO 52: READ A$(
       I): NEXT
4C 210 GOSUB 280
5D 220 X = PEEK ( - 16384):Y = P
       EEK ( - 16287):Z = PEEK (
        - 16286): IF X < = 127 A
       ND Y < = 127 AND Z < = 12
       7 THEN 220
5A 230 POKE - 16368,0:X = X - 12
       8: IF X = 87 THEN 570
94 240 IF Z > 127 AND P = 0 THEN
        P = 1: GOTO 210
B6 250 IF Y > 127 AND P = 1 THEN
        P = 0: GOTO 210
9D 260 IF X = 65 THEN 360
1C 270 GOTO 220
30 280 HOME : VTAB 2: HTAB 11: I
       NVERSE : PRINT R$(P);: NO
       RMAL : PRINT " KEYWORDS:"
       : PRINT
9A 290 PRINT :L = 1:H = 13: FOR
       J = 1 TO 22 STEP 21: FOR
       I = L TO H: INVERSE : HTA
       B J: PRINT CHR$ (64 + I);
       : NORMAL : PRINT " ";
C4 300 D$ = A$(I + (P = 1) * 26)
       : FOR Z = 1 TO LEN (D$):X
        = ASC ( MID$ (D$,Z,1)):
       IF X < 32 THEN INVERSE :
       PRINT CHR$ (X + 64);: NOR
       MAL : GOTO 320
98 310 PRINT CHR$ (X);
5A 320 NEXT Z: PRINT MID$ (F$,1,
       16 - LEN (A$(I + (P = 1)
       * 26))): NEXT :L = 14:H =
        26: VTAB 5: NEXT
FA 330 VTAB 20: PRINT "PRESS: ";
       : INVERSE : PRINT "A";: N
       ORMAL : PRINT " TO ";: IN
       VERSE : PRINT "ALTER";: N
       ORMAL : PRINT " A KEYWORD
       ,"
BA 340 VTAB 21: HTAB 8: INVERSE
       : PRINT R$(P = 0);: NORMA
       L : PRINT " FOR ";: INVER
       SE : PRINT R$(P = 0);: NO
       RMAL : PRINT " SET,": HTA
       B 8: INVERSE : PRINT "W";
       : NORMAL : PRINT " TO ";:
        INVERSE : PRINT "WRITE";
       : NORMAL : PRINT " TABLE
       TO DISK."
68 350 REM INPUT KEYWORD
91 360 VTAB 20: HTAB 28: PRINT "
        ": HTAB 8: PRINT "

        ": HTAB 8: PRINT "
                          "
28 370 VTAB 20: PRINT "ENTER KEY
        (A-Z) TO CHANGE ";: INPU
       T L$:L = ASC (L$) - 64: I
       F L < 0 OR L > 26 OR LEN
       (L$) > 1 THEN 370
71 380 VTAB 22: PRINT "NEW KEYWO
       RD FOR ";: INVERSE : PRIN
       T L$;: NORMAL : PRINT " ?
       ";: PRINT F$
80 390 VTAB 24: PRINT "('\' WILL
        EMBED A CARRIAGE RETURN)
       ";: HTAB 20: VTAB 22:C =
       0:D$ = ""
C7 400 X = PEEK ( - 16384): IF X
        < = 127 THEN 400
5B 410 POKE - 16368,0:X = X - 12
       8: IF X = 13 THEN 460
B0 420 IF X = 92 THEN X = 13
09 430 C = C + 1:D$ = D$ + CHR$
       (X): IF X < 32 THEN INVER
       SE : PRINT CHR$ (X + 64);
       : NORMAL : GOTO 450
9F 440 PRINT CHR$ (X);
D7 450 IF C < 16 THEN 400
B8 460 A$(L + (P = 1) * 26) = D$
       : FOR I = 1 TO 400: NEXT
       : GOTO 210
92 470 REM LOAD TABLE
C2 480 ONERR GOTO 750
47 490 HOME : HTAB 6: VTAB 10: G
       OSUB 690: PRINT : PRINT C
       HR$ (4)"BLOAD "FL$: POKE
       216,0
57 500 VTAB 16: HTAB 10: PRINT "
       READING TABLE..."
74 510 C = 0: FOR I = 1 TO 52:EF
       = 0
E9 520 A = PEEK (TL + C): IF A >
        127 THEN A = A - 128:EF
       = 1
3E 530 A$(I) = A$(I) + CHR$ (A):
       C = C + 1: IF EF THEN NEX
       T I
37 540 IF I < 53 THEN 520
1F 550 RETURN
63 560 REM SAVE TABLE
EF 570 HOME : VTAB 7: HTAB 9: NO
       RMAL : PRINT "...SETTING
       UP TABLE"
2F 580 C = 0:A = 0: FOR I = 1 TO
        52:C = C + A:A = LEN (A$
       (I)): FOR J = 1 TO A - 1
2E 590 G = ASC ( MID$ (A$(I),J,1
       )):: IF G = 92 THEN G = 1
       3
EA 600 POKE TL + C + J - 1,G: NE
       XT J
6D 610 B = ASC ( RIGHT$ (A$(I),1
       )) + 128: IF B = 220 THEN
        B = 141
19 620 POKE TL + C + A - 1,B: NE
       XT I
54 630 VTAB 10: HTAB 6: PRINT "R
       EADY TO SAVE TABLE TO DIS
       K.": GOSUB 830:W = 1: HOM
       E
BC 640 ONERR GOTO 750
B1 650 VTAB 10: HTAB 6:V = 13: G
       OSUB 690: PRINT : PRINT C
       HR$ (4)"BSAVE "FL$",A" ST
       R$ (TL)",L832": POKE 216,
       0
55 660 VTAB 16: HTAB 6: PRINT "A
       NOTHER COPY";: GOSUB 790
F8 670 IF X = 89 THEN HOME : GOT
       O 640
9E 680 END
58 690 PRINT "TABLE FILENAME: ";
       : INPUT FL$: IF FL$ = ""
       THEN FL$ = "TABLE"
CA 700 VTAB V: PRINT "PUT PROPER
        DISK IN DRIVE & HIT <RET
       URN>.";
0E 710 X = PEEK ( - 16384): IF X
        < = 127 THEN 710
2E 720 POKE - 16368,0:X = X - 12
       8: IF X < > 13 THEN 710
1D 730 RETURN
C7 740 REM DISK ERROR ROUTINE
9F 750 PRINT : HTAB 8: PRINT "DI
       SK ERROR #" STR$ ( PEEK (
       222))"."
FD 760 CALL 768: VTAB 18: VTAB 2
       0: HTAB 8: PRINT "TYPE 'C
       ' TO CONTINUE";: GET S$:
       IF W = 0 THEN 480
42 770 IF W = 1 THEN HOME : GOTO
        640
1B 780 HOME :V = 15: GOTO 840
DD 790 PRINT " (";: INVERSE : PR
       INT "Y";: NORMAL : PRINT
       "/";: INVERSE : PRINT "N"
       ;: NORMAL : PRINT ")?"
CC 800 X = PEEK ( - 16384): IF X
        < = 127 THEN 800
25 810 GET S$: POKE - 16368,0:X
       = X - 128: IF X < > 78 AN
       D X < > 89 THEN 800
1C 820 RETURN
11 830 V = 16: VTAB 13: PRINT "N
       EED A LOOK AT THE CATALOG
        FIRST";: GOSUB 790: IF X
        = 78 THEN RETURN
22 840 W = 2: ONERR GOTO 750
4F 850 GOSUB 700
B6 860 POKE 34,0: HOME : HTAB 12
       : PRINT "DISK CATALOG:":
       HTAB 8: PRINT "----------
       ----------"
DE 870 POKE 34,2: PRINT : PRINT
       CHR$ (4)"CATALOG": POKE 2
       16,0
76 880 HTAB 8: PRINT : PRINT "CA
       TALOG ANOTHER DISK";: GOS
       UB 790: IF X = 89 THEN V
       = 23: GOTO 850
33 890 PRINT : PRINT "PRESS RETU
       RN TO CONTINUE": GOSUB 71
       0
43 900 POKE 34,0: RETURN
C5 910 REM PADDLE 0 OR OPEN APPL
       E KEY WORDS
98 920 DATA AND,BLOAD ,CATALOG,D
       ATA ,END,FOR,GOSUB,HOME,I
       NPUT,GET,READ,LOAD ,MID$(
A3 930 DATA NEXT,OR,PRINT,STOP,R
       UN ,SAVE ,THEN,TEXT,VTAB,
       WRITE,PEEK,REM,CONT
26 940 REM PADDLE 1 OR CLOSED AP
       PLE KEY WORDS
02 950 DATA ASC(,BRUN ,CLOSE,DEL
       ,DIM,FLASH,GOTO,HTAB,INVE
```

```
      RSE,RESTORE,NORMAL,LIST
FA 960 DATA LEFT$(,NEW,OPEN,POKE
      ,RIGHT$(,RETURN,STR$(,STE
      P,TAB(,VERIFY,INT(,CALL,L
      EN(,CLEAR
```

Program 2:PowerKey Binary File Creator

```
A4 100 REM OMNIKEY.LOADER
DJ 110 FOR I = 768 TO 939: READ
      A: POKE I,A:X = X + A: NE
      XT
A2 120 IF X < > 18010 THEN PRINT
       "ERROR IN DATA STATEMENT
      S.": STOP
E2 130 PRINT CHR$ (4)"BSAVE OMNI
      KEY.BINARY,A768,L172"
81 140 DATA 162,146,134,7,160,0,
      132,6
A4 150 DATA 162,33,160,3,173,0,1
      91,201
86 160 DATA 76,208,7,142,50,190,
      140,51
1F 170 DATA 190,96,134,56,132,57
      ,76,234
1A 180 DATA 3,44,169,3,48,94,32,
      27
28 190 DATA 253,72,32,74,255,173
      ,97,192
A3 200 DATA 16,7,169,0,141,170,3
      ,240
FA 210 DATA 10,173,98,192,16,65,
      169,26
F7 220 DATA 141,170,3,104,56,233
      ,193,48
C1 230 DATA 55,201,26,176,51,24,
      109,170
4A 240 DATA 3,141,170,3,169,255,
      141,169
F9 250 DATA 3,173,170,3,240,38,1
      60,0
F4 260 DATA 162,0,230,6,208,2,23
      0,7
91 270 DATA 177,6,48,2,16,244,23
      2,236
1D 280 DATA 170,3,208,238,32,63,
      255,230
DB 290 DATA 6,208,9,230,7,208,5,
      104
0F 300 DATA 32,63,255,96,160,0,1
      77,6
6C 310 DATA 141,171,3,230,6,208,
      2,230
88 320 DATA 7,173,171,3,48,4,24,
      105
57 330 DATA 128,96,169,0,141,169
      ,3,133
23 340 DATA 6,169,146,133,7,173,
      171,3
11 350 DATA 96,0,0,0
```

Program 3: PowerKey Loader

```
75 100 REM OMNIKEY.SYSTEM
C6 110 TEXT :TL = 37376
1A 120 HIMEM: TL: IF PEEK (48896
      ) = 76 THEN HIMEM: TL - 1
      024
AA 130 HOME : PRINT "ENTER KEYWO
      RD TABLE NAME";: INPUT N$
      : IF N$ = "" THEN N$ = "T
      ABLE"
A5 140 PRINT CHR$ (4)"BLOAD "N$"
      ,A" STR$ (TL)
A0 150 PRINT CHR$ (4)"BLOAD OMNI
      KEY.BINARY"
68 160 CALL 768: PRINT : PRINT "
      OMNIKEY IS ACTIVATED.": E
      ND
```


Atari 130XE Automated RAM Disk

Stephen J. Rockower

Offering high speed and instantaneous access to programs and files, the Atari 130XE's RAM disk is one of its most attractive features. Now it's even more effective with this utility that moves selected programs and files into the RAM disk automatically whenever you boot the system. Your system will be custom configured on power up. A floppy disk drive and Atari DOS 2.5 are required.

If you own an Atari 130XE, you may have a number of BASIC programs or other files which you like to put on the RAM disk whenever you boot up. Once in the RAM disk, those files are available almost instantly, but it's a tedious process to copy each file to RAM manually. "RAM Disk Loader" for the Atari 130XE automates that chore with a custom AUTORUN.SYS file. When you boot the system, it automatically transfers selected BASIC programs and text files from the default drive (D1:) to the RAM disk (D8:).

Typing Instructions

Here's how to create the RAM Disk Loader. First, boot your computer with DOS 2.5. Go to the DOS menu to select option L; then load SETUP.COM. Use option 2 to create an AUTORUN.SYS file named D1TOD8.SAV. Now go back to BASIC and type in the program.

Note that the DATA statement in line 30 should contain the names of the BASIC programs or text files that you want to transfer to the RAM disk on power-up. When adding these names, include the full name and extender (such as PROG-.BAS), but not the drive specifier (don't put D1: at the beginning of the name). Every extender must be exactly three characters long; add extra spaces if necessary to pad the extender to the correct length. The last DATA item in this series must be END which acts as a marker for the end of the list of filenames.

When you type line 40, substitute the name of the program you want to run when the system boots. For example, if you want to run MYPROG.BAS from drive D1:, line 40 should look like this:

```
40 READ F$:IF F$="END" THEN RUN
   "D1:MYPROG.BAS"
```

Note that this program can be one of the programs you just put on the RAM disk (to run such a program, use the D8: drive prefix).

Be very careful when typing lines 290 and 560, which contain tiny machine language routines stored in strings. These strings must be typed correctly, or the computer will probably crash. The REM statements at the end of each line explain exactly which characters to type in the strings. After you finish typing in the program, be sure to save a copy to disk. For the program

to work properly, you *must* use the same filename you specified when you created the AUTORUN.SYS file (D1TOD8.SAV). Now you are ready to boot up again. This time, all your programs and data will be on D8.

With only slight modifications, you can use this program to transfer programs from D1: to D2: (rather than to D8:) without having to copy each file manually. This modification allows you to do batch file copies from one drive to another. A second possibility is to eliminate the DATA line altogether and read the filenames from a previously created disk file rather than from DATA. With a statement like INPUT#1,STRING$, you can bring in the name of each file to be transferred. The file could terminate with the name of the next program to run (IF STRING$="END" THEN INPUT#1,STRING$:RUN STRING$).

Program Techniques

The program begins by READing filenames one at a time from the DATA statements in line 30. If the name is not END, the program loops through the directory sectors (361–368) one at a time in search of the file. When the file is found, FLEN holds its length.

The subroutine named GETBYTES determines whether this is a BASIC program or a file containing text or other data. Since the file header for a BASIC program always starts with two zeros, we assume that anything lacking two zeros in the header is not BASIC. The next six pairs of header bytes contain information about the size and location of certain memory pointers. We are interested in the last two bytes, which tell us how many more bytes must be loaded to find the end of the file (DEND). The computation in line 680 adjusts the total number for BASIC program files.

At this point, the program opens an IOCB (Input/Output Control Block) to read the bytes from FROM$ into the string ZZ$. Then ZZ$ is manipulated to allow for text/data (FLEN*125) or a BASIC program (actually held as a string of length BYTES). Before writing the string, we must find the true end of the data. If you think about it, a text file of FLEN characters will have fewer than FLEN*125 bytes. By eliminating the zero bytes—CHR$(0), the heart symbol—we arrive at the true length of the file. This feature, incidentally, makes the program unsuitable for use with machine language files, since ML programs often contain one or more zero bytes.

Once you have this program working, you're likely to find many uses for it. I use it to move a main menu program onto the RAM disk, along with a number of programs and files I use to manage our household accounts. This method takes 20 to 30 percent less time than loading in the same files manually.

Atari 130XE RAM Disk Loader

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
CK 15  POKE 712,148:POKE 559,
       0:POKE 8,255:POKE 731,
       1
PP 20  DIM A$(128),ZZ$(125*15
       0),F$(15),FROM$(15),RD
       ISK$(15),B$(16),FNAME$
       (16)
DG 25  TRAP 710
KI 30  DATA JUNK.1   ,JUNK.2
       ,D1TOD8.BXE,END
BL 40  READ F$:IF F$="END" TH
       EN RUN "D1:NEXTPROG.SA
       V"
KK 50  FOR SNUM=361 TO 368
PM 60  CLOSE #1:FLEN=0
JJ 70  A$=CHR$(0):A$(128)=CHR
       $(0):A$(2)=A$
FC 90  DRIVE=1:TYPE=82:BUF=AD
       R(A$):GOSUB 260:REM "D
       ISC" ROUTINE
ND 100 GOSUB 330:REM "DECODE
       " ROUTINE
JG 110 IF FLEN THEN SNUM=368
BF 120 NEXT SNUM
HI 130 REM
HA 140 FROM$="D1:":FROM$(LEN
       (FROM$)+1)=F$:RDISK$=
       FROM$:RDISK$(2,2)="8"
MF 150 GOSUB 600:REM "GETBYT
       ES"
AB 170 INDEX=BYTES*(BYTES<>0
       )+FLEN*125*(BYTES=0)
IJ 180 ZZ$="":ZZ$(1)=CHR$(0)
       :ZZ$(INDEX)=CHR$(0):Z
       Z$(2)=ZZ$
KO 190 OPEN #2,8,0,RDISK$:OP
       EN #1,4,0,FROM$
DC 200 IOCB=1:TYPE=7:BUF=ADR
       (ZZ$):GOSUB 500:REM "
       IOCB" FOR READ
NK 210 IF BYTES>0 THEN 220
EK 211 IF ZZ$(LEN(ZZ$))=CHR$
       (0) THEN ZZ$=ZZ$(1,LE
       N(ZZ$)-1):GOTO 211
FC 212 INDEX=LEN(ZZ$)
MP 220 IOCB=2:TYPE=11:BUF=AD
       R(ZZ$):GOSUB 500:REM
       "IOCB" FOR WRITE
BE 230 CLOSE #1:CLOSE #2
DD 240 GOTO 40
BO 250 END
IM 260 REM PROCEDURE "DISC"
KD 270 POKE 779,INT(SNUM/256
       ):POKE 778,SNUM-256*I
       NT(SNUM/256)
JA 280 POKE 769,DRIVE:POKE 7
       73,INT(BUF/256):POKE
       772,BUF-256*INT(BUF/2
       56):POKE 770,TYPE
NC 290 X=USR(ADR("h S□(.)"))
       :REM D.104,32,83,228,
       96 or small h,space,
       Cap. S, inverse small
        d,ctrl-.
HD 300 RETURN
HB 310 REM TYPE=82 FOR READ,
        87 FOR WRITE
HJ 320 REM
AL 330 REM PROCEDURE "DECODE
       "
CJ 340 FLEN=0
AJ 350 FOR A=1 TO 8
NN 360 B$=A$((A-1)*16+1,A*16
       ):IF ASC(B$(1,1))>127
        THEN GOTO 460
BB 370 FLEN=ASC(B$(2))+256*A
       SC(B$(3))
MF 380 FSTART=ASC(B$(4))+256
       *ASC(B$(5))
OB 390 FNAME$=B$(6,13)
KD 394 IF FNAME$(LEN(FNAME$)
       )=" " THEN FNAME$=FNA
       ME$(1,LEN(FNAME$)-1):
       GOTO 394
EP 400 FNAME$(LEN(FNAME$)+1)
       ="."
       :FNAME$(LEN(FNAME
       $)+1)=B$(14,16)
EJ 410 IF FNAME$=F$ THEN A=8
       :GOTO 470
CK 440 FLEN=0
BL 470 NEXT A
HM 480 RETURN
IB 490 REM
ID 500 REM Procedure "IOCB"
BL 510 REM ASSUMES IOCB ALRE
       ADY OPEN FOR READ OR
       WRITE
LF 520 BLOCK=832+IOCB*16
AB 530 POKE BLOCK+2,TYPE:REM
        READ=7,WRITE=11
LJ 540 POKE BLOCK+5,INT(BUF/
       256):POKE BLOCK+4,BUF
       -256*INT(BUF/256)
JD 550 POKE BLOCK+9,INT(INDE
       X/256):POKE BLOCK+8,I
       NDEX-256*INT(INDEX/25
       6)
KA 560 I=USR(ADR("hhh■LV□"),
       IOCB*16):REM h,h,h,in
       verse *, L,V, inverse
       d
FC 570 CLOSE #IOCB
HN 580 RETURN
IC 590 REM
MO 600 REM PROCEDURE "GETBYT
       ES"
FN 610 OPEN #1,4,0,FROM$
CF 620 GET #1,I:GET #1,J
OF 630 IF I<>0 OR J<>0 THEN
       BYTES=0:GOTO 690
CA 640 FOR X=1 TO 6
CI 650 GET #1,I:GET #1,J
DD 660 NEXT X
HK 670 DEND=256*J+I
NH 680 BYTES=DEND-256+14
GJ 690 CLOSE #1
HH 700 RETURN
HM 710 REM
PO 720 POKE 559,34
IL 730 ? "ERROR ";PEEK(195);
       " AT LINE ";PEEK(186)
       +256*PEEK(187)
```

IF-THEN-ELSE For *SpeedCalc*

Anthony Chandler

This tutorial shows you how to get more out of SpeedCalc. *By using clever formulas, you can set up a spreadsheet to perform different computations based on the result of logical IF tests. The techniques apply to any version of* SpeedCalc, COMPUTE!*'s powerful machine language spreadsheet program. (The Commodore 64/128 version of* SpeedCalc *appeared in the January, 1986 issue of* COMPUTE!. *The Apple II and Atari versions were published in February 1986 and March 1986, respectively.)*

SpeedCalc, the versatile spreadsheet program published in the January–March, 1986 issues of COMPUTE!, offers a great variety of built-in functions. It supports all the math operations of BASIC, as well as two new ones (@ave and @sum), but there is no specific mention of how the program can perform conditional operations and make decisions. Here are techniques to make *SpeedCalc* calculate based on the outcome of logical tests modeled after the IF-THEN-ELSE construction in BASIC.

More Than A Glorified Calculator

Many people use a spreadsheet as little more than a glorified calculator: Once a sheet has been set up, you punch a button and the program performs a large number of related calculations. While the result of one calculation frequently serves as input for another, the process doesn't involve anything resembling intelligence on the part of the program. Nevertheless, the *SpeedCalc* spreadsheet program *can* test conditions and take action based on the results. The process works very much like the familiar IF-THEN-ELSE construction in BASIC.

In plain English, a typical IF-THEN-ELSE construction would be translated as, "IF a certain condition is true, THEN do the first task. ELSE if the condition is false, do the second task." A computer can't work with abstract concepts such as truth or falsity, but it's very good at telling the difference between one numeric value and another. When the computer performs an IF test in BASIC, it uses numeric values (usually −1 and 0) to represent true and false, respectively. You can verify this by entering the following statements in BASIC direct mode:

```
A=1:PRINT (A=1)
A=0:PRINT (A=1)
```

In Microsoft BASIC and most other versions, the computer prints −1 and 0, indicating that it uses −1 to represent a true condition and 0 to represent a false condition. The BASICs on Apple II and eight-bit Atari computers use 1 instead of −1 to represent true. To implement IF-THEN-ELSE with a formula in *SpeedCalc*, we can take advantage of the fact that true and false are represented as simple numeric values.

How Many Tests Do You Need?

If you give the matter some thought, you'll discover that only two basic IF tests are needed to cover all possible cases. Here they are:

IF A>B THEN (this cell=) **C ELSE** (this cell=) **D**
IF A<>B THEN (this cell=) **C ELSE** (this cell=) **D**

In these examples the letters A, B, C, and D represent the values contained in particular cells within the spreadsheet. A cell, of course, can contain a simple numeric value such as 2500, a reference to another cell, or a complex expression such as (ab2*(@sqr(2))) or (12*ac24+52*11).

Other IF tests can be achieved by varying one of the preceding constructions. For example, these two statements are logically equivalent:

```
IF A =< B THEN C ELSE D
IF B > A THEN C ELSE D
```

Likewise, these two statements are equivalent:

```
IF A = B THEN C ELSE D
IF A <> B THEN D ELSE C
```

IF-THEN-ELSE Formulas

Every IF-THEN-ELSE statement can be broken into two separate parts—the IF test and its consequence. The first portion (for example, IF A=B) tests a logical condition. The second portion (for example, THEN C ELSE D) states the consequence of the test. The

THEN portion of the consequence is performed when the IF test is true, and the ELSE portion is performed when the IF test is false. Table 1 shows *SpeedCalc* formulas for the two IF tests described in the preceding section.

The consequence (THEN-ELSE) portion of the formula will always be the same expression—D+(C−D)*(...)—which represents the logical statement ELSE + (THEN − ELSE)*(...). When the ELSE portion of the consequence is to be 0, the expression reduces to a simple C*(...). When the THEN portion of the consequence is to be 0, all you need is the expression D − D*(...).

To express a complete IF-THEN-ELSE statement in a *SpeedCalc* formula, you need to multiply the consequence portion of the statement by the IF portion. For example, say that you wish to use this statement:

IF A>B THEN C ELSE D

The *SpeedCalc* equivalent is expressed by this formula:

D+(C−D) * @int((@sgn(A−B)+1)/2)

Note that we have placed the consequence portion—D+(C−D)—first and the IF portion—@int((@sgn(A−B)+1)/2)—last. The multiplication operator (*) separates the two portions of the statement.

Inside The IF Test

Recall that the computer ordinarily makes a decision based on an IF test by comparing two numbers. More specifically, it subtracts one number from the other, then determines whether the result is positive (true), or zero or negative (false). For example, to perform the statement IF A>B, we want to know whether the result of (A−B) is positive or not. If it is positive, then A is greater than B. If it is zero, then A equals B. If it is negative, A is less than B. In other words, after subtracting the two numbers, we then need to know the *sign* of the remainder.

SpeedCalc, of course, has no difficulty performing the subtraction. To determine the sign of the result, you need only enclose the expression in a @sgn( ) function, using the formula @sgn(A−B). When the result of A−B is positive, @sgn(A−B) resolves to 1. When the result of A−B is negative, it resolves to −1, and when the subtraction yields 0, @sgn(A−B) yields 0.

Now let's build on this basic expression to perform specific IF tests. To select only cases where A is greater than B (IF A>B), you need to select only the positive result. To do this, add the value of 1, divide by 2, and make the result an integer with the @int( ) function:

@int((@sgn(A−B)+1)/2)

This formula yields 1 when A is greater than B, and 0 in all other cases.

To select only cases where A is unequal to B (IF A<>B), you need to include negative as well as positive results (in other words, all nonzero results). The @abs( ) function easily converts any negative value into a positive value:

@abs(@sgn(A−B))

This formula yields 1 whenever A is unequal to B, and 0 only when A equals B.

Now we have formulas which resolve to the value 1 when the desired condition is true or the value 0 when it is false. Table 2 shows the complete formulas.

For both formulas in Table 2, when the IF test is true (resolves to 1), the cell is made equal to D+(C−D)*1. This performs the THEN part of the IF-THEN-ELSE statement, making the cell equal to C. When the IF test is false (resolves to 0), the cell is made equal to D+(C−D)*0. This performs the ELSE part of the IF-THEN-ELSE statement by making the cell equal to D.

To take a more realistic example, say that you want *SpeedCalc* to compute the equivalent of the following statement:

IF Q>9 THEN (this cell=) **Q*P*.85 ELSE** (this cell=) **Q*P**

Now assume that the value Q is in

Table 1: IF Formulas

IF Test	*SpeedCalc* formula
IF A > B	@int((@sgn(A−B)+1)/2)
IF A <> B	@abs(@sgn(A−B))

Table 3: Quantity Discounts

Unit price	$10.00
Quantity discounts:	1 to 9 - net
	10 to 99 -10%
	100 up -15%

Table 2: IF-THEN-ELSE Formulas

Logical expression	SpeedCalc Formula
IF A> B THEN C ELSE D	=D+(C−D)*@int((@sgn(A−B)+1)/2)
IF A<> B THEN C ELSE D	=D+(C−D)*@abs(@sgn(A−B))

Table 4: Quantity Discounts

Quantity	1	9	10	99	100	1000
Tot. list	10	90	100	990	1000	10000
Disc 10	0	0	10	99	0	0
Disc 100	0	0	0	0	150	1500
Tot amt	10	90	90	891	850	8500

Sample Spreadsheet

	AA	AB
001	price p	10.00
002	qty q	0.00
003	tot list	=ab1*ab2
004	disc 10	=ab3*.1*@int((@sgn(ab2−9)+1)/2) * @int((@sgn(100−ab2)+1)/2)
005	disc 100	=ab3*.15*@int((@sgn(ab2−99)+1)/2)
006	tot amt t	=ab3−ab4−ab5

cell AB1 and the value P is in cell AB2. This formula produces the desired result:

```
=ab1*ab2+(ab1*ab2*.85-ab1*ab2)*@int
((@sgn(ab1-9)+1)/2)
```

Boolean Operators

In certain cases the Boolean operator OR, NOT, or AND is required to perform a conditional test. The easiest of these to implement is NOT. If the value of A is 1, then the expression NOT A yields 0. If A equals 0, then NOT A equals 1. Both alternatives can be handled with this *SpeedCalc* expression:

```
abs(1-A)
```

The AND and OR operations can be simulated by combining two IF tests. For an AND operation, the results of both IF tests are multiplied:

```
[consequence] * [IF test 1] * [IF test 2]
```

For an OR operation, the results of both IF tests are added together:

```
[consequence] * ([IF test 1] + [IF test 2])
```

A Practical Illustration

For example, say that your business wants to calculate the quantity discounts diagrammed in Table 3. When you sell items in quantities of 9 or fewer, no discount is given. A 10 percent discount is given on purchases of 10 to 99 items, and purchases of 100 or more items qualify for a 15 percent discount.

To calculate the discounts within *SpeedCalc*, you need to set up a sheet with two conditional calculations; the first one requires an AND function. Run *SpeedCalc* and enter the sheet as shown in the figure.

To test whether the sheet performs as expected, enter some test results in cell AB2. You should get the results shown in Table 4.

Although the algorithms are simple, it is easy to make mistakes in logic when setting up such involved formulas. It often helps to write the statements on paper before entering the actual formula. Before using the formula for serious purposes, you should test it with some sample values to make sure it works correctly. ©

Amiga BASIC Style

Jim Butterfield, Associate Editor

Here's how to manage custom menus and output windows, read mouse input, trap background events, and master other techniques which give Amiga BASIC its unique character. The article also highlights some of the differences between Amiga BASIC and earlier BASICs, and includes a useful program for calculating mortgages.

There's a different style to BASIC programming on the Amiga. You should take a close look at new features; you'll discover concepts that lead to a radically different style of programming and user interaction.

To illustrate some of these concepts, let's construct a simple Amiga BASIC program which analyzes the five important variables in a home mortgage: principal (amount borrowed), interest rate, period of loan, monthly payment, and balance due. Since interest-compounding schedules are different in Canada than in the United States, the program includes an option for choosing either schedule. We'll discuss elements of the program as we go through it.

[Editor's note: In the following listing we have used the ◄ character to indicate the end of a program line. Don't try to type this character—we've deliberately chosen one that's not on the Amiga keyboard. The ◄ character merely shows where you should press RETURN to end one program line and start another.]

Initialization

```
REM Mortgage (Version 1)◄
DIM title$(6),site$(2),pudef$(5)
,value#(5),peryear(2),compound(2
)◄
cal=4:site=1◄
```

The REM identifies the program and version. The DIM statement defines the six arrays used in the program, which we'll discuss as we go along. Note that there are no line numbers in Amiga BASIC. They are not needed. Even with GOTO or GOSUB, it's usual to identify a line with a label, not a number. (You may include line numbers if you like—a feature included for the sake of compatibility with other BASICs—but since the line numbers are treated simply as labels, numeric order is irrelevant.)

Also, notice that we use descriptive words for variable names.

In the versions of BASIC on earlier Commodore computers, only the first two characters of the variable name were significant (HO$ and HOUSEHOLD$ would be considered the same name). In Amiga BASIC, names can be up to 40 characters long with every character significant (Householdbudget1 and Householdbudget2 are recognized as distinct names). Descriptive variable names make the program much easier to understand and reduce the need for explanatory REM statements. We also set the default value of the two variables that determine which menu items are selected. The loan variable to be calculated (*cal*) is 4, the payment amount. The default interest compounding schedule (*site*) is that for country 1, Canada. Change either of these if you wish.

```
DATA Principal,Rate,Years,Paymen
t,Balance,Quit↵
MENU 5,0,1,"Calculate"↵
FOR j=1 TO 6:READ title$(j)↵
MENU 5,j,1-(j=cal)," "+title$(j
):NEXT j↵
```

The DATA statement contains the items for the first of our custom menus, as well as the captions for the output window (the array *title$*). One of the most significant features of Amiga BASIC is that the programmer can easily construct custom menus.

We'll choose menu 5 for our first custom menu so that menus 1–4 can retain their default uses: Project, Edit, Run, and Windows. The first MENU statement sets Calculate as the title for the menu, then the FOR-NEXT loop reads the DATA items into the corresponding menu slots. Note the expression *1−(j=cal)* for the third parameter of the MENU statement in the loop. Just like earlier Commodore BASICs, Amiga BASIC interprets a true expression as −1 and a false expression as 0, so 1−(j=cal) will evaluate to 1−(−1) = 2 when the value of *j* equals the value of *cal*, and 1−(0) = 1, otherwise. A value of 2 for this parameter puts a check to the left of the menu item, so this feature is used to indicate which calculation option is currently selected. A value of 1 displays the menu item without a checkmark, but still makes it active; a value of 0 would deactivate the menu item, leaving it dimmed, or *ghosted*, and impossible to select.

```
DATA Canada,2,6,USA,12,1↵
MENU 6,0,1,"Country"↵
FOR j=1 TO 2:READ site$(j),perye
ar(j),compound(j)↵
MENU 6,j,1-(j=site)," "+site$(j
):NEXT j↵
```

Different rules are used in the U.S. and Canada to work out a monthly interest rate based on the annual interest figure. In the U.S., the annual amount is simply divided by 12. In Canada, semiannual compounding is used, which involves dividing by two to get the semiannual rate and then using a more complex formula. The user will be able to pick the appropriate system from menu 6, which is titled Country. It would not be too hard to add extra menu items, such as compounding quarterly (the numeric DATA items would be 4,3). The FOR-NEXT loop here uses the same technique for flagging the current menu selection as the one above.

Format With PRINT USING

```
DATA "#,###,###.##"↵
DATA "   ###.###% "↵
DATA "   ###.###  "↵
DATA "#,###,###.##"↵
DATA "#,###,###.##"↵
FOR j=1 TO 5:READ pude$(j):NEXT
j↵
```

These are the PRINT USING templates that tell how the numeric values of the five loan variables are to be printed. The principal amount, for example, is printed as a dollars-and-cents value. The annual interest rate, in contrast, will be shown to three decimal places with a percent sign.

```
DATA 10000,10,10,0,0↵
FOR j=1 TO 5:READ value#(j):NEXT
j↵
```

These are just arbitrary figures to appear on the initial screen. I've picked a principal amount of $10,000 at 10 percent over ten years. You could substitute your own default values if you like. Once the program is running, any of these values can easily be changed.

An important point: Note that the array into which the values are read, *value#*, has an extra symbol at the end. The # sign (pound sign, hash mark, or whatever you want to call it) indicates that these variables are *double precision*. If you've worked with previous Commodore machines which offered only one level of numeric precision, you might be unclear about this issue. Here's the story: In earlier Commodore BASICs, variables worked to about ten digits of accuracy. That was enough—just barely enough—to do most home finance calculations. Normal (single-precision) Amiga BASIC variables—the type you usually get if you don't add a type identifier after the variable name—are reliable to only about seven digits. This means that it can't handle amounts of over about $167,000 without losing pennies.

Computer scientists will tell you that single-precision Amiga BASIC variables have a 24-bit *mantissa*, as opposed to the 32-bit mantissa in earlier Commodore BASICs. What it means to you is this: Whenever you need to deal with dollars-and-cents values—or with other values requiring a high accuracy—you need to call for a double-precision variable. Such a variable will have more accuracy—enough to cover a federal budget and still be exact on the pennies. To specify double precision, add a # sign to the end of the variable name. Be careful to include the sign each time you use the variable name, however. Amiga BASIC will consider *value* and *value#* to be two different variables.

A Custom Window

```
WINDOW 2,"Mortgage",(10,10)-(400
,100),8↵
WINDOW OUTPUT 2↵
GOSUB calc:GOSUB showval↵
LOCATE 7,1↵
PRINT "Use menu buttons to selec
t option."↵
PRINT "Click on existing values
to change."↵
GOSUB hang↵
WINDOW CLOSE 2↵
END↵
```

Now we open a new window in which the calculations will appear. The only gadget we put on the window is the closing gadget (code 8). It's there so that the user can still put away the window manually in case the program is stopped. The window is not only created, but also selected for output. Then the initial calculations are displayed, along with brief instructions near the bottom of the window.

The program's main job is a subroutine called *hang*. We'll stay in that subroutine until the user

wants to quit, at which time the window will be closed. Here is the *hang* subroutine:

```
hang:
ON MENU GOSUB event
ON MOUSE GOSUB event
MOUSE ON
MENU ON
kwit=0
WHILE kwit<>1:WEND
MOUSE OFF
MENU OFF
MENU RESET
RETURN
```

We define an action for the mouse and for the menus we previously defined. Clicking the left mouse button or selecting a menu item invokes the *event* subroutine. These two activities are *interrupts* or *event traps*. After they are activated with MENU ON and MOUSE ON, they will remain in place, waiting for the appropriate event to happen, until they are canceled or turned off. While they are active, it doesn't matter what the program is doing; a suitable stimulus will immediately cause the program to jump to the specified subroutine.

A variable called *kwit* is used by the program to tell when it's time to quit. As long as it's zero, the program stays in the WHILE–WEND loop. How does it ever get out of this seemingly endless loop? Remember the event traps we just enabled. Pressing the left mouse button or selecting a menu item will trigger a GOSUB to the *event* routine, which in turn calls subroutines to process the button click or menu selection. One menu selection, the *Quit* option from the Calculate menu, will change the value of *kwit* to one to end the loop. After exiting the loop, we'll shut off the menu and mouse, disconnect the event traps, and return to the main program which ties things up.

A Major Event

```
event:
ms=MOUSE(0):mn=MENU(0)
IF mn THEN GOSUB menuhit
IF ms THEN GOSUB eek
IF kwit=0 THEN GOSUB calc:GOSUB
showval
RETURN
```

Now let's look at the routine where the real action takes place. When we arrive at the *event* subroutine, we know that one of two things has happened. Either the left mouse button has been clicked or a menu item has been selected by using the right mouse button. The MOUSE and MENU functions are used to check which, and the appropriate service subroutine is called. Once the new value for *cal* or *site* has been established, we're ready to calculate new values, but first we check that *kwit* is still zero—we don't want to calculate values if the Quit option from the Calculate menu was selected. The new financial values are determined by calling the subroutine *calc*, then displayed using the *showval* subroutine. Keep in mind that we'll come back to this routine to recalculate anytime the data elements—or the rules—are changed.

```
calc:
ON ERROR GOTO oops
principal#=value#(1)
rl#=(value#(2)/100/peryear(site)
+1)^(1/compound(site))
rate#=rl#-1
months=value#(3)*12
payment#=value#(4)
balance#=value#(5)
ON cal GOSUB fprin,fintr,fper,fp
ay,fbal
scale=100:IF cal=2 OR cal=3 THEN
scale=1000
value#(cal)=INT(value#(cal)*scal
e+.99)/scale
ON ERROR GOTO 0
RETURN
```

The *calc* subroutine is where the dirty work begins. The principal, interest rate, number of periods, payment amount, and final balance are extracted from the *value#* array so that they can be used by the various calculation programs more easily. Note that in most cases, we retain double-precision accuracy with the # sign. The monthly interest rate is worked out by a fairly complex formula, and the number of months equals the number of years times 12.

The variable *cal* tells us what to calculate. Depending on its value, we'll call *fprin* (find principal), *fintr* (find interest rate), *fper* (find period), *fpay* (find payment), or *fbal* (find balance). The calculation with *scale* rounds any calculated value to the next highest penny, or, if not a money figure, to three decimal places.

The calculation subroutine also includes an error trap, since some calculations are impossible or ridiculous (for example, how long would it take to pay off a $1,000 mortgage with a payment of $0 per month?). Problems are directed to an event trap named *oops*.

```
oops:
value#(cal)=0
RESUME oops2
oops2:
WINDOW 2
RETURN
```

If there's any calculation problem, we set the calculated value to zero and give up. We do not go back to the detailed calculation program. Instead, using *oops2*, we return to the main *calc* routine. But, first, it's necessary to reopen WINDOW 2, since the Amiga always closes any secondary windows when an error occurs. Notice that the message at the bottom of the window is not reprinted. So if you see the window blink, then reappear minus the message and with the value being calculated set to zero, an error has been trapped. If this occurs when you enter what seem to be legitimate values, it may indicate that you made an error while entering the program. For this reason you may want to omit the ON ERROR statements until you are confident that you have eliminated all typing mistakes in the program.

Here are the five calculation routines. We won't plunge into details of the math here, since it's rather complex.

```
fprin:
value#(1)=(balance#+payment#*(rl
#^months-1)/rate#)/rl#^months
RETURN

fintr:
r0#=0:rl#=EXP(75/months):IF rl#>
2 THEN rl#=2
rate#=rl#-1:r9#=rate#*100
p0#=balance#+payment#*months-pri
ncipal#
p9#=(balance#+payment#*(rl#^mont
hs-1)/rate#)/rl#^months-principa
l#
IF p0#<0 OR p9#>0 THEN
r2#=0
ELSE
flop%=0
WHILE ABS(r9#-r0#)>.0001
flop%=1-flop%
IF flop%>0 THEN
r2#=(r0#+r9#)/2
ELSE
r2#=r0#-p0#*(r9#-r0#)/(p9#-p0#)
END IF
rl#=(1+r2#/100/peryear(site))^(1
/compound(site))
rate#=rl#-1
p2#=(balance#+payment#*(rl#^mont
hs-1)/rate#)/rl#^months-principa
l#
IF p2#>0 THEN
r0#=r2#:p0#=p2#
ELSE
r9#=r2#:p9#=p2#
END IF
WEND
END IF
value#(2)=r2#
```

```
RETURN
'
fper:
value#(3)=LOG((payment#-rate#*ba
lance#)/(payment#-rate#*principa
l#))/LOG(rl#)/12#
RETURN
'
fpay:
value#(4)=rate#*(principal#*rl#^
months-balance#)/(rl#^months-1)
RETURN
'
fbal:
value#(5)=principal#*rl#^months-
payment#*(rl#^months-1)/rate#
RETURN
```

The only one of the above routines that's lengthy is *fintr*. There's no simple formula for the interest rate, so we must zero in on the correct value by repeated calculations.

Displaying Results

Now to display the calculated values:

```
showval:
FOR j=1 TO 5
LOCATE j,1
IF j=cal THEN
PRINT "*";
ELSE
PRINT " ";
END IF
PRINT title$(j);SPACE$(20)
LOCATE j,12
PRINT USING pudef$(j);value#(j)
NEXT j
RETURN
```

For a good human interface, I wanted to distinguish between the calculated item and the entered values. The title for the value being calculated will be preceded by an asterisk. SPACE$ is used to generate a string of blanks to wipe out any old values.

A Choice Is Made

```
menuhit:
ms=0
IF mn>4 THEN
mn1=MENU(1)
ON mn-4 GOSUB newcalc,style
END IF
RETURN
```

Here's the routine to handle menu selections. The value *mn*, given the value of MENU(0) in the calling routine, is used to determine which menu is involved. MENU(1) tells us which item from the menu has been selected. We then subtract 4 from *mn* to get an offset of 1 or 2 for the ON-GOSUB statement.

```
eek:
x=MOUSE(3):y=MOUSE(4)
IF x>5 AND x<190 THEN
v=INT((y+8)/8)
IF v>0 AND v<6 AND v<>cal THEN
LOCATE v,12:PRINT SPACE$(20)
LOCATE v,12:INPUT value#(v)
LOCATE v,12:PRINT USING pudef$(v
);value#(v)
END IF
END IF
RETURN
```

The *newcalc* subroutine is called when menu 5, the Calculate menu, is selected. If the item selected from that menu is 1–5, the previously selected menu item has its checkmark removed, and a checkmark is placed beside the newly selected item. The value of *cal* is updated to show which variable is now being calculated. If menu item 6, Quit, was chosen, we instead set the value of *kwit* accordingly. The *style* subroutine sets *site* to the selected country when an item is selected from menu 6, the Country menu.

```
newcalc:
IF mn1<6 THEN
MENU 5,cal,1
cal=mn1
MENU 5,cal,2
ELSE
IF mn1=6 THEN kwit=1
END IF
RETURN
style:
IF mn1<3 THEN
MENU 6,site,1
site=mn1
MENU 6,site,2
END IF
RETURN
```

When the left mouse button is clicked, the *eek* subroutine allows entry of a new value. It's important to read MOUSE(0) before reading the mouse's position, but in this case, that's already been done in the *event* routine that calls *eek*. The *x* and *y* coordinates of the mouse pointer's current position come from MOUSE(3) and MOUSE(4), since those functions return the position of the mouse when the button was clicked. MOUSE(1) and MOUSE(2) return the mouse's position at the time of the MOUSE(0) call, so either would probably give comparable results in this case. Remember that we are reading pixel positions, not character positions. Before recognizing a click as a request to enter input, we check that the pointer was reasonably close to one of the displayed values. One more limitation is that we won't allow an entry for the *cal* variable: The computer calculates that value.

Once we know it's a valid variable, we clear the old value using SPACE$, input a new value, and then print it neatly formatted in the space provided.

Maiden Voyage

Let's give the program a trial run. You'll see the window appear. If you have used the initial values suggested, you'll notice that the program has calculated a payment of $131.04. That's the Canadian computation. Now press the right button, slide the mouse pointer up to the Country menu, and move down to *USA* before you release the button. The payment should change to $132.16.

This is a ten-year mortgage. Let's see what the balance would be after five years. Use the right button (also called the menu button, for obvious reasons) to select the Balance option from the Calculate menu. The balance will show a slightly negative amount. That's okay (each payment is rounded up a fraction of a penny, so the final payment will be slightly less than zero). Next, move the pointer up to the Years value in the display window menu and click the left button. The computer is inviting you to enter a new value: Enter 5 for five years. Observe that the balance still due after five years is a little over $6,000.00.

How long to pay it off at $150 a month? Select Years from the Calculate menu. Change the Balance value to 0 and the Payment value to 150. The answer is a little over eight years. If you change the interest rate to 12 percent, you'll see that it would take over nine years to pay off the loan. At 18 percent, you wouldn't live long enough to pay it off at $150 a month, and at 20 percent, it's impossible (note the Years value is set to zero to indicate the error). When you've snooped through the combinations enough to satisfy yourself, select Quit. And don't forget to save the program. If your answers don't match these, check the formulae for typographical errors.

After running through this exercise, think how different things would be on any eight-bit computer. It's not just the mortgage calculation; it's the style of the machine. With a fresh approach, you can make your Amiga more flexible and useful than any computer you've used before. ©

Home Financial Calculator For Atari ST

Patrick Parrish, Programming Supervisor

Rarely has there been a program integrating as many useful loan and investment features as "Home Financial Calculator." It is versatile, easy to use, and flexible. Rapid recalculation features make it an ideal tool for "what if" projections. A calculator mode with memory lets you solve problems not directly supported by the program, and you can pass values generated by one calculation to another. Home Financial calculator was originally published in the May 1985 issue of COMPUTE!. *This new version is for any Atari ST computer which has TOS in ROM.*

"Home Financial Calculator" integrates a number of common financial calculations in a menu-driven package. It also features a calculator mode or scratch pad area where program variables can be manipulated using common mathematical operations.

Be particularly careful when typing the long lines in this program which contain financial formulae. A mistyped program may still run, but the results it gives could be inaccurate.

When you run the program, a main menu offers you a choice of Investment or Loan calculations. Type I or L to reach the appropriate submenu.

Easy "What If" Projections

Before looking at any calculations, let's consider some basics of the program. Home Financial Calculator uses some parameters or variables repeatedly in the calculations. These variables are *Total* (also referred to as Future Value, Total Owed, and so forth, depending on the calculation); *Present Value* (principal); *Interest Rate; Years; Months; Number of Periods* (of either compounding, deposits, withdrawals, or payments, depending on the application); *Deposits;* and *Withdrawals.* When in the calculator mode (explained below), you'll reference these eight variables with the single letters *T, P, I, Y, M, N, D,* and *W.*

As you work with Home Financial Calculator, the values of the eight variables are preserved until you change them. Whenever the program asks you for an input (for example, Interest), the current value of that variable is displayed (zero if no value has been entered yet). If you want to keep the current value, just press Return. Otherwise, enter the new value and press Return.

With this feature, Home Financial Calculator makes it easy for you to generate "what if" projections. Simply run the same calculation repeatedly, each time changing a previously entered value. Press Return to keep a value, and change only one or two values to see the effect on the final result.

You can also store the current value into the calculator mode's Memory Register or recall a value from the Memory Register. To see how all this works, let's take a closer look at your options.

Your Investment Menu

Here is the Investment submenu that appears when you type I from the main menu:

1) Future Value with Periodic Interest
2) Future Value with Interest Compounded Continuously
3) Future Value with Regular Deposits
4) Future Value with Cash Flows
5) Withdrawal of Funds
6) Net Present Value
7) Calculator Mode
8) Return to Main Menu.

Determine which option you want and press the appropriate key.

Each option displays screen prompts which ask you to input several values. These values are stored in the eight variables mentioned above: *T* for Total (Future Value), *P* for Present Value (principal), *I* for Interest Rate, *Y* for Years, *M* for Months, *N* for Number of Periods, *D* for Deposits, and *W* for Withdrawals. Of course, not all calculations require you to enter all these values, while others may ask for additional information.

Most calculations can be solved for any *one* of the variables. To solve for a variable, enter an uppercase X at the corresponding input prompt. For example, you could enter values for everything except the Interest Rate, typing X at the Interest Rate prompt. Home Financial Calculator then solves for the Interest Rate.

Remember, however, that the program can solve for only *one* variable during each calculation. If you enter an X at more than one prompt, the program does not have enough information to calculate an answer.

Future Value With Periodic Interest

Home Financial Calculator's options are fairly self-explanatory when you run the program, but let's try an example. We'll calculate the future value of an investment drawing periodic interest. This kind

of investment could be a savings account, interest-bearing checking account, bonds, or a money market account. Choose this option by entering 1 at the Investment submenu.

After the screen clears, the program asks for the first input—Future Value, which appears with an asterisk (*). Below this is a zero (the current value of this variable in memory; all variables start out with a value of zero). Following this is an input prompt.

The asterisk preceding Future Value means that this is one of the variables you can solve for. (A variable *not* preceded by an asterisk means that variable *cannot* be solved for in that particular calculation, so X would be an illegal response.) If you'd like to calculate the Future Value, enter an X here, and answer all the other prompts with the appropriate values.

Let's calculate the future value of a $1,000 investment drawing 8 percent interest for two years and three months, with four compounding periods each year. Enter an X for *Future Value,* since we'll be solving for this total. Answer *Present Value* with 1000 (the principal you're investing); *Annual Int Rate (%)* with 8 (enter the percentage, not a fraction); *For # Of Years* with 2; *For # Of Months* with 3; and *# Of Periods (Compounding)* with 4. After you enter the last value, Home Financial Calculator figures the *Total Future Value* and displays the answer—$1195.09.

Now suppose you wish to know the future value of the same $1,000 investment if you make 9 percent interest. Choose option 1 on the Investment submenu again and rerun the calculation. Notice how Home Financial Calculator automatically prints the current value of each variable at each prompt. The *Future Value* prompt shows a current value of 1195.09 from the previous calculation. Type an X at this prompt, 9 for Interest Rate, and Return at all other prompts to preserve their values. The result should be $1221.71.

The versatility of Home Financial Calculator becomes apparent when you realize how many different ways you can run this calculation. Using this same menu option, you can calculate the initial investment (or present value) necessary to accrue a certain future value with periodic interest; the interest rate necessary to accrue a future value from a present value; or the time (in years and months) it would take to accumulate a future amount from an initial investment with periodic interest payments. Just enter an X for the unknown value you're seeking and fill in all the other prompts.

Future Value With Interest Compounded Continuously

Option 2, a variation of option 1, handles investments paying a continuous interest rate. Like option 1, option 2 can handle a number of calculations—just place an X in the slot you'd like to solve for.

Here, after entering all other parameters, you can calculate the future value of an investment; the initial investment required to reach a certain future value; the interest required to reach a desired future value; or the time required to reach a certain future value at a specified interest rate.

Notice that any variables used in option 1 will be displayed with their current values when running option 2. Recall that the eight major variables in Home Financial Calculator retain their values throughout the program until you change them. This feature is convenient when going from one option to another on the Investment or Loan submenus.

In addition, the values are preserved for use in the calculator mode. For instance, you could compare the effect of continuously compounded interest to periodic interest (option 1) without having to retype the input.

Future Value With Regular Deposits

If you're interested in setting up an annuity, you'd choose option 3 on the Investment submenu. You can determine the future value of an account (such as a savings account, Individual Retirement Account, or college or vacation fund) with regular deposits where interest is compounded with each deposit.

Option 3 can also tell you the amount of each deposit necessary to accrue a future value; the interest rate needed to provide some future value with regular deposits; or the time it would take to amass a future value with regular deposits.

Future Value With Cash Flows

Option 4 does a single calculation—it always solves for *Future Value,* so don't enter an X anywhere. It calculates the future value of an investment with yearly cash flows (either positive or negative). The *Annual Interest Rate* you input here is the growth rate on the money you've invested.

As an example, suppose you wish to determine the value of a vacation fund collected over four years. You're asked for the number of years, then for the deposit or withdrawal each year. You deposit $500 in the fund the first year and $200 the second. The third year you are forced to withdraw $300 (entered as −300), and the fourth year, you put in $400. The fund has a growth rate of 12 percent. Its value after four years will be $1,017.34.

A future value determination can also tell you whether an investment is worthwhile. If the future value of all cash flows is positive or zero, the investment is profitable. A negative future value, on the other hand, represents a losing investment.

Withdrawal Of Funds

If you intend to open an account from which you can regularly withdraw funds, choose option 5. With this option, you can determine the initial deposit required in the account to cover your withdrawals; the amount you can withdraw regularly from this account; the rate of interest you must make on funds in the account; or the period of time over which you can make withdrawals.

Net Present Value

Option 6 lets you determine the feasibility of a prospective investment by calculating its net present value. Net present value is the current value of all future yearly cash flows to an investment along with any initial cash requirement. The interest rate you input here is the rate of return you require on your investment. A positive net present

value indicates a profitable investment, while a negative result signifies a losing investment.

As an example, suppose you have the opportunity to make a $2,000 investment which would return $1,500 the first year, cost you $750 the second year, and return $1,900 the third year. You hope to make 13 percent on your money. With option 6, you would determine a net present value of $56.87, representing a profitable investment.

The Calculator Mode

Option 7 puts you in the calculator mode (also available from the Loan submenu). Calculator mode works very much like a hand-held calculator with a single memory. You can type in a value or recall one from a variable by entering its symbol—T(otal), P(resent Value), I(nterest Rate), Y(ears), M(onths), N(umber of Periods), D(eposits), and W(ithdrawals). You can perform simple math on values stored in the Memory Register using reverse Polish notation. And you can use the results in future calculations.

When you enter calculator mode, the calculator command line appears on the screen:

V S H R M+ M− M* M/ MR MC MEM=0

Here are the commands:

V	View the values of the eight primary variables
S	Store Memory Register into a variable
H	Help—prints the command line
R	Return to main menu, exit calculator mode
M+	Add the last input to the Memory Register
M−	Subtract the last input from the value in the Memory Register and store the result in the Register
M*	Multiply the last input times the value in the Memory Register and store the result in the Register
M/	Divide the last input into the value in the Memory Register and store the result in the Register
MR	Memory Recall
MC	Memory Clear to zero
MEM=	Memory Register's current value

If you've run through a sample investment calculation, you now have some variables in memory. Enter V in the calculator mode to see them. The screen displays the eight values currently in memory for the eight variables.

To work with one of these variables, enter one of their letters (*T, P, I, Y, M, N, D,* or *W*) and press Return. Then type M+ to add it to the Memory Register (all variables must be stored in the Register before you can perform any operations on them). Suppose you put the current value for T into the Register and now wish to add $229 to this value. Enter 229, press Return, then type M+ and press Return. The addition is performed and the result displayed. To store this value back into the T variable, enter S for Store. A prompt appears, requesting the variable in which you intend to store the value. Type T to store the value into the variable T.

You can also use the Memory Register to hold a value not represented by any of the eight variables. To do this, determine a value using the calculator mode and store it into the Memory Register with M+. Then, when you're running a calculation elsewhere in the program, you can substitute this value for any of the eight primary variables by typing MR (Memory Recall) at the appropriate prompt. MR can be used both in the calculator mode and at any prompt where the previous value is displayed.

Finally, option 8 on the Investment submenu returns you to the main menu. Once there, you can perform some loan calculations by typing L.

Loan Calculations

Here is the Loan calculations submenu:

1) Regular Loan Payments
2) Remaining Loan Liability
3) Final Loan Payment
4) Single Payment Loan
5) Loan Amortization Schedule
6) Calculator Mode
7) Return to Main Menu

Regular Loan Payments

Option 1 handles a number of calculations for equal payment loans. You can figure the principal of a loan; the amount of each regular payment necessary to repay a loan; the annual interest rate on a loan with regular payments; or the term of the loan.

Remaining Loan Liability

With option 2, you can determine the remaining balance on a loan with regular payments after a number of payments have been made. Enter the principal on the loan, the amount of each payment, the annual interest rate, the number of payments yearly, and the last payment number.

Final Loan Payment

Option 3 calculates the amount of the final payment on a loan. In many cases, the last payment of a loan will vary from the amount of the regular payment. This option handles situations where the final payment is greater than ("balloon payments") or less than the regular payment.

Single Payment Loan

Option 4 calculates the amount owed on a loan that is paid off with a single payment. You must input the principal on the loan, its annual interest rate, its term in years and months, and the number of times a year the interest on the principal is compounded.

Loan Amortization Schedule

Option 5 displays a loan amortization schedule. Enter the principal on the loan, the amount of each payment, the annual interest rate, the term of the loan, and the number of payments yearly. Then enter the period of the year in which the loan began (for instance, 10 for October) and the range in years of the amortization schedule you'd like to examine.

Because of the complexity of these calculations, there may be a delay before the output appears on the screen, especially if you have chosen to look at the latter years in a long-term loan repayment schedule (such as a home mortgage). When the amortization table appears, it displays the payment number, the beginning balance for the period, the amount paid toward the loan principal, the amount paid in interest, and the ending balance. To keep the information from scrolling off the screen, the program shows only a few payment periods at a time. Press Return to view another screenful. When the end of a year is reached, the program gives the total amounts paid on the principal and

in interest for the year. In addition, when the last period of the loan is reached, the program displays the final payment for the loan.

The last two options on the Loan submenu are the same as those on the Investment submenu.

Modifying The Program

Home Financial Calculator is written in a modular format for easy modification. For many routines, it uses common input labels (lines 4590–4960) and some output labels (lines 4970–5050). If you want to add an investment or loan calculation routine, choose the labels from these lines that fit your application.

Also, you may wish to add a printer option to the loan amortization schedule. Examine lines 3140–3840. Here, variable D5 (defined in line 140) determines the number of loan payments considered on each screen. Variables S1, S2, S3, and S4 (defined in lines 150–180) format the output horizontally on the screen.

Home Financial Calculator For Atari ST

Version by George Miller, Assistant Technical Editor

```
10    GOSUB 5340
20    RES = PEEK(SYSTAB+0)
30    IF RES <> 4 THEN 60
40    ?"Please switch to Medium
       or High"
50    ? "Resolution.":STOP
60    COLOR 1,1
70    DIM V(8)
80    V$="TPIYMNDW"
90    C$="VSHR"
100   C0$="V S H R "
110   C1$="M+ M- M* M/ MR MC"
120   C2$="M+M-M*M/MRMC"
130   Q$=""
140   D5=12
150   S1=10
160   S2=25
170   S3=40
180   S4=55
190   TITLE$=" Home Financial C
      alculator "+CHR$(0)
200   GOSUB 5340:GOSUB TITLEBAR

210   PRINT "INVESTMENTS OR LOA
      NS? (Select 'I' or 'L')"
220   A$=CHR$(INP(2))
230   IF A$="I" OR A$ = "i" THE
      N 260
240   IF A$="L" OR A$ = "l" THE
      N 2120
250   GOTO 220
260   GOSUB 5340
270   TITLE$=" INVESTMENTS ":GO
      SUB TITLEBAR
280   GOTOXY 10,5:PRINT "1) FUT
      URE VALUE WITH PERIODIC I
      NTEREST"
290   GOTOXY 10,6:PRINT "2) FUT
      URE VALUE WITH INTEREST C
      OMPOUNDED CONTINUOUSLY"
300   GOTOXY 10,7:PRINT "3) FUT
      URE VALUE WITH REGULAR DE
      POSITS"
310   GOTOXY 10,8:PRINT "4) FUT
      URE VALUE WITH CASH FLOWS
      "
320   GOTOXY 10,9:PRINT "5) WIT
      HDRAWAL OF FUNDS"
330   GOTOXY 10,10:PRINT "6) NE
      T PRESENT VALUE"
340   GOTOXY 10,11:PRINT "7) CA
      LCULATOR MODE"
350   GOTOXY 10,12:PRINT "8) RE
      TURN TO MAIN MENU"
360   GOTOXY 10,14:PRINT "YOUR
      CHOICE?";
370   A=INP(2)-48
380   IF A<1 OR A>8 THEN 370
390   ON A GOTO 420,680,920,131
      0,1500,1890,400,190
400   GOSUB 4060
410   GOTO 190
420   GOSUB 5340
430   TITLE$=" FUTURE VALUE WIT
      H PERIODIC INTEREST ":GOS
      UB TITLEBAR
440   PRINT
450   GOSUB 4590
460   GOSUB 4630
470   PRINT "$";
480   GOSUB 4720
490   PRINT "$";
500   GOSUB 4760
510   IF E=4 THEN 530
520   GOSUB 4800
530   GOSUB 4850
540   IF E<>1 THEN 570
550   V(1)=INT(V(2)*(1+V(3)/V(6
      ))^(V(6)*Y)*100+.5)/100
560   GOSUB 4970
570   IF E<>2 THEN 600
580   V(2)=INT(V(1)/((1+V(3)/V(
      6))^(V(6)*Y))*100+.5)/100

590   GOSUB 5000
600   IF E<>3 THEN 630
610   V(3)=INT((V(6)*(V(1)/V(2)
      )^(1/(V(6)*Y))-V(6))*1000
      0+.5)/10000
620   GOSUB 5030
630   IF E<>4 THEN 660
640   V(4)=LOG(V(1)/V(2))/(V(6)
      *LOG(1+V(3)/V(6)))
650   GOSUB 5060
660   GOSUB 5210
670   GOTO 260
680   GOSUB 5340
690   TITLE$=" FUTURE VALUE WIT
      H INTEREST COMPOUNDED CON
      TINUOUSLY ":GOSUB TITLEBA
      R
700   PRINT
710   GOSUB 4590
720   GOSUB 4630
730   PRINT "$";
740   GOSUB 4720
750   PRINT "$";
760   GOSUB 4760
770   IF E=4 THEN 790
780   GOSUB 4800
790   IF E<>1 THEN 820
800   V(1)=INT(V(2)*EXP(V(3)*Y)
      *100+.5)/100
810   GOSUB 4970
820   IF E<>2 THEN 850
830   V(2)=INT(V(1)/EXP(V(3)*Y)
      *100+.5)/100
840   GOSUB 5000
850   IF E<>3 THEN 880
860   V(3)=INT(LOG(V(1)/V(2))/Y
      *10000+.5)/10000
870   GOSUB 5030
880   IF E<>4 THEN 660
890   V(4)=INT(LOG(V(1)/V(2))/V
      (3)*100+.5)/100
900   GOSUB 5060
910   GOTO 660
920   GOSUB 5340
930   TITLE$=" FUTURE VALUE WIT
      H REGULAR DEPOSITS ":GOSU
      B TITLEBAR
940   PRINT
950   GOSUB 4590
960   PRINT "$REGULAR DEPOSIT $
      "
970   C=6
980   GOSUB 3850
990   PRINT "$";
1000  GOSUB 4720
1010  PRINT "$";
1020  GOSUB 4760
1030  IF E=4 THEN 1050
1040  GOSUB 4800
1050  GOSUB 4850
1060  IF E<>1 THEN 1090
1070  V(1)=INT(V(7)*V(6)*((1+V(
      3)/V(6))^(V(6)*Y)-1)/V(3)
      *100+.5)/100
1080  GOSUB 4970
1090  IF E<>3 THEN 1230
1100  V(3)=.99
1110  I=0
1120  T=INT(V(7)*(((1+V(3)/V(6)
      )^(V(6)*Y)-1)/(V(3)/V(6))
      )*100+.5)/100
1130  TE=ABS(V(3)-I)/2
1140  I=V(3)
1150  IF ABS(T-V(1))/V(1)<.0000
      5 THEN 1210
1160  IF T<V(1) THEN 1190
1170  V(3)=V(3)-TE
1180  GOTO 1120
1190  V(3)=V(3)+TE
1200  GOTO 1120
1210  V(3)=INT(V(3)*10000+.5)/1
      0000
1220  GOSUB 5030
1230  IF E<>4 THEN 1260
1240  V(4)=LOG(V(3)*V(1)/(V(6)*
      V(7))+1)/(V(6)*LOG(1+V(3)
      /V(6)))
1250  GOSUB 5060
1260  IF E<>7 THEN 660
1270  V(7)=INT(V(1)*(V(3)/V(6))
      /((1+V(3)/V(6))^(V(6)*Y)-
      1)*100+.5)/100
1280  PRINT
1290  PRINT "REGULAR DEPOSITS R
      EQUIRED:$";V(7)
1300  GOTO 660
1310  GOSUB 5340
1320  TITLE$=" FUTURE VALUE WIT
      H CASH FLOWS ":GOSUB TITL
      EBAR
1330  PRINT
1340  GOSUB 4720
1350  GOSUB 4760
1360  PRINT "CASH FLOW (+/-)"
1370  PRINT
1380  V(1)=0
1390  FOR I=1 TO V(4)
1400  PRINT "CASH FLOW - YEAR #
      ";I
1410  INPUT A$
1420  A=VAL(A$)
1430  V(1)=V(1)+A*(1+V(3))^(V(4
      )-I)
1440  NEXT I
1450  V(1)=INT(V(1)*100+.5)/100

1460  GOSUB 4970
1470  TE=V(1)
1480  GOSUB 5150
1490  GOTO 660
1500  GOSUB 5340
```

```
1510  TITLE$=" WITHDRAWAL OF FU
      NDS ":GOSUB TITLEBAR
1520  PRINT
1530  GOSUB 4630
1540  PRINT "*REGULAR WITHDRAWA
      L $"
1550  C=7
1560  GOSUB 3850
1570  PRINT "*";
1580  GOSUB 4720
1590  PRINT "*";
1600  GOSUB 4760
1610  IF E=4 THEN 1630
1620  GOSUB 4800
1630  GOSUB 4850
1640  IF E<>2 THEN 1670
1650  V(2)=INT(V(8)*V(6)/V(3)*(
      1-(1+V(3)/V(6))^(-V(6)*Y)
      )*100+.5)/100
1660  GOSUB 5000
1670  IF E<>3 THEN 1810
1680  V(3)=.99
1690  I=0
1700  R=INT(V(2)*V(3)/V(6)*(1/(
      (1+V(3)/V(6))^(V(6)*Y)-1)
      +1)*100+.5)/100
1710  TE=ABS(V(3)-I)/2
1720  I=V(3)
1730  IF ABS(R-V(8))/V(8)<.0000
      5 THEN 1790
1740  IF R<V(8) THEN 1770
1750  V(3)=V(3)-TE
1760  GOTO 1700
1770  V(3)=V(3)+TE
1780  GOTO 1700
1790  V(3)=INT(V(3)*10000+.5)/1
      0000
1800  GOSUB 5030
1810  IF E<>4 THEN 1840
1820  V(4)=LOG(V(6)*V(8)/(V(6)*
      V(8)-V(3)*V(2)))/(V(6)*LO
      G(1+V(3)/V(6)))
1830  GOSUB 5060
1840  IF E<>8 THEN 660
1850  V(8)=INT(V(2)*V(3)/V(6)*(
      1/((1+V(3)/V(6))^(V(6)*Y)
      -1)+1)*100+.5)/100
1860  PRINT
1870  PRINT "REGULAR WITHDRAWAL
      S:$";V(8)
1880  GOTO 660
1890  GOSUB 5340
1900  PRINT "NET PRESENT VALUE:
      $"
1910  PRINT
1920  PRINT "INITIAL INVESTMENT
      "
1930  C=1
1940  GOSUB 3850
1950  GOSUB 4720
1960  GOSUB 4760
1970  PRINT "CASH FLOW (+/-)"
1980  PRINT
1990  NV=-V(2)
2000  FOR I=1 TO V(4)
2010  PRINT "CASH FLOW - YEAR #
      ";I
2020  INPUT A$
2030  A=VAL(A$)
2040  NV=NV+A/((V(3)+1)^I)
2050  NEXT I
2060  NV=INT(NV*100+.5)/100
2070  PRINT
2080  PRINT "NET PRESENT VALUE:
      $";NV
2090  TE=NV
2100  GOSUB 5150
2110  GOTO 660
2120  GOSUB 5340
2130  TITLE$=" LOANS ":GOSUB TI
      TLEBAR
2140  GOTOXY 21,5:PRINT "1) REG
      ULAR LOAN PAYMENTS"
2150  GOTOXY 21,6:PRINT "2) REM
      AINING LOAN LIABILITY"
2160  GOTOXY 21,7:PRINT "3) FIN
      AL LOAN PAYMENT"
2170  GOTOXY 21,8:PRINT "4) SIN
      GLE PAYMENT LOAN"
2180  GOTOXY 21,9:PRINT "5) LOA
      N AMORTIZATION SCHEDULE"
2190  GOTOXY 21,10:PRINT "6) CA
      LCULATOR MODE"
2200  GOTOXY 21,11:PRINT "7) RE
      TURN TO MAIN MENU"
2210  GOTOXY 21,13:PRINT "YOUR
      CHOICE?";
2220  A=INP(2)-48
2230  IF A<1 OR A>7 THEN 2220
2240  ON A GOTO 2270,2690,2870,
      3030,3140,2250,190
2250  GOSUB 4060
2260  GOTO 190
2270  GOSUB 5340
2280  TITLE$=" REGULAR LOAN PAY
      MENTS ":GOSUB TITLEBAR
2290  PRINT
2300  PRINT "*";
2310  GOSUB 4670
2320  PRINT "*";
2330  GOSUB 4890
2340  PRINT "*";
2350  GOSUB 4720
2360  PRINT "*";
2370  GOSUB 4760
2380  IF E=4 THEN 2400
2390  GOSUB 4800
2400  GOSUB 4850
2410  IF E<>2 THEN 2460
2420  V(2)=INT(V(7)*V(6)/V(3)*(
      1-(1+V(3)/V(6))^(-V(6)*Y)
      )*100+.5)/100
2430  PRINT
2440  PRINT "AMT OF PRINCIPAL:$
      ";V(2)
2450  GOTO 2670
2460  IF E<>3 THEN 2600
2470  V(3)=.99
2480  I=0
2490  P=INT(V(7)*V(6)/V(3)*(1-(
      (1+V(3)/V(6))^(-V(6)*Y)))
      *100+.5)/100
2500  TE=ABS(V(3)-I)/2
2510  I=V(3)
2520  IF ABS(P-V(2))/V(2) < .00
      005 THEN 2580
2530  IF P<V(2) THEN 2560
2540  V(3)=V(3)+TE
2550  GOTO 2490
2560  V(3)=V(3)-TE
2570  GOTO 2490
2580  V(3)=INT(V(3)*10000+.5)/1
      0000
2590  GOSUB 5030
2600  IF E<>4 THEN 2630
2610  V(4)=-LOG(1-V(3)*V(2)/(V(
      6)*V(7)))/(V(6)*LOG(V(3)/
      V(6)+1))
2620  GOSUB 5060
2630  IF E<>7 THEN 2670
2640  V(7)=INT(V(3)*V(2)/(V(6)*
      (1-(V(3)/V(6)+1)^(-V(6)*Y
      )))*100+.5)/100
2650  PRINT
2660  PRINT "REQ PAYMENT:$";V(7
      )
2670  GOSUB 5210
2680  GOTO 2120
2690  GOSUB 5340
2700  TITLE$=" REMAINING LOAN L
      IABILITY ":GOSUB TITLEBAR
2710  PRINT
2720  GOSUB 4670
2730  GOSUB 4890
2740  GOSUB 4720
2750  GOSUB 4850
2760  PRINT "LAST PAYMENT # WAS
      :"
2770  INPUT A$
2780  A=VAL(A$)
2790  FOR J=1 TO A
2800  I=INT(P*V(3)/V(6)*100+.5)
      /100
2810  P=P+I-V(7)
2820  NEXT J
2830  LI=INT(P*100+.5)/100
2840  PRINT
2850  PRINT "LIABILITY AFTER ";
      A;" PAYMENTS:$";LI
2860  GOTO 2670
2870  GOSUB 5340
2880  TITLE$=" LAST LOAN PAYMEN
      T ":GOSUB TITLEBAR
2890  PRINT
2900  GOSUB 4670
2910  GOSUB 4890
2920  GOSUB 4720
2930  GOSUB 4930
2940  GOSUB 4850
2950  FOR J=1 TO V(6)*Y
2960  I=INT(P*V(3)/V(6)*100+.5)
      /100
2970  P=P+I-V(7)
2980  NEXT J
2990  LP=INT(P*100+.5)/100+V(7)

3000  PRINT
3010  PRINT "LAST PAYMENT:$";LP

3020  GOTO 2670
3030  GOSUB 5340
3040  TITLE$=" SINGLE PAYMENT L
      OAN ":GOSUB TITLEBAR
3050  PRINT
3060  GOSUB 4670
3070  GOSUB 4720
3080  GOSUB 4930
3090  GOSUB 4850
3100  V(1)=INT(V(2)*(1+V(3)/V(6
      ))^(Y*V(6))*100+.5)/100
3110  PRINT
3120  PRINT "TOTAL OWED:$";V(1)
3130  GOTO 2670
3140  C5=0
3150  N5=0
3160  F=0
3170  P1=0
3180  I1=0
3190  GOSUB 5340
3200  TITLE$=" LOAN AMORTIZATIO
      N SCHEDULE ":GOSUB TITLEB
      AR
3210  GOSUB 4670
3220  GOSUB 4890
3230  GOSUB 4720
3240  GOSUB 4930
3250  PRINT "# OF PAYMENTS YEAR
      LY"
3260  GOSUB 3850
3270  PRINT "ENTER THE PERIOD O
      F THE YEAR IN WHICH THE L
      OAN BEGAN"
3280  INPUT N
3290  NE=N
3300  NP=(V(4)*12+V(5))/(12/V(6
      ))
3310  NY=INT(((N-1)+NP)/V(6)+.9
      9)
3320  PRINT "ENTER THE RANGE OF
       YEARS YOU'D LIKE TO EXAM
      INE (FIRST, LAST)"
3330  INPUT F1,L1
3340  IF L1<=NY THEN 3360
3350  L1=NY
3360  FOR J1=1 TO L1
3370  IF J1<F1 THEN 3390
3380  GOSUB 5250
3390  FOR J=1 TO V(6)-N+1
```

```
3400  I=INT(P*V(3)/V(6)*100+.5)
      /100
3410  N5=N5+1
3420  PP=V(7)-I
3430  IF J1<>NY THEN 3470
3440  IF N5<>NP THEN 3470
3450  PP=P
3460  F=1
3470  IF J1<F1 THEN 3500
3480  PRINT TAB(5);MID$(STR$(N5
      ),2,LEN(STR$(N5))-1);TAB(
      S1);INT(P*100+.5)/100;
3490  PRINT TAB(S2);INT(PP*100+
      .5)/100;Q$;TAB(S3);
3500  P=P+I-V(7)
3510  IF F=0 THEN 3540
3520  P=0
3530  J=V(6)
3540  IF J1<F1 THEN 3570
3550  PRINT I;TAB(S4);INT(P*100
      +.5)/100;
3560  PRINT
3570  I1=I1+I
3580  P1=P1+PP
3590  C5=C5+1
3600  IF C5<>D5 THEN 3670
3610  IF J1<F1 THEN 3670
3620  GOSUB 5210
3630  GOSUB 5340
3640  C5=0
3650  IF J=V(6)-N+1 THEN 3670
3660  GOSUB 5250
3670  NEXT J
3680  IF J1<F1 THEN 3790
3690  IF F=0 THEN 3720
3700  GOTOXY 0,0
3710  PRINT "FINAL PAYMENT :$";
      INT((PP+I)*100+.5)/100
3720  PRINT
3730  PRINT "TOTAL INT PAID IN
      YR ";J1;":$";INT(I1*100+.
      5)/100
3740  PRINT "TOTAL PRINC PAID I
      N YR ";J1;":$";INT(P1*100
      +.5)/100
3750  IF F=1 THEN 3830
3760  IF J1=L1 THEN 3830
3770  GOSUB 5210
3780  GOSUB 5340
3790  C5=0
3800  P1=0
3810  I1=0
3820  N=1
3830  NEXT J1
3840  GOTO 2670
3850  C=C+1
3860  IF C<>3 THEN 3890
3870  PRINT V(3)*100,
3880  GOTO 3900
3890  PRINT V(C),
3900  INPUT A$
3910  IF LEN(A$)<>0 THEN 3930
3920  RETURN
3930  IF A$<>"MR" THEN 3990
3940  PRINT "MEM=";M;"  USE AS
      VARIABLE HERE (Y/N)"
3950  INPUT A$
3960  IF A$="N" THEN 3900
3970  V(C)=M
3980  RETURN
3990  IF A$="X" THEN E=C:RETURN

4000  IF A$="x" THEN E=C:RETURN

4010  V(C)=VAL(A$)
4020  IF C<>3 THEN 4040
4030  V(C)=V(C)/100
4040  RETURN
4050  REM CALCULATOR MODE
4060  GOSUB 5340:TITLE$=" Calcu
      lator Mode ":GOSUB TITLEB
      AR
4070  M5=0
4080  GOSUB 4410
4090  INPUT A$
4100  IF ASC(A$)>57 THEN 4130
4110  T=VAL(A$)
4120  GOTO 4090
4130  FOR I=1 TO 8
4140  IF A$<>MID$(V$,I,1) THEN
      4170
4150  PRINT V(I)
4160  T=V(I)
4170  NEXT I
4180  FOR J=1 TO 6
4190  IF A$<>MID$(C2$,(J-1)*2+1
      ,2) THEN 4210
4200  ON J GOSUB 4460,4480,4500
      ,4520,4540,4560
4210  NEXT J
4220  FOR K=1 TO 4
4230  IF A$<>MID$(C$,K,1) THEN
      4250
4240  ON K GOSUB 4290,4340,4410
      ,4440
4250  NEXT K
4260  IF M5=0 THEN 4090
4270  M5=0
4280  RETURN
4290  FOR I=1 TO 8
4300  PRINT MID$(V$,I,1);"  ";V
      (I)
4310  NEXT I
4320  PRINT
4330  RETURN
4340  PRINT "IN WHAT VARIABLE "
      ;
4350  INPUT A$
4360  FOR I=1 TO 8
4370  IF A$<>MID$(V$,I,1) THEN
      4390
4380  V(I)=M
4390  NEXT I
4400  RETURN
4410  COLOR 2,1:GOTOXY 0,0:PRIN
      T C0$;" ";C1$;" MEM=";M:C
      OLOR 1,1
4420  PRINT
4430  RETURN
4440  M5=1
4450  RETURN
4460  M=M+T
4470  GOTO 4570
4480  M=M-T
4490  GOTO 4570
4500  M=M*T
4510  GOTO 4570
4520  M=M/T
4530  GOTO 4570
4540  T=M
4550  GOTO 4570
4560  M=0
4570  PRINT "MEM=";M
4580  RETURN
4590  PRINT "*FUTURE VALUE $"
4600  C=0
4610  GOSUB 3850
4620  RETURN
4630  PRINT "*PRESENT VALUE $"
4640  C=1
4650  GOSUB 3850
4660  RETURN
4670  PRINT "PRINCIPAL $"
4680  C=1
4690  GOSUB 3850
4700  P=V(C)
4710  RETURN
4720  PRINT "ANNUAL INT RATE (%
      )"
4730  C=2
4740  GOSUB 3850
4750  RETURN
4760  PRINT "FOR # OF YEARS"
4770  C=3
4780  GOSUB 3850
4790  RETURN
4800  PRINT "FOR # OF MONTHS"
4810  C=4
4820  GOSUB 3850
4830  Y=V(C-1)+V(C)/12
4840  RETURN
4850  PRINT "# OF PERIODS (COMP
      OUNDING, DEPOSITS, WITHDR
      AWALS, PAYMENTS) YEARLY"
4860  C=5
4870  GOSUB 3850
4880  RETURN
4890  PRINT "PAYMENTS $"
4900  C=6
4910  GOSUB 3850
4920  RETURN
4930  PRINT "TERM OF LOAN:"
4940  GOSUB 4760
4950  GOSUB 4800
4960  RETURN
4970  PRINT
4980  PRINT "FUTURE VALUE:$";V(
      1)
4990  RETURN
5000  PRINT
5010  PRINT "REQUIRED INVESTMEN
      T:$";V(2)
5020  RETURN
5030  PRINT
5040  PRINT "ANNUAL INT RATE (%
      ) REQUIRED:";V(3)*100
5050  RETURN
5060  V(5)=V(4)-INT(V(4))
5070  V(5)=INT(INT(12*V(5)*10+.
      5)/10)
5080  V(4)=INT(V(4))
5090  IF V(5)<>12 THEN 5120
5100  V(4)=V(4)+1
5110  V(5)=0
5120  PRINT
5130  PRINT "# OF YEARS AND MON
      THS:";V(4);",";V(5)
5140  RETURN
5150  PRINT
5160  IF TE>=0 THEN 5190
5170  PRINT "THIS IS A LOSING I
      NVESTMENT."
5180  RETURN
5190  PRINT "THIS IS A PROFITAB
      LE INVESTMENT."
5200  RETURN
5210  PRINT
5220  COLOR 2,2:PRINT "Press an
      y key to continue";:COLOR
       1,1
5230  A = INP(2)
5240  RETURN
5250  GOSUB 5340
5260  PRINT "LOAN AMORTIZATION
      SCHEDULE FOR YR ";J1
5270  PRINT "PRIN $";V(2);"  RA
      TE ";V(3)*100;"%";"  PAYM
       $";V(7)
5280  PRINT
5290  COLOR 3,1
5300  PRINT TAB(5);"#";TAB(11);
      "BEG BAL";TAB(26);"PRINC"
      ;TAB(41);"INT";
5310  PRINT TAB(56);"END BAL"
5320  COLOR 1,1
5330  RETURN
5340  CLEARW 2:FULLW 2:GOTOXY 0
      ,0
5350  RETURN
5360  TITLEBAR:
5370  A# = GB : GINTIN = PEEK(A
      #+8)
5380  POKE GINTIN+0,PEEK(SYSTAB
      +8) : POKE GINTIN+2,2
5390  S# = GINTIN+4 : TITLE$ =
      TITLE$ + CHR$(0)
5400  POKE S#,VARPTR(TITLE$) :
      GEMSYS(105)
5410  RETURN                    ©
```

Fast IBM Batch File Editor

Tony Roberts, Production Director

Now it's quick and easy to edit and fine-tune batch files with this DOS utility. It works on any IBM PC or PCjr with an 80-column monitor.

The power of the batch file quickly becomes evident to anyone who works regularly in PC-DOS. The hardy AUTOEXEC.BAT handles a variety of chores each time the system is booted, and any number of other .BAT files stand by, ready to help with such tasks as initializing applications, sending out printer codes, and presenting program menus.

The problem with batch files is that to be effective and helpful, they need to be adjusted as your system grows and your applications change. Performing the necessary batch-file maintenance, however, is often so cumbersome that it's discouraging. Loading a full-blown word processor to edit a five- to ten-line batch file can be a lot more time and trouble than it's worth.

"EdBat" solves this problem by focusing all its energy on your batch files. EdBat is without frills, but it's fast and easy to use.

What EdBat Does

EdBat is a full-screen editor with very limited features. Because it is designed for speed, it limits itself to files of fewer than 512 bytes—adequate for most batch files. (If your file is longer, you're probably better off with a more sophisticated editor.)

When called, the program clears the screen and displays the file you want to edit. Using the cursor keys, you can move to the appropriate place, make the necessary changes, and press Alt-S to save the edited file. It is not impossible to open a file, edit it, close it, and be back at the DOS prompt in as little as 15 seconds.

The price you pay for this fast operation is that EdBat has very few features. You're essentially limited to the regular character keys and the cursor keys. The Insert key does not work, the Delete key does not work, nor do the function keys perform any function. The Backspace key moves the cursor back a character, but it does not perform a delete.

If you were writing a novel, these restrictions would be serious, but in batch file editing, none of them is particularly restrictive. With batch files, you're usually just performing one or two simple operations such as adding, deleting, or correcting a line. EdBat can handle all these tasks efficiently.

Using The Program

EdBat is a machine language program that is activated from the DOS prompt. The program listed below, "EdBat Loader," is a BASIC program that creates the file EDBAT-.COM from the information in BASIC DATA statements. Type in EdBat Loader using the "IBM Automatic Proofreader," save a copy to disk, and then run it once to create EDBAT.COM.

To run EdBat, enter this line from the DOS prompt:

EDBAT *filename*

(The EDBAT.COM file must be on the disk in the current drive when you enter this command.) *Filename* is the name of the file you wish to edit. Full drive and subdirectory specifications are allowed when indicating a filename. If the file is too long or if EdBat is unable to open the file, the program will print a message and exit. If the file you have specified does not exist, EdBat assumes you are creating a new file.

In a matter of seconds, the file you are to edit is displayed on the screen below a line containing the program title and the name of the current file. If you have started a new file, the screen's work area will be blank.

Use the cursor keys to move around the file, editing as needed. Notice that a triangle signals the end of each line. If you decide to cut a line short, move to the appropriate spot and press Enter. A triangle is inserted and the cursor moves to the beginning of the next line. The screen may continue to show characters beyond the end-of-line marker, but they will be ignored when the file is saved.

To delete an entire line, simply move to the first position on that line and press Enter. An end-of-line marker appears at that spot, indicating that the line will be ignored.

Inserting a line is slightly more difficult since there is no insert function. Move the cursor to the end-of-line marker on the line that will precede your new line. Press Ctrl-Y and a down-arrow character (↓) will replace the end-of-line marker. Add the new line right after the down arrow and press Enter as usual. When the file is saved, the lines will be adjusted.

Saving The Changes

When you're finished editing, press

Alt-S to save the file. The program's save routine reads the screen and saves what it sees to your file. It begins with the first line of the text area and continues until it finds a space in the first position of any line. EdBat ignores any characters in a line which follow the first end-of-line marker.

The only other option the program offers is Alt-Q, the Quit option, which returns you to DOS without changing the original file. In nearly every case, your entire file will fit easily on the screen. If part of your file scrolls off the screen, use Alt-Q to quit and find another method of editing the file. EdBat cannot save what it cannot see.

Unlike many word processors, EdBat does not make a backup of your original file. In most cases, though, a backup of a very short file is superfluous. For years, EDLIN, the line editor included with PC-DOS, had been my batch file editor. Eventually, though, I lost patience with it over the time it spent writing backup files and went to work on EdBat.

EdBat Command Summary

Alt-Q	Quit
Alt-S	Save
Ctrl-Y	Multistatement delimiter (prints as a down arrow)
Enter	End-of-line (prints as left-pointing triangle)
Space	Space in first position of line signals text end

EdBat Loader

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
HL 10 CLS
EI 20 OPEN "EDBAT.COM" AS 1 LEN
    = 1
FC 30 FIELD 1, 1 AS A$
GP 40 PRINT:PRINT"Writing EDBAT.
    COM to disk. Please wait."
GC 50 FOR I=1 TO 8:READ B$:GOSUB
    130:NEXT I
CN 60 FOR I=1 TO 75:B$="5F":GOSU
    B 130:NEXT I
GM 70 B$="24":GOSUB 130
OF 80 FOR I=1 TO 74:B$="0":GOSUB
    130:NEXT I
HG 90 FOR I=1 TO 648:READ B$: GO
    SUB 130: NEXT I
OG 100 CLOSE
MA 110 PRINT:PRINT"EDBAT.COM has
    been created."
LO 120 END
MF 130 REM write byte to disk
QO 140 LSET A$ = CHR$(VAL("&H"+B
    $))
LK 150 PUT #1
MH 160 RETURN
```

```
DN 170 DATA E9, E0, 0, 45, 64, 4
    2, 61, 74, 2, 0
CE 180 DATA 2, 50, 6C, 65, 61, 7
    3, 65, 20, 73, 70, 65, 63
    , 69, 66, 79, 20
EK 190 DATA 66, 69, 6C, 65, 6E,
    61, 6D, 65, 2E, D, A, 24,
     45, 72, 72, 6F
EN 200 DATA 72, 20, 6F, 70, 65,
    6E, 69, 6E, 67, 20, 66, 6
    9, 6C, 65, 2E, D
BL 210 DATA A, 24, 46, 69, 6C, 6
    5, 20, 74, 6F, 6F, 20, 6C
    , 6F, 6E, 67, 2E
GP 220 DATA D, A, 24, FC, BF, 54
    , 1, BE, 80, 0, AC, A2, 9
    9, 1, FE, E
JJ 230 DATA 99, 1, 3C, 0, 75, 9,
     BA, A1, 1, E8, 7, 2, E8,
     25, 2, AC
FH 240 DATA 3C, D, 74, 3, AA, EB
    , F8, E8, BA, 1, 73, E, 3
    D, 2, 0, 74
GA 250 DATA 30, BA, BC, 1, E8, E
    C, 1, E8, A, 2, BA, 26, 4
    , 8B, 1E, 9A
QI 260 DATA 1, 8B, E, 9F, 1, B4,
     3F, CD, 21, 3B, 6, 9F, 1
    , 75, C, E8
AD 270 DATA A0, 1, BA, D2, 1, E8
    , CB, 1, E8, E9, 1, A3, 9
    6, 1, E8, 91
HA 280 DATA 1, E8, CB, 1, BA, 3,
     1, E8, B9, 1, C6, 6, 9E,
    1, 0, C6
KF 290 DATA 6, 9D, 1, 14, E8, 60
    , 1, BE, 55, 1, 33, C9, 8
    A, E, 99, 1
HP 300 DATA AC, 8A, D0, 80, FA,
    61, 72, 3, 80, E2, DF, E8
    , 9C, 1, E2, F0
HL 310 DATA C6, 6, 9E, 1, 2, C6,
     6, 9D, 1, 0, E8, 3A, 1,
    83, 3E, 96
OJ 320 DATA 1, 0, 74, 1F, FC, BE
    , 26, 4, 8B, E, 96, 1, AC
    , 8A, D0, 80
JN 330 DATA FA, D, 75, 7, B2, 11
    , E8, 71, 1, B2, D, E8, 6
    C, 1, E2, EC
HM 340 DATA E8, 14, 1, B4, 0, CD
    , 16, 3C, 0, 74, 13, 3C,
    D, 74, A, 3C
NO 350 DATA 8, B4, 4B, 74, 1C, 3
    C, 19, 72, EA, E8, 1F, 1,
     EB, E5, 80, FC
PE 360 DATA 48, 75, E, 80, 3E, 9
    E, 1, 2, 74, D9, FE, E, 9
    E, 1, E8, E6
OG 370 DATA 0, 80, FC, 4B, 75, E
    , 80, 3E, 9D, 1, 0, 74, C
    6, FE, E, 9D
DG 380 DATA 1, E8, D3, 0, 80, FC
    , 4D, 75, E, 80, 3E, 9D,
    1, 4F, 74, B3
OJ 390 DATA FE, 6, 9D, 1, E8, C0
    , 0, 80, FC, 50, 75, E, 8
    0, 3E, 9E, 1
NJ 400 DATA 18, 74, A0, FE, 6, 9
    E, 1, E8, AD, 0, 80, FC,
    10, 75, 6, E8
QK 410 DATA FD, 0, E8, F, 1, 80,
     FC, 1F, 75, 89, C7, 6, 9
    6, 1, 0, 0
JD 420 DATA BF, 26, 4, C6, 6, 9E
    , 1, 2, C6, 6, 9D, 1, 0,
    E8, 87, 0
ML 430 DATA C6, 6, 95, 1, 0, B4,
     8, CD, 10, 3C, 20, 74, 4
    E, 3C, 11, 75
BB 440 DATA 9, FE, 6, 9E, 1, E8,
     6F, 0, EB, DE, 80, 3E, 9
    5, 1, 50, 77
```

```
DJ 450 DATA 18, B4, 8, CD, 10, 3
    C, 11, 74, 10, 3C, 19, 75
    , 1C, B0, D, AA
DE 460 DATA FF, 6, 96, 1, B0, A,
     EB, 11, 90, B0, D, B4, A
    , AB, 83, 6
AB 470 DATA 96, 1, 2, FE, 6, 9E,
     1, EB, AF, AA, FF, 6, 96
    , 1, FE, 6
LC 480 DATA 95, 1, FE, 6, 9D, 1,
     E8, 2E, 0, EB, BF, F8, B
    A, 55, 1, B4
CF 490 DATA 3C, B9, 0, 0, CD, 21
    , 73, 9, BA, BC, 1, E8, 6
    5, 0, E8, 83
LA 500 DATA 0, 8B, D8, 8B, E, 96
    , 1, BA, 26, 4, B4, 40, C
    D, 21, E8, 21
HD 510 DATA 0, E8, 5B, 0, E8, 6D
    , 0, 8A, 36, 9E, 1, 8A, 1
    6, 9D, 1, B4
CG 520 DATA 2, CD, 10, C3, F8, B
    A, 55, 1, B0, 2, B4, 3D,
    CD, 21, A3, 9A
LC 530 DATA 1, C3, 8B, 1E, 9A, 1
    , B4, 3E, CD, 21, C3, 8A,
    D0, 80, FA, D
PH 540 DATA 74, 8, E8, 25, 0, FE
    , 6, 9D, 1, C3, B2, 11, E
    8, 1B, 0, B2
JD 550 DATA D, E8, 16, 0, B2, A,
     E8, 11, 0, FE, 6, 9E, 1,
    C6, 6, 9D
ID 560 DATA 1, 0, C3, 50, B4, 9,
     CD, 21, 58, C3, B4, 2, C
    D, 21, C3, B4
IG 570 DATA F, CD, 10, 88, 3E, 9
    C, 1, B4, 0, B0, 2, CD, 1
    0, B4, 5, B0
BF 580 DATA 0, CD, 10, C3, CD, 2
    0
```

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3-D Tic-Tac-Toe For Atari ST

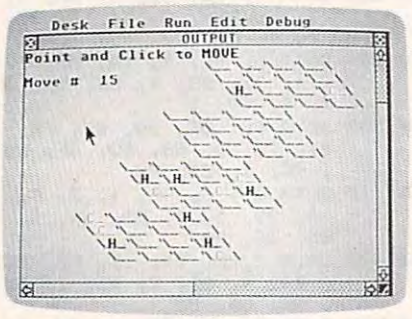
David Bohlke

This new rendition of an old favorite lets you match wits against the ST computer in a three-dimensional contest. You can even, if you like, make changes to the program which will make the computer play more aggressively or more cautiously. "3-D Tic-Tac-Toe" runs on any Atari 520ST or 1040ST computer with a color monitor.

"3-D Tic-Tac-Toe" is a strategy game where you take on the Atari ST in a battle of wits. The object of the game is similar to the traditional Tic-Tac-Toe game, except this version takes place in a simulated three-dimensional space containing four game boards. To win, you must place four pieces in a row. The row may extend across a single plane or vertically though all four planes. Though it's not a flawless player, the ST will provide you with a formidable opponent.

Entering Tic-Tac-Toe

Type in the program as listed and save it to disk. The program works in either low- or medium-resolution modes. When you run the program, it randomly selects whether you or the computer should go first. The computer needs only a few seconds to pick its move and places a red uppercase *C* at the selected square. (The ST takes less time to move if you refrain from moving the mouse pointer around while it is calculating; moving the pointer freezes normal BASIC operations. In addition, you should avoid moving the slider bars on the output window, since this may jumble part of the game board.)



"3-D Tic-Tac-Toe For Atari ST" challenges you to best the computer in a three-dimensional strategic simulation.

It's your turn when the screen prompt appears. Use the mouse to move to the square of your choice, then click the left mouse button. Due to the slowness of ST BASIC, you may need to hold the button down for as long as one second before the computer recognizes your choice. A blue uppercase *H* appears on the square you have chosen. The *H*, of course, stands for the Human, you, and the *C* stands for Computer.

Programmed Strategy

You may be interested in learning how the ST plays this simple strategy game. The computer does not use a "look-ahead" technique, but rather determines its move by assigning a numeric value to each empty square. This value is explained in the table, which shows a sample Tic-Tac-Toe combination of four squares in a row, along with the corresponding BASIC line number that assigns the value.

Combination Values

Line	Pattern	Value
540	HHHH	human wins
540	CCCC	computer wins
550	H_HH	33 points
560	_H_H	5 points
570	__H_	2 points
580	CC_C	77 points
590	C__C	6 points
600	_C__	1 point

Each computer piece is stored with a value of 5 in the V( ) array, and each human piece has a value of 1 in the array. So if a row of four squares contains two computer pieces, that combination has a value of 10. Lines 540–600 then convert these combination values into point values, which are evaluated to choose the next move. Note that the order of pieces in the table has no significance: What matters is the number of pieces and blanks. In the third entry, for instance, the se-

quence H_HH merely indicates that the row contains one blank and three human pieces, in any order. No value is assigned to a row that contains both computer pieces and human pieces since it's clearly impossible to win on that row.

This game is designed so that the computer plays a nearly equal balance of offense and defense. If you would like the computer to play more aggressively, increase the values for offensive moves in lines 590 and 600. For a more conservative game, you can increase the values in lines 560 and 570. With a little experience, you'll find that a change of just one or two points in these four lines will make a significant difference in the computer's move strategy.

3-D Tic-Tac-Toe

```
100   fullw 2:clearw 2
110   dim b(64),v(64),x(64),m(6
      4,28):gosub 670
120   ' new game
130   clearw 2:color 1:print:fo
      r s=1 to 64:gosub 870
140   gotoxy x-1,y:print"\__\";
      :next
150   for i=1 to 64:b(i)=0:x(i)
      =0:v(i)=0:next:w(1)=0:mv=
      0
160   randomize 0:if rnd(1)<.5
      then s=int(rnd(1)*64)+1:g
      osub 840:color 2:goto 370
170   ' human moves
180   gosub 840:color 4:print:g
      otoxy 0,0:print"Point and
       Click to MOVE"
190   gosub mousexy:mx=int(msx/
      9):my=int(msy/9.3)
200   sq=0:if msb<>1 then 190
210   for s=1 to 64:gosub 870
220   if y=my-2 and abs(x-mx)<=
      1 then sq=s
230   next:if sq=0 then 190
240   s=sq:gosub 870
250   if b(s)<>0 then 190
260   sx=1:gotoxy x,y:print"H_"
      ;:b(s)=1:v(s)=0:gosub 520
270   if w(1)>0 then 440
280   ' computer moves
290   gosub 840:color 2:print:g
      otoxy 0,0:print"Atari ST'
      s Move          "
300   sx=0:for s=1 to 64:if b(s
      )>0 or x(s)=0 then 310 el
      se v(s)=0:gosub 520
310   next
320   s=0:h=0:for i=1 to 64
330   if v(i)=h and rnd(1)<.3 a
      nd h>0 then h=v(i):s=i
340   if v(i)>h then h=v(i):s=i
350   next
360   if s=0 then gotoxy 0,0:pr
      int"     DRAW game      "
      ;:a$="D":color 1:w(1)=1:
       w(2)=2:w(3)=3:w(4)=4:got
      o 460
370   gosub 870:b(s)=5:v(s)=0
380   for i=1 to 4:gotoxy x,y:p
      rint" *";:sound 1,8,1,4,1
      0
390   gotoxy x,y:print"C_";:sou
      nd 1,8,1,5,10:next:sound
      1,0,0,0,0
400   sx=1:for i=1 to 64:x(i)=0
      :next:gosub 520
410   if w(1)>0 then 450
420   goto 170
430   ' game over
440   gotoxy 0,0:print"You WIN
                    ";:a
      $="H":goto 460
450   gotoxy 0,0:print"Computer
       WINS     ";:a$="C"
460   gotoxy 0,1:print"CLICK fo
      r new game";
470   for i=1 to 4:s=w(i):gosub
       870:gotoxy x,y:print a$;
      :next:for i=1 to 99:next
480   sound 1,8,5,5,10:sound 1,
      0,0,0,0
490   for i=1 to 4:s=w(i):gosub
       870:gotoxy x,y:print"  "
      ;:next:for i=1 to 99:next
500   gosub mousexy:if msb<>0 t
      hen 120 else 470
510   ' adjust value array V(64
      ) for computer move at sq
      uare s
520   sg=0:j=1:for i=1 to m(s,0
      )
530   p=0:for k=1 to 4:p=p+b(m(
      s,j)):j=j+1:next:q=0
540   if p=4 or p=20 then for k
      =0 to 3:w(k+1)=m(s,j+k-4)
      :next
550   if p=3 then q=33:goto 620
560   if p=2 then q=5:goto 620
570   if p=1 then q=2:goto 620
580   if p=15 then q=77:goto 62
      0
590   if p=10 then q=6:goto 620
600   if p=5 then q=1:goto 620
610   if sx=1 then 620 else 660
620   v(s)=v(s)+q:if b(s)>0 the
      n v(s)=0
630   if sx=0 then 660
640   for k=0 to 3:if b(m(s,j+k
      -4))=0 then x(m(s,j+k-4))
      =1
650   next
660   next:return
670   ' load legal win combos i
      nto M(64,28)
680   clearw 2:color 1:print" L
      oading DATA ..."
690   for i=1 to 64:m(i,0)=0:ne
      xt
700   for i=1 to 16:a=i*4-3:for
       j=1 to 4:w(j)=a:a=a+1:ne
      xt:gosub 820:next
710   for i=1 to 4:for j=i to i
      +48 step 16:n=j
720   for k=1 to 4:w(k)=n:n=n+4
      :next:gosub 820:next:next
730   for i=1 to 16:for j=0 to
      3:w(j+1)=j*16+i:next:gosu
      b 820:next
740   for i=1 to 28:for j=1 to
      4:read a:w(j)=a:next:gosu
      b 820:next:return
750   data 1,21,41,61,2,22,42,6
      2,3,23,43,63,4,24,44,64
760   data 1,18,35,52,5,22,39,5
      6,9,26,43,60,13,30,47,64
770   data 4,19,34,49,8,23,38,5
      3,12,27,42,57,16,31,46,61
780   data 13,25,37,49,14,26,38
      ,50,15,27,39,51,16,28,40,
      52
790   data 1,6,11,16,17,22,27,3
      2,33,38,43,48,49,54,59,64
800   data 4,7,10,13,20,23,26,2
      9,36,39,42,45,52,55,58,61
810   data 1,22,43,64,4,23,42,6
      1,13,26,39,52,16,27,38,49
820   for k=1 to 4:l=m(w(k),0)*
      4+1:m(w(k),0)=m(w(k),0)+1
830   for p=1 to 4:m(w(k),l)=w(
      p):l=l+1:next:next:return
840   color 1:mv=mv+1:gosub clr
      prt:gotoxy 0,2:print"Move
       # ";mv;:return
850   clrprt:gotoxy 0,0:print s
      pc(23);:return
860   ' input s=square to move
      to, returns x,y as print
      position
870   a=int((s-1)/16):y=a*4+3:b
      =s-a*16
880   c=int((b-1)/4):y=y+c-2:x=
      (4-a)*4+c
890   x=x+(b-c*4)*3-1:return
900   mousexy:poke contrl,124:p
      oke contrl+2,0
910   poke contrl+6,0:vdisys(0)
920   msx=peek(ptsout):msy=peek
      (ptsout+2):msb=peek(intou
      t):return
```

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Rapid Transfer

Buck Childress

The Commodore 64's BASIC has no built-in search-and-replace function, so renaming variables in a program can be a very time-consuming job. With this utility, you can easily rename any type of variable in a BASIC program. Though it's written in machine language for extra speed, no machine language knowledge is needed to use it.

No matter how well you plan ahead, nearly every BASIC programmer needs to modify his or her work from time to time. Renaming variables is one of the most tedious and exacting tasks you will face as a BASIC programmer. You must painstakingly comb every line of the program to insure that you have changed every reference to the variable involved. Should one reference be overlooked, the program will refuse to run correctly, if at all. The longer the program, the more tiresome the task becomes, and the greater the risk of introducing errors. The next time you find yourself in this situation, give "Rapid Transfer" a try. It automatically renames any variable you choose, whether string, numeric, integer, or array. It's easy to use, and gets the job done in a jiffy.

Getting Started

Type in the program as listed, then save a copy to disk or tape. To install Rapid Transfer, simply type RUN and press RETURN. The program automatically loads a machine language routine into the memory area beginning at location 50000. Since this memory zone isn't part of BASIC program space, you can load and save BASIC programs without interference.

Next, load the BASIC program you want to work on. To activate Rapid Transfer, type SYS 50000 and press RETURN. It begins by asking you for the old variable name—the name of an existing variable which you want to change. Type in this name, then press RETURN. At this point, you're asked to supply a new name for the variable. Should you happen to make a mistake while answering a prompt, press the INST/DEL key (pressing it twice will start you at the beginning).

You can enter up to ten characters for each variable name, in case you like to use extended names such as HOUSE$ or MATH%. If the variable you want to change is an integer or string, you will not be able to enter any additional characters after pressing the % or $ key (BASIC syntax doesn't allow it). Also, you can enter a number only after you've entered a letter (another BASIC syntax rule). Should you enter different types of variables, such as renaming a numeric variable with a string variable, Rapid Transfer displays the message TYPE MISMATCH. You'll then be given the option of going ahead with the transfer or starting over.

If the variable you want to change is an array, press the asterisk (*) key. You can do this at any time while you are entering the variable names, and it has to be done only once. Note that Rapid Transfer can tell when a variable is an array and responds accordingly. It is not necessary to enter the parentheses which ordinarily indicate an array—just enter the name itself. For example, to enter an array that you DIMension as A(20), you would enter A, not A( ).

After you press the asterisk key, the message ARRAY? begins flashing at the top of your screen. This is your prompt to enter the number of dimensions in the array. Enter 1, 2, or 3, depending on whether the array has one, two, or three dimensions. After you answer the prompt, the message stops flashing. If you make a mistake or want to cancel the array option, press the English pound (£) key. Rapid Transfer will not change an array variable to a nonarray variable, or vice versa, nor will it change the number of dimensions in an array.

After entering the new variable name and pressing RETURN, you'll see the message ARE YOU SURE? (Y/N). Press Y to proceed or N if you wish to reenter your choices.

Prescan For Name Conflicts

The first thing you'll notice when Rapid Transfer begins working is the line numbers of your program flashing at the top of the screen. Rapid Transfer is prescanning every line of the program to see whether it already contains a variable with the new name that you have chosen. If a name conflict is found, Rapid Transfer displays a warning message. If the variable is an array, an asterisk appears next to its name (a two-dimensional array has two asterisks, and so forth).

After it finishes the prescan, Rapid Transfer displays the prompt ARE YOU SURE? (Y/N). If no name conflicts appeared, or if you wish to proceed despite the conflict, press Y. Press N if a conflict is found or if you simply change your mind.

Rapid Transfer now displays the lines of your program as it seeks out the old variables and renames

them. If the old variable doesn't exist in your program, Rapid Transfer displays a warning message indicating that the designated variable can't be found. Again, array variable names are displayed with one, two, or three asterisks, depending on the number of dimensions in the array. When it's done, the program lets you continue with another change (press Y) or quit (press N).

Safety Features

Rapid Transfer has several built-in safety features to insure accurate operation. It won't change anything enclosed within quotation marks or anything which appears on a line following a REM or DATA statement. While scanning each line, it also checks for excessive length. If, for example, you decide to change the variable CO$ to COST$ and, as a result, one of the program lines will exceed the 80-character logical length, Rapid Transfer aborts operation and displays the line number where the excessive length occurred. It also displays that line as it currently appears in the program so that you can make any necessary adjustments.

In addition, Rapid Transfer can tell the difference between different kinds of variables. For example, let's say that you want to rename the numeric variable A to A1. Rapid Transfer will rename only the numeric variable A. It will not rename any integer, string, or array variables of the same name, nor will it inadvertently change a variable which happens to begin with *A*, such as AB. The same holds true for the other types of variables, including arrays. If you have a one-dimensional array named A, Rapid Transfer will not change a two- or three-dimensional array of the same name, or vice versa.

Rapid Transfer works equally well with extended variable names. If you have used HOUSE$ in a home budget program, Rapid Transfer will recognize it as HO$, exactly as the 64 does. The entire name is present in the program line, but only the first two characters are significant. So you can use and change extended variable names as much as you like, with variables of any type.

Rapid Transfer can be brought to a halt at any time by pressing the RUN/STOP key. Enter SYS 50000 to reactivate it.

Rapid Transfer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
GD 10 PRINTCHR$(147)CHR$(5)"LO
      ADING AND CHECKING DATA
      {SPACE}LINE:":J=50000:L=
      45:C=11
GS 20 PRINTCHR$(19)TAB(31)L:PR
      INT
CG 30 FORB=0TOC:READA:POKEJ+B,
      A:X=X+A:NEXTB:READA
DR 40 IFX<>ATHENPRINT"ERROR IN
       DATA LINE:"L:END
SJ 50 X=0:J=J+12:L=L+5:IFL<685
      THEN20
GQ 60 IFL=685THENC=9:GOTO20
EE 70 PRINT"DATA OK AND LOADED
      ...":PRINT:PRINT"SYS 500
      00 TO ACTIVATE...":END
HM 80 DATA32,59,200,133,198,13
      3,253,162,96,134,251,142
      ,1793
GF 90 DATA138,2,157,0,201,232,
      208,250,202,142,224,201,
      1957
PG 100 DATA142,225,201,169,94,
      133,252,141,247,201,162
      ,10,1977
HH 110 DATA32,71,200,133,254,1
      66,252,169,100,157,0,4,
      1538
JD 120 DATA173,134,2,157,0,216
      ,32,162,200,173,141,2,1
      392
AC 130 DATA201,2,176,246,32,22
      8,255,201,13,208,3,76,1
      641
DA 140 DATA179,196,201,20,208,
      3,76,136,196,201,92,240
      ,1748
AS 150 DATA51,201,42,208,87,14
      1,239,201,173,33,208,14
      1,1725
GX 160 DATA25,216,32,36,200,20
      6,221,201,208,17,32,36,
      1430
ER 170 DATA200,238,222,201,48,
      6,32,116,200,76,203,195
      ,1737
DJ 180 DATA32,110,200,206,248,
      201,32,162,200,32,228,2
      55,1906
QC 190 DATA201,92,208,11,169,0
      ,141,239,201,32,110,200
      ,1604
JD 200 DATA76,247,195,201,49,1
      44,206,201,52,176,202,1
      41,1890
JP 210 DATA25,4,56,233,49,141,
      234,201,32,116,200,141,
      1432
EK 220 DATA25,216,140,222,201,
      76,134,195,201,36,240,4
      ,1690
EB 230 DATA201,37,208,31,166,2
      51,48,14,174,96,201,240
      ,1667
PA 240 DATA236,141,253,201,141
      ,254,201,76,34,196,174,
      192,2099
FR 250 DATA201,240,222,141,255
      ,201,133,254,76,90,196,
      166,2175
PC 260 DATA254,224,10,144,13,2
      40,2,176,204,162,88,32,
      1549
EM 270 DATA71,200,230,254,208,
      195,201,48,144,191,201,
      58,2001
BF 280 DATA176,16,174,96,201,1
      64,251,16,3,174,192,201
      ,1664
KA 290 DATA224,0,240,173,208,8
      ,201,65,144,167,201,91,
      1722
MA 300 DATA176,163,230,254,166
      ,251,157,0,201,230,251,
      48,2127
FM 310 DATA12,174,236,201,224,
      2,176,15,238,236,201,20
      8,1923
XS 320 DATA10,174,237,201,224,
      2,176,3,238,237,201,32,
      1735
BM 330 DATA210,255,230,252,165
      ,251,141,247,201,76,121
      ,195,2344
XF 340 DATA174,247,201,16,112,
      166,211,32,210,255,202,
      208,2034
DA 350 DATA250,142,192,201,142
      ,237,201,142,247,201,14
      2,255,2352
CR 360 DATA201,169,145,32,53,2
      00,169,192,162,27,160,1
      74,1684
JM 370 DATA133,251,132,252,76,
      116,195,166,252,173,33,
      208,1987
GC 380 DATA157,0,216,173,96,20
      1,240,197,166,251,16,22
      6,1939
CD 390 DATA173,192,201,240,188
      ,141,208,201,173,193,20
      1,141,2252
RF 400 DATA209,201,169,0,141,1
      38,2,141,98,201,157,0,1
      457
AA 410 DATA201,173,254,201,205
      ,255,201,240,5,162,44,3
      2,1973
RC 420 DATA71,200,162,64,32,71
      ,200,32,162,200,32,42,1
      268
CB 430 DATA200,201,25,240,67,2
      01,39,208,242,76,80,195
      ,1774
PB 440 DATA173,251,201,208,26,
      162,96,32,82,200,173,25
      4,1858
EM 450 DATA201,240,8,205,97,20
      1,240,3,32,210,255,32,1
      724
RP 460 DATA93,200,162,117,76,3
      3,197,162,112,32,71,200
      ,1455
BM 470 DATA162,130,32,71,200,3
      2,162,200,32,42,200,201
      ,1464
JE 480 DATA25,240,202,201,39,2
      08,242,169,0,133,198,96
      ,1753
GX 490 DATA141,235,201,169,1,1
      62,8,141,240,201,142,24
      1,1882
DG 500 DATA201,32,59,200,133,1
      98,168,173,240,201,174,
      241,2020
RP 510 DATA201,133,253,134,254
      ,32,216,199,177,253,208
      ,14,2074
EX 520 DATA173,243,201,208,155
      ,238,243,201,141,252,20
```

```
         1,76,2332
EC 530 DATA60,197,32,216,199,1
       77,253,170,32,216,199,1
       77,1928
JA 540 DATA253,142,249,201,141
       ,250,201,32,205,189,169
       ,32,2064
KD 550 DATA32,210,255,32,216,1
       99,169,201,133,252,169,
       96,1964
EP 560 DATA174,243,201,208,2,1
       69,208,133,251,162,0,14
       2,1893
DK 570 DATA228,201,142,231,201
       ,142,242,201,173,232,20
       1,240,2434
KM 580 DATA6,142,232,201,142,2
       52,201,161,253,240,28,3
       2,1890
BJ 590 DATA223,199,133,2,32,52
       ,199,165,2,162,0,193,13
       62
SR 600 DATA251,208,99,230,251,
       161,251,240,102,32,216,
       199,2240
RE 610 DATA76,175,197,142,216,
       201,142,244,201,142,246
       ,201,2183
CM 620 DATA142,252,201,32,62,2
       00,173,245,201,208,16,3
       2,1764
RQ 630 DATA216,199,165,253,166
       ,254,141,240,201,142,24
       1,201,2419
MG 640 DATA76,73,197,142,245,2
       01,173,249,201,172,250,
       201,2180
FG 650 DATA205,224,201,208,5,2
       04,225,201,240,221,141,
       224,2299
XJ 660 DATA201,140,225,201,32,
       71,200,169,19,141,119,2
       ,1520
FA 670 DATA169,13,141,120,2,14
       1,121,2,141,122,2,169,1
       143
DG 680 DATA4,133,198,76,49,168
       ,32,162,200,32,216,199,
       1469
DD 690 DATA76,142,197,142,227,
       201,142,228,201,142,233
       ,201,2132
SC 700 DATA202,134,2,142,230,2
       01,173,246,201,208,227,
       173,2139
HF 710 DATA252,201,32,141,200,
       164,2,200,238,230,201,1
       77,2038
EX 720 DATA253,201,32,240,246,
       132,2,238,227,201,174,2
       39,2185
RF 730 DATA201,208,53,201,40,2
       40,195,32,223,199,173,2
       28,1993
XC 740 DATA201,208,7,173,252,2
       01,208,48,240,15,164,2,
       1719
MQ 750 DATA200,177,253,201,32,
       240,249,132,2,201,40,24
       0,1967
FR 760 DATA165,32,24,200,205,2
       32,201,208,84,173,232,2
       01,1957
JE 770 DATA208,82,206,230,201,
       76,224,198,201,40,240,3
       2,1938
QA 780 DATA32,223,199,173,252,
       201,240,61,173,227,201,
       201,2183
DG 790 DATA2,144,162,173,97,20
       1,174,243,201,208,3,173
       ,1781
SJ 800 DATA209,201,201,0,208,1
       47,240,37,32,24,200,205
       ,1704
RS 810 DATA232,201,208,29,164,
       2,200,177,253,240,22,20
       1,1929
BD 820 DATA44,208,3,238,233,20
       1,201,41,208,240,206,23
       0,2053
HM 830 DATA201,173,233,201,205
       ,234,201,240,3,76,38,19
       8,2003
PS 840 DATA173,242,201,32,141,
       200,172,243,201,208,32,
       173,2018
EG 850 DATA216,201,208,237,169
       ,29,32,53,200,162,192,3
       2,1731
JS 860 DATA82,200,32,93,200,16
       2,102,142,243,201,32,71
       ,1560
HG 870 DATA200,141,252,201,76,
       234,196,140,245,201,140
       ,251,2277
HF 880 DATA201,174,236,201,202
       ,169,20,32,103,200,172,
       230,1940
PP 890 DATA201,240,10,48,6,32,
       216,199,136,208,250,160
       ,1706
KA 900 DATA0,185,192,201,240,1
       75,32,120,199,200,208,2
       45,1997
FE 910 DATA201,128,144,57,166,
       212,208,53,201,131,208,
       2,1711
RR 920 DATA240,4,201,143,208,3
       ,141,246,201,56,233,127
       ,1803
RM 930 DATA170,160,255,202,240
       ,8,200,185,158,160,16,2
       50,2004
HC 940 DATA 48,245,200,185,158,
       160,48,14,238,238,201,3
       2,1767
JE 950 DATA113,199,169,0,141,2
       38,201,76,90,199,56,233
       ,1715
EQ 960 DATA128,201,32,240,3,23
       8,242,201,174,244,201,4
       8,1952
CC 970 DATA11,208,30,166,211,2
       24,79,144,3,238,244,201
       ,1759
FH 980 DATA174,243,201,208,13,
       201,34,208,8,173,216,20
       1,1880
PK 990 DATA73,1,141,216,201,96
       ,76,210,255,173,238,201
       ,1881
GH 1000 DATA240,2,104,104,104,
        104,162,148,142,244,20
        1,32,1587
QS 1010 DATA71,200,174,249,201
        ,173,250,201,32,205,18
        9,169,2114
AE 1020 DATA32,32,210,255,173,
        240,201,174,241,201,13
        3,253,2145
RF 1030 DATA134,254,169,4,133,
        251,164,251,177,253,24
        0,14,2044
MR 1040 DATA32,52,199,230,251,
        76,202,199,230,253,208
        ,2,1934
JG 1050 DATA230,254,96,164,212
        ,240,5,160,0,76,17,200
        ,1654
PD 1060 DATA201,32,240,242,201
        ,36,240,4,201,37,208,9
        ,1651
SK 1070 DATA141,228,201,141,23
        2,201,76,13,200,201,48
        ,144,1826
SC 1080 DATA16,201,58,144,8,20
        1,65,144,8,201,91,176,
        1313
KJ 1090 DATA4,238,252,201,96,1
        40,232,201,140,252,201
        ,96,2053
RB 1100 DATA173,255,201,174,24
        3,201,240,3,173,254,20
        1,96,2214
HA 1110 DATA169,40,141,221,201
        ,96,165,203,205,235,20
        1,240,2117
FC 1120 DATA249,141,235,201,96
        ,32,210,255,76,210,255
        ,32,1992
SH 1130 DATA68,229,169,0,133,1
        99,133,212,133,216,96,
        189,1777
JP 1140 DATA177,200,240,250,32
        ,210,255,232,208,245,1
        89,0,2238
QR 1150 DATA201,240,239,32,210
        ,255,232,208,245,173,2
        39,201,2475
GX 1160 DATA240,228,174,234,20
        1,169,42,32,210,255,20
        2,16,2003
KE 1170 DATA250,96,173,33,208,
        76,119,200,173,134,2,1
        33,1597
SD 1180 DATA2,162,96,160,5,189
        ,177,200,153,18,4,165,
        1331
MK 1190 DATA2,153,18,216,232,1
        36,16,241,96,172,243,2
        01,1726
PA 1200 DATA208,6,205,237,201,
        76,155,200,205,236,201
        ,240,2170
CJ 1210 DATA239,104,104,76,38,
        198,32,225,255,208,229
        ,104,1812
EM 1220 DATA104,169,0,141,138,
        2,76,68,229,13,83,89,1
        112
HE 1230 DATA83,53,48,53,48,53,
        0,13,13,79,76,68,587
EF 1240 DATA32,86,65,82,73,65,
        66,76,69,63,32,0,709
AQ 1250 DATA13,13,78,69,87,32,
        86,65,82,73,65,66,729
AF 1260 DATA76,69,63,32,0,13,1
        3,18,84,89,80,69,606
RH 1270 DATA32,77,73,83,77,65,
        84,67,72,46,46,46,768
ME 1280 DATA0,13,13,18,65,82,6
        9,32,89,79,85,32,577
KE 1290 DATA83,85,82,69,63,32,
        40,89,47,78,41,0,709
QP 1300 DATA32,32,18,76,73,77,
        73,84,0,191,153,129,93
        8
FG 1310 DATA146,146,129,32,32,
        18,69,88,73,83,84,83,9
        83
FJ 1320 DATA0,68,79,78,69,0,32
        ,32,18,78,79,84,617
EK 1330 DATA32,70,79,85,78,68,
        0,13,13,67,79,78,662
PA 1340 DATA84,73,78,85,69,63,
        32,40,89,47,78,41,779
HF 1350 DATA0,13,18,69,88,67,6
        9,83,83,73,86,69,718
QK 1360 DATA32,76,69,78,71,84,
        72,13,13,0,508
```

Dr. Sound For The 64

Don Malone

Music enthusiasts will have a field day with this Commodore 64 program, which allows you to experiment with a great variety of different sound parameters while the music plays. A disk drive is required.

"Dr. Sound" is an algorithmic note sequencer which plays notes according to parameters which you choose in realtime. Using the 64's built-in SID (Sound Interface Device) chip, it simulates a single-voice electronic synthesizer with dynamic timbre (tone color) control. If you're familiar with conventional electronic synthesizers, you'll probably recognize the screen display as a flowchart of the synthesizer's current *patch* or configuration. By changing different elements of the patch, you can alter the character of the music dramatically. After you create a patch you like, you can save it to disk for later reloading and use within the program. If you're new to computer-generated music, you'll enjoy experimenting and you can also learn a good deal from this program. Experts will appreciate all the features available in Dr. Sound.

Type in the program as listed and save a copy before you try to run it. Dr. Sound always begins with a short pause while it initializes. Then you will see the main display screen. The top portion of the screen contains a flowchart of the synthesizer's current patch. At the bottom are several prompts indicating parameters you can change by pressing various function keys. The bottom screen line is reserved for your input.

Music In The Background

When the display screen appears, you'll notice that background music begins playing immediately. The music will continue to play at all times while the program runs, except during disk operations.

Using Dr. Sound involves changing various program parameters to alter the character of the music. As a rule, whenever you change the synthesizer's patch, the screen display changes color to indicate which part of the synthesizer you are affecting. The different program options are selected by pressing one of the eight special function keys, f1–f8. Once an option is selected, the bottom screen line changes color and displays the keys you may press to select a choice within that option. In some cases, pressing the indicated key increases the value associated with that parameter; for these options, pressing the SHIFT key along with the indicated key decreases the same value.

Waveform And ADSR

One of the most fundamental changes involves waveforms. To choose a different waveform, press the f1 key. The bottom screen line then indicates your choices. To change the waveform, press the W key. There are four wave shapes available. The triangle is the sweetest of these, containing only odd-numbered overtones decreasing in loudness exponentially. The sawtooth is the brightest, containing all of the harmonic overtones. The pulse wave depends on its width (duty cycle) for its harmonic content. The closer to 99 percent or 1 percent, the more nasal (oboe-like) the pulse wave sounds. The closer to a 50 percent duty cycle, the more hollow (clarinet-like) it will be. Press P to change the pulse width. The noise waveshape is the most unpitched.

Ring modulation is a special SID effect, which you can toggle on and off by pressing the M key. When an *M* appears in the flowchart between the sound source and the modulator, you can see that modulation is on. Ring modulation is possibly the most sophisticated timbre control on the SID chip, making nonharmonic, bell-like overtones. The timbre of the sound depends on the frequency relationship between the sound source and the modulator. (Because of the way the SID chip circuitry is designed, only triangle waveshapes are available for this option.)

Pressing H toggles the harmony option on and off, which forces

the sound source to be harmonic—that is, synchronous at an exact integer multiple with the modulator. When the harmony option is selected, an *H* appears in the display between the modulator and the sound source. This can be used to shift the A440 tuning of the sound source or to insure harmonic (more pitched) modulation. *Modulation*—like most of the other terms in this article—can be best understood by listening to the effect it has on different sounds.

The A, D, S, and R keys control attack, decay, sustain, and release, respectively. Attack is the amount of time it takes to begin the note. Decay is the amount of time it takes to drop to the sustain level, which is indicated as a percentage of the loudest sound possible. Release is the amount of time it takes to return to silence.

Special Effects

The f3 key allows you to change the low-pass filter parameters. Q changes the electronic resonance, which at 100 percent almost whistles, indicating sonically the changes in the cutoff frequency. F changes the percentage of the envelope generator (ADSR) used to control the cutoff frequency, and therefore the timbre, during each note. The lower the percentage, the more muffled the sound will be.

The f5 key selects the modulator section. W and P work just like the sound source section. T toggles on and off a trigger that allows the modulator to be heard while also modulating the sound source. I toggles parallel/oblique modes of the interval relationship between the modulator and the sound source. In the parallel mode the frequency follows the sound source at an interval indicated as a percentage of the sound source frequency. M and L change this relationship in 10 percent and 1 percent increments, respectively. Note that there is a delay of about six seconds to calculate these increments. In the oblique mode the frequency of the modulator is always the same. That frequency is tunable from 1 to 3995 Hz (cycles per second). The F, Q, C, and Y keys change the frequency in 1000 Hz, 100 Hz, 10 Hz, and 1 Hz increments, respectively. The ADSR articulation control for the modulator is apparent only when the modulator trigger is on.

The f7 key selects the control section. The W, P, F, Q, C, and Y keys work the same way here as they do in the modulator section. However, in this case the waveshape and the relationship of the frequency to the duration of the current note determine the next note. The triangle and sawtooth waveshapes will produce easily recognizable patterns. The pulse produces a more austere pattern, and the noise waveform produces a random pattern.

G and A change the gate length. During the gate, the attack, decay, and sustain portions of the envelope generators are active. The gate time does not necessarily need to be longer than the attack time plus the decay time, but if it isn't, strange effects, including complete silence, may occur. R and E change the release time. During the release time, the release portion of the envelope generators are active. After the gate and release time, it takes about 223 microseconds to look at the keyboard. This delay becomes much longer if a key has been pressed. It takes another 104–195 microseconds to calculate the next note. However, if the release time of the sound source envelope generator is long enough, these delays will not be apparent.

Pitch Sets

The f2 key allows a choice of one of the 16 pitch sets. The patterns generated by Dr. Sound will be restricted to one of these sets at a time. They are defined as shown here:

0	**Major scale**
1	**Tonic**
2	**Supertonic**
3	**Mediant**
4	**Subdominant**
5	**Dominant**
6	**Submediant**
7	**Diminished**
8	**Subtonic**
9	**Augmented**
A	**Chromatic**
B	**Whole tone**
C	**East**
D	**Harmonic minor**
E	**Pure minor**
F	**Phrygian**

The f4 key allows control over the pitch range. The octaves are labeled from 0 to 7, with octave 0 being the lowest. The octave of each note is chosen from a set of eight possibilities, all of which are displayed on the screen. Pressing a number from 0 to 7 changes the next octave number in the set.

The f6 key allows control over the rhythm. This is also a set of eight, controlled like the octaves. The release time is multiplied by a factor from 1 to 8.

The f8 key permits you to save all of the current Dr. Sound settings with a filename of your choice, or to load a file of previously saved settings.

Dr. Sound For The 64

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
CB 10 POKE53280,0:POKE53281,0:
      PRINTCHR$(142)CHR$(8):PR
      INT"{8}{CLR}":POKE214,10
      :PRINT
DM 20 PRINTTAB(16)"DR. SOUND":
      PRINTTAB(13)"{DOWN}WILL
      {SPACE}BE RUNNING"
RK 30 PRINTTAB(14)"{DOWN}IN 24
       SECONDS":C$=CHR$(13)
FD 40 DIMPI$(11),PT$(15),OC$(7
      ),RH$(7),PI(12),PM(12),A
      $(15),R$(16),S$(15),P$(1
      5)
GS 50 FORC=0TO7:POKE49920+C,4*
      16:NEXT:FORC=0TO7:POKE49
      936+C,1:NEXT:SI=54272
FJ 60 FORC=SITOSI+24:POKEC,0:N
      EXT:POKESI+24,9*16+15:PO
      KE53236,31:POKE53239,128
CR 70 M$(0)="B":M$(1)="M":H$(0
      )="B":H$(1)="H":T$(0)="*
      OFF*":T$(1)="*****"
CG 80 WS$(0)=" TRIANGLE":WS$(1
      )=" SAWTOOTH":WS$(2)="
      {4 SPACES}PULSE":WS$(3)=
      "{2 SPACES}NOISE
      {2 SPACES}"
SR 90 F$(0)="100% ":F$(1)="50%
      {2 SPACES}":F$(2)="25%
      {2 SPACES}":F$(3)="12.5%
      "
MB 100 FORC=50176TO50399:READD
       :POKEC,D:NEXT:FORC=0TO1
       2:READD:PI(C)=D:NEXT
AR 110 FORI=0TO15:READPT$(I):F
       ORC=0TO15:READD:POKE496
       64+I*16+C,D:NEXT:NEXT
MF 120 FORC=0TO15:READA$(C):NE
       XT:FORC=0TO16:READR$(C)
       :NEXT:FORC=0TO7:E(C)=2↑
       C:NEXT
QQ 130 FORC=0TO15:S$(C)=STR$(I
       NT(C*6.66666667)):S$(C)
       =S$(C)+"%{2 SPACES}":NE
       XT
KJ 140 FORC=0TO15:P$(C)=STR$(I
       NT(C*256/40.95)):P$(C)=
       P$(C)+"?% ":NEXT
KR 150 ML=.99:GOSUB550:GOSUB62
       0:CW=1:H=0:M=0:PC=0:AC=
```

```
      0:DC=0:SC=15:RC=4:GOSUB
      710
XK 160 RS=4:FC=1:AF=7:DF=3:SF=
      13:RF=5:GOSUB780:PW=0:P
      C=0:AP=0:DP=0:SP=8:RP=1
      5
SD 170 TP=1:FM=1:FP=0:GOSUB830
      :WW=1:FQ=112:GG=20:RR=2
      2:GOSUB940:PT=13
FP 180 IN$="TRUMPET":POKE53232
      ,PT*16:GOSUB1050:GOSUB1
      080:GOSUB1120:GOSUB1150
PB 190 SYS50176:GETK$:IFK$<>""
      THEN1170
FB 200 GOTO190
QF 210 DATA 162,0,173,27,212,4
      1,7,170,189,16,195,170,
      173,244,207,202
JP 220 DATA 48,6,109,244,207,7
      6,15,196,141,243,207,16
      2,0,173,27,212
DP 230 DATA 41,15,141,239,207,
      173,240,207,109,239,207
      ,170,189,0,194,170
QC 240 DATA 173,27,212,41,7,16
      8,185,0,195,141,238,207
      ,138,109,238,207
XH 250 DATA 170,189,0,192,141,
      7,212,189,128,192,141,8
      ,212,173,248,207
GA 260 DATA 208,12,189,0,193,1
      41,0,212,189,128,193,14
      1,1,212,173,252
BG 270 DATA 207,105,1,141,18,2
      12,173,251,207,105,1,14
      1,11,212,173,250
SB 280 DATA 207,109,249,207,14
      1,4,212,173,247,207,141
      ,255,207,173,246,207
KC 290 DATA 141,237,207,172,24
      5,207,173,28,212,174,25
      3,207,240,4,74,202
HB 300 DATA 208,252,141,22,212
      ,136,208,238,206,237,20
      7,208,230,206,255,207
MS 310 DATA 208,219,173,252,20
      7,141,18,212,173,251,20
      7,141,11,212,173,250
XQ 320 DATA 207,141,4,212,173,
      243,207,141,254,207,173
      ,242,207,141,237,207
PH 330 DATA 172,241,207,173,28
      ,212,174,253,207,240,4,
      74,202,208,252,141
KF 340 DATA 22,212,136,208,238
      ,206,237,207,208,230,20
      6,254,207,208,219,96
XG 350 DATA268,284,301,318,337
      ,358,379,401,425,451,47
      7,506,536
BQ 360 DATA"MAJOR{10 SPACES}",
      5,7,9,10,12,5,4,2,0,0,1
      2,9,5,9,5,0
XS 370 DATA"TONIC{10 SPACES}",
      5,9,12,0,5,9,12,0,5,9,1
      2,0,5,9,12,0
GR 380 DATA"SUPERTONIC 7TH ",7
      ,10,2,5,7,10,2,5,7,10,2
      ,5,7,10,2,5
HP 390 DATA"MEDIANT{8 SPACES}"
      ,9,12,0,3,9,12,0,3,9,12
      ,0,3,9,12,0,3
XP 400 DATA"SUBDOMINANT
      {4 SPACES}",10,2,5,10,2
      ,5,10,2,5,10,2,5,10,2,5
      ,10
HS 410 DATA"DOMINANT 7TH
      {3 SPACES}",0,4,7,10,12
      ,0,4,7,10,12,0,4,7,10,1
      2,0
KC 420 DATA"SUBMEDIANT
      {5 SPACES}",2,5,9,12,0,
      2,5,9,2,5,9,2,5,9,12,0
MC 430 DATA"DIMINISHED 7TH ",4
      ,7,10,1,4,7,10,1,4,7,10
      ,1,4,7,10,1
DJ 440 DATA"SUBTONIC{7 SPACES}
      ",3,7,10,3,7,10,3,7,10,
      3,7,10,3,7,10,3
CE 450 DATA"AUGMENTED
      {6 SPACES}",0,4,8,12,0,
      4,8,12,0,4,8,12,0,4,8,1
      2
MG 460 DATA"CHROMATIC
      {6 SPACES}",0,1,2,3,4,5
      ,6,7,8,9,10,11,12,0,12,
      6
MJ 470 DATA"WHOLETONE
      {6 SPACES}",0,2,4,6,8,1
      0,12,10,8,6,4,2,0,2,10,
      12
KD 480 DATA"EAST{11 SPACES}",0
      ,2,5,7,9,12,0,2,5,7,9,1
      2,5,2,5,7
EE 490 DATA"HARMONIC MINOR ",5
      ,7,8,10,12,10,8,7,5,4,1
      ,0,1,4,5,8
CA 500 DATA"PURE MINOR
      {5 SPACES}",5,7,8,10,12
      ,10,8,7,5,3,1,0,1,3,5,8
JQ 510 DATA"PHRYGIAN{7 SPACES}
      ",5,6,8,10,12,10,8,6,5,
      3,2,0,2,3,5,8
XF 520 DATA.002S,.008S,.016S,.
      024S,.038S,.056S,.068S,
      .08S ,.1S{2 SPACES},.25
      S ,.5S{2 SPACES},.8S
GE 530 DATA1S{3 SPACES},3S
      {3 SPACES},5S{3 SPACES}
      ,8S{3 SPACES},.006S,.02
      4S,.048S,.072S,.114S,.1
      68S,.204S
PS 540 DATA.24S ,.3S{2 SPACES}
      ,.75S ,1.5S ,2.4S ,3S
      {3 SPACES},9S{3 SPACES}
      ,15S{2 SPACES},"24S
      {2 SPACES}","{7 SPACES}
      "
EK 550 FORC=0TO12:FORI=0TO7:PI
      =PI(C)*E(I):HP=INT(PI/2
      56):IFHP>255THENHP=255
EM 560 POKE49280+I*16+C,HP:POK
      E49152+I*16+C,PI-256*HP
      AND255:NEXT:NEXT
GP 570 IFLEN(STR$(ML))>5THENML
      =INT(ML*100)/100
CP 580 FORC=0TO12:PM(C)=PI(C)*
      ML:NEXT
BX 590 FORC=0TO12:FORI=0TO7:PI
      =PM(C)*E(I):HP=INT(PI/2
      56):IFHP>255THENHP=255
XP 600 POKE49536+I*16+C,HP:Z=P
      I-256*HP:IFZ>255THENZ=2
      55
SB 610 POKE49408+I*16+C,Z:NEXT
      :NEXT:RETURN
CE 620 PRINT"{CLR}{2 DOWN}"SPC
      (10)"CCC>AMPC*CCCC{S}"
BP 630 PRINTTAB(4)"↑"SPC(10)"↑
      "SPC(7)"B"
MB 640 PRINTTAB(4)"B"SPC(18)"B
      "
GB 650 PRINTTAB(4)"B"SPC(18)"B
      "
JQ 660 PRINTTAB(4)"B"SPC(18)"
      {Q}**>FILTER**>OUT"
CR 670 PRINTTAB(4)"B"SPC(18)"B
      "SPC(5)"↑"
MQ 680 PRINTTAB(4)"B"SPC(18)"B
      "
GQ 690 PRINTTAB(23)"B"SPC(5)"↑
      ":PRINTTAB(9)"*****>AMP
      "SPC(5)"{X}":PRINTTAB(1
      6)"↑"
RA 700 RETURN
CE 710 PRINT"{HOME}{DOWN}":IFM
      =1THENCW=0
QH 720 PRINTTAB(2)WS$(CW):IFCW
      =2THENPRINT" {UP}"P$(PC
      )
SG 730 PRINTTAB(7)"{DOWN}[F1]"
      SPC(3)"A "A$(AC):PRINTT
      AB(4)M$(M)SPC(9)"D "R$(
      DC)
XP 740 PRINTTAB(14)"S"S$(SC):P
      RINTTAB(4)H$(H)SPC(9)"R
       "R$(RC)
PP 750 WC=2↑(CW+4):IFM=1THENWC
      =20
SA 760 IFH=1THENWC=WC+2
CD 770 POKE53243,WC:POKESI+10,
      PC:POKESI+12,AC*16+DC:P
      OKESI+13,SC*16+RC:RETUR
      N
JE 780 POKE214,4:PRINT:PRINTTA
      B(28)"Q"S$(RS)
SG 790 PRINTTAB(28)"{2 DOWN}"F
      $(FC):PRINTTAB(34)"{UP}
      [F3]"
BJ 800 PRINTTAB(28)"{DOWN}A "A
      $(AF):PRINTTAB(28)"D "R
      $(DF)
FC 810 PRINTTAB(28)"S"S$(SF):P
      RINTTAB(28)"R "R$(RF)
CB 820 POKESI+23,RS*16+3:POKE5
      3245,FC:POKESI+19,AF*16
      +DF:POKESI+20,SF*16+RF:
      RETURN
AH 830 POKE214,8:PRINT:IFM=1TH
      ENPW=0
CS 840 PRINT"{DOWN} "WS$(PW)SP
      C(8)T$(TP):IFPW=2THENPR
      INT"{UP}"P$(PP)
QS 850 IFFP=1THENPRINT"
      {4 SPACES}FQCY
      {4 SPACES}":PRINTTAB(4)
      STR$(FM)+"HZ{3 SPACES}"
EJ 860 IFFP=1THENZ=FM/.06097:P
      H=INT(Z/256):PL=Z-PH*25
      6:POKESI,PL:POKESI+1,PH
JA 870 IFFP=0THENPRINT"
      {4 SPACES}PARALLEL":PRI
      NTTAB(4)"ML"STR$(INT(ML
      *100+.5))+"{2 SPACES}"
GC 880 IFTP=1THENPRINTTAB(15)"
      {UP}A "A$(AP):PRINTTAB(
      15)"D "R$(DP)
RH 890 IFTP=0THENPRINTTAB(15)"
      {UP}"R$(16):PRINTTAB(15
      )R$(16)
PF 900 IFTP=1THENPRINTTAB(9)"[
      F5]"SPC(2)"S"S$(SP):PRI
      NTTAB(15)"R "R$(RP)
SA 910 IFTP=0THENPRINTTAB(9)"[
      F5]"SPC(2)R$(16):PRINTT
      AB(15)R$(16)
XQ 920 WP=2↑(PW+4):POKE53242,W
      P:POKESI+3,PP:POKE53241
      ,TP:POKE53240,FP
FQ 930 POKESI+5,AP*16+DP:POKES
      I+6,SP*16+RP:RETURN
QC 940 POKE214,16:PRINT
EC 950 PRINT"[F7] "WS$(WW)SPC(
      1)"FQCY"STR$(FQ)+"HZ
      {3 SPACES}"
RP 960 IFWW=2THENPRINTTAB(4)"
      {UP}"P$(CP)
RF 970 SS=2↑(WW+4):POKE53244,S
      S:POKESI+17,CP:Z=FQ/.06
```

```
      097:CH=INT(Z/256):CL=Z-
      CH*256
FR 980 POKESI+14,CL:POKESI+15,
      CH:GY=(GGAND127)+1:GL=1
      :IFGG>127THENGL=128
GG 990 GT=(40+(((8+(((4+(((8+(
      (7*FC)+2)+9)*GY)-1)+9)*
      GL)-1)+9)*128)-1))/1020
      000
FF 1000 GT=INT(GT*1000)/1000:P
      RINTTAB(27)"{2 UP}GA"S
      TR$(GT)+"S{2 SPACES}"
CE 1010 RY=(RRAND127)+1:RL=1:I
      FRR>127THENRL=128
FG 1020 RT=(32+(((8+(((4+(((8+
      ((7*FC)+2)+9)*RY)-1)+9
      )*RL)-1)+9)*31)-1))/10
      20000
KP 1030 RT=INT(RT*1000)/1000:P
      RINTTAB(27)"RE"STR$(RT
      )+"S{2 SPACES}"
EX 1040 POKE53238,GL:POKE53237
      ,GY:POKE53234,RL:POKE5
      3233,RY:RETURN
CS 1050 POKE214,18:PRINT:PRINT
      "[F2] PITCH SET(0-F)";
      :IFPT<10THENPRINTPT;PT
      $(PT)
GD 1060 IFPT>9THENPRINT" "CHR$
      (PT+55)" "PT$(PT)
FP 1070 POKE53232,PT*16:RETURN
RJ 1080 POKE214,19:PRINT
AE 1090 FORC=0TO7:OC$(C)=RIGHT
      $(STR$((PEEK(49920+C))
      /16),1):NEXT
AD 1100 PRINT"[F4] OCTAVE (0-7
      ) ";:FORC=0TO7:PRINTOC
      $(C);CHR$(44);:NEXT:PR
      INT"{LEFT} "
CE 1110 RETURN
SF 1120 POKE214,20:PRINT:FORC=
      0TO7:RH$(C)=RIGHT$(STR
      $((PEEK(49936+C))+1),1
      ):NEXT
PG 1130 PRINT"[F6] RHYTHM (1-8
      ) ";:FORC=0TO7:PRINTRH
      $(C);CHR$(44);:NEXT:PR
      INT"{LEFT} {HOME}"
KG 1140 RETURN
XA 1150 POKE214,21:PRINT:PRINT
      "[F8] DISK ACCESS
      {HOME}"
FX 1160 POKE214,0:PRINT:PRINTT
      AB(27)IN$:RETURN
KX 1170 K=ASC(K$+CHR$(0)):IFK>
      =132ANDK<=140THENGOSUB
      1190
GE 1180 ONJGOSUB1230,1380,1520
      ,1800,2040,2080,2110,2
      140:GOTO190
KS 1190 IFJ=0THEN1210
RK 1200 PRINT"{8}":ONJGOSUB123
      0,1380,1520,1800,2040,
      2080,2110,2140
XP 1210 J=K-132:PRINT"{4}":RET
      URN
RR 1220 RETURN
HJ 1230 POKE214,22:PRINT:PRINT
      "{RVS} SOUND SOURCE
      {5 SPACES}W P M H A D
      {SPACE}S R{6 SPACES}
      {OFF}"
JQ 1240 IFK$="W"THENCW=(CW+1)A
      ND3
PP 1250 IFK$="H"THENH=H+1AND1
EP 1260 IFK$="M"THENM=M+1AND1
AM 1270 IFK$="P"THENPC=PC+1AND
      15
JA 1280 IFK$="P"THENPC=ABS(PC-
      1)
EH 1290 IFK$="A"THENAC=AC+1AND
      15
FX 1300 IFK$="D"THENDC=DC+1AND
      15
KB 1310 IFK$="S"THENSC=SC+1AND
      15
EC 1320 IFK$="R"THENRC=RC+1AND
      15
EB 1330 IFK$="A"THENAC=ABS(AC-
      1)
QE 1340 IFK$="D"THENDC=ABS(DC-
      1)
CF 1350 IFK$="S"THENSC=ABS(SC-
      1)
FH 1360 IFK$="R"THENRC=ABS(RC-
      1)
SJ 1370 K$="":GOTO710
SB 1380 POKE214,22:PRINT:PRINT
      "{RVS} FILTER
      {4 SPACES}Q F A D S R
      {17 SPACES}{OFF}"
BG 1390 IFK$="Q"THENRS=RS+1AND
      15
MP 1400 IFK$="Q"THENRS=ABS(RS-
      1)
BP 1410 IFK$="F"THENFC=FC+1AND
      3
AP 1420 IFK$="F"THENFC=ABS(FC-
      1)
CG 1430 IFK$="A"THENAF=AF+1AND
      15
FQ 1440 IFK$="D"THENDF=DF+1AND
      15
FB 1450 IFK$="S"THENSF=SF+1AND
      15
GD 1460 IFK$="R"THENRF=RF+1AND
      15
CX 1470 IFK$="A"THENAF=ABS(AF-
      1)
MC 1480 IFK$="D"THENDF=ABS(DF-
      1)
ED 1490 IFK$="S"THENSF=ABS(SF-
      1)
KH 1500 IFK$="R"THENRF=ABS(RF-
      1)
RP 1510 K$="":GOTO780
EJ 1520 POKE214,22:PRINT:PRINT
      "{RVS} MODULATOR W P T
       I M/L F/Q/C/Y A D S R
      {OFF}"
JQ 1530 IFK$="W"THENPW=(PW+1)A
      ND3
FM 1540 IFK$="P"THENPP=PP+1AND
      15
BX 1550 IFK$="P"THENPP=ABS(PP-
      1)
MP 1560 IFK$="T"THENTP=TP+1AND
      1
SA 1570 IFK$="I"THENFP=FP+1AND
      1
AH 1580 IFK$="F"THENFM=FM+1000
RK 1590 IFK$="Q"THENFM=FM+100
PD 1600 IFK$="C"THENFM=FM+10
SP 1610 IFK$="Y"THENFM=FM+1
HR 1620 IFFM>3995THENFM=3995
CF 1630 IFK$="F"THENFM=ABS(FM-
      1000)
BK 1640 IFK$="Q"THENFM=ABS(FM-
      100)
BP 1650 IFK$="C"THENFM=ABS(FM-
      10)
HD 1660 IFK$="Y"THENFM=ABS(FM-
      1)
RK 1670 IFK$="M"THENML=ML+.1:G
      OSUB570
RJ 1680 IFK$="L"THENML=ML+.01:
      GOSUB570
BD 1690 IFK$="M"THENML=ABS(ML-
      .1):GOSUB570
DA 1700 IFK$="L"THENML=ABS(ML-
      .01):GOSUB570
MQ 1710 IFK$="A"THENAP=AP+1AND
      15
MC 1720 IFK$="D"THENDP=DP+1AND
      15
AH 1730 IFK$="S"THENSP=SP+1AND
      15
GK 1740 IFK$="R"THENRP=RP+1AND
      15
DD 1750 IFK$="A"THENAP=ABS(AP-
      1)
KG 1760 IFK$="D"THENDP=ABS(DP-
      1)
BF 1770 IFK$="S"THENSP=ABS(SP-
      1)
KJ 1780 IFK$="R"THENRP=ABS(RP-
      1)
RM 1790 K$="":GOTO830
RM 1800 POKE214,22:PRINT:PRINT
      "{RVS} CONTROL
      {4 SPACES}W P F/Q/C/Y
      {2 SPACES}G/A
      {2 SPACES}R/E
      {6 SPACES}{OFF}"
JM 1810 IFK$="W"THENWW=(WW+1)A
      ND3
SG 1820 IFK$="P"THENCP=CP+1AND
      15
XQ 1830 IFK$="P"THENCP=ABS(CP-
      1)
PK 1840 IFK$="F"THENFQ=FQ+1000
RD 1850 IFK$="Q"THENFQ=FQ+100
PH 1860 IFK$="C"THENFQ=FQ+10
GS 1870 IFK$="Y"THENFQ=FQ+1
XF 1880 IFFQ>3995THENFQ=3995
RJ 1890 IFK$="F"THENFQ=ABS(FQ-
      1000)
KS 1900 IFK$="Q"THENFQ=ABS(FQ-
      100)
KB 1910 IFK$="C"THENFQ=ABS(FQ-
      10)
DH 1920 IFK$="Y"THENFQ=ABS(FQ-
      1)
PJ 1930 IFK$="G"THENGG=GG+25
MQ 1940 IFK$="A"THENGG=GG+1
QM 1950 IFGG>255THENGG=255
XJ 1960 IFK$="G"THENGG=ABS(GG-
      25)
MR 1970 IFK$="A"THENGG=ABS(GG-
      1)
BK 1980 IFK$="R"THENRR=RR+25
XH 1990 IFK$="E"THENRR=RR+1
KG 2000 IFRR>255THENRR=255
PF 2010 IFK$="R"THENRR=ABS(RR-
      25)
AS 2020 IFK$="E"THENRR=ABS(RR-
      1)
QF 2030 K$="":GOTO940
QD 2040 POKE214,22:PRINT:PRINT
      "{RVS} PITCH SET
      {2 SPACES}0 1 2 3 ...
      {SPACE}9 A B C D E F
      {2 SPACES}{OFF}"
HE 2050 IFK<58ANDK>47THENPT=K-
      48
PM 2060 IFK<71ANDK>64THENPT=K-
      55
GJ 2070 K$="":GOTO1050
KR 2080 POKE214,22:PRINT:PRINT
      "{RVS} OCTAVES
      {4 SPACES}0,1,2,3,4,5,
      6,7{12 SPACES}{OFF}"
DJ 2090 IFK<56ANDK>47THENK=K-4
      8:CT=CT+1AND7:POKE4992
      0+CT,K*16
JQ 2100 K$="":GOTO1080
AC 2110 POKE214,22:PRINT:PRINT
      "{RVS} RHYTHMS
      {6 SPACES}1,2,3,4,5,6,
      7,8{10 SPACES}{OFF}"
RA 2120 IFK<57ANDK>48THENK=K-4
      9:YT=YT+1AND7:POKE4993
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```
        6+YT,K
KK 2130 K$="":GOTO1120
AS 2140 POKE214,22:PRINT:PRINT
        "{RVS}{2 SPACES}DISK A
        CCESS{5 SPACES}S L
        {18 SPACES}{OFF}"
SC 2150 IFK$="S"THENGOSUB2180
FR 2160 IFK$="L"THENGOSUB2300:
        GOSUB2440
BD 2170 K$="":GOTO1150
AA 2180 POKE214,22:PRINT:PRINT
        "{RVS} SAVE FILE NAME
        {21 SPACES}{OFF}"
BS 2190 PRINTTAB(18)"{UP}{RVS}
        ";:INPUTIN$:PRINT"{UP}
        {OFF}":IN$=LEFT$(IN$,1
        2)
AX 2200 OPEN15,8,15:OPEN2,8,2,
        "0:"+IN$+",S,W"
QS 2210 GOSUB2410:IFEN>1THENFO
        RC=0TO5000:NEXT:CLOSE2
        :CLOSE15:RETURN
CD 2220 PRINT#2,CW;C$;H;C$;M;C
        $;PC;C$;AC;C$;DC;C$;SC
        ;C$;RC
EG 2230 PRINT#2,RS;C$;FC;C$;AF
        ;C$;DF;C$;SF;C$;RF
AH 2240 MD=ML:PRINT#2,PW;C$;PP
        ;C$;MD;C$;FM;C$;TP;C$;
        FP;C$;AP;C$;DP;C$;SP;C
        $;RP
SQ 2250 PRINT#2,WW;C$;CP;C$;FQ
        ;C$;GG;C$;RR;C$;PT:GOS
        UB2410
GF 2260 FORC=0TO7:PRINT#2,PEEK
        (49920+C)
GJ 2270 NEXT:FORC=0TO7:PRINT#2
        ,PEEK(49936+C)
ER 2280 NEXT:GOSUB2410
XQ 2290 CLOSE2:CLOSE15:RETURN
EJ 2300 POKE214,22:PRINT:PRINT
        "{RVS} LOAD FILE NAME
        {21 SPACES}{OFF}"
FA 2310 PRINTTAB(18)"{UP}{RVS}
        ";:INPUTIN$:PRINT"{UP}
        {OFF}":IN$=LEFT$(IN$,1
        2)
JP 2320 OPEN15,8,15:OPEN2,8,2,
        "0:"+IN$+",S,R"
RG 2330 GOSUB2410:IFEN>1THENFO
        RC=0TO5000:NEXT:CLOSE2
        :CLOSE15:RETURN
BF 2340 INPUT#2,CW,H,M,PC,AC,D
        C,SC,RC
GK 2350 INPUT#2,RS,FC,AF,DF,SF
        ,RF
JX 2360 INPUT#2,PW,PP,MD,FM,TP
        ,FP,AP,DP,SP,RP
SE 2370 INPUT#2,WW,CP,FQ,GG,RR
        ,PT:GOSUB2410
RQ 2380 FORC=0TO7:INPUT#2,X:PO
        KE(49920+C),X:NEXT
QP 2390 FORC=0TO7:INPUT#2,X:PO
        KE(49936+C),X:NEXT:GOS
        UB2410
HG 2400 CLOSE2:CLOSE15:RETURN
KG 2410 INPUT#15,EN,EM$,ET,ES
SH 2420 IFEN>1THENPOKE214,22:P
        RINT:PRINTCHR$(18);EM$
        ;CHR$(32);"{5 SPACES}"
CK 2430 RETURN
RK 2440 IFFP=0THENIFMD<>MLTHEN
        ML=MD:GOSUB570
RM 2450 PRINT"{8}{HOME}":GOSUB
        710:GOSUB780:GOSUB830:
        GOSUB940
EG 2460 GOSUB1050:GOSUB1080:GO
        SUB1120:PRINT"{4}
        {HOME}":GOSUB1150:RETU
        RN
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Fast Data For 64

Bob Kodadek

This handy Commodore 64 routine offers a speedy alternative to READing large amounts of information from DATA statements and POKEing it into memory. By using this automatic technique, you can cut program initialization delays dramatically. Use it for new programs or convert all your old ones—either way, you'll be delighted at the difference it makes.

Have you ever waited for a BASIC program to READ loads of data from DATA statements and POKE it into memory? This has always been the traditional way to store data for sprite images or custom characters, to set up musical note tables, and for many other purposes. No matter what the goal, there are few experiences more tedious than staring at a PLEASE WAIT message while BASIC executes hundreds (or even thousands) of READ and POKE statements. "Fast Data For 64" can perform such operations in a flash, at the speed of machine language. Yet, it becomes part of your BASIC program and is simply called with a GOSUB. For example, 2000 bytes of data can be read and POKEd into memory in only 6/10 second—about 3000 bytes per second. It takes BASIC over 27 full seconds to do the same job. Best of all, this routine automatically appends itself to any BASIC program and can be used even if you don't know anything about machine language.

A Speedy Alternative

Type in and save the program as it appears in the listing. When you run it, the program installs a machine language routine in memory, then displays several instructions on the screen. Next, load the BASIC program you wish to convert. After the load is finished, enter SYS 49152 and press RETURN. When the word LIGHTNING appears on the screen, a special routine has been added to your program. If you list the program, you will notice that it now contains four extra lines, numbered 63996–63999. (These line numbers are used because the routine must be located at the very end of your program, and BASIC will not allow line numbers higher than 63999.)

Now locate the very last DATA statement in your program and add a comma followed by −1. For instance, say that the last DATA line in the program looks like this:

5000 DATA 224,169,255,96

You'd change it to:

5000 DATA 224,169,255,96,−1

The value −1 marks the end of the data. (Because −1 is used as a marker, you cannot use this program for data that contains the value −1 elsewhere. This shouldn't pose any problems when the program is used for its intended purpose, since it's impossible to POKE a negative value into a memory location.)

To call the routine, add a line which sets the variable D equal to the beginning of the memory area where you want to store the data and then executes GOSUB 63997. For example, to move a block of data into screen memory, which normally begins at location 1024, you could use this line:

100 D=1024:GOSUB 63997

The same procedure is used whether you're writing a new program or enhancing an existing one. If you're updating an existing program, be sure to remove the old lines that previously did the POKEing. (Of course, you must not remove the DATA lines themselves, since the ML routine still needs something to read.) This routine uses the variable names D, D%, and A, so you must not use those variables anywhere in your own program. When you're finished making the changes, save the modified version of the program with a new filename.

If you're interested in how all this works: Line 63997 of the conversion routine changes the variable D into a low-byte/high-byte address and sets up a pointer at 253–254 ($FD–$FE) for the machine language routine to use in storing the data. Line 63998 updates the DATA pointer at 65 ($41) by reading and POKEing the first byte of data from BASIC. It then calculates the location of the machine language routine in BASIC memory and calls it with the resultant SYS number. Line 63999 contains the actual machine language in a REM statement. This technique works fine as long as the code is relocatable and does not contain any zero bytes or control characters. Note that this special line contains more than the usual 80 characters. Do *not* attempt to edit or change this line in any way; the BASIC editor will shorten the line and scramble the machine language it contains.

Fast Data For 64

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
XB 10 PRINT"{CLR}{DOWN}PLEASE
      {SPACE}WAIT":FOR I=0 TO
      {SPACE}386:READ BY:POKE
      {SPACE}49152+I,BY:CK=CK+
      BY:NEXT
RF 20 IF CK <> 38541 THEN PRIN
      T"ERROR IN DATA STATEMEN
      T!":END
GG 30 DATA 162,0,189,101,193,2
      40,6,32
XC 40 DATA 210,255,232,208,245
      ,169,77,133
GS 50 DATA 170,169,192,133,171
      ,32,51,165
FQ 60 DATA 160,0,177,170,201,3
      ,240,18
EM 70 DATA 145,34,230,34,208,2
      ,230,35
SD 80 DATA 230,170,208,2,230,1
      71,160,0
MG 90 DATA 240,232,32,51,165,1
      65,34,24
QF 100 DATA 105,2,144,2,230,35
       ,133,45
FJ 110 DATA 133,47,133,49,165,
       35,133,46
GA 120 DATA 133,48,133,50,96,5
       8,8,252
MR 130 DATA 249,128,58,143,32,
       82,38,80
SG 140 DATA 32,82,79,85,84,73,
       78,69
BB 150 DATA 46,70,73,82,83,84,
       32,83
JP 160 DATA 69,84,32,68,61,84,
       79,32
QR 170 DATA 68,69,83,84,32,84,
       72,69
FM 180 DATA 78,32,71,79,83,85,
       66,32
DC 190 DATA 54,51,57,57,55,0,1
       03,8
DR 200 DATA 253,249,68,37,178,
       68,173,50
KA 210 DATA 53,54,58,151,50,53
       ,52,44
QX 220 DATA 68,37,58,151,50,53
       ,51,44
CB 230 DATA 68,171,68,37,172,5
       0,53,54
PM 240 DATA 58,135,32,65,58,15
       1,32,68
PB 250 DATA 44,65,0,156,8,254,
       249,158
RD 260 DATA 32,194,40,52,54,41
       ,172,50
JX 270 DATA 53,54,170,194,40,5
       2,53,41
RJ 280 DATA 171,32,49,49,56,32
       ,58,142
KK 290 DATA 58,143,32,70,73,78
       ,68,32
CX 300 DATA 49,83,84,32,66,89,
       84,69
FK 310 DATA 32,79,70,32,77,47,
       76,0
KG 320 DATA 22,9,255,249,143,3
       4,230,253
XR 330 DATA 208,2,230,254,160,
       255,200,132
GP 340 DATA 98,132,99,132,100,
       230,65,208
MS 350 DATA 02,230,66,177,65,2
       08,014,165
CF 360 DATA 65,24,105,5,133,65
       ,144,44
MM 370 DATA 230,66,208,40,234,
       201,44,240
EK 380 DATA 35,201,32,240,224,
       201,45,208
FK 390 DATA 12,165,65,24,105,2
       ,133,65
RX 400 DATA 144,2,230,66,96,56
       ,233,48
QE 410 DATA 166,99,134,98,166,
       100,134,99
FP 420 DATA 133,100,176,193,16
       2,100,165,98
FC 430 DATA 240,9,201,1,240,2,
       162,200
BF 440 DATA 138,133,98,165,99,
       240,8,162
XX 450 DATA 9,24,101,99,202,20
       8,250,24
QR 460 DATA 101,98,24,101,100,
       145,253,144
JE 470 DATA 141,0,0,0,3,76,73,
       71
AF 480 DATA 72,84,78,73,78,71,
       33,013
FJ 490 DATA 0,40,67,41,49,57,5
       6,54
DC 500 DATA 66,79,66,75,79,68,
       65,68,69,75,0
```

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Enhancements For Atari *SpeedCalc*

Fred Chapman

Here are two enhancements for the Atari version of COMPUTE!*'s popular spreadsheed program* SpeedCalc *(published March 1986). These new features give you greater control over printed output and allow you to copy or move blocks of cells without recalculating the entire spreadsheet. A disk drive is required.*

Atari *SpeedCalc* is an excellent spreadsheet program, but even a good program can be improved here and there. "Enhancements For Atari *SpeedCalc*" makes several modifications to *SpeedCalc* to increase its power and convenience. Type in the program and save it to disk or tape, then run it.

When the program begins, you are prompted to insert a disk containing Atari *SpeedCalc. Make sure you have a backup copy of* SpeedCalc *stored safely on another disk, in case you experience a disk error or change your mind about using the enhanced version of* SpeedCalc. Press RETURN when the disk is in place. The enhancement program automatically appends the necessary code to the *SpeedCalc* AUTORUN.SYS file. After a few moments, the computer prints DONE. To enter *SpeedCalc*, remove or disable BASIC, then reboot the system.

Selective Printing

When printing to a device (a printer, disk drive, or the screen), the original *SpeedCalc* always starts printing at the upper left cell in the spreadsheet (cell AA1). This feature effectively limits the width of any printout to seven- or eight-cell columns on an 80-column printer. The enhanced version of *SpeedCalc* has the ability to send the contents of any block of cells to the device you select.

To print out a selected block of cells, move the cursor to the bottom right cell of the block that you want to print, then press CTRL-P (hold down CTRL, then press P). When prompted for the output device, enter P: to select the printer, E: to select the screen, or D: followed by a filename to print to a disk file. Now move the cursor to the top left cell of the block you wish to print, then press RETURN. *SpeedCalc* prints only the selected block.

Improved Move And Copy

The new version of *SpeedCalc* also has the ability to copy or move blocks of cells without recalculating. This permits you to piece together sections of the spreadsheet for printing without causing calculation errors. For example, you may want to move a column of titles just to the left of the cells to be printed. Recalculation during copy and move operations is now consistent with *SpeedCalc*'s automatic recalculation mode. If automatic recalculation is turned on, copy and move commands cause the entire spreadsheet to be recalculated. If automatic recalculation is turned off, copy and move simply move the contents of the selected block from one place to another within the sheet. Just as in the original version, you can toggle automatic recalculation mode on or off by pressing CTRL-R.

Enhancements For Atari *SpeedCalc*

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
NM 10 REM PRINT ROUTINE ENHA
      NCEMENTS FOR SPEEDCALC
BI 20 REM THIS PROGRAM APPEN
      DS SEVERAL PATCHES TO
      THE ORIGINAL SPEEDCALC
DB 30 TRAP 430
NI 40 CHECKSUM=0:NBYTES=80
JL 50 FOR BYTE=1 TO NBYTES:R
      EAD ABYTE:CHECKSUM=CHE
      CKSUM+ABYTE:NEXT BYTE
OJ 60 IF CHECKSUM<>7369 THEN
      PRINT "ERROR IN DATA
      STATEMENTS":GOTO 440
CI 70 DIM A$(1)
PM 80 PRINT "{CLEAR}INSERT S
      PEEDCALC DISK & PRESS
      RETURN":INPUT A$
DD 90 CLOSE #1
ID 100 OPEN #1,9,0,"D:AUTORU
      N.SYS":REM APPEND PAT
      CHES TO END OF ORIGIN
      AL FILE
EO 110 RESTORE 170
BC 120 PRINT "WRITING..."
DF 130 FOR BYTE=1 TO NBYTES:
      READ ABYTE:PUT #1,ABY
      TE:NEXT BYTE
FP 140 CLOSE #1
JO 150 PRINT "DONE":END
CG 160 REM $1F00-$1F2B, 1ST
      PATCH
HC 170 DATA 0,31
KK 180 DATA 43,31
DD 190 DATA 162,0,32,199,58,
      32
BI 200 DATA 88,46,173,17,66,
      205
CB 210 DATA 1,66,144,240,173
      ,1
JF 220 DATA 66,133,205,173,1
      9,66
JE 230 DATA 205,2,66,144,227
      ,169
CM 240 DATA 65,160,79,162,0,
      32
HC 250 DATA 199,58,32,89,33,
      162
IB 260 DATA 4,96
HN 270 REM
BK 280 REM $1F40-$1F4A, 2ND
      PATCH
KP 290 DATA 64,31
KI 300 DATA 74,31
MC 310 DATA 173,143,62,240,3
FP 320 DATA 76,150,51,76,152
      ,33
HK 330 REM
CH 340 REM $2CDB-$2CE0,REPL
      6 BYTES IN SPEEDCALC
      CODE
DC 350 DATA 219,44
NP 360 DATA 224,44
PO 370 DATA 32,0,31,32,199,5
      8
HP 380 REM
PL 390 REM $31C9-$31CB,COPY/
      MOVE PATCH
NK 400 DATA 201,49
NN 410 DATA 203,49
ED 420 DATA 76,64,31
LI 430 ERR=PEEK(195):PRINT "
      ERROR- ";ERR
KD 440 PRINT "PROGRAM ABORTE
      D!"
BD 450 CLOSE #1
```

Commodore 128 Machine Language

Part 2

Jim Butterfield, Associate Editor

This second in a series of articles on programming the 128 computer in its 128 mode, explores the built-in machine language monitor and looks at ways to link machine language programs to BASIC.

A Monitor At Your Fingertips

Some of the earlier Commodore products had no built-in machine language monitor. To work on machine language on the VIC-20 or Commodore 64, for example, you had to load a machine language monitor from tape or disk, or rely on a plug-in cartridge. Other products had simple monitors: Many PET/CBM models had monitors which could display and change memory, save or load programs, and not much else. The built-in monitor on the Commodore 128 has many attractive features; the best way to learn them is to try them.

Type MONITOR and press RETURN. You'll see the familiar register display, with values under the titles: PC (program counter), SR (status register), AC (accumulator or A register), XR (X register), YR (Y register), and SP (stack pointer). They are all similar to what you may have met on other machines except that the value under PC looks a little odd. It has five digits instead of four. The extra digit at the beginning is the *bank number*, and since it's an *F*, we're in bank 15.

We've noted previously that *bank* isn't quite the right term. We should more properly say *configuration* 15, since each configuration consists of a mixture of memory elements. Figures 1 and 2 show the configurations for banks 15 (the default) and 0. You'll notice that for addresses below $4000, both bank 0 and bank 15 use exactly the same memory. Thus, the contents of address $F1000 is exactly the same as the contents of address $01000. In fact, it's the same memory. We'll look for ourselves in a few moments.

Number Conversion

You may be quite comfortable with hexadecimal numbers. You may even be able to do hex-to-decimal conversions in your head and amaze your friends. I can't, however, and I like the number conversion features that are built into the monitor.

Figure 1: Bank 15

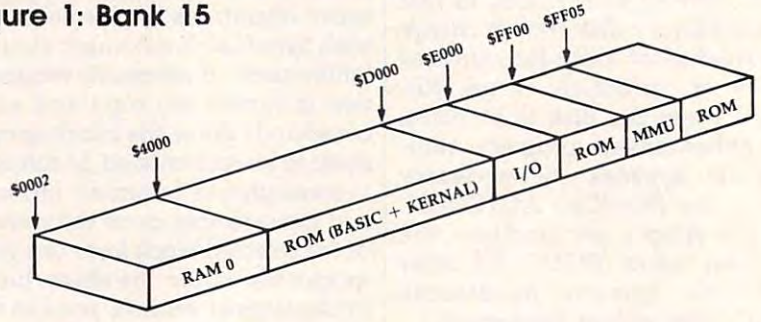
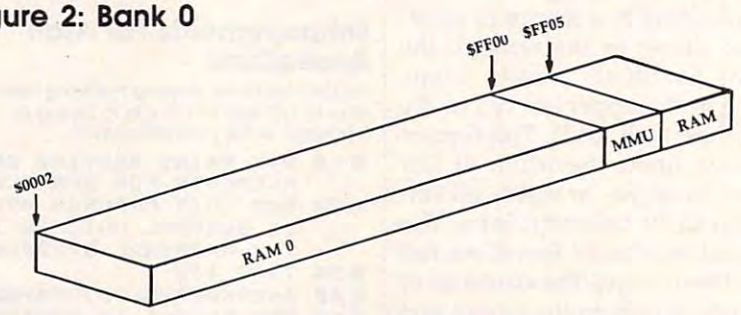


Figure 2: Bank 0



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City/State/Zip _____

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We've talked about hexadecimal address $4000 already. Let's find its value in decimal.

Type in the value $4000 on a line by itself and press RETURN. You'll see a display of this number as it appears in various number bases. First, the hexadecimal number. The dollar sign means hex, of course, so the monitor simply echoes what you typed in: $4000. The next line starts with a plus sign (+). To the 128's monitor, the plus sign means decimal. So you can see that $4000 equals decimal 16384. The following line starts with an ampersand (&), which means *octal*, a notation that's rarely if ever used with Commodore machines. (Octal numbers are base 8, so &40000 is equal to four times eight raised to the fourth power.) Finally, the number that starts with a percent sign (%) is the *binary* representation of $4000. Since the computer's internal code is always binary—not decimal or hexadecimal—it's sometimes useful to be able to look at a number this way.

You may also convert a decimal number to the other bases by typing it in, leading off with a plus sign. If you like, try entering +16384 and watch the computer figure out that it's the same as $4000. And if you ever need to do so, you can convert from octal or binary the same way.

Conversions are convenient, but the monitor includes another bonus: *Any number may be entered in any base, any time.* If you put in a number without a prefix, the monitor will assume you mean it to be hexadecimal. But you can slip in a decimal number anywhere by prefixing it with the plus sign. We'll be doing this; you'll see how handy it is.

Looking At Memory

You may display memory with the command M. If you follow M with two addresses, the monitor displays all the values between them. Thus, to display the contents of addresses $1000–$1029, just type M 1000 1029 and press RETURN.

You'll get more than you bargained for. Depending on whether you are on a 40-column or 80-column screen, the monitor will display 8 or 16 memory locations at a time. Each group of locations is on a single line, with the address of the first item on the line showing at the left. We asked for 42 locations, but we got 48, since the computer always finishes the line it's working on.

On the right, we see the ASCII character equivalent of the contents of the memory locations; some locations don't happen to have an alphanumeric equivalent, in which case a period is printed. If you display the addresses suggested above, you'll see some readable text in this area. The zone of memory we're looking at holds the function key definitions.

Just to confirm something that was said before, try using M to display memory locations F1000–F1029. That's bank 15 instead of bank 0, but you'll see that it is in fact the same memory. And you might like to try M +4096 +4137 which uses decimal addresses for the same locations.

If you follow an M command with only one address, you'll get a fixed number of memory locations. This can save you typing, and here's a tip for browsing through large amounts of memory: If you type M alone with no addresses, you'll get a continuation of the last memory display.

Making Changes Directly

The simplest way to change memory is to display the area you're interested in, then move the cursor back and type over the values on the screen. When you press RETURN, the monitor enters all the values for that line. It's a bit like screen editing in BASIC.

Try it. If you have displayed memory as suggested above, you may see the word GRAPHIC on the right-hand side of the memory display. Let's change the *G* stored in memory to a *T* so that it says TRAPHIC. The code for a *G* is $47; it's found in the left-hand part of that line. Move the cursor over the 47 and type 54, which is the code for *T*. Now press RETURN and the memory change is made.

Remember that you can't change the right-hand ASCII side of the display. And by the way, this is *not* the recommended way to change the function key definitions. It's easier (and better) to use BASIC's KEY command.

You can't change locations in read only memory (ROM). Try this: M F4200 F4200 will show you part of the BASIC ROM. Move the cursor back, type over a value, and press RETURN. You'll see from the display that the original values have been restored and ROM has not changed. Here's a note for technical types: The values from the line have "poked through" into the RAM memory which lies beneath ROM, but the monitor shows only the ROM.

The first character on the memory display line is the greater-than sign (>). This is in fact a synonym for the change memory command. On rare occasions, you might like to use this command directly.

Here's a typical case where the greater-than sign might be typed: You want to change a single location in an I/O chip. Using the "display and type over" method, you'd change 8 or 16 locations at a time. Usually, that's okay, but I/O chips are delicate and you don't want to change other registers accidentally. As a simple example, you might like to change the 40-column border color to red, but you don't want to change anything else. You may type >FD020 2 (remember that the I/O chips are in bank 15) and the border will change. The monitor will display a full line of memory locations, but you've changed only one. By the way, did you notice that the address you changed does not now contain the value 2 you put in? Funny things, I/O chips. If you're interested, you might type $D020 to ask the computer what decimal address in bank 15 you have changed. You might recognize the answer, +53280.

Write A Simple ML Program

Let's write a short program to print a line of asterisks. We'll use the built-in *assembler*. Here goes:

```
A 1500 LDX #0
```

The A means assemble. The address at which we will put this instruction is 1500; it's in hexadecimal (put a dollar sign in front if you like). The instruction itself is LDX #0, load counter X with a value (the # character means a value, not an address) of zero. Press RETURN