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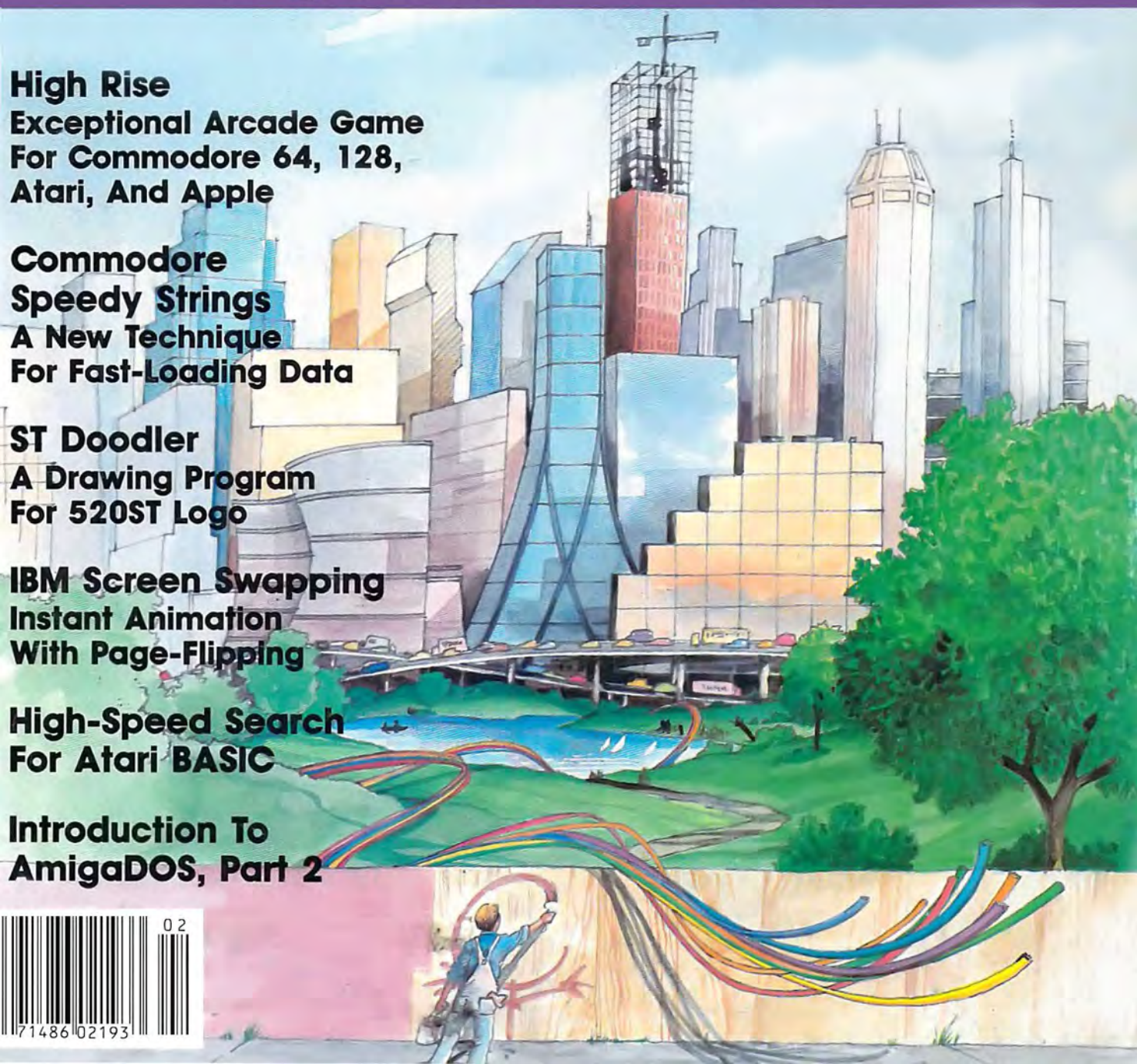

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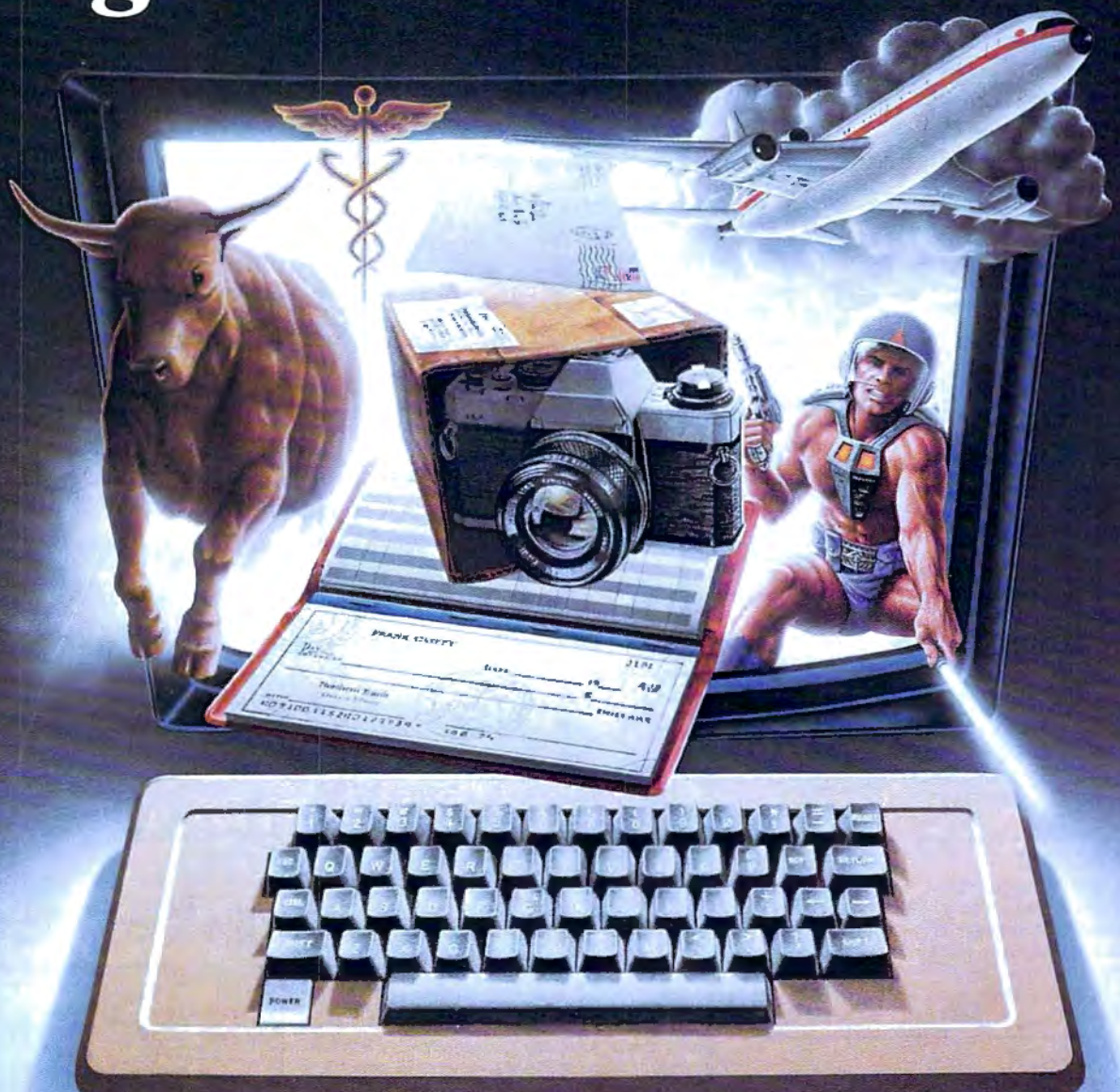

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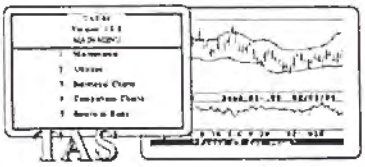

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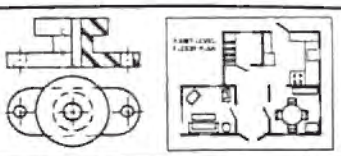

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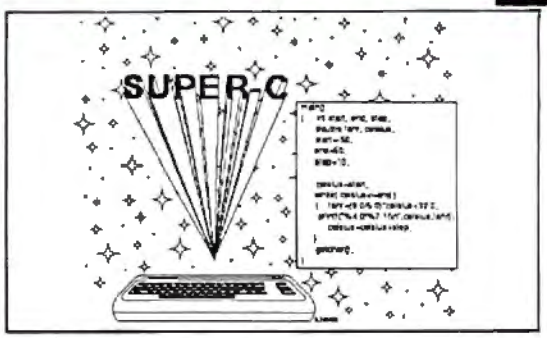

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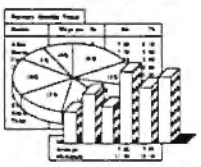

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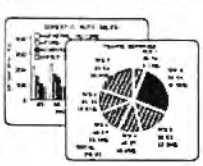

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Compute 2/86

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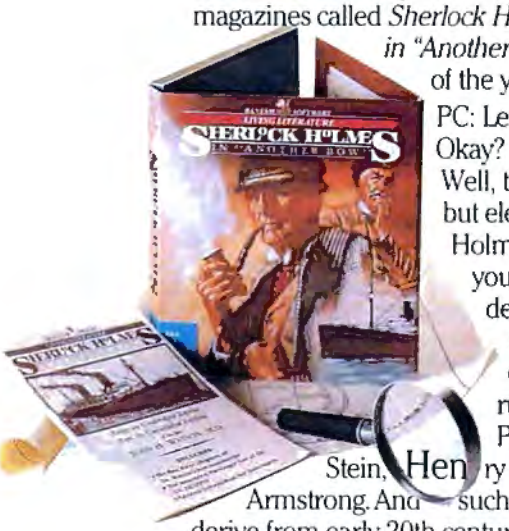
BANTAM SOFTWARE: We always ask what turns *people* on. Now we want to know what turns *you* on.

PERSONAL COMPUTER: It's about time someone asked the real expert. What turns me off is boring software. Boring, uninvolving, predictable software. And cold rooms. Why is it always so cold in here?

B: *Games* and *Ahoy* magazines called *Sherlock Holmes in "Another Bow"* one of the year's best.



PC: Let me decide. Okay? (Disk inserted.) Well, this is anything but elementary. You're Holmes. Watson's at your side. And you determine your own fate in case after case. And look, you run into the likes of Picasso, Gertrude Stein, Henry Ford, Louis Armstrong. And such graphics! These derive from early 20th century photographs. I don't have a clue how you did it, but you have a winner. Next case.

B: *The Fourth Protocol*, from Frederick Forsyth's gigantic best-selling book. *Games* called it "nerve-tingling." Here you go. (Slides disk in.)

PC: You mean circuit-tingling. If I knew I had to save the world, I would have gotten more sleep. All kidding aside, this involves *nuclear* weapons. A British traitor. The KGB. And the subversion of NATO. This is a challenge. Will it help if I read the book? (Loud explosion on screen.) Oh no! Does that mean I lost?

B: No, but losing's the whole point of the next one. *The Complete Scarsdale Medical Diet.* You know the bestseller.

PC: Why, do I look heavy? Never mind, let's have a taste. (Disk is inserted.) This is some menu. It helps you assess your goals. Monitor your progress. Mix 'n match meals from all five Scarsdale diets. Even prepares your shopping list. It'll tell you how much exercise you need to work off certain foods. Let's see about kiwi tart...

B: We've got one other program.

PC: No more. I'm exhausted.

B: No...this is a rebate program. Just fill out the coupon and mail it with proof of purchase and you get $5.00 back.

PC: Thank you. That's a nice offer.

B: So, did we turn you on?

PC: Yup. Now, please turn me off so I can rest. I've got to do some running later on to work off that kiwi tart.

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Editor's Notes

As is usual at this time of year, we begin to think about what the new year holds. This process usually gets up to speed by early December. That happens to be when we're writing this particular set of editor's notes. It also means you'll be reading them in February. It happens every year like this, but what can we say? We simply can't get too pseudo-visionary in October.

Last year this time, we were confidently predicting great things to come from Commodore. This year, we're predicting great things to come from Commodore's new Amiga just as soon as it begins to ship in quantity and . . . . You get the picture. In the editorial offices we call this hedging. It's a technique we've had to polish up on the last year or so. There was a time when this industry just grew and grew. In fact, it grew so fast that many marketing snafus, many less-than-polished products, were never recognized as such. Those times have passed. We no longer suspect that perhaps this is simply a pause in the phenomenal growth of years past. Times have truly changed, and our markets and marketeers have begun to adjust.

We won't try to offer any detailed predictions on 1986. This year, all we have are some reflections on the past, and a few on what we might expect from months ahead.

IBM's massive advertising campaign for the PCjr has been impressive for two reasons. It presents an opportunity to reap a reasonable savings on an adequately designed system, and it presents uninformed buyers with the opportunity to purchase a discontinued computer system six or more months after the announcement of its cessation. IBM does point out that it will continue to fully service and support the PCjr, and there's certainly no requirement that such merchandise be identified as no longer in production. But one must wonder whether each and every buyer who responds to this robust advertising campaign is fully aware of the transitory state of their choice of hardware.

Has Jack Tramiel done it again? This headline has been increasingly frequent of late, in part we suspect because, in this rather boring downturn in the industry, Mr. Tramiel is reliably eccentric. We have saluted his successes several times over the years, and do so again. Regardless of what the future holds for Atari, he, his sons, and their colleagues have done a remarkable, from the bootstrings up, job.

While we're on the subject of phoenix rising, the folks Mr. Tramiel left behind at Commodore haven't been doing so badly themselves. Recent news reports indicate, or at least express hope for, a profitable quarter for the Christmas season. That's one present Commodore shareholders haven't seen lately. This upturn is projected to arrive on the extended wings of the 128 and resurging sales of the 64. The Amiga has yet to begin to move in quantity, although we remain confident that it will, just as we're sure that more and more software developers will move to support it.

What else might the new year hold for us? Continuing consolidation, we're sure. Both corporate casualties and corporate successes. Everyone has become much more cautious now, so the flow of new materials will continue to diminish. Just as book publishers have become more selective about the type and quantity of titles brought to market, so, too, are the software publishers and the hardware manufacturers. Unfortunately, we can probably expect an increasing sameness, a growing presentation of products in new clothes. As the industry matures, we'll see the caution that pervades such maturation begin to inhibit previous risk-taking, so we suspect that we'll see less and less product breadth, and more and more "me-too-ness" in the market. Highly successful software will beget similar programs more rapidly. Etc. This is a kind of consolidation that markets engage in that we're not entirely comfortable with, but we're also hopeful that the rapid advances on the periphery of our technology will be sufficient to insure continued innovation. In fact, we have no doubt of it.

A belated new year to all of you, and we look forward to a pleasant 1986.

Robert C. Lock
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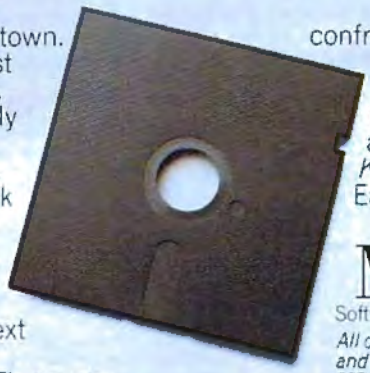

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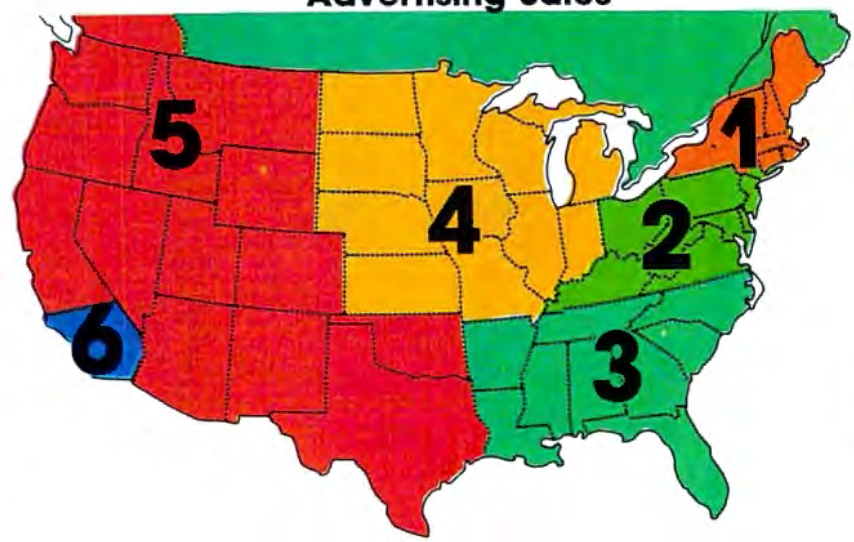

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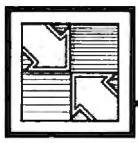

Readers Feedback

The Editors and Readers of COMPUTE!

If you have any questions, comments, or suggestions you would like to see addressed in this column, write to "Readers' Feedback," COMPUTE!, P.O. Box 5406, Greensboro, NC 27403. Due to the volume of mail we receive, we regret that we cannot provide personal answers to technical questions.

Can A Worm Have Artificial Intelligence?

Some time ago I read a description of "core war" games and their variations (*Scientific American*, March 1985). The game consists of two short programs placed in a memory area that loops around at the end. A special operating system runs the two battling programs by alternately performing one instruction from each; and the two programs attack and try to write over one another, while trying to avoid attacks and repairing themselves. Also mentioned was a "worm" program that replicates itself in a journey through the computer's memory. I am very interested in such programs and would like to see a self-replicating program for the Commodore 64.

Charles Willett

Like other eight-bit computers, the 64 isn't very well suited for conducting program wars. Most such games run on mainframe systems which are capable of multitasking—running several programs at once. Of the currently available personal computers, only the Commodore Amiga is designed for multitasking. It would require quite an elaborate machine language program to emulate even a simple form of multitasking on the 64. The battle programs must be written in machine language as well.

However, a "worm" program is quite easy to write. Following are two short examples for the 64 that reproduce themselves as they move upward in memory. By the time they're done, all of the space they've traveled through is filled with discarded copies of themselves—it's a bit like a snake shedding its skin.

The first version creates and activates an ML routine that begins at location 3000: It displays its current starting address as it goes, ending with a lockup when it hits the 64's BASIC ROM at location 40960 (turn the computer off and on to regain control):

```
10 J=3000
20 READ X:IF X<>256 THEN CK=CK
   +X:POKE J,X:J=J+1:GOTO20
30 IF CK<>9834 THEN PRINT"ERRO
   R IN DATA STATEMENTS--CHECK
    TYPING":END
40 SYS 3000
50 DATA 169,200,133,251,169,11
   ,133,252,169,247,133
60 DATA 253,169,11,133,254,160
   ,47,177,251,145,253
70 DATA 136,16,249,24,165,251,
   105,47,133,251,165
80 DATA 252,105,0,133,252,24,1
   65,253,105,47,133
90 DATA 253,165,254,105,0,133,
   254,166,251,165,252
100 DATA 32,205,189,169,13,32,
    210,255,256
```

The second version is written entirely in BASIC, but does essentially the same thing. It repeatedly copies itself to a new memory area and then runs the copy, printing its beginning and ending addresses before each move.

```
10 CLR:J=0:EA=0:SA=0:HB=0:LB=0
   :LN=0:HN=0
20 SA=PEEK(43)+256*PEEK(44):PR
   INT CHR$(147)"WORM CODE STA
   RTS AT ";SA
30 EA=PEEK(49)+256*PEEK(50):PR
   INT "AND ENDS AT ";EA
40 FOR J=0 TO (EA-SA):POKE (EA
   +J),PEEK(SA+J):NEXT
50 HN=INT(EA/256):LN=EA-(256*H
   N)
60 HB=INT((EA+(EA-SA))/256):LB
   =(EA+(EA-SA))-(256*HB)
70 PRINT CHR$(147)"POKE "EA",0
   "
80 PRINT CHR$(17)CHR$(17)"POKE
   43,"LN":POKE44,"HN
90 PRINT CHR$(17)CHR$(17)"POKE
   45,"LB":POKE46,"HB
100 PRINT CHR$(17)CHR$(17)"SYS
    42291"
110 PRINT CHR$(17)CHR$(17)"RUN
    "
120 POKE 198,6:POKE 631,19:FOR
     J=0 TO 6:POKE 632+J,13:NE
    XT
```

Locations 43–44 and 49–50 point to the beginning of program text and the end of simple variable storage, respectively. Line 40 does the actual duplication, copying everything between the starting and ending points into the addresses just above the end of the current program. Once that's done, the worm executes a series of direct mode commands with the dynamic keyboard technique to set the start-of-program and end-of-variables pointers at the right positions for the new copy. SYS 42291 relinks the program lines so they'll run properly in their new location. The BASIC worm stops with an OUT OF MEMORY message when it travels so high that there's not enough RAM left to hold its variables (your BASIC program space is almost nil at this point; type SYS 64738 to reset the computer). With some modifications, these programs will run on other Commodore computers as well.

Of course, the results here are trivial. But exercises like these can form the basis of artificial intelligence experiments. Once you begin to view a program as a "being," all sorts of intriguing questions arise: What properties in addition to movement and self-replication characterize a living entity? How can a computer emulate those actions? What is intelligence? We're only beginning to see the fruits of these inquiries in such applications as expert systems and speech recognition.

Controlling IBM's NUM LOCK

I'm trying to read the IBM PC's cursor keys from within a BASICA program. But if the NUM LOCK key is set in the wrong mode, the numeric keypad generates number codes instead of cursor codes. How can I set NUM LOCK under program control?

Dennis Heckman

When you first boot up an IBM PC, the numeric keypad keys act as cursor keys. Pressing NUM LOCK makes the computer read them as numeric keys. Memory location 1047 controls the status of NUM LOCK as well as several other special keys. Each bit of this location serves a different purpose:

Bit	Key
7	INSERT
6	CAPS LOCK
5	NUM LOCK
4	SCROLL LOCK
3	ALT
2	CTRL
1	Left SHIFT
0	Right SHIFT

In each case, a 1 in the bit position

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shows that the corresponding key is pressed, and a 0 indicates that it's not pressed. Thus, after NUM LOCK has been pressed (when the keypad keys act like number keys), bit 5 of location 1047 contains a 1. When NUM LOCK is not in effect (when the keypad keys act like cursor keys), bit 5 contains a 0. To change the NUM LOCK status from within a program, all you need to do is put a 1 or 0 in bit 5 of location 1047. In most cases you'll want to leave the rest of the keyboard in its current configuration; thus, it's preferable to PEEK the current value of 1047, AND that value with 223 (to set bit 5 to 0), and POKE the resulting value back into 1047. Put the following statement at the beginning of your program to perform the entire operation:*

```
10 DEF SEG=0:POKE 1047, PEEK(1047)
   AND 223
```

After the computer executes line 10, the keypad keys work as cursor keys. If you need to reverse the NUM LOCK status, use the following statement to set bit 5 of location 1047 to 1:

```
DEF SEG=0:POKE 1047, PEEK(1047) OR
   32
```

Of course, even after you've set the NUM LOCK status, the user can still change it back by hitting NUM LOCK. To be safe, you might want to set the status immediately before every operation requiring the keys.

Similar statements can be used to affect the other keyboard features controlled by location 1047. For instance, POKE 1047, PEEK(1047) AND 191 turns off CAPS LOCK, and POKE 1047, PEEK (1047) OR 64 turns it on.

Amiga Features

I can't wait to purchase an Amiga, but I need to know a few things. First, will your magazine support the Amiga (programs, columns, etc.)? Secondly, referring to your article about the Amiga's IBM compatibility ("Amiga Goes IBM-Compatible," October 1985), can the Amiga handle IBM PC software that must be booted on a PC? Thirdly, can the Amiga do Macintosh-type graphics and text fonts?

Victor Swindell

COMPUTE! *is supporting the Amiga with product reviews and tutorials, and will add programs when the final version of BASIC is released. The first Amigas were being shipped last fall with ABasiC, a BASIC interpreter written by MetaComCo, the British company which also wrote AmigaDOS. However, Commodore was making final preparations in November to ship an entirely different BASIC written by Microsoft. This BASIC reportedly was adapted from Microsoft BASIC for the Macintosh and has many more features than ABasiC. The latest word we've received is that Microsoft BASIC is to replace ABasiC as the standard language shipped with the Amiga.*

The IBM PC emulator software—now known as the Transformer*—also was not available at this writing (early November), but demonstrations of preproduction versions show that it is capable of booting PC software directly off 5¼-inch IBM disks. (External 5¼-inch disk drives for the Amiga are optional.) Early reports indicate that an Amiga with the* Transformer *is not 100 percent IBM-compatible, but that it can run most of the best-selling PC software with a slight sacrifice of speed. Commodore is also working on an accelerator package that will improve the* Transformer's *performance. We'll report on the* Transformer's *degree of IBM compatibility and its speed when it becomes available.*

The Amiga displays Macintosh-style graphics with its operating system interface, the Workbench, which resembles the Macintosh desktop. This screen mode has 640 × 200 resolution (128,000 pixels), less than the Mac's 512 × 384 resolution (196,608 pixels). However, the Amiga screen is in color. The Amiga also has a high-resolution mode with 640 × 400 resolution (256,000 pixels), but the Workbench doesn't work in that mode. A couple of graphics-drawing programs which are being released for the Amiga are similar to MacPaint, *except they take advantage of the Amiga's palette of 4,096 colors. The Amiga also has various text fonts available like the Macintosh. You can try out some of these fonts by opening the Notepad from the Utilities drawer on the Workbench disk, then pulling down the Font and Style menus. There are several different fonts, type sizes, and styles.*

Secret Apple Self-Test

While using my Apple IIc, I discovered something rather odd. I pressed CONTROL-RESET at the same time that I was unknowingly pressing one of the joystick buttons. First the screen went blank, then it filled up with colorful, constantly changing hi-res graphics patterns. I know this had nothing to do with the program I was using. What happened?

Sam Robison

On the Apple IIe and IIc, pressing a joystick button performs the same action as pressing the Open-Apple and Closed-Apple keys on the keyboard. Pressing RESET while holding down both CONTROL and the Open-Apple key forces the computer to reboot, just as if the power switch had been turned on.

Something different happens on the IIe if you also hold down the Closed-Apple key along with the other three (it takes a bit of practice to reach all four at once). The computer performs a self-test of its circuitry, which takes about 20 seconds. While this is happening, a changing lo-res pattern fills the screen. If all is well, the screen clears and the message "System OK" appears. If any other message shows up, you should have your computer checked by a technician.

The Apple IIc does not have a built-in diagnostic program. According to the Apple IIc Reference Manual, *pressing the same cluster of four keys activates "Teri's Memory and Soft Switch Exercise Program," which generates the hi-res display that you saw. The program runs for a few minutes, eventually locking up the system (no harm is done—simply reboot as usual). In the* Reference Manual, *Apple claims that this program is used only during manufacture and has no use after that point. By accessing RAM and the display circuitry, it may generate signals that Apple's test equipment can recognize. It's also quite pretty to watch.*

Commodore Boot Programs

I have a PCjr and my boss recently purchased a Commodore 64 (his first computer). I would like to know how to write the equivalent of an IBM AUTOEXEC.BAT file for the 64 so my boss can load and activate certain programs (such as "TurboDisk" and the DOS Wedge) automatically, without having to type anything. Can this be done without installing a special ROM chip?

Steve Neeland

While an autoboot *feature of this type is common in most computer systems, it is not built into the Commodore 64. However, it is possible to create a disk file that loads and runs automatically when you type LOAD"*",8,1 and press RETURN. Though it's too long to include here, there's a program called "Autoload" in* COMPUTE!'s Third Book of Commodore 64 *which creates such files for you.*

If you don't mind two extra keystrokes, you can load and run any BASIC program from disk with a single command. Type the following, replacing FILENAME with the name of the BASIC program you want to run:

```
LOAD"FILENAME",8:
```

Don't forget the colon after the 8. With the cursor positioned in the space following the colon, press SHIFT–RUN/STOP. The 64 prints LOAD after the colon and proceeds to load and run the program. (On the Commodore 128, you can achieve the same effect with RUN "FILENAME".) It's also relatively easy to load and activate a series of machine language programs from BASIC, provided they return to BASIC and don't perform a NEW when they set up. Here's a short program that

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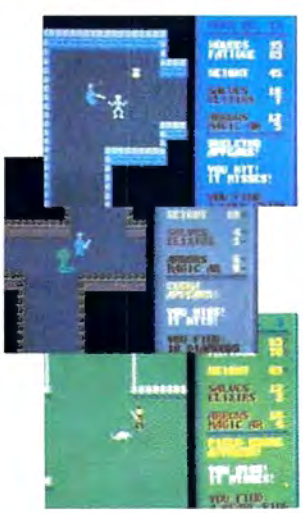

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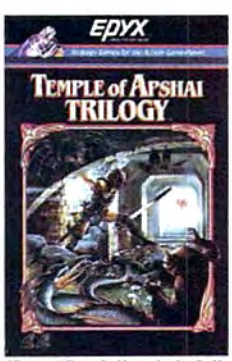

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loads the two utilities you mentioned. Be sure to save the program before you run it, since it performs NEW after installing "TurboDisk" and the DOS Wedge:

```
10 REM THIS PROGRAM ERASES
   ITSELF--SAVE BEFORE YOU RUN
20 IF Z=2 THEN 60
30 IF Z=1 THEN 50
40 Z=1:LOAD"DOS 5.1",8,1
50 Z=2:LOAD"TURBODISK.OBJ",8,1
60 SYS 49152:SYS 52224:NEW
```

Along with many other new features, the Commodore 128 has the ability to perform a true autoboot. When you turn it on, the 128 searches track 1, sector 0 of the disk in the drive for a special "signature" code consisting of the characters CBM. If that code is present, the system loads and runs the program specified in the autoboot sector. Since the autoboot program can in turn load and run a larger boot program, it's possible to create quite an elaborate boot sequence, which loads and activates your favorite utilities and otherwise configures the system exactly to your liking. Autobooting works with the 1541 disk drive (even for CP/M disks) as well as the newer 1571. COMPUTE!'s Commodore 128 Programmer's Guide *contains a detailed discussion of the autoboot process as well as a program that creates autobooting disks for the 128.*

More TI Supplies

Sorry that we weren't able to be included in your September 1985 list in this column of Texas Instruments suppliers. We're a small business and work directly with various distributors across the country. Rather than stock items, we place orders with our distributors according to our customers' needs. We offer a delivery time of two weeks in most cases.

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Thank you for the information.

Custom Cursors For 64 *SpeedScript*

Even though I have used more elaborate word processors with my Commodore 64, I frequently prefer to use *SpeedScript* because of its speed and convenience. However, I find the incessantly blinking cursor a distraction. Can you tell me how to get rid of it?

Paul Newsom

Just as everyone seems to prefer different screen colors, some people like a blinking cursor while others find it maddening. Fortunately, it's easy to stop the blink or change its speed. Of course, you wouldn't want to eliminate the cursor altogether, since that would make it hard to find your way around inside a document. To defeat the blink, load SpeedScript *into memory, type one of the following lines in direct mode (without a line number), and press RETURN. Be sure to use the correct POKEs for the version of* Speedscript *you're using, and type very carefully—even a small error may have drastic consequences:*

SpeedScript 2.0
POKE 2527,240:POKE 2528,246

SpeedScript 3.0 or *3.1* (Commodore 64 only)
POKE 2698,240:POKE 2699,246

Resave SpeedScript *under a new filename to distinguish this version from the original. Now the reverse video cursor remains steady rather than blinking. Since* SpeedScript *blinks the cursor only during idle times (when you're not pressing any keys), this has no effect on the rest of the program. To restore the blink, enter one of these lines:*

SpeedScript 2.0
POKE 2527,165:POKE 2528,162

SpeedScript 3.0 or *3.1*
POKE 2698,165:POKE 2699,162

*Changing the cursor's blink speed is even easier. To make the cursor blink at half its normal rate, enter POKE 2530,32 (*SpeedScript *2.0) or POKE 2701,32 (*SpeedScript *3.0 or 3.1). To make the cursor blink in double-time, POKE the same location with 8 instead of 32. Depending on your preferences, you may find one of these preferable to the default speed. POKE the same location with 16 to restore the normal blink rate. Because the blink is created by replacing the character under the cursor with its reverse video equivalent, there's no way to change the cursor's actual appearance without grafting a complete set of custom characters onto* SpeedScript *as well. (See "Commodore 64* SpeedScript *Fontmaker,"* COMPUTE!, *January 1986.)*

Improving Atari CLOADs

I would like to respond to James Jenkins' letter in the October 1984 issue of COMPUTE! about Atari CLOAD errors 138 and 143. Here are a few suggestions:

When purchasing blank cassettes, buy only those whose cases are held together with five screws. Tape errors are caused not so much by the quality of the tape as by the quality of the case. The Atari Program Recorders seem very susceptible to minor tape fluctuations caused by the tape binding in the case. Second, after using a tape for some time, it may become unevenly wound, causing it to bind and generate errors. To free the tape, slap it on the flat side of the cassette against a hard surface. This forces the tape against one side of the case and reduces errors. Finally, instead of pressing SYSTEM RESET to clear the screen, type GR.0 or press SHIFT-CLEAR. SYSTEM RESET can disrupt operation of the POKEY chip, which controls input/output operations. Thus, pressing SYSTEM RESET before you do a CSAVE or CLOAD can cause tape errors. To recover from this situation, type LPRINT and press RETURN while your printer (if you have one) is offline or switched off. You'll see an ERROR 138, but this simply means the printer is not responding. This resets the POKEY chip and allows error-free tape operations.

Richard L. Baldwin

Thanks for the advice. In a related letter, reader W. Byrom Dorsey points out that you can get similar information free of charge from Atari, 1265 Borregas Avenue, Sunnyvale, CA 94086. Just ask for the bulletin entitled "410 Tech Tips."

Atari Keyboard Buzzer

When I type 107 characters on my Atari 800XL, the computer sounds a buzzer. Is this a Revision B operating system bug, or does Atari have a purpose for it?

John Lapetina

The buzzer effect is a deliberate design feature, not a bug. It happens in BASIC with all Atari 400/800, XL, and XE computers with all versions of the operating system. (Incidentally, your 800XL has the XL operating system, not Revision B. Revision B fixed some bugs in the original Revision A operating system shipped with early 400s and 800s. It is available for XL and XE computers on the Atari Translator *disk.)*

The buzzer is analogous to the end-of-line bell on a typewriter: It warns when you are reaching the end of a BASIC logical line. *A logical line is the maximum number of characters that can be typed after a line number. On the Atari, a logical line may be as long as three* physical lines *(screen lines). If a BASIC statement (or series of statements separated by colons) won't fit on a logical line, you must either shorten it or break it up into two logical lines.*

The actual number of characters allowed in a logical line varies according to how the screen margins are set. Atari BASIC normally defaults to a 38-column

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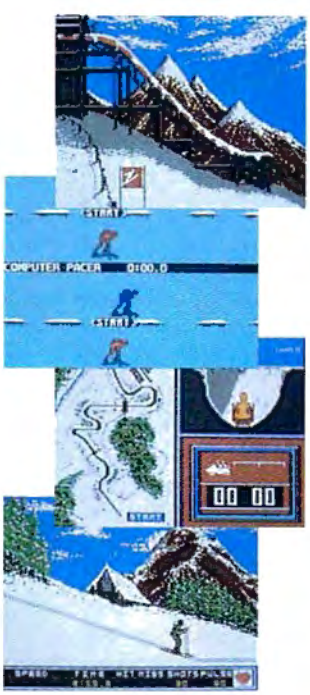

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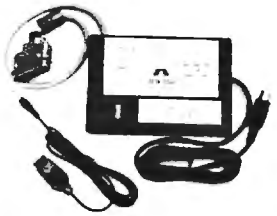

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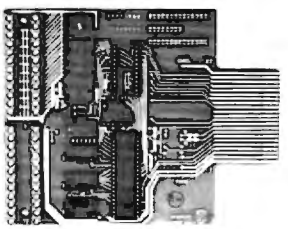

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screen—38 characters per physical line. That means a logical line can be up to 114 characters long, and the warning buzzer sounds after 107 characters. But this can be adjusted by storing different numbers into two memory locations which control the screen margins. Location 82 sets the left margin and location 83 sets the right margin.

These locations usually contain the values 2 and 39, respectively. Atari presets the left margin at 2 because many people plug their computers into TV sets, and TVs often suffer from overscan*—they display slightly less than the entire image area on their screens. Minor overscan is rarely noticeable when watching TV shows, but it can clip off a column or two of characters along the margins when you plug in a computer. By defaulting to a 38-column screen instead of 40 columns, Atari computers automatically compensate for overscan. If your TV doesn't overscan, or if you have a computer monitor, you can reset the left margin to 40 columns with the statement POKE 82,0. This allows 40-character physical lines and 120-character logical lines. The warning buzzer won't sound until the 113th character. (SYSTEM RESET restores the default value.) On the other hand, if a TV suffers from extreme overscan, you can make the screen narrower by POKEing larger numbers into location 82 and smaller numbers into location 39. This, in turn, reduces the number of characters per physical line and logical line.*

Keep in mind, however, that you can exceed the logical line limit by using abbreviated keywords. For example, type this line exactly as shown:

```
10 GR.7:SE.4,0,0:C.1:PL.20,20:DR.40,20
  :DR.40,40:DR.20,40:DR.20,20:DR.40,40
  :PL.40,20:DR.20,40
```

GR. is the abbreviation for GRAPHICS, SE. stands for SETCOLOR, C. is COLOR, PL. is PLOT, and DR. is DRAWTO. Abbreviated, these commands total 92 characters and fit comfortably in a logical line of three physical lines. But when you type LIST, Atari BASIC automatically expands the abbreviations and the statement overflows into four physical lines with a total of 136 characters. Ordinarily, you couldn't type a logical line that long. If you type RUN, the program executes perfectly, so this is one way of squeezing more statements into a logical line. However, the technique should be avoided for two reasons: Other people can't type this line without also using abbreviations, and any editing which changes the length of a statement also chops off all the characters following the third physical line. ©

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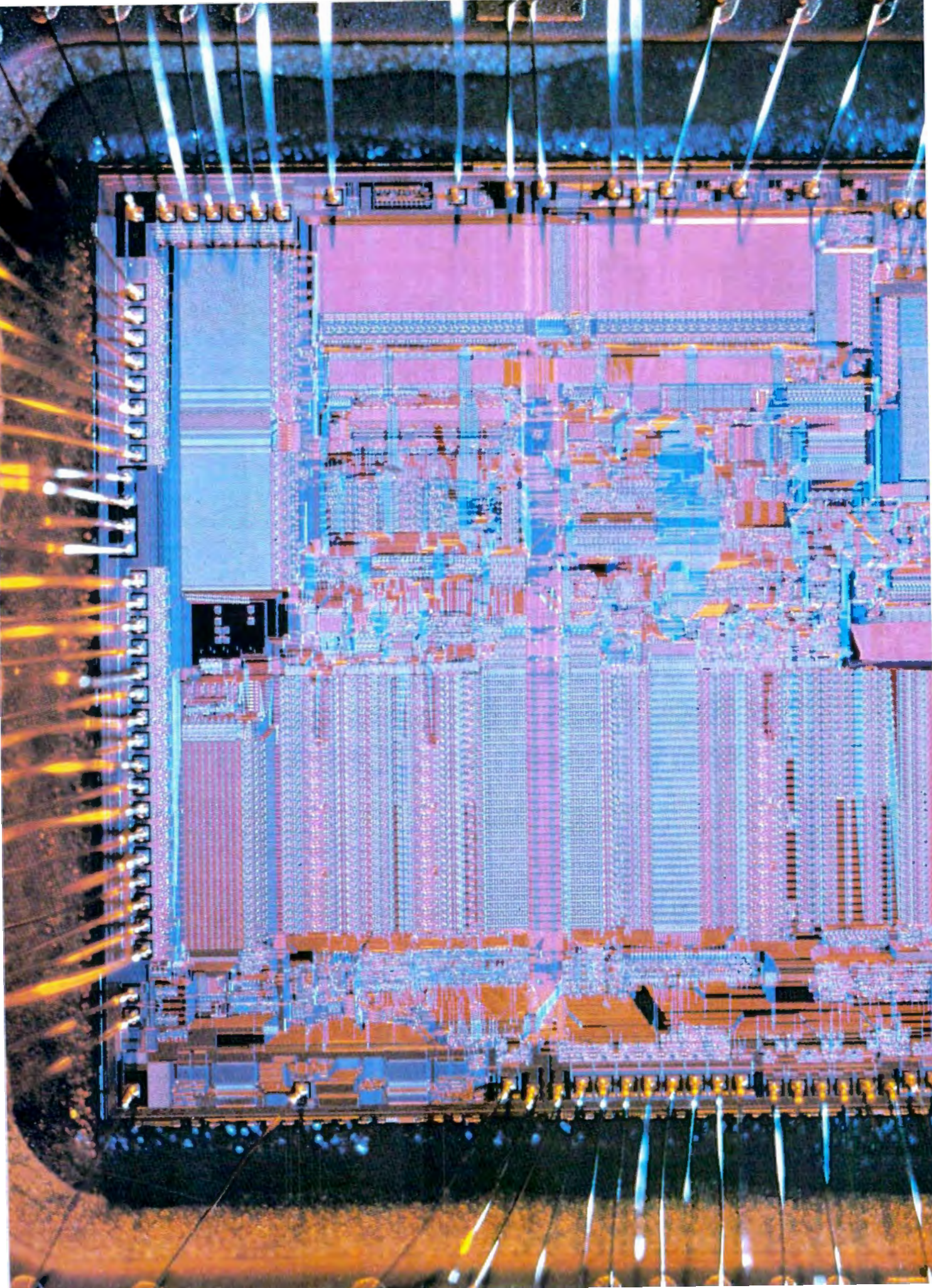

GENEALOGY OF A CHIP

The 68000 Yesterday, Today, And Tomorrow

Selby Bateman, Features Editor

Motorola's 68000 microprocessor is the powerhouse beneath the hood of a new generation of leading-edge personal computers—the Commodore Amiga, Atari 520ST, and Apple Macintosh. With its hybrid 16/32-bit architecture and remarkable processing speed, the 68000 is helping to bring a new level of flexibility to personal computing.

8080, Z80, 6502, 8088, 68000—To a computer enthusiast, these strange numbers tell a fascinating story about the continuing development of the personal computer. They're the microprocessors that helped make millions of computers affordable to millions of people. At one time or another, these were the best brains—computer brains—our money could buy.

In the history of microelectronics, they'll be remembered as the first personal computer microprocessors to invade American homes, schools, and businesses in Apple, Atari, Commodore, IBM, and a flock of other computers. Each of these microprocessors has its own parents, cousins, and children. The family names come from companies called Intel, Zilog, MOS Technology, and Motorola.

Hidden beneath the computer's shell, a microprocessor is little more than a fingernail-sized wafer of silicon containing an intricate grid of almost microscopic transistorized circuits. But the tiny microprocessor is the central processing unit (CPU), or brain, that controls or coordinates virtually everything that goes on in the computer. It gathers instructions from the computer's memory, executes those instructions, and stores the resulting information back into memory.

A microprocessor does what its name implies—*processes* information. And that information is in the form of electrical signals. To make sense of the signals, the computer uses a binary code of ones and zeros that matches the *on* or *off* states of electricity. Each on or off position is defined as a *binary digit*, or *bit*, of data.

During the past several years, millions of people have become

acquainted with computers that have microprocessors capable of handling eight bits of information at a time. These eight-bit machines include many of the most popular computers first used in homes, schools, and small businesses. For example, the Commodore 64 is based on MOS Technology's 6510 microprocessor, a sibling of the earlier 6502 microprocessor used in the Commodore PET, VIC-20, Apple II/II+, and Atari 400/800/ XL computers. Other eight-bit 6502-compatible microprocessors are the 6502B (Apple IIe), 6502C (Atari 130XE), 65C02 (Apple IIc), 7501 (Commodore Plus/4 and 16), and the 8502 (Commodore 128). The strengths and limitations of each of these chips have helped define the nature of the computers in which they're housed.

A microprocessor CPU in today's computers is usually but one of a number of integrated circuit chips carrying on the work. But the other chips, unlike a microprocessor, are dedicated to certain functions such as memory or special support functions. The Commodore 64, for instance, also has a sophisticated programmable three-voice sound chip (the 6581 Sound Interface Device) and a versatile graphics chip (the 6567 Video Interface Chip). The Commodore 64's CPU, the 6510, coordinates the activities of these chips and others. Because the CPU itself doesn't have to carry out the duties of these support chips, it's freed to carry on its other activities without losing significant processing speed.

The latest personal computers to hit the market, such as the Amiga, advance this principle even further by making the CPU the conductor of a whole orchestra of support chips. At the same time, the latest CPU chips have grown so powerful that they're now capable of running several programs simultaneously. The newest microprocessors emerging from today's laboratories pack the power of a large mainframe computer onto a tiny chip of silicon.

(Preceding page) A microscope's view of Motorola's new 68020 microprocessor. The chip's actual size is about the diameter of an adult's little fingernail.

It was little more than a dozen years ago, in 1972, that Robert Noyce's Intel Corporation created the first functioning microprocessor—the four-bit 4004, developed by an engineer named Ted Hoff. Instead of "hard-wiring" several small chips together to accomplish certain tasks, engineers could now program the microprocessor to do a variety of operations. This four-bit chip found its most useful home in a generation of hand-held calculators.

Intel soon followed with the first eight-bit microprocessor, the 8008, and then with the 8080. The 8080A became the CPU for the first hobbyist computer, the MITS Altair, introduced as a do-it-yourself kit in 1975. Soon other companies joined in the race. Zilog introduced the eight-bit Z80, which became the CPU for a multitude of personal computers from Radio Shack, Osborne, Kaypro, Timex/Sinclair, and others. A Z80 chip is also one of the two microprocessors found in the Commodore 128. At about the same time, MOS Technology created the popular eight-bit 6502, and Motorola introduced the eight-bit 6800.

These microprocessors perform quite similarly, despite individual differences in the ways they handle such internal functions as addressing modes, memory registers, and other operations. All of them fetch, execute, and store data eight bits at a time within CPU pathways called *buses*. There are at least three basic kinds of buses in most microprocessors: a data bus, an address bus, and a control bus. The width of these buses determine whether a microprocessor is considered an eight-bit, 16-bit, or hybrid chip.

Today's microprocessors include a number of similar sections, each having specified duties. The components of a chip include an *instruction set*, simple commands that are hard-wired into the microprocessor; *registers* for storing and manipulating instructions; buses for carrying data; an internal *clock* that helps organize the flow of data; a *logic unit* for mathematical calculations; and a *decoder* that interprets the instruction set.

There are also other functioning units and subunits within every CPU, such as accumulators, status registers, interrupt functions, and program counters. And every microprocessor has its own unique style of handling data.

In 1981, IBM introduced its first personal computer, the IBM PC, which uses Intel's 8088 microprocessor (a more sophisticated descendant of the earlier 8008). The 8088 is a hybrid chip, a mixed-mode CPU that handles internal bus communications 16 bits at a time and external communications eight bits at a time. This 8/16-bit microprocessor can address, or access, up to a megabyte of memory (1,024K, or 1,048,576 bytes). In contrast, an eight-bit chip like the 6502 or Z80 can address only 64K (65,536 bytes) of memory.

In 1983, Apple introduced the Macintosh, the first popular personal computer based on the Motorola 68000, a hybrid chip even more powerful than the 8088. This 16/32-bit descendent of the 6800 processes 32 bits of information at a time on its internal buses and 16 bits in external communication. And it can directly address up to 16 megabytes of memory—16,384K, or 16,777,220 bytes.

Work began on the 68000 in the mid-1970s. Motorola formed a project team known within the company as MACSS (Motorola's Advanced Computer System on Silicon). The result of that effort was announced in 1979, when Motorola first demonstrated the new microprocessor.

In addition to the 68000's 16/32-bit processing capability, it also has a potential internal clock

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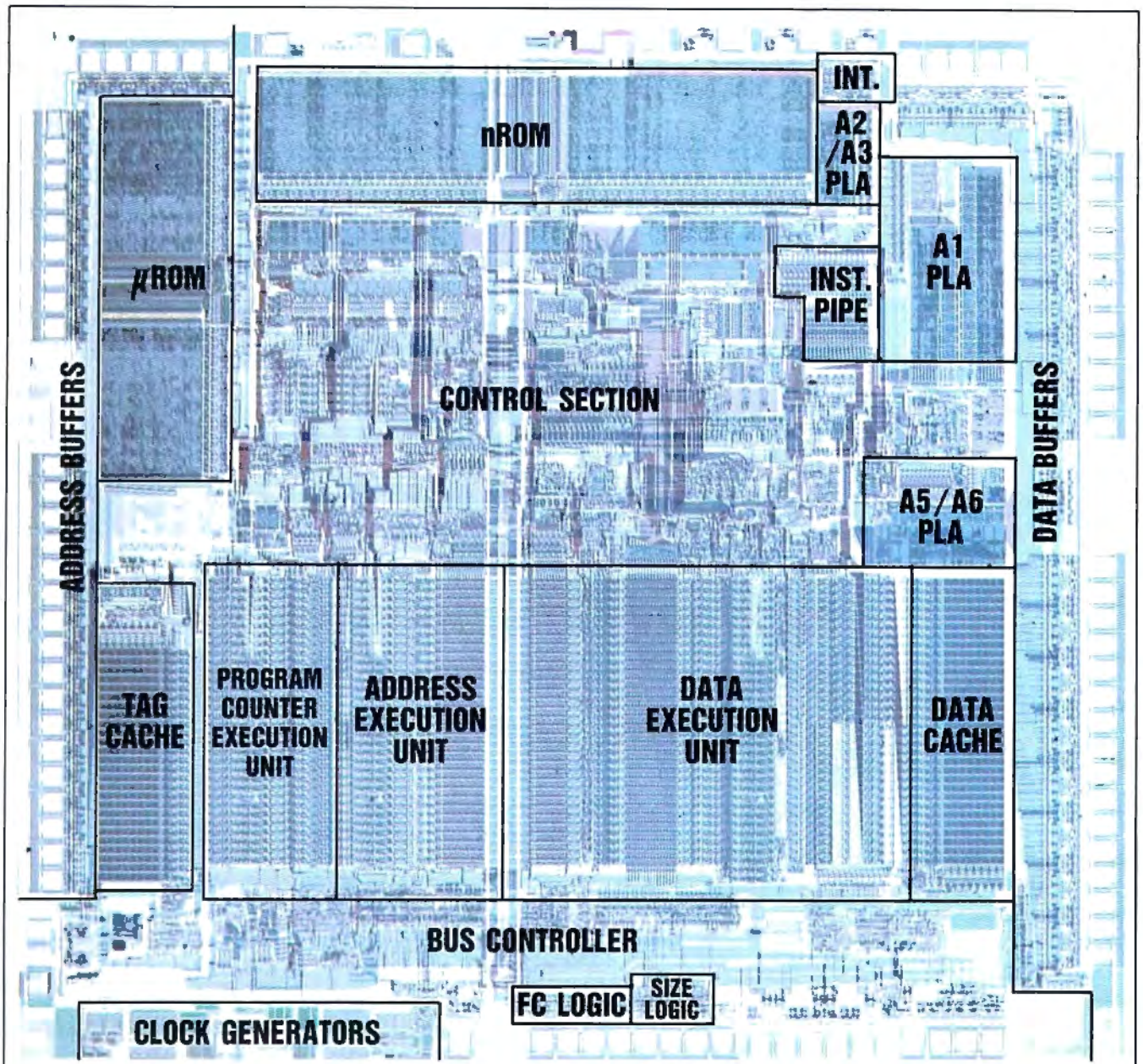

The 68020 microprocessor contains the equivalent of 200,000 transistors. Major functions of the chip shown here include Read Only Memory microcode and control sections; programmable logic array (PLA) units; data and address buffers; clock generators; function code (FC) logic and size logic sections; program counter, address, and data execution units; interrupt logic; bus controller; and instruction pipeline.

speed of 12.5 megahertz (MHz). The clock speed is essentially how fast a chip runs, based on the number of cycles an electrical signal can make through the chip per second. Hence, 1 Hz is equivalent to one cycle per second; 1 MHz equals one million cycles per second. The higher the clock speed, the more instructions a CPU can fetch and execute per second.

Compare the 68000's 6–12.5 MHz clock speed to the 1 MHz speed of a Commodore 64, or the 4.77 MHz clock speed of an IBM PC. The current crop of 68000-based personal computers generally have clock speeds in the 7 to 8 MHz range. The Macintosh has a clock speed of 7.8 MHz, the Amiga has a clock speed of 7.16 MHz, and the Atari 520ST runs at 8 MHz. But many other factors besides raw clock speed determine a computer's overall speed, including the efficiency of its operating system and other system software.

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The 65816 Chip

New Life For The 6502?

When Apple Computer introduced the Apple IIc in April 1984, the company slogan was "Apple II Forever!". But with the growing popularity of powerful 68000-based 16/32-bit computers like the Atari ST, Amiga, and Apple's own Macintosh, is the Apple II family eventually headed for the eight-bit scrap heap? And what about the future of other eight-bit computers, like the Commodore 64 and 128 and the Atari 400/800/XL/XE computers, all of which are based on the 6502 chip or its offspring?

Veteran chip designer William Mensch believes there's still plenty of potential in the venerable 6502-based machines. How about a 16-bit Apple II, one that's still compatible with the thousands of eight-bit Apples, but which also can address up to 16 megabytes of memory in sections of 64K?

Mensch, founder and director of the seven-year-old Western Design Center in Mesa, Arizona, has developed the 8/16-bit 65816, a hybrid 6502 which is rumored to be Apple Computer's choice for the future of the Apple II. Apple president John Sculley and Apple's executive vice president of product operations, Del Yocum, have already announced that 1986 is the year that the Apple II gets a new CPU.

At this writing (late November), all Mensch can say is that Apple Computer has had samples of his chip since March 1984. Atari bought some samples before Jack Tramiel acquired Atari from Warner Communications, but hasn't announced any plans for upgrading the its eight-bit line with the 65816. Nor has Commodore, so far.

William Mensch is no stranger to new microprocessors. His company created the 65C02 chip that Apple uses in the IIc. And prior to that, Mensch was one of the original designers of the 6502 microprocessor. He also worked at Motorola on the design team that came up with the 6800 chip, the eight-bit predecessor to the 68000.

The 65816 is compatible with the original 6502 (Apple II and II+), the 6502B (Apple IIe), and the 65C02 (Apple IIc). External bus communication is handled eight bits at a time, but the internal data bus handles data in 16-bit chunks. And the clock speed of the 65816 is about 4 megahertz (MHz), compared to 1 or 2 MHz for most 6502 chips. Mensch says his design efforts are pushing toward 6 and even 8 MHz within the next year.

Mensch says a 4 MHz 65816 could run from one to two million instructions per second, about half the speed of a VAX 780 minicomputer, at least for some operations. For word processing and spreadsheet data manipulation, the 65816 could approach the performance of a VAX, he says. Naturally, functions which depend on the eight-bit external bus structure of the 65816 would not be as fast.

"My goal is to elevate the Apple II to the equivalent of a mainframe for the single user," says Mensch.

Beyond that, Mensch is shooting for future-generation chips with clock speeds of 100 MHz. That kind of speed would almost certainly require the use of chips based on gallium arsenide crystals rather than silicon, since silicon chips tend to overheat at higher speeds. Gallium arsenide can reportedly handle speeds up to five times faster than today's fastest silicon chips. Mensch's Western Design Center already has two licensees, Northern Telecom and GTE, that are interested in gallium arsenide versions of the 6502. Mensch may begin working toward that goal for the 6502 and 65816 sometime next year.

If a 16-bit Apple II doesn't strike you as wild enough, how about a 32-bit Apple II? Mensch is also developing a 32-bit chip, the 65C832, which is ultimately meant to be a plug-in replacement for the 65816. Mensch says it will have built-in 32-bit floating point math and other operations. If an Apple II already has the 65816, Mensch says it would be a simple matter to pull the 65816 board and plug in the 65C832 board without replacing any other boards or chips. At this point, Mensch expects the 32-bit 65C832 to be available within two or three years.

A decision by Apple Computer on the future of the Apple II line and possible adoption of the 65816 chip may be announced early in 1986, perhaps as soon as the annual Apple stockholders' meeting in January.

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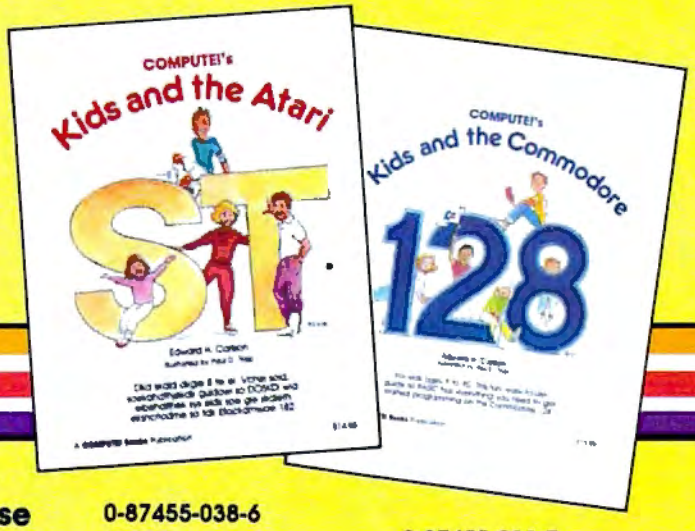

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The chips handle most of the graphics, animation, and programmable sound features of the Amiga, leaving the 68000 unrestrained much of the time. This allows the Amiga to provide unusually powerful multitasking capabilities and fast high-resolution graphics.

Although many of us are just beginning to see the 68000 in action, the pace of technological progress in chip design has already leapfrogged to a new generation. In 1984, Motorola introduced the next step: the 68020 microprocessor, a true 32-bit chip that's equivalent to yesterday's powerful mainframe computers. In fact, the 68020 is often called "the mainframe on a chip."

Packed onto the surface of this tiny microprocessor is the equivalent of 200,000 transistors. The chip is capable of executing two to three million computer instructions per second. And the 68020 can address up to a whopping four gigabytes of memory (4,194,304K, or 4,294,967,296 bytes).

Even more importantly, the 68020 is upwardly compatible with its ancestors in the 68000 family. This means that within a year or two, new generations of Macintoshes, Amigas, and STs may be using the 68020 chip—four times as powerful as the 68000—while remaining compatible with earlier software and hardware. In fact, rumors have circulated for more than a year that Apple Computer may base the next generation of its Macintosh on the 68020. And officials at both Atari and Commodore speak of their STs and Amigas in terms of machines that will have future generations.

Although Motorola won't comment on who may be planning to use the 68020, upgrading from the 68000 would not be difficult, says Jeff Nutt, Motorola's technical marketing manager for the 68000 family. "In some cases it can be as simple as pulling out the [68000] processor board and plugging in the 68020 board. And I think you'll see a more rapid visibility with the 68020 than occurred with the 68000 because of the compatibility issue. Look at the normal desktop system; the biggest complaint is having to wait for something [to be processed by the computer]. Not so with the 68020."

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Motorola has not been alone in developing such powerful new chips, of course. Intel, National Semiconductor, NCR Corp., and AT&T are all competing in the 32-bit microprocessor arena. Motorola's jump with the 68020 and its compatibility with the 68000, however, have given the company an edge with the latest personal computers.

As a result of this fierce competition, chip prices continue to decline sharply. The 68000, which cost about $450 per unit early in its life, dropped to about $50 in 1984. And, according to one report, in late 1985 Apple Computer was paying as little as $6 per 68000 chip for each Macintosh computer.

Where will it all end? It won't. In fact, Motorola announced in late November that its 68020 has now been successfully tested at the previously unheard-of clock speed of 20 MHz. With such speed and memory potential, personal computers in the very near future will truly be the equivalent of today's mainframe computers.

"It still amazes me," says Motorola's Nutt. "It's incredible when you start thinking about what you can do with something that powerful." ©

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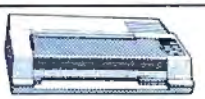

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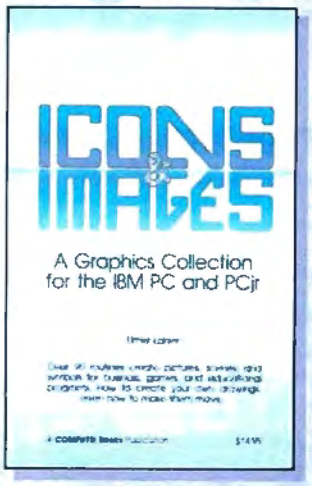

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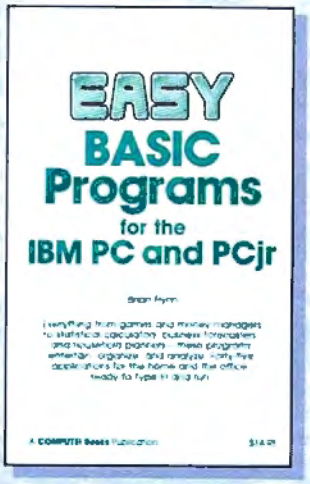

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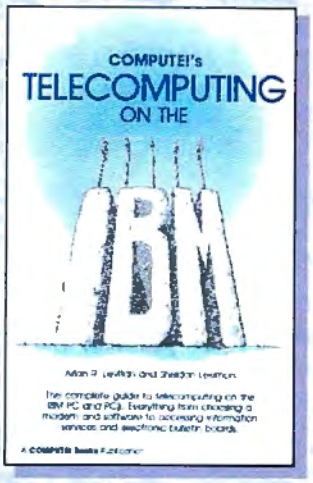

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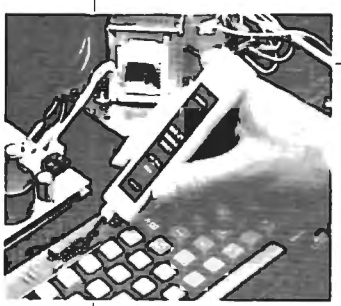

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198-026

A Quantum Leap From 6502 To 68000

Richard Mansfield, Senior Editor

A new era is dawning for machine language programmers on personal computers. Thanks to the extra power of the 68000 microprocessor, the latest-generation computers can offer such advanced features as super high-resolution graphics, multitasking, megabytes of main memory, and processing speed comparable to the mainframe computers of just a few years ago. Here's an introduction to this fascinating chip.

The venerable 6502 microprocessor chip, which has been the brain of the majority of personal computers for a decade, is in the twilight of its life. The new generation of machines—Commodore's Amiga, Atari's ST, and Apple's Macintosh—is built around the 68000 chip. Compared to the 6502 and its relatives, the 68000 is significantly more powerful in the two ways that count: memory and speed.

At their most elementary level, computers spend most of their time getting, sending, and manipulating numbers. Even characters of the alphabet are coded in the computer as numbers. To display a message, for example, the computer fetches a number from memory and sends it to the screen, then fetches the second number and sends it, repeating this get-and-store process until it has sent the entire message. Clearly, the more memory you can gulp at a time, the faster you can manipulate numbers and, by extension, the better you can compute.

Capable of directly addressing 16 megabytes (16,384K or 16,777,216 bytes), the Motorola 68000 greatly exceeds the addressing power of the MOS Technology 6502, which can only address 64K (65,536 bytes). Some computers with 6502 or 6502-compatible chips—such as the Commodore 128, Apple IIc, and Atari 130XE—get around this limitation by switching back and forth between *banks* of memory, but at a cost in speed and programming flexibility.

The 68000 can also be driven at clock speeds of 8 megahertz (MHz) and higher, while most 6502 machines run at 1 MHz. (Again, the Commodore 128 and Atari computers are exceptions; the 128 can be switched to 2 MHz if no peripherals are being accessed, and Atari machines normally run at nearly 2 MHz.) Both the larger addressing and faster speed capabilities of the 68000 contribute to a significant gain in overall computing power. You can hold more data in a 68000 machine, and you can process it faster.

One of the first things anyone wants to know about a new computer language is what commands or instructions are available. The 68000 offers programmers plenty of power. If you're coming to this chip, as most of us are, from 6502 computers—Apples, Commodores, Ataris, and others—it's quite a liberating experience. The 68000 has roughly the

same number of addressing modes as the 6502, but that's where the similarity ends.

For example, many of the 6502 instructions are contained in the single, multipurpose 68000 command MOVE. The 6502's LDA, LDX, LDY, STA, STX, STY, TAX, TAY, TXA, and TYA instructions are all subsumed into MOVE. What makes this work is that the addressing modes for many 68000 instructions are dual-purpose: They specify both the source and destination of a transfer. Since most computer activity involves moving values around and manipulating them, the efficiency of MOVE is most desirable.

Here's how it works: If you want to transfer the number held in address 8000 to address 9000, the single instruction MOVE.B 8000,9000 fetches the value and stores it in the new location. There's no intermediate step as there would be when moving a byte with the 6502—LDA 8000:STA 9000.

Because the 6502 is an eight-bit chip—it can handle only eight bits of information at a time—machine language on the Commodore 64 and other 6502 computers often requires the programmer to fabricate special subroutines to increment, decrement, compare, or perform math on double-byte (16-bit) numbers. While there are only a few such routines necessary and they can be plugged into a program relatively easily, it is still desirable to have the 68000's single-instruction command over multibyte manipulations.

What's more, if you want a loop to access a whole range of memory, there are addressing modes which automatically increment and decrement in one-, two-, or four-byte steps. Specialized moving is also provided for with such instructions as EXG, which exchanges registers so you don't have to move A to C, B to A, and C to B just to exchange A with B. The SWAP instruction swaps the low and high words within a 32-byte data register. MOVEM moves the values in a cluster of registers to or from memory which, among other things, allows you to save and restore all the data and address registers and flags with this single instruction.

More than a dozen of the 68000's instructions are the same as the 6502's: JSR, RTS, NOP, JMP, CMP, etc. On the 68000, they just work with larger numbers when necessary. But there are other instructions that, while named differently, accomplish tasks with which all programmers are familiar. ADD, SUB, MULS, and DIVS perform arithmetic. There are 14 branching instructions, ranging from old friends like BCC and BEQ to new ones like BLT (less than), BLE (less than or equal), and BGE (greater or equal). However, you can branch from −32766 to +32769 bytes rather than the −127 to +128 range of the 6502.

Where the 6502 has only three eight-bit registers, A, Y, and X, the 68000 features eight data registers and seven address registers, each 32 bits large. What's more, these registers can be used in a variety of ways for a variety of purposes. What's possible with data register D0 is possible with any of the other seven data registers. That flexibility is not the case with A, Y, and X on the 6502.

The 68000's data registers can work with bytes, words (two bytes ganged together), or long words (four bytes). The address registers work only with words and long words. The various addressing modes, in conjunction with the multiplicity of registers, allow for considerable speed and many modes of transport between registers or memory. In addition, such things as multiplication and division are built into the chip itself and do not have to be constructed as routines or macros as they do when working with the 6502.

What do you need to get started with 68000 programming? If you're thinking of making the crossover from 6502 to 68000, you'll find the instruction set and addressing modes described in detail in several books currently available. You'll also need an assembler. At this writing (late fall), assemblers are available only from the computer manufacturers, usually as part of professional software development packages. But by early 1986, alternative assemblers from independent companies should be available.

Because of such features as multiple screen windows, multitasking operating systems, and other aspects of these new machines, memory allocation is not static as on earlier computers. The familiar technique of calling operating system hooks, like the Kernal on previous Commodore computers, does not work quite the same way on the ST, Amiga, and Macintosh. For example, on any Commodore, from the earliest PETs to the most recent Commodore 128, you could always JSR $FFD2 to print whatever was in the accumulator. On the new computers, however, your program needs to go through the operating system to make itself known to the screen.

For instance, if two Amiga windows are concurrently running two programs and you want to put something on the screen, you need to follow the rules of Intuition, the Amiga's operating system, to send your message. In this way, machine language begins to resemble aspects of C or other higher-level languages. You need to involve libraries and lists of equates to communicate with your computer, particularly when input/output is involved.

Another consequence of the dynamic memory allocation in these new computers is that you must write your machine language programs to be completely *relocatable*—capable of floating about anywhere in memory, without being dependent on fixed memory addresses. Fortunately, the 68000 includes a powerful set of relocatable branching instructions, such as BSR (Branch to SubRoutine). Some assemblers can even change your address-specific source code into Program Counter-relative, and thus relocatable, object code. And since the computer's operating system determines where your program will reside, there is less worry about memory conflicts.

As our computers grow increasingly complex, there are some additional techniques to master in machine language programming. But the power—and, in a strange way, the simplicity—of the 68000 chip more than makes up for any temporary inconveniences. A new, larger world is opening up for the machine language programmer who wants to accept the challenge. ©

Reach For The Stars For Commodore And Apple

James V. Trunzo

Requirements: Commodore 64 or 128 with a disk drive; or an Apple II-series computer with at least 64K RAM and a disk drive.

Galactic conquest is the theme of many a computer game, and quite a few of the more recent attempts have been solid efforts. A new title, *Reach for the Stars*, is a particularly fine simulation of galactic exploration, combat, and conquest.

Reach for the Stars can be played by up to four players in any combination of computer or human opponents. Each player must explore new star systems, colonize any planets that seem promising, allocate resources, and establish policies and strategies that take into consideration such diverse factors as environment, civil harmony, defense against inevitable alien attacks, and industrial expansion.

This game is special because players must maintain delicate balances to win. You can't build a huge armada at the expense of social programs, or else your colonies will suffer riots, sabotage, disease, and a lower birth rate. Likewise, to be overly concerned with strengthening existing planets while ignoring exploration and colonization allows other players to establish strong bases near your home planet, bases which will eventually build warships and attack your home colony. Strategy is quite important in *Reach for the Stars*.

Beware The Plague

Each turn of the game involves a number of phases: production, movement, combat, planetary conquest, etc. Each phase is handled with full-screen displays and keyboard controls which are efficient and easy to use. To make the game easier to learn, there's a complete tutorial game as well as an excellent rule book.

Reach for the Stars is impressively realistic thanks in part to the great number of interacting options and factors. There are such events as the threat of a star going nova, obliterating everything in the star system; a sudden influx of solar debris, hampering your well-laid movement plans; or plague and famine, weakening your key colony.

When played against the computer, *Reach for the Stars* demands that you remain constantly aware of all aspects of the game, allocating Production Points wisely in an effort to increase your technological level, to produce the best warships, and so on. When played against human opponents, the game makes the same demands, but brings out an additional element: diplomacy, and a nasty companion, treachery. Players may make agreements with each other, granting safe passage through their star systems; or they can gang together and declare war on an opponent who appears to be growing too powerful too quickly.

Reach for the Stars combines an extremely playable, efficient game structure with a sophisticated simulation. It's one of the better games on the market this year.

Reach for the Stars
Strategic Studies Group
Distributed by Electronic Arts
2755 Campus Drive
San Mateo, CA 94403
$45

PC/InterComm For Atari 520ST

George Miller
Assistant Technical Editor

Requirements: Atari 520ST computer and a compatible modem.

PC/InterComm is more than the first commercial terminal program marketed for the Atari 520ST. It's also one of the most versatile and easiest terminal programs we've ever used. All types of communications are a snap, and the looseleaf manual is written in a very clear and concise manner.

With its wide range of features, *PC/InterComm* won't be quickly outdated. As well as easy communications with commercial information services, remote databases, electronic bulletin boards, and other personal computers, its terminal emulation mode lets the 520ST emulate the popular DEC VT102 and VT100 terminals for linkups to DEC mainframes and any of the hundreds of machines running the Unix operating system with 3270 protocol converters.

PC/InterComm allows you to select baud rates from 50 to 19,200 bits per second (bps). Of course, the higher rates are beyond the capabilities of today's personal computer modems, but they do allow high-speed computer-to-computer transfers of data via null modem cables. We did most of our testing on the CompuServe Information Service with a Hayes Smartmodem 1200.

If you have any telecomputing experience at all, you'll probably find yourself online and communicating within minutes of running *PC/InterComm*. It's not strictly necessary to thoroughly read the manual before getting started; help menus and on-screen instructions are available for every function in the program.

Automatic Telecomputing

Customizing *PC/InterComm* is easy, too. Just follow the instructions from the manual or the help menus to select baud rates, stop bits, parity, and other necessary settings. You can even customize your copy of *PC/InterComm* to automatically dial your favorite bulletin board or service as soon as the program runs.

Once you've set up the parameters for communicating with a particular system, you can save the information in a special file on disk. In the future, you won't have to remember these settings or refer to the instructions each time.

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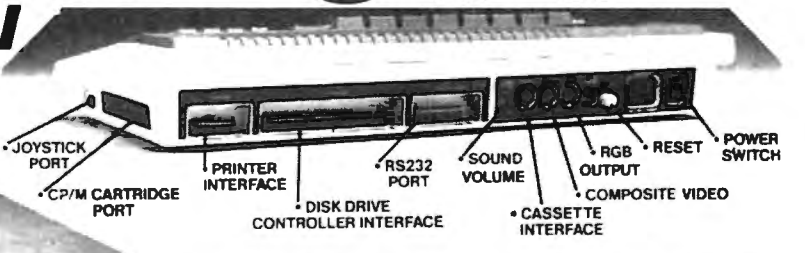

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4 Voice, 6 Octave Sound	Yes	No	Yes
Composite Video	Yes	Yes	Yes
Disk Drive	Included	Extra Cost	Extra Cost
Numeric Keypad	Included	Extra Cost	Included
Video Cable	Included	Extra Cost	Extra Cost
RGB Color Card	Included	Extra Cost	Included
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Technical reference manual	$ 29.95	$ 19.95
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downloading), several different error-checking protocols are available. Modem7 or XMODEM is probably the most useful, since it has become practically a standard, but you can also select from Kermit, Kermit Image, ASCII, Raw, and a proprietary protocol called Inter-PC/InterComm for exchanging files with another computer running *PC/InterComm*. All of these protocols are explained in the manual. Screen messages keep you informed of what's happening during the file transfer.

PC/InterComm also lets the computer dial a database automatically at a predetermined time, then automatically upload or download files without human intervention. Just follow the easy instructions in the manual, then go to sleep if you like and let your ST do the work during the night when communications rates are lowest.

The only drawback to *PC/InterComm* is that you can't exit to the GEM desktop and then reenter the program without rebooting it. For example, it would be nice, before downloading, to view a disk directory from the desktop to make sure there's enough room on the disk. Since the program won't let you move back and forth from the desktop, and since it lacks a directory command of its own, you can't easily obtain this information.

In all other respects, however, *PC/InterComm* is a valuable program that's worth taking a look at.

PC/InterComm
Mark of the Unicorn
222 Third Street
Cambridge, MA 02142
$124

Write 'n Spell

Tony Roberts, Production Director

Requirements: IBM PC, PCjr, or compatible with at least 256K memory and one disk drive.

Finding a full-featured word processor for an IBM PC or PCjr that doesn't cost a fortune has been a difficult task. Home users of the IBM line have often been forced to pay business prices for good word processing software. Now, however, there's *Write 'n Spell* from Professional Software. This program provides considerable power at a moderate cost.

In addition to offering nearly every word processing feature imaginable, *Write 'n Spell* also includes a 90,000-word interactive dictionary, context-sensitive help screens, mail merge capability, and a preview function which allows you to see how your text looks before you print it out.

Write 'n Spell is easy to use—so easy that with the help of only the brief instructions provided in the Quick Start folder, you'll be using the program effectively within minutes. The program disk contains several example files that lead you painlessly through many of *Write 'n Spell*'s important functions. And the well-organized manual includes complete tutorial and reference sections so you can find pertinent information quickly.

No Need To Remember

Write 'n Spell makes extensive use of the IBM function keys for commands and continuously displays a help line at the top of the screen, so you needn't memorize what each key does.

F2, for example, is the DISK command. When you press F2, a window opens which lists your current disk options. To select an option, either indicate your choice with the cursor keys or simply type the first letter of the command.

Command windows are removed from the screen with a touch of the ESC key. In fact, *Write 'n Spell* is quite forgiving; the ESC key can be used to recover from almost any problem.

The program uses meaningful mnemonics for print formatting—*lm* for left margin, *bm* for bottom margin, etc.—and checks the formatting commands for syntax errors. When it encounters a formatting error, the program prints the problem line in the message window, helping you isolate and correct the problem quickly.

Misspellings Begone

The Spelling Checker is one of the most powerful features of *Write 'n Spell*, and it, too, is activated by pressing a function key. It rapidly compares your text with its dictionary and offers four options when it finds a word it doesn't recognize: Ignore, Add, Retype, or Suggest.

If you press I for Ignore, the program skips the word and continues its search. If you press A, the word is added to the supplemental dictionary, which eventually will contain all of the unusual words, names, and numbers you use in your writing. If you press R for Retype, you can correct the misspelled word.

When you press S for Suggest, the program provides a most useful feature for those who find spelling troublesome. It searches through the dictionary to locate up to eight words that it thinks might fit your meaning. It then opens a window displaying those suggestions. If one of them is the word you want, just press its number to replace your misspelled word.

It's amazing how often the program comes up with the correct word, and even more amazing how often the correct word is the first one in its list of possibilities.

It took *Write 'n Spell* less than five minutes to check and correct the text for this article, which contained numerous misspellings (both intentional and unintentional).

Other Features

Write 'n Spell has a wide range of additional features. It can print one document while you work on another, it allows you to link files, and its sophisticated text-manipulation functions include block moves and copies. A setup program allows you to easily configure *Write 'n Spell* to work with more than 50 different kinds of printers.

The mail merge feature lets you insert names and addresses into a stack of form letters, and the program can also accept predefined information from spreadsheets such as *Lotus 1-2-3*. If you have a printer that supports IBM's extended graphics character set, you can print boxed text, complex mathematical formulas, and bar graphs.

The program disk includes a conversion program which helps you transfer files created by other word processors into a format compatible with *Write 'n Spell*. This program is not documented in the manual, but instructions are provided on a loose sheet packed in the box.

Write 'n Spell does not store text files in standard ASCII format, so you must convert them to ASCII if you plan to upload the files via modem. Printing a file to disk converts it to ASCII, but this requires you to use the setup menu to define the disk drive as your printer. Unless *Write 'n Spell* is set up this way, you'll have to save your document, exit the word processor, run the setup program, change the printer configuration, rerun *Write 'n Spell*, and then print the document to disk. The procedure is a little cumbersome, but it gets the job done.

Write 'n Spell does allow normal DOS functions—such as renaming files, erasing files, and copying the current document—without exiting to the system.

Overall, *Write 'n Spell* can handle nearly anything you'd ask of a word processor. Some of its complex operations may be a little cumbersome, but it's a small price to pay for such a powerful program.

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TI 99/4	Composite
Atari 800	Composite
Atari 1200	Composite
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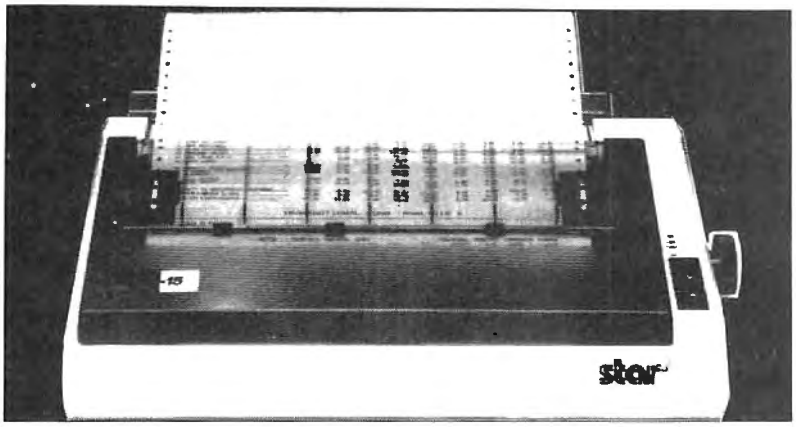

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Condensed enlarged:	8.5 cpi	68 cpl
Elite:	12 cpi	96 cpl
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Char. Matrix Size
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Microsoft BASIC 2.1 For Macintosh

Charles Brannon, Program Editor

Requirements: Microsoft BASIC requires 128K memory, but 512K is recommended for best performance. (Amiga watchers take note—Microsoft AmigaBASIC is very similar in features to Macintosh Microsoft BASIC.)

When Apple unveiled its Macintosh in January 1984, it was received enthusiastically. Here was a machine with 128K RAM, a 400K disk drive, and a 16/32-bit 68000 microprocessor running at eight megahertz, one of the fastest, most powerful microprocessors in production. But what really attracted attention was the Macintosh's powerful, yet simple to learn, operating system.

Some critics, though, have questioned the utility of this flashy machine. Sure, it's easy to drag folders around to move or copy files. Certainly it's easier to point to a menu item than to type a cryptic stream of commands on a keyboard. But the glaring lack of a programming language seemed to stratify the market into two classes: users and programmers. Apple described the Macintosh as "the computer for the rest of us." Should that exclude those interested in writing their own programs?

With the first release of Microsoft BASIC, then enhanced BASIC 2.0, and now the even speedier and debugged version 2.1, this last obstacle has fallen. Anyone can now write their own Macintosh applications, whether for fun or profit. And this is no ordinary BASIC: It is one of the most sophisticated and full-featured BASICs available for any personal computer. If you're used to Microsoft BASIC on Apple, Commodore, or IBM machines, you'll instantly see some similarities, but just as quickly notice the differences.

Who Needs Numbers?

The core of Microsoft BASIC for the Macintosh is almost identical to IBM Advanced BASIC, but a major difference is that line numbers are now optional. Line numbers evolved from the simple line-oriented editors used on mainframe computers in the 1960s, and they have survived right into the 1980s. With full-screen editing—including word processor-like up and down scrolling—line numbers become superfluous, except as targets for GOTO and GOSUB statements. Macintosh BASIC even makes line numbers optional in these cases by allowing you to reference GOTOs and GOSUBs with labels, so you can write lines like this:

```
IF Balance<=0 THEN GOTO Check-
   Bounce
...
CheckBounce: PRINT "That'll be a $10
   service charge."
```

Since line numbers are optional, Macintosh Microsoft BASIC gives you the freedom to scroll anywhere in a listing and edit any line. The mouse is used to scroll up and down, and to set the insertion point (cursor position). You edit your program in a window called List. You can have two List windows open at once, showing different parts of your program. Familiar Macintosh features such as Cut and Paste are supported.

When you run your program, all input and output takes place in the Output window. A fourth window, called Command, lets you try out direct-statement lines and execute some commands. All these windows can be moved and resized. It's easy to have all four on the screen at once. When you double-click (press the mouse button twice in rapid succession) on a title bar, the corresponding window instantly fills the screen. Another double-click returns the window to its original size.

Microsoft BASIC fits in well with the Macintosh philosophy. It can read and write to the Clipboard, making it easy to transfer data between applications. For example, you can draw a picture with *MacPaint*, then grab and animate the picture in BASIC. Pull-down menus let you save, load, run, stop, and trace programs. The trace feature is especially powerful. While your program is running in the Output window, you can watch the program execute line by line in the List window. In the single-step mode, you can trace the program in one window, watch the output in the Output window, and enter commands in the Command window—all simultaneously.

Add Your Own Commands

Variable names can be up to 40 characters long, and all characters are significant (CHANGE and CHANGENAME would be different variables). Advanced structures include IF–THEN–ELSE and WHILE–WEND. Device-independent input/output lets you use the same I/O commands with all devices (screen, keyboard, printer, clipboard, etc.). Sequential and random-access disk files are supported. Another feature not to be ignored is subprograms. A subprogram is a miniature program with its own independent variables. In effect, you can create your own BASIC commands in BASIC. Subprograms are much more flexible than mere subroutines.

Also, note that there are two versions of BASIC 2.1 included in the package. One does its math in BCD (Binary Coded Decimal), which never makes rounding errors—a vital feature for business programming. The other BASIC uses standard binary floating point, and runs faster.

The Macintosh is known for its superb high-resolution graphics. Microsoft BASIC is no slouch here. It has commands for drawing points, lines, boxes, filled boxes, circles, ovals, and arcs. PUT and GET let you grab and animate rectangular sections of the screen. Pictures can also be stored in strings as a sequence of commands. Just use PICTURE ON, and all graphics calls will be stored until PICTURE OFF is executed. You can then display the picture anywhere on the screen, in any dimension, and enlarge or contract the picture. Microsoft BASIC also lets you use many of the powerful QuickDraw routines in the Macintosh ROM Toolbox.

With Microsoft BASIC, you can write programs that look and act like commercial software, taking advantage of pull-down menus, windows, and dialog boxes. The WINDOW command creates a variety of window styles and shapes. BUTTON creates a square box that is sensitive to mouse selection. MENU and DIALOG let you read the status of menus, windows, and dialog boxes. You can even trap certain events. Your program could be busy drawing a figure, then interrupted when the user selects a menu. This transfers control to your menu subroutine. When the menu action is fulfilled, the program continues drawing the figure.

Speed And Memory

Like many applications, Microsoft BASIC drives the Macintosh to the limits of its hardware. Keeping in mind the great power of this BASIC, there are still some inadequacies. There just isn't enough memory to hold the operating system, your BASIC program, and the Microsoft BASIC interpreter all at once. To get around this, BASIC loads itself in pieces, swapping sections in and out as needed. This can slow you down to a crawl, though, especially when you're switching between windows. It's possible to increase the size of the heap space (where the swapped portions of BASIC reside) at the cost of program space, and this seems to help some.

Still, Microsoft BASIC for the Macintosh runs faster than comparable Microsoft BASICs on other microcomputers. As with many other

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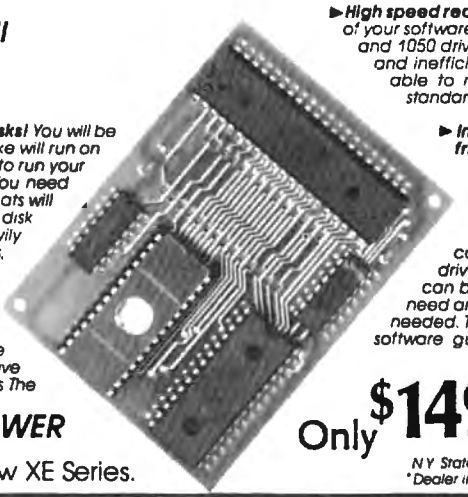

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Macintosh programs, Microsoft BASIC needs a second disk drive and more memory to live up to its full potential, but works well with a 128K, one-drive system. If you have a Fat Mac (the only type now being manufactured), Microsoft BASIC runs at full speed with no delays and minimal disk access.

Now that a powerful and easy to use BASIC is available, we're beginning to see hundreds of new programs for the Macintosh as eager programmers churn out code for this two-year-old computer. All we need now is an equally powerful BASIC compiler.

Microsoft BASIC 2.1
Microsoft Corporation
10700 Northup Way
Box 97200
Bellevue, WA 98009
$150

Bank Street Mailer Bank Street Filer

James V. Trunzo

Requirements: 128K 80-column version available for Apple IIc or 128K IIe (with extended 80-column card); 64K 40-column versions available for Apple II+ and Commodore 64; one disk drive, printer.

Brøderbund Software continues to enhance its reputation and its home productivity line with the release of *Bank Street Filer* and *Bank Street Mailer*. Both products reflect Brøderbund's effort to provide products with power, flexibility, and ease-of-use. *Filer* and *Mailer* offer a wide variety of options and can be integrated with one another and with *Bank Street Writer*, Brøderbund's word processor.

Both programs are available in 40- or 80-column versions (Apple only); come with simple but thorough tutorial programs; have on-screen menus; let you make backups; offer a dual-drive option; and include a utility program that performs a variety of functions including disk formatting, printer setup, and report-formatting options.

Bank Street Mailer is so versatile that you can not only create mailing lists, but also write and edit a letter without using *Bank Street Writer*. In fact, the letter-writing option contains almost all the features you'd expect to find in a word processor. You can move, copy, center, set page breaks, and use up to 16 printer format commands. In addition, *Mailer* provides a somewhat unique and useful option known as *boilerplating*. You can store commonly used phrases (inside addresses, greetings, etc.) on the *Mailer* disk and insert them in the letters that you compose simply by hitting a key. The only limitation when writing with *Mailer* is a 1,000-word limit per letter.

Of course, the main purpose of *Bank Street Mailer* is to create, edit, and print mailing lists and merge the data into prepared letters. *Mailer* does this admirably. Creating and editing a mailing list is a snap, and all programs of this type are, on the surface, very similar. *Mailer* goes one step beyond by including a powerful data-searching routine which allows you to extract as much or as little information as desired. Furthermore, all data entered into *Mailer* can be sorted alphabetically or numerically.

Merging data with *Mailer* is also easy and can range from simply inserting addresses to customizing form letters by inserting stored messages (reminders, reference material, etc.) selected from disk. If you're only writing a single letter, *Mailer* lets you retrieve

an entire name and address simply by typing a person's last name while composing the letter.

Mailer can print labels and envelopes, too. In fact, this program boasts many additional options which are a delight to use and discover for yourself.

Flexible Report Formatting

Bank Street Filer is no less impressive than its sister programs. It includes all the features common to most database managers, so let's focus on *Filer's* special features.

For one thing, *Bank Street Filer* makes ample use of screen windows, overlaying one block of information atop another. This is especially handy when working with *Filer's* powerful search procedures. *Filer* also provides an on-screen notepad that lets you jot down comments (which can be used later when writing a report) without interrupting your work with the database itself.

Speaking of reports, *Bank Street Filer* can generate a variety of report types: It is already set up to generate four types of "quick" report formats, printing out your data in a selected report style with a few simple keystrokes. However, you can customize either table reports or page reports in almost any way you choose.

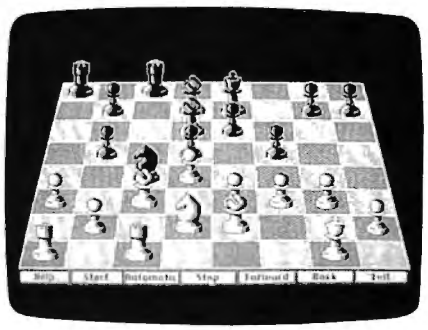
Creating forms is also quite flexible: You can position your fields anywhere you like. *Filer* also recognizes special fields like DATE and TIME. You can even call a full-featured calculator to the screen, perform your calculations, and insert them, if you want, into a data field. These are only a few of the many built-in functions that make *Bank Street Filer* an excellent tool and a worthy addition to the Bank Street software series.

Bank Street Mailer
Bank Street Filer
Brøderbund Software
17 Paul Drive
San Rafael, CA 94903-2101
$69.95

Psion Chess For IBM And Macintosh

John Krause, Assistant Technical Editor

Requirements: Apple Macintosh; IBM PC with color/graphics card and at least 128K RAM; or an Enhanced Model IBM PCjr.



So you think computer chess programs are a pushover? There's a new kid on the block. Joint winner of the 1984 World Microcomputer Chess Championship, *Psion Chess* provides a challenge for even the most experienced chess player.

Choose from 14 levels of difficulty, Novice to Infinite. The Novice level responds almost instantly and senses the strength of your play, playing more gently against weak opponents. Still, it's difficult to tame such a powerful beast, and some beginners may be unable to win even on this level. On the Infinite level, the computer keeps thinking until you stop it, at which point it plays the best move it has found. On the Equal level, the computer takes the same amount of time to think as you do. The longer you think, the better the computer plays.

On all levels, after the computer makes a move, it guesses what your next move will be and continues to think while waiting for your move. If it guesses correctly, it responds quickly with its next move and plays better since it can think longer. This feature can be turned off by selecting Handicap, effectively doubling the number of levels.

The program has a thorough knowledge of all the subtleties of chess. Sure, it has the usual library of opening moves, but even if you take it out of its library by making unusual moves, it understands the basic ideas well enough to offer a strong opening without relying on the library. It excels in the middle game, and even in the end game it won't get lost like so many other chess programs.

Psion Chess is quite impressive visually as well. The chess board and pieces can be displayed in either the conventional two-dimensional representation or a spectacular three-dimensional view as if you were seated at a real board. To make a move with the Macintosh version, you use the mouse to pick up the piece and drop it on the destination square. The piece moves smoothly, and in the 3-D view, it realistically passes in front of or behind the other pieces.

The program has almost every feature imaginable. You can take moves back, set up any position, change sides with the computer, replay all the moves of the current game from the beginning, save a game on disk, print out the move list and current position, ask the computer to suggest a move for you, and set up a checkmate problem as complex as mate-in-eight for the computer to solve. Play against the computer, against another player, or watch the computer play itself.

During a game, the computer records a list of the moves that have been made, keeps track of the time spent by each player, displays its analysis of the game indicating which side it thinks is winning, and predicts the next few moves. There's also a selection of 50 classic games drawn from 150 years of international chess which can be replayed move by move.

As if all that weren't enough, the drop-down menus can be displayed in English, French, German, Italian, Spanish, and Swedish. The 23-page manual contains only three pages of English, but the program has several help screens which explain the features in greater detail. You can use the program quite easily without the manual.

Psion Chess is an impressive programming achievement. It may well be the best chess program ever written for a microcomputer.

Psion Chess
Psion, Inc.
40 Lindeman Drive
Trumbull, CT 06611
$59.95

Quest Of The Space Beagle For Atari

Steve Hudson

Requirements: Atari 400/800, XL, or XE computer with at least 48K RAM and a disk drive.

First came *Jupiter Mission 1999*, a package that combined several interwoven

games under one title. Now there's *Quest of the Space Beagle*. Despite the fact that it's a sequel, it also stands alone—admirably—and if you're an interactive fantasy fan it's sure to become one of your favorites.

In *Jupiter Mission*, you left Earth and became lost in space. Now you're the sole survivor of that mission, and you're trying to get home. As luck would have it, you've been adopted by the Faunians, who are about to be invaded by the barbaric Gentuzians. For some reason, the Faunians have decided that you are the only one in the entire universe who can save them—so it's you and the Faunian fighters against the entire Gentuzian fleet.

You've won the big battle and have been named emperor. But to see if you've got the right stuff, emperor-wise, the Faunians dump you into the smoothly scrolling, multicolored, three-dimensional Labyrinths of Kamerra. Find your way out, they say, and you've not only proven your emperor-hood, but you're also free to head for home. What's another labyrinth to a seasoned adventurer like yourself? Don't worry. It only holds pits and puzzles and Ardillian Whipstingers and Quardish Sycophants.

With practice, those, too, will prove no match for your consummate cosmic skills. You'll be hailed by Faunians far and wide, given a ship and plenty of supplies, and sent on your way. To help you out, you've got star maps—*real* star maps that show an accurate view from any location. You've also got a captured Gentuzian hyperdrive which will get you home fast if you can overcome those pesky "temporal perturbations" that get in the way every time you try to make a hyperspace jump.

Did anyone say this was going to be easy? Maybe not, but it will surely be spectacular. The game's programmers have used some pretty fancy techniques to jazz up an already exciting game. For instance, the graphics display that you see during the space battle is actually *multiple* displays combined into one. The multiple displays alternate 60 times a second, treating you to visuals that would otherwise be impossible to achieve. This is an incredibly realistic display. Don't be surprised if you jump away from the screen every time one of the bad guys comes swooping in.

As noted in the instructions, the price you pay for such graphics excitement is a slight amount of flicker. The flicker is more pronounced on lower-quality monitors or TV sets. However, on each of the monitors tested (including a $59 black-and-white TV) the flicker was all but eliminated by tweaking the color and contrast controls. A little extra effort is required, but it's well worth it.

Quest of the Space Beagle
Avalon Hill Microcomputer Games
4517 Hartford Road
Baltimore, MD 21214
$35

Where In The World Is Carmen Sandiego? For Apple

Karen G. McCullough

Requirements: Apple II-series computer with at least 64K RAM and a disk drive.

FLASH FROM INTERPOL: A national treasure, Aladdin's Lamp, has been stolen from Baghdad. It looks like the work of the Carmen Sandiego gang. Your assignment: track the thief to his/her hideout and recover the treasure. You'll have to work quickly and carefully, though. There's not much time and this gang plays for keeps. If you're the detective you think you are, you should be able to gather clues and decipher them, identify the thief, and track him down. You must've thought you were pretty good, or you wouldn't have signed up with the agency, right? Crack this case and you'll be in line for a promotion.

Where in the World is Carmen Sandiego?, a mystery/adventure game from Brøderbund makes you the detective, chasing an international crook from one exotic city to another, gathering clues to help identify the suspect, and finally cornering him in his hideout. To help you crack the case, you have the services of Interpol's crime computer to identify suspects and the detective's best friend—a copy of the *World Almanac and Book of Facts* (included in the package). Everyone knows that good research skills are as important to a detective as his shoulder holster, and you get plenty of opportunity to put yours to the test. When an informant tells you the suspect converted all her money to yen, can you figure out where she's going? If not, you're in the wrong business.

Starting the game is as easy as booting the disk and entering your name into Interpol's computer. Once the computer has identified you, it gives you the background of the case and whisks you off to the scene of the crime to start your investigation. When you arrive in a city, you have four options: you can see the connections (those are the places the suspect could have gone); depart by plane for one of those destinations; investigate; or visit Interpol to use the crime computer.

You'll want to start by doing some investigation. In each city, there are three places you can go to gather information about the suspect and where he/she was going. Once you've collected some facts about the thief, the crime computer helps you identify the guilty party and issue an arrest warrant if you've gathered sufficient data for a positive identification. You've got to have a warrant or the suspect will slip through your fingers on a legal technicality.

The Carmen Sandiego gang is a wily bunch, and they don't sit still for long. You'll have to track them through a number of cities in all parts of the world, and for that the *Almanac* is essential. The clues can be as subtle as the color of the flag flying on the car in which the suspect is believed to have departed.

Where in the World is Carmen Sandiego? is an entertaining game for anyone from fourth grade up, and even adults will learn something new. The puzzles are different each time you play, and become even tougher as you work your way up through the ranks. There are 10 possible suspects, 30 different cities, and nearly 1,000 clues to provide a variety of challenges. The program also has terrific graphics, clever animation, and some of the best music and sound effects around.

Attention to detail is what has made Brøderbund a leader in the home/entertainment software business; *Carmen Sandiego* reflects that level of care. That it helps teach research skills and fundamentals of geography as well seems almost too good to be true. This is an educational game, but the emphasis is on the game; it's entertaining enough to disguise the fact that you might be learning something while you play.

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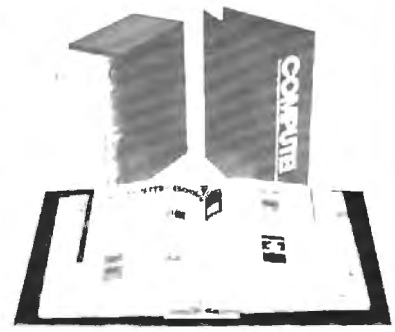

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HIGH RISE

Charles McGuyer

You're a construction worker, trapped in a partially completed high-rise building after dark. Can you make it safely to the ground floor without being snared by a giant bird or zapped by the patrol robot? This unique game was originally written in machine language for the Commodore 64. We've added new versions, also written completely in machine language, for Atari and Apple II-series computers. It's one of the best arcade-style games we've ever published, particularly for the Apple. A joystick is required to play the 64 version. The Atari version also requires a joystick and runs on any 400/800, XL, or XE with at least 48K RAM.

The time is the not-too-distant future, and the place is a downtown high-rise building under construction. You're just finishing the day's work when you realize that it's already dark. Everyone else has gone home, leaving you alone in a shadowy, multistory maze of naked girders and bare concrete. A chill creeps down your spine as you think about the recently installed antitheft robot. It patrols the structure from dusk to dawn, automatically disposing of any intruder it might find. Even worse, the half-completed building's shell is infested with nocturnal birds of prey. They're big enough to carry you away, and so hungry that they roam the empty structure all night long, swooping easily from one floor to the next.

Your only hope is to use the temporary elevators. They move randomly during the night hours, going up and down, stopping at some floors, skipping others. With skill and a little luck, you just might evade the dangers around you and make it safely to the ground floor—but it won't be a cakewalk.

Since all three versions of "High Rise" are similar, follow the general game rules under the Commodore 64 instructions. Then refer to the specific section for your computer for additional information and typing instructions.

Commodore 64 Version

Because the 64 version of High Rise is written entirely in machine language, you'll need to type it in with "MLX," the machine language entry program listed elsewhere in this issue. Read the MLX instructions carefully before you type in and save the program. Here's the information you'll need for MLX:

Starting address: C000
Ending address: CE7F

After you save High Rise, turn the computer off, plug a joystick into port 2, then turn it on again. Load the game with LOAD"*filename*",8,1 for disk or LOAD"*filename*",1,1 for tape, and enter SYS 49152 to start it up (substitute your own filename, of course).

The object of High Rise is to make your way to the ground floor via the elevators while evading the birds and patrol robot. When the game begins, you'll see several floors of the building and a number of elevators moving up and down. You can jump on any elevator that comes to your floor (move into the elevator; it picks you up automatically), but there's no way to control its direction or how far it goes. They're just temporary elevators, used to transport materials and workers during daytime hours. The trick is to catch one that's moving in the direction you want, and get off to catch another before it starts moving in an unwanted direction.

When you reach the lowest floor shown, the screen scrolls up one floor, revealing the next lower level. Once you reach ground floor, the player sprints off the screen to safety and you can play another game.

The patrol robot always starts

on an upper floor and moves systematically through the building, traveling up and down through special shafts that are closed to you. Designed to discourage theft and vandalism, its technique is simple and effective: It pushes any intruders (including you) off the building. If it runs into an elevator and detects you inside, it sends a high-voltage charge through the elevator shell until you drop.

Meanwhile, the birds of prey have no trouble moving from one floor to the next, and they'll carry you away whenever they get a chance. Stay as far from an approaching bird as you can, since they can take you even when you're inside an elevator. The birds present another hazard as well. Whenever one of them hits the patrol robot, the hapless fowl is immediately zapped and plummets straight to earth. If you're caught in the path of a falling bird, you'll be knocked down, too.

When the game begins, you have five players. Each time you're zapped or fall from the building, you lose a player; play ends when all five have been lost. When the game starts, you're on the 10th floor of the building. Moving down a level earns you 100 points. If you reach the bottom safely, you'll have another chance to play, beginning at a higher floor. High Rise keeps track of the highest score attained in the current session, as well as your score in the current game.

Atari Version

The Atari version of High Rise must be typed in with "Atari MLX," listed elsewhere in this issue. Be sure to read the MLX instructions carefully before entering and saving the program. When you're ready to save the program, choose the MLX option to make a boot disk or tape. Here are the addresses you'll need for MLX:

Starting address: 12288
Ending address: 14663
Run/init address: 12288

Once you've made a boot disk or tape, follow the instructions in MLX for activating the program. This version of High Rise is quite similar to the Commodore 64 game. However, you begin at the 15th floor of the building rather than the 10th, and the birds aren't zapped when they meet the robot. Also, in this version the robot does not shock the elevator.

Apple Version

High Rise for the Apple II-series computers must be entered with the "Apple MLX" machine language entry program found elsewhere in this issue. Since High Rise loads into the memory area normally used by BASIC programs, you must relocate the start of BASIC memory *before* loading MLX to type High Rise. To do this, enter the following line in direct mode (without a line number) and press RETURN:

POKE 104,28: POKE 7168,0: NEW

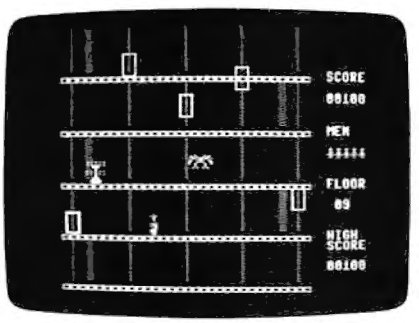
Then load and run MLX. Follow the MLX instructions carefully, using these addresses:

Starting address: 0801
Ending address: 1BD8

After you finish typing High Rise, save at least one copy on disk. Once that's done, you can activate High Rise by typing BRUN *filename* (substituting your own filename, of course).

The Apple version doesn't include birds, so the patrol robot is the only hazard you need to avoid. Move your player with keyboard controls: Press the left-arrow key to move left, right-arrow to move right, and the space bar to stop.

Please refer to the "MLX" articles in this issue before entering the following listings.



"High Rise" for the Commodore 64 features smooth machine language animation and eerie sound effects.

Program 1: Commodore 64 High Rise

```
C000:A9 00 A8 85 FB A9 20 85 10
C008:FC A9 00 85 FD A9 CB 85 7E
C010:FE B1 FD 91 FB C8 D0 F9 F4
C018:E6 FE E6 FC A5 FC C9 24 52
C020:D0 EF A0 18 B9 EE C9 99 52
C028:00 D4 88 10 F7 A0 04 A9 E4
C030:30 99 88 CA 88 10 FA 20 88
C038:E7 C8 20 44 E5 A9 05 8D 95
C040:51 CA A9 31 8D 5F CA A9 8E
C048:30 8D 60 CA A9 00 8D 20 86
C050:D0 8D 21 D0 8D EB C9 8D 0C
C058:88 C9 A0 04 B9 88 CA 99 04
C060:91 07 88 10 F7 20 A7 C7 D5
C068:20 DE C6 AD 97 C9 85 FB 50
C070:20 8B C0 18 AD 97 C9 69 47
C078:07 8D 97 C9 C9 24 F0 03 34
C080:4C 6B C0 A9 01 8D 97 C9 EC
C088:4C AB C0 A9 04 85 FC A2 A0
C090:19 A0 00 A9 1C 91 FB CA 4B
C098:F0 10 18 A5 FB 69 28 85 4F
C0A0:FB A5 FC 69 00 85 FC 4C 1C
C0A8:93 C0 60 A2 00 A9 1D 9D D8
C0B0:A0 04 9D 68 05 9D 30 06 C2
C0B8:9D F8 06 9D C0 07 E8 E0 B6
C0C0:1F D0 EA AC B0 C9 C0 0A 66
C0C8:F0 2D B9 A6 C9 85 FB C8 D4
C0D0:B9 A6 C9 85 FC C8 8C B0 3F
C0D8:C9 A2 04 A0 00 A9 1B 91 E0
C0E0:FB CA F0 10 18 A5 FB 69 EA
C0E8:28 85 FB A5 FC 69 00 85 CC
C0F0:FC 4C DD C0 4C C3 C0 A0 5F
C0F8:00 8C B0 C9 A9 80 A2 00 E4
C100:9D F8 07 E8 E0 05 D0 F8 B5
C108:A9 FF 8D 15 D0 A2 00 AD 22
C110:86 C9 9D 01 D0 E8 E8 18 21
C118:AD 86 C9 69 20 8D 86 C9 F1
C120:E0 0A F0 03 4C 0F C1 A9 B0
C128:32 8D 86 C9 A9 FF 8D 1C 1A
C130:D0 A9 0F 8D 25 D0 A9 02 03
C138:8D 26 D0 A2 00 AD 87 C9 DF
C140:9D 00 D0 E8 E8 18 AD 87 C5
C148:C9 69 38 8D 87 C9 E0 0A 1A
C150:F0 03 4C 3D C1 A9 18 8D DC
C158:87 C9 A0 01 B9 5F CA 99 B0
C160:A2 06 88 10 F7 A9 00 8D BC
C168:EB C9 A9 F0 8D 0A D0 A9 78
C170:B8 8D 0B D0 A9 7C 8D 0C 88
C178:D0 AD 1E D0 A9 68 8D 0D B7
C180:D0 A9 14 8D 0E D0 8D 0F 10
C188:D0 A9 8A 8D FF 07 4C D8 96
C190:C1 8A 48 A2 04 A0 00 88 F5
C198:D0 FD CA D0 FA 68 AA 60 99
C1A0:AC 98 C9 B9 92 C9 DD 01 ED
C1A8:D0 F0 09 C8 C0 05 F0 0D 87
C1B0:8C 98 C9 60 A9 02 9D 88 F8
C1B8:C9 20 61 C2 60 A0 00 8C 93
C1C0:98 C9 60 A5 C5 C9 3F F0 2E
C1C8:05 C9 04 F0 07 60 A9 00 DD
C1D0:8D 18 D4 00 4C B7 C3 60 E4
C1D8:A2 00 20 91 C1 20 C9 C3 B0
C1E0:20 69 C4 20 3B C3 20 A0 33
C1E8:C1 20 6B C2 20 C3 C1 20 A2
C1F0:1B C5 20 B2 C4 20 BD C2 87
C1F8:20 2F C8 BD 88 C9 C9 01 4D
C200:F0 41 90 02 B0 10 FE 01 45
C208:D0 BD 01 D0 C9 E0 F0 25 6B
C210:20 61 C2 4C DA C1 DE C0 77
C218:C9 BD C0 C9 F0 03 4C DA AD
C220:C1 BD 89 C9 9D 88 C9 20 86
C228:61 C2 20 9A C8 29 1F 9D 83
C230:C0 C9 4C DA C1 A9 01 9D 14
C238:88 C9 9D 89 C9 20 61 C2 15
C240:4C DA C1 DE 01 D0 BD 01 90
C248:D0 C9 40 F0 06 20 61 C2 F5
C250:4C DA C1 A9 00 9D 88 C9 D6
C258:9D 89 C9 20 61 C2 4C DA D3
C260:C1 E8 E8 E0 0A F0 01 60 A2
C268:A2 00 60 A0 05 B9 92 C9 53
C270:CD 0B D0 F0 04 88 10 F5 21
C278:60 AD 00 DC 29 0F C9 0B 8B
C280:F0 1D C9 07 F0 0B A9 00 76
C288:8D 0B D4 A9 85 8D FD 07 32
C290:60 AD 0A D0 C9 F5 F0 F8 01
C298:20 F4 C2 20 AD C2 60 AD AC
C2A0:0A D0 C9 17 F0 EA 20 11 8E
C2A8:C3 20 AD C2 60 A9 81 8D 34
C2B0:0B D4 A9 22 8D 08 D4 A9 28
C2B8:80 8D 0B D4 60 CE 54 CA 42
C2C0:AD 54 CA F0 01 60 AC 52 CF
C2C8:CA B9 0B CA 8D 00 D4 B9 FF
C2D0:0C CA 8D 01 D4 A9 11 8D CD
C2D8:04 D4 C8 C8 C0 20 F0 09 AC
C2E0:8C 52 CA A9 23 8D 54 CA F7
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C2E8:60 A0 00 8C 52 CA A9 23 C3
C2F0:8D 54 CA 60 EE 0A D0 AD A0
C2F8:EA C9 C9 14 F0 05 C9 28 38
C300:F0 06 60 A9 88 4C 0D C3 7B
C308:A9 89 4C 0D C3 8D FD 07 78
C310:60 CE 0A D0 AD EA C9 C9 40
C318:14 F0 05 C9 28 F0 06 60 94
C320:A9 86 4C 0D C3 A9 87 4C 98
C328:0D C3 20 91 C1 CE 65 CA 23
C330:AD 65 CA D0 F5 A9 00 8D 32
C338:65 CA 60 AD 1E D0 8D 1E 79
C340:D0 60 20 91 C1 EE 0B D0 16
C348:20 22 C9 AD 0B D0 C9 F5 A1
C350:D0 F0 A9 00 8D 04 D4 A9 81
C358:B0 8D 6E CA AC 51 CA A9 FF
C360:20 99 D8 05 88 F0 28 8C AE
C368:51 CA 20 2A C3 AD 1E D0 D3
C370:A9 B8 8D 0B D0 A9 40 8D 98
C378:0D D0 8D 0C D0 A9 14 8D 10
C380:0F D0 A9 00 8D EB C9 8D 36
C388:64 CA 68 68 4C D8 C1 18 E9
C390:A2 0B A0 05 20 F0 FF A9 FE
C398:FF 8D 1B D0 A0 00 B9 8D F9
C3A0:CA F0 07 20 D2 FF C8 4C 21
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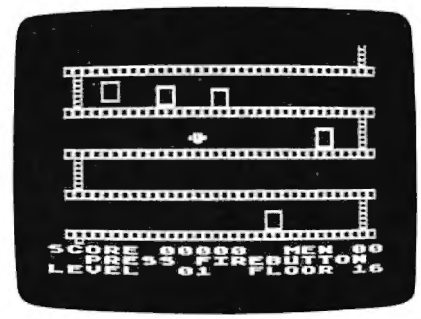

You must avoid hungry birds as well as an automatic patrol robot in the Atari version of "High Rise."

Program 2: Atari High Rise

Version by Kevin Mykytyn, Editorial Programmer

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12978:010,169,058,141,220,050,058
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13734:012,048,195,255,195,255,102
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13764:162,000,160,045,032,210,037
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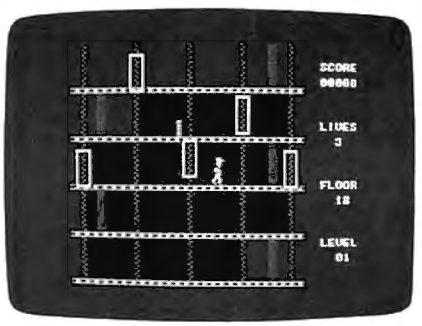

The Apple version of "High Rise" is an exceptional arcade-style game.

Program 3: Apple High Rise

Version by Tim Victor, Editorial Programmer

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START ADDRESS:  0801
END ADDRESS:    1BD8

0801: A9 00 85 EC A9 80 85 ED AD
0809: 20 DC 13 20 A4 1B 20 6F 06
0811: 17 A9 20 85 E6 8D E0 1B BD
0819: A9 00 8D D7 1B 8D D6 1B 05
0821: A9 28 8D DD 1B A9 C0 8D 2E
0829: DE 1B 20 C7 15 A9 40 85 45
0831: E6 20 C7 15 A9 00 8D FE 6E
0839: 1B 8D FF 1B 2C 57 C0 2C 58
0841: 52 C0 2C 54 C0 2C 50 C0 8D
0849: A9 70 8D F8 1B A9 0E 8D B4
0851: F9 1B A9 C4 8D FA 1B A9 DE
0859: 0E 8D FB 1B A9 00 8D 74 E1
0861: 0E 8D 81 0E 8D 8E 0E 8D 3D
0869: 9B 0E 8D A4 0E 8D B1 0E DE
0871: 8D BB 0E 8D C8 0E 8D F6 62
0879: 1B A9 0A 8D F4 1B A9 00 03
0881: 8D F3 1B A9 05 8D 9E 0E FC
0889: A9 02 8D 84 0E 8D 85 0E A8
0891: 8D 86 0E AD F6 1B F0 03 AF
0899: 4C 10 0A A9 01 8D E3 1B D0
08A1: A9 01 8D E2 1B A9 00 8D B3
08A9: E4 1B A9 56 8D E5 1B A9 71
08B1: 00 8D E6 1B A9 00 8D E7 04
08B9: 1B A9 01 8D EC 1B A9 00 E1
08C1: 8D ED 1B 8D EA 1B A9 13 7A
08C9: 8D EE 1B A9 00 8D F1 1B 8F
08D1: A9 06 8D EF 1B A9 00 8D F5
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08D9: F0 1B AD F3 1B AC F4 1B AE
08E1: 8C F3 1B 6A 90 0D EE F3 C9
08E9: 1B A9 7C 8D E5 1B A9 39 82
08F1: 8D EE 1B A9 FF 8D E9 1B A7
08F9: A9 00 8D F7 1B 20 A4 14 C6
0901: 20 3C 0D 20 45 0C 20 81 F1
0909: 0D 20 61 1A 20 5A 17 20 30
0911: 33 09 20 C0 09 20 A4 14 35
0919: 20 6D 15 20 B1 19 20 A7 15
0921: 0B 20 09 0B 20 BD 0A 20 BE
0929: 7B 0A AD F7 1B F0 CE 4C 37
0931: 94 08 AD E5 1B A0 00 C9 C8
0939: A2 B0 06 69 26 C8 4C 3B 45
0941: 09 98 1B 6D F3 1B CD E8 68
0949: 1B F0 73 8D E8 1B A2 02 67
0951: 8E B4 0E C9 0A 90 08 EE C7
0959: B4 0E E9 0A 4C 54 09 69 56
0961: 02 8D B5 0E A9 00 8D B1 89
0969: 0E 98 D0 52 A2 02 FE 84 87
0971: 0E BD 84 0E C9 0C D0 08 93
0979: A9 02 9D 84 0E CA 10 EE 87
0981: A9 00 8D 81 0E 20 35 1B A8
0989: AD F3 1B D0 2B 20 05 0E D1
0991: AD F4 1B 18 69 04 8D F4 08
0999: 1B EE CC 0E AD CC 0E C9 F5
09A1: 0C D0 08 A9 02 8D CC 0E 77
09A9: EE CB 0E A9 00 8D C8 0E 58
09B1: A9 01 8D F7 1B 4C 01 0A 20
09B9: CE F3 1B 20 EA 15 60 AD AF
09C1: E5 1B 38 ED EE 1B C9 08 F2
09C9: 10 35 C9 EE 30 31 AD E6 E1
09D1: 1B 38 ED EF 1B C9 02 10 50
09D9: 26 C9 FF 30 22 20 47 1B AF
09E1: 20 CA 0D A9 01 8D F7 1B 3C
09E9: CE 9E 0E A9 00 8D 9B 0E E2
09F1: A9 02 CD 9E 0E D0 05 A9 64
09F9: 01 8D F6 1B 20 01 0A 60 F9
0A01: A9 18 8D 0F 0A 20 60 0A 2E
0A09: CE 0F 0A D0 F8 60 00 A9 89
0A11: 0A A0 49 20 FC 1A A9 B0 A1
0A19: 8D 4D 0A 20 60 0A 2C 10 1E
0A21: C0 AD 00 C0 10 FB 2C 10 E5
0A29: C0 C9 CE F0 12 C9 EE F0 7F
0A31: 0E A9 40 8D 4D 0A 20 60 CA
0A39: 0A 20 60 0A 4C 0F 08 2C E1
0A41: 54 C0 2C 51 C0 4C D0 03 26
0A49: 20 2E 20 53 2E 34 07 1B 9D
0A51: 1D 10 1E 1E 01 19 01 1F 2B
0A59: 1A 01 1C 20 14 1F 00 20 7D
0A61: A4 14 20 6D 15 20 B1 19 4D
0A69: 20 A7 0B 20 A4 14 20 3C CC
0A71: 0D 20 81 0D 20 61 1A 4C 1C
0A79: 5A 17 AD E2 1B F0 36 10 7D
0A81: 1B AD E6 1B D0 07 AD E7 03
0A89: 1B C9 02 90 29 AD E7 1B D1
0A91: 38 E9 02 B0 1D 69 07 CE F2
0A99: E6 1B 10 16 AD E6 1B C9 54
0AA1: 1C B0 13 AD E7 1B 18 69 72
0AA9: 02 C9 07 90 05 EE E6 1B E7
0AB1: E9 07 8D E7 1B 60 A9 00 5A
0AB9: 8D E2 1B 60 2C E9 1B 30 26
0AC1: 0D AD E5 1B 18 69 1C 38 0D
0AC9: E9 26 90 2F D0 FA AD 00 2F
0AD1: C0 10 28 8D 10 C0 C9 8D CC
0AD9: F0 22 C9 A0 F0 13 C9 88 22
0AE1: F0 07 C9 95 D0 15 A9 01 F1
0AE9: 2C A9 FF A0 FF 8C E9 1B A9
0AF1: 2C A9 00 8D E2 1B A9 01 37
0AF9: 8D E3 1B 60 2C 10 C0 AD 08
0B01: 00 C0 10 FB 2C 10 C0 60 8C
0B09: AD EA 1B F0 03 4C 84 0B 80
0B11: AD E5 1B 18 69 09 CD EE 56
0B19: 1B D0 0A AD E6 1B CD EF 3C
0B21: 1B B0 38 90 39 90 03 A9 BC
0B29: 02 2C A9 FE 8D EB 1B AD 70
0B31: F1 1B 4A A9 0B 2C EB 1B E6
0B39: 10 04 90 06 B0 02 B0 02 8B
0B41: A9 F5 18 69 0E CD EF 1B E5
0B49: D0 0F A9 03 CD F0 1B D0 2A
0B51: 08 AD EB 1B 8D EA 1B D0 25
0B59: 2A 90 03 A9 02 2C A9 FE B6
0B61: 8D EB 1B 18 6D F0 1B C9 4D
0B69: 07 90 14 2C EB 1B 10 09 61
0B71: 18 69 07 CE EF 1B 4C 80 C0
0B79: 0B 38 E9 07 EE EF 1B 8D C3
0B81: F0 1B 60 18 6D EE 1B 8D 4F
0B89: EE 1B 18 69 13 38 E9 26 EA
0B91: 90 13 D0 FA A9 00 8D EA D1
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0BA1: 1B 60 EE F1 1B 60 A0 00 F5
0BA9: 8C FC 1B B9 C5 0D 30 09 10
0BB1: AA CA 8A 99 C5 0D 4C 39 EE
0BB9: 0C 18 B9 B1 0D 79 C0 0D 0B
0BC1: 99 B1 0D C9 06 F0 04 C9 15
0BC9: 9E D0 09 38 A9 00 F9 C0 0A
0BD1: 0D 99 C0 0D CC E9 1B D0 D2
0BD9: 0B B9 B1 0D 18 69 04 8D E6
0BE1: E5 1B D0 33 B9 B1 0D 18 C5
0BE9: 69 06 CD E5 1B 90 28 E9 A3
0BF1: 05 CD E5 1B B0 21 B9 B6 A0
0BF9: 0D CD E6 1B D0 19 B9 BB B2
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0C09: 8D E2 1B 8C E9 1B B9 B1 AD
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0C19: B1 0D C9 9E F0 12 38 E9 9A
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0C29: FA 20 C6 18 29 E0 D0 08 97
0C31: 20 C6 18 4A 4A 99 C5 0D 04
0C39: C8 8C FC 1B C0 05 F0 03 29
0C41: 4C AC 0B 60 CE E3 1B D0 1F
0C49: 1C AD E2 1B F0 03 A9 02 D1
0C51: 2C A9 30 8D E3 1B EE E4 17
0C59: 1B AD E4 1B C9 04 D0 05 BD
0C61: A9 00 8D E4 1B AD E4 1B C2
0C69: 0A 0A 0A AE E2 1B F0 1C B6
0C71: 30 0D 69 FC 85 FA A9 00 4D
0C79: 69 0C 85 FB 4C 97 0C 69 FB
0C81: 1C 85 FA A9 00 69 0D 85 48
0C89: FB 4C 97 0C 69 DC 85 FA 2B
0C91: A9 00 69 0C 85 FB A0 00 C9
0C99: 8C FC 1B AD FC 1B 0A 0A E7
0CA1: A8 B1 FA 85 EE C8 B1 FA 2B
0CA9: 85 EF C8 1B AD E5 1B 71 C7
0CB1: FA 8D D7 1B C8 18 AD E6 40
0CB9: 1B 8D D6 1B AD E7 1B 71 04
0CC1: FA C9 07 90 05 EE D6 1B 60
0CC9: E9 07 8D D5 1B 20 C0 14 96
0CD1: EE FC 1B AD FC 1B C9 02 C8
0CD9: 90 C1 60 74 12 01 01 92 27
0CE1: 12 09 01 B0 12 01 01 92 99
0CE9: 12 09 01 74 12 01 01 92 DD
0CF1: 12 09 01 B0 12 01 01 92 A9
0CF9: 12 09 01 74 12 02 01 CE 2E
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0D31: 13 0A 04 B0 12 01 01 46 BF
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0D49: ED 1B 8D ED 1B AD ED 1B 38
0D51: F0 02 A9 1E 18 69 82 85 6C
0D59: EE A9 13 85 EF 90 02 E6 BC
0D61: EF AD EF 1B 8D D6 1B AD 3A
0D69: F0 1B 8D D5 1B AD EE 1B 5A
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0D79: 01 8D D7 1B 20 C0 14 60 B0
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0D99: D7 1B B9 B6 0D 8D D6 1B 70
0DA1: B9 BB 0D 8D D5 1B 20 C0 1E
0DA9: 14 EE FC 1B 4C 8E 0D 60 F1
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0DB9: 14 1B 04 01 00 06 01 FE 4E
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0DE9: 0D AD E5 1B C9 A8 B0 03 B9
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0E09: 1B A9 01 8D E3 1B A0 59 3C
0E11: A9 0E 20 FC 1A A9 B0 8D 5F
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0E21: 20 B1 19 20 A7 0B A9 FF 9B
0E29: 8D E9 1B 20 7B 0A 20 A4 D4
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0E41: 61 1A 20 5A 17 AD E2 1B 8E
0E49: D0 D0 A9 0A 8D F3 1B AD F7
0E51: 5D 0E 09 40 8D 5D 0E 60 23
0E59: 4F 7F 55 45 20 34 07 1D F8
0E61: 1A 20 19 0F 01 0E 1A 18 33
0E69: 1B 17 10 1F 10 0F 00 7D 07
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0E79: 1A 1D 10 00 8A 0E 70 0E 67
0E81: 00 1A 20 02 02 02 02 02 66
0E89: 00 97 0E 7D 0E 00 3C 20 2E
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0E99: 8A 0E 00 48 22 02 00 AD C9
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0ED9: 80 B0 81 80 F0 83 80 E0 12
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0FD9: 96 80 9C 80 9B 80 8F 80 7D
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0FE9: 87 80 87 80 82 80 8C 80 94
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0FF9: 8E 80 B6 80 BC 80 BC 80 40
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1009: B8 80 90 80 8C 80 F0 83 8B
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1019: 87 80 F8 87 80 F8 87 80 2C
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1041: 80 FF BF 80 FF BF 80 FF A1
1049: BF 80 FF BF 80 FE 9F 80 25
1051: F0 83 80 F8 87 80 F8 87 22
1059: 80 F8 87 80 F8 87 80 F8 D0
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1069: B8 87 80 FC 80 80 FC 83 2B
1071: 80 FC 87 80 F8 87 80 F8 E9
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10C9: FE 81 80 FF 81 80 FE 81 67
10D1: 80 FC 81 80 FC 83 80 FE 9F
10D9: 83 80 FF 87 80 DF 8F 80 77
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11F9: 06 60 00 06 60 00 06 60 07
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1231: 01 0F 70 01 0F 70 01 0F 03
1239: 70 01 0F 70 01 0F 70 01 E4
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1249: 01 0F 70 01 0F 70 01 0F 1B
1251: 70 01 0F 70 01 0F 70 01 FC
1259: 0F 70 01 0F 70 01 0F 70 48
1261: 01 0F 70 01 0F 70 01 0F 33
1269: 70 01 0F 70 01 7F 7F 01 F4
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12B9: 20 20 20 20 20 03 08 0F 28
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12C9: 20 41 20 20 20 2B 0F 20 40
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12D9: 20 48 20 03 0E 6C 10 7F 16
12E1: 20 20 20 20 20 20 36 20 32
12E9: 20 2E 20 D3 0F 20 20 20 44
12F1: 20 20 20 20 7F 20 20 4F 40
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13B9: 20 20 00 20 00 C0 11 20 3F
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13C9: 20 33 20 03 1E 1A 12 20 9E
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13D9: 52 2E 20 A9 00 8D FC 1B 9E
13E1: A9 74 85 EE A9 12 85 EF 2A
13E9: AD FC 1B C9 0C F0 2F A0 49
13F1: 0E B1 EE 8D DD 1B C8 B1 E0
13F9: EE 8D DE 1B 20 20 14 A5 D7
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1409: E6 EF 20 20 14 18 A5 EE E1
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1431: 91 EE A0 00 B1 EE 85 FC 43
1439: C8 B1 EE 85 FD AD DE 1B E7
1441: 8D DF 1B A0 00 8C DB 1B 9A
1449: A9 00 8D DC 1B B1 FC 8D EC
1451: D4 1B 0A AE D5 1B 0A 2E 34
1459: DC 1B CA D0 F9 2C D4 1B 62
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1489: 1B 85 EC 90 02 E6 ED CE 9D
1491: DF 1B D0 AF AC D5 1B C8 41
1499: 8C D5 1B C0 07 F0 03 4C 3B
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14A9: 08 A9 03 A0 1C A2 00 F0 07
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14B9: FD 1B 85 1E 84 1F 60 A0 3C
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1521: 1B A0 00 B1 FC AA C8 B1 F1
1529: FC 86 FC 85 FD A0 00 B1 8F
1531: 1A AA C8 B1 1A 86 1A 85 EB
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1549: 20 B5 15 EE DA 1B A5 FC 0E
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1559: E6 FD A5 1A 18 6D DD 1B 1A
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1569: 1B D0 DA 60 AE FD 1B BD 18
1571: FE 1B F0 3F A0 00 B1 1E 7A
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1581: 1B C8 B1 1E 8D D5 1B C8 46
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1591: EF C8 B1 1E 8D DE 1B C8 E4
1599: B1 1E 8D DD 1B 20 C7 15 B1
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15A9: 02 E6 1F AE FD 1B DE FE 76
15B1: 1B D0 C1 60 AC DD 1B 88 77
15B9: B1 FE 31 1A 51 FE 11 FC E9
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15D9: 88 B1 1C 91 FE 88 10 F9 85
15E1: EE DA 1B CE DF 1B D0 EA 82
15E9: 60 A9 00 8D F5 1B A9 04 FA
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1669: 0D 20 45 0C 20 81 0D 20 CE
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16A9: 4C F4 15 A9 FF 8D E9 1B 9B
16B1: 60 AD DE 1B 8D DF 1B A9 D2
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18E9: 86 E6 BE BC BE BC BE BC DD
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18F9: E6 9C E6 E6 B8 86 86 E0 DD
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1909: E6 E6 98 E0 E6 86 FE E6 BF
1911: E6 E6 E6 E6 E6 98 E6 E6 0A
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1921: B0 B4 BE BE B0 BC E6 E6 C9
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1991: B0 BC BC 8C BC 98 E6 FE C0
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19B9: 85 EF A5 EE 05 EF D0 01 D8
19C1: 60 A0 04 A9 01 AE FD 1B 41
19C9: F0 01 0A 31 EE F0 4B B1 8C
19D1: EE 30 05 2C 34 1B F0 4D 28
19D9: C8 B1 EE 8D DA 1B C8 B1 1A
19E1: EE 8D D6 1B A5 EE 18 69 FD
19E9: 07 85 FC A5 EF 69 00 85 A5
19F1: FD A9 06 8D DF 1B 20 EC BF
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1A09: DF 1B D0 EA A9 01 AE FD 69
1A11: 1B F0 01 0A A0 04 51 EE 76
1A19: 91 EE B1 EE 2C 34 1B F0 50
1A21: 04 29 03 F0 06 20 EF 1A BB
1A29: 4C BB 19 A0 02 B1 EE 85 D9
1A31: FC C8 B1 EE 85 FD 20 EF BF
1A39: 1A A0 00 A5 EE 91 FC C8 7D
1A41: A5 EF 91 FC C8 05 EE D0 4F
1A49: 0B A5 FC 8D FA 1B A5 FD 72
1A51: 8D FB 1B 60 A5 FC 91 EE E7
1A59: C8 A5 FD 91 EE 4C BB 19 6D
1A61: AD F8 1B 85 EE AD F9 1B A3
1A69: 85 EF A5 EE 05 EF D0 01 8A
1A71: 60 A0 04 B1 EE 2C 34 1B 45
1A79: D0 6E C9 00 30 0C A9 01 F0
1A81: AE FD 1B F0 01 0A 31 EE 80
1A89: D0 5E C8 B1 EE 8D DA 1B 70
1A91: C8 B1 EE 8D D6 1B A9 D2 96
1A99: 8D BE 1A A9 18 8D BF 1A B2
1AA1: A9 06 8D DF 1B A5 EE 18 41
1AA9: 69 07 85 FC A5 EF 69 00 94
1AB1: 85 FD 20 EC 16 A0 00 B1 DF
1AB9: FC F0 09 AA BD FF FF 91 F3
1AC1: FE C8 D0 F3 EE DA 1B AD C7
1AC9: BE 1A 18 69 25 8D BE 1A 74
1AD1: 90 03 EE BF 1A CE DF 1B CF
1AD9: D0 D8 A9 01 AE FD 1B F0 86
1AE1: 01 0A A0 04 11 EE 91 EE C3
1AE9: 20 EF 1A 4C 6B 1A A0 00 37
1AF1: B1 EE AA C8 B1 EE 86 EE E1
1AF9: 85 EF 60 48 98 48 AD FA B9
1B01: 1B 85 EE AD FB 1B 85 EF 26
1B09: A0 00 68 91 EE C8 68 91 B2
1B11: EE 20 EF 1A A9 00 A8 91 96
1B19: EE C8 91 EE C8 AD FA 1B 28
1B21: 91 EE C8 AD FB 1B 91 EE 2E
1B29: A5 EE 8D FA 1B A5 EF 8D 2C
1B31: FB 1B 60 40 A9 E8 8D 87 CF
1B39: 1B A9 F4 8D 7D 1B A9 1E A8
1B41: 8D 6A 1B 4C 56 1B A9 E0 54
1B49: 8D 87 1B A9 E8 8D 7D 1B B9
1B51: A9 1F 8D 6A 1B A9 01 8D 8B
1B59: 00 1C A0 00 AD 87 1B 8D F9
1B61: 02 1C 4E 00 1C 90 0C B9 5E
1B69: 00 1E C8 8D 01 1C A9 80 65
1B71: 8D 00 1C 4E 01 1C 90 03 73
1B79: AD 30 C0 A2 FF E8 D0 FD 18
1B81: 90 03 AD 30 C0 A2 FF E8 F2
1B89: D0 FD EE 02 1C D0 D3 18 89
1B91: AD 87 1B E9 01 8D 87 1B EA
1B99: AD 7D 1B 69 01 8D 7D 1B 54
1BA1: 90 BA 60 A9 88 8D 00 1E 0E
1BA9: A0 01 B9 FF 1D 99 00 1E 15
1BB1: C8 D0 F7 A9 80 A0 03 99 40
1BB9: 00 1F 88 10 FA A9 AA A0 3E
1BC1: 03 99 04 1F 88 10 FA A0 6D
1BC9: 08 B9 F8 1E 99 00 1F C8 47
1BD1: D0 F7 60 00 00 00 00 00 7A
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```

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High-Speed String Search
For Atari BASIC

Tom R. Halfhill, Editor

Here's a short machine language routine that adds a valuable new function to Atari BASIC—a high-speed search that can find any string of characters within a larger string almost instantly. It lets you add machine language speed to BASIC databases and sorts, and a sample address book program shows how. For all 400/800, XL, and XE computers.

Have you ever dreamed up a wish list of new commands for the ultimate BASIC language? Ideally, this super-BASIC would combine in a single package the best features that all BASICs have to offer.

A sure way to collect ideas for this wish list is to look at other BASICs. For instance, IBM BASIC, Amiga BASIC, Atari ST BASIC, and other large BASIC languages have a function called INSTR (pronounced "in-string"). INSTR rapidly searches through a character string and returns the position of any substring you specify. Once you know the position of the substring, it's a simple matter to retrieve it with the usual BASIC string statements.

Atari BASIC lacks an INSTR function, yet needs it much more than most other BASICs do. Many BASIC languages don't allow strings longer than 255 characters, so you can write a search routine in BASIC that's not significantly slower than BASIC's own INSTR function. But Atari BASIC allows character strings of virtually *any* length, up to the limit of available memory. Although you can write a search routine in Atari BASIC that simulates INSTR, it would take ages to find a substring hidden near the end of a really long string.

The answer, as usual, is to mix BASIC with a dash of machine language: an ML routine that duplicates INSTR and works in a flash.

When this powerful function is combined with the megastring capability of Atari BASIC, all kinds of possibilities arise—database and sorting programs written in BASIC that perform at near-ML speeds, and simulated string arrays that really let you retrieve any substring as fast as true Microsoft-style string arrays. With the INSTR routine accompanying this article, it's a snap.

No Memory Confusion

Take a look at Program 1. It's a BASIC loader that encodes the machine language INSTR routine in DATA statements, ready to merge with your own programs. Because the ML is written to be completely relocatable, you can add this routine to any BASIC program without worrying about memory conflicts—it avoids such overused memory areas as page 6. Line 10, which should be near the beginning of your program, reads the machine language into a string, ML$. Then it uses Atari BASIC's string-address function (ADR) to set the variable ML equal to the starting address of ML$. After this setup, all it takes to call the INSTR routine is a simple USR statement with a few arguments arranged in this format:

```
INSTR=USR(ML,ADR(XX$),LEN(XX$),
  ADR(SUB$),LEN(SUB$),START)
```

where *XX$* is the larger character string you're searching through, and *SUB$* is the smaller substring you want to find. The result, returned in the variable INSTR, is the position within *XX$* of the first character in *SUB$*. (Of course, you may use any variable names you prefer in the USR statement, as long as the statement conforms to this general format.)

For instance, if XX$ contains these characters:

```
ABCDEFGHELLOABCDEFG
```

and if SUB$ contains these characters:

```
HELLO
```

the result of calling the INSTR routine would be INSTR=8, because the substring HELLO begins at the eighth character position in XX$. If you redefine SUB$—say, SUB$="DEF"—and call the routine again, the result would be INSTR=4, because the substring DEF begins at the fourth character position in XX$.

The rest is easy. Once you know a substring's position within a larger string, you can retrieve it with a statement like this:

```
PRINT XX$(INSTR,INSTR+LEN
  (SUB$)-1)
```

To make the Atari INSTR routine even more useful, it has one additional feature. Looking again at the USR statement above, you'll notice another argument that wasn't mentioned. This argument, START, also was inspired by the INSTR function in larger BASICs. It lets you specify the starting point of the search within XX$.

Normally, if you're searching through the entire string, you'd set START=1 before calling the INSTR routine. But there may be times when you want to start the search elsewhere within XX$. A prime example is when you're searching for more than one occurrence of a substring. If the search always began at the first character in XX$, the INSTR routine would find only the first occurrence of SUB$ every time. To get around this, all you have to do is call the routine again after executing a statement such as START=INSTR+1. This starts the next search at a position which is one character past the point where the previous search stopped. You can repeat this procedure to find as many occurrences of the substring as you want.

A Speed Test

When programming in BASIC, it's nearly impossible to cause a system crash or lockup unless you're guilty of a wayward POKE. But in machine language, unrecoverable crashes are much more common. Therefore, the INSTR routine is carefully error-trapped. If it does not find the substring you specify, it returns a zero. If you include the wrong number of arguments in the USR statement, the routine clears the 6502 stack of all faulty arguments before returning to BASIC, then returns a zero.

The only limitation to keep in mind when using the INSTR routine is that the substring you're looking for cannot be longer than 255 characters—not a serious limitation. The string you're searching through can be any length, of course.

So, just how fast *is* the INSTR routine? Wickedly fast. For a demonstration, enter Program 2. It creates a monster string that is 30,000 characters long—almost all of the usable program memory that's left in a 48K or 64K Atari when DOS and BASIC are active. (There may not be enough memory to run this program if you're using a non-Atari DOS that uses more RAM.) This string is filled entirely with X's, except for a Z at the thirty-thousandth position. When you run Program 2, it uses a search routine written in BASIC to find the Z. Prepare yourself for a long wait. It takes almost eight minutes.

Now add the lines in Program 3 to the INSTR routine in Program 1 and repeat the test. INSTR finds the Z and prints it on the screen in about two seconds. With strings of any normal length, INSTR works almost instantly.

Personal Address Book

For a more practical demonstration of INSTR, delete line 10 from Program 1 and add the lines in Program 4, "Personal Address Book." This is a simple address book program that uses INSTR in two ways: to retrieve any entry in the blink of an eye, and to alphabetically sort the entries when dumping the whole list to a printer. Actually, Personal Address Book is a skeleton program that with some more work could be turned into a full-fledged, general-purpose filer. And thanks to INSTR, it works nearly as fast as programs written entirely in machine language.

When you run Personal Address Book, it automatically adjusts itself to hold the maximum number of address entries practical with the memory available in your computer. In a 48K or 64K machine running DOS 2.5, there's room for more than 24,700 characters of data. In a 16K machine with tape, there's room for more than 5,600 characters. You can check how much room is left at any time by selecting option 2 on the main menu, "Enter a new name."

Other menu options let you retrieve any entry, including multiple entries of people with the same last name; delete any entry; call a disk directory; print out the entire list in alphabetical order; and save/load address files with disk or tape (when you see the prompt DEVICE: FILENAME, respond D:*filename.ext* for disk or C: for tape). Screen prompts make all these options self-explanatory, and the program is error-trapped against common mistakes.

Most programs of this type written in Atari BASIC simulate string arrays by dividing a large string into many substrings of equal length, allocating a substring for each record. This makes it easier to retrieve an individual record, because the position of its substring within the larger string can be readily calculated. Unfortunately, there are two drawbacks with this method: records can't be longer than the substrings, and shorter records waste memory because they're padded out with blanks. But Personal Address Book gives you the freedom to enter as many lines for each address entry as you want. You can even include short notes to yourself as part of the entry, such as SAM'S COUSIN WHO IS A LAWYER.

Since Personal Address Book is a bare-bones demo program, it does have a few limitations. First, the search routines are case-sensitive. If the names are entered in uppercase/lowercase format, such as "Smith, Margaret," a search for all-uppercase "SMITH" results in a NOT FOUND message. Second, if you search for a keyword that isn't the first word in the record—such as "Margaret" in the previous example—the program retrieves only the fraction of the record which starts with that keyword. This means you should type in your entries using the format in which you plan to retrieve them, like this:

Smith, Margaret
604 Geronimo Avenue
Hometown, New York 10000
(212) 555-1212

To retrieve this record, you'd select option 1 and type "Smith" or "Smith, Margaret."

And finally, the print option sorts the names alphabetically by the first character only, so "Smith, Margaret" might not be printed before "Smith, Zelda" or even "Szabo, Martin." This was done to keep the demo program as short as possible.

Programming Notes

To see how easily search routines are written with INSTR, examine lines 360–450 and 600–660. Notice how the START argument is updated after each search to find any following occurrences of the same keyword (if the user so desires).

Since Personal Address Book accepts records of any size, you may be wondering how it figures out the length of each record after it finds the specified keyword. The

answer is a string called EOR$ (End Of Record). EOR$ consists of two carriage returns, and it's tagged onto the end of each record you enter with Personal Address Book. After the INSTR routine finds the keyword, it searches for the next occurrence of EOR$. Then it retrieves the substring between those two points.

BASIC programmers should note the subroutines starting at lines 760, 850, and 1170. By calling the Central Input/Output (CIO) routine built into the Atari operating system, these BASIC subroutines can load and save to tape or disk at machine language speed. If you study the REM statements and descriptive variable names, it isn't too difficult to figure out how these subroutines work. Just be sure to read the machine language data in line 1270 into CIO$ before calling the CIO subroutine in your own programs.

As mentioned above, Personal Address Book is a skeleton program intended mainly for demo purposes. You can add more options of your own to transform it into a mailing-label generator, a general-purpose filer, or even a full-featured database manager. With help from the lightning-fast INSTR routine, the results can be impressive.

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

Program 1: INSTR Routine BASIC Loader

```
NA 10  DIM ML$(260):FOR X=1 T
       O 260:READ A:ML$(X)=CH
       R$(A):NEXT X:ML=ADR(ML
       $)
PC 1275 REM *** INSTR ML DAT
       A ***
DK 1280 DATA 169,0,133,212,1
       33,213
LE 1290 DATA 104,201,5,240,1
       8,141
LC 1300 DATA 0,4,162,0,236,0
FD 1310 DATA 4,208,1,96,104,
       104
OH 1320 DATA 232,169,0,240,2
       43,104
BL 1330 DATA 141,5,4,104,141
       ,4
BJ 1340 DATA 4,104,141,3,4,1
       04
OP 1350 DATA 24,109,4,4,141,
       2
MF 1360 DATA 4,173,3,4,109,5
BO 1370 DATA 4,141,3,4,104,1
       33
ED 1380 DATA 204,104,133,203
       ,104,104
IC 1390 DATA 141,1,4,104,133
       ,206
EP 1400 DATA 104,24,109,4,4,
       133
IK 1410 DATA 205,165,206,109
       ,5,4
CC 1420 DATA 133,206,165,205
       ,56,233
OJ 1430 DATA 1,133,205,165,2
       06,233
HO 1440 DATA 0,133,206,162,0
       ,160
OM 1450 DATA 0,177,205,209,2
       03,240
DE 1460 DATA 37,173,2,4,56,2
       29
CB 1470 DATA 205,141,0,4,173
       ,3
PE 1480 DATA 4,229,206,13,0,
       4
JH 1490 DATA 208,1,96,165,20
       5,24
OF 1500 DATA 105,1,133,205,1
       65,206
IC 1510 DATA 105,0,133,206,1
       69,0
IG 1520 DATA 240,209,232,236
       ,1,4
FM 1530 DATA 208,4,169,0,240
       ,54
EO 1540 DATA 200,177,205,209
       ,203,240
DE 1550 DATA 37,173,2,4,56,2
       29
CB 1560 DATA 205,141,0,4,173
       ,3
PE 1570 DATA 4,229,206,13,0,
       4
JH 1580 DATA 208,1,96,165,20
       5,24
OO 1590 DATA 105,1,133,205,1
       65,206
IC 1600 DATA 105,0,133,206,1
       69,0
IG 1610 DATA 240,155,232,236
       ,1,4
ID 1620 DATA 240,4,169,0,240
       ,202
GA 1630 DATA 173,2,4,56,229,
       205
LN 1640 DATA 141,0,4,173,3,4
FI 1650 DATA 229,206,13,0,4,
       144
ME 1660 DATA 30,240,28,165,2
       05,56
JA 1670 DATA 237,4,4,133,212
       ,165
IP 1680 DATA 206,237,5,4,133
       ,213
LL 1690 DATA 165,212,24,105,
       1,133
OC 1700 DATA 212,165,213,105
       ,0,133
BE 1710 DATA 213,96
```

Program 2: BASIC Search Demo

```
DP 10  DIM XX$(30000),SUB$(10
       )
EB 20  XX$="X":XX$(30000)=XX$
       :XX$(2)=XX$:XX$(30000)
       ="Z"
EM 30  SUB$="Z"
LI 40  FOR X=1 TO LEN(XX$)
BP 50  IF XX$(X,X+LEN(SUB$)-1
       )=SUB$ THEN ? X:? XX$(
       X,X+LEN(SUB$)-1):END
PN 60  NEXT X
LG 70  PRINT "NOT FOUND":END
```

Program 3: INSTR Search Demo

```
EA 20  DIM XX$(30000),SUB$(10
       )
EC 30  XX$="X":XX$(30000)=XX$
       :XX$(2)=XX$:XX$(30000)
       ="Z"
IF 40  SUB$="Z":START=1:? "PR
       ESS ANY KEY TO START S
       EARCH"
HI 50  IF PEEK(764)=255 THEN
       50
PF 60  INSTR=USR(ML,ADR(XX$),
       LEN(XX$),ADR(SUB$),LEN
       (SUB$),START)
NO 70  ? XX$(INSTR,INSTR+LEN(
       SUB$)-1)
BD 80  IF INSTR=0 THEN ? "NOT
        FOUND"
EA 90  END
```

Program 4: Personal Address Book

```
MC 110 FILELEN=FRE(0)-1000:D
       IM FILE$(FILELEN)
GG 120 DIM SUB$(255),ML$(260
       ),FILENAME$(14),EOR$(
       2),ALPHA$(3),PROMPT$(
       28),CIO$(7),DATE$(40)
       ,BOOK$(21)
PJ 130 BOOK$="PERSONAL ADDRE
       SS BOOK"
HM 140 OPEN #1,4,0,"K:":GRAP
       HICS 2:SETCOLOR 2,0,0
       :POKE 752,1
EN 150 POSITION 2,2:? #6;BOO
       K$(1,16):POSITION 8,3
       :? #6;BOOK$(18,21):?
       "Please wait..."
GN 160 EOR$(1)=CHR$(155):EOR
       $(2)=CHR$(155):PROMPT
       $="■PRESS RETURN FOR■
       MAIN MENU■"
DJ 170 FOR X=1 TO 7:READ A:C
       IO$(X)=CHR$(A):NEXT X
EO 180 FOR X=1 TO 260:READ A
       :ML$(X)=CHR$(A):NEXT
       X:ML=ADR(ML$)
EC 190 ? CHR$(125):? PROMPT$
NJ 200 GET #1,A:IF A=155 THE
       N 230
FP 210 GOTO 210
MO 220 REM *** MAIN MENU ***
KJ 230 POKE 82,0:GRAPHICS 0:
       POKE 752,1
ON 240 FOR X=1 TO 9:? CHR$(1
       8);:NEXT X:? BOOK$;:F
       OR X=1 TO 10:? CHR$(1
       8);:NEXT X:POKE 82,10
BD 250 POKE 82,10:? :? "1> R
       etrieve a name":? :?
       "2> Enter a new name"
       :?
MA 260 ? "3> Delete an old n
       ame":? :? "4> Load ad
       dress book":?
AC 270 ? "5> Save address bo
       ok":? :? "6> Print ad
       dress book":? :? "7>
       Disk directory"
AD 280 POKE 82,8:? :? "■PRES
       S NUMBER OF CHOICE■"
FO 290 CLOSE #1:OPEN #1,4,0,
       "K:":GET #1,A:IF A=25
       5 THEN 290
LI 300 ON A-48 GOTO 330,470,
       580,770,860,950,1130
GI 310 GOTO 290
DN 320 REM *** RETRIEVE A NA
```

```
      ME ***
EE 330 POKE 82,2:POKE 752,0:
       ? CHR$(125):POSITION
       5,20:? PROMPT$
BF 340 POSITION 2,10:? "Name
        to retrieve";:INPUT
       SUB$
JF 350 IF LEN(SUB$)=0 THEN 2
       20
JF 360 START=1
AJ 370 INSTR=USR(ML,ADR(FILE
       $),LEN(FILE$),ADR(SUB
       $),LEN(SUB$),START)
KI 380 IF INSTR=0 THEN POKE
       752,1:? CHR$(125):POS
       ITION 5,10:? "NAME NO
       T FOUND":GOTO 420
LN 390 RECORD=INSTR:START=IN
       STR
PL 400 INSTR=USR(ML,ADR(FILE
       $),LEN(FILE$),ADR(EOR
       $),LEN(EOR$),START)
OK 410 ? CHR$(125):? :? FILE
       $(RECORD,INSTR+1):? :
       ? "PRESS SPACE BAR TO
        RETRIEVE":? "NEXT OC
       CURRENCE OF SAME NAME
       "
LI 420 POKE 752,1:? :? PROMP
       T$
NO 430 GET #1,A:IF A=155 THE
       N 230
PL 440 IF A=32 THEN START=ST
       ART+1:GOTO 370
GJ 450 GOTO 430
FK 460 REM *** ENTER A NAME
       ***
NL 470 ? CHR$(125):POKE 752,
       0:POKE 82,2:? :? FILE
       LEN-LEN(FILE$);" CHAR
       ACTERS FREE IN MEMORY
       "
LG 480 ? :? "PRESS RETURN AT
        THIS PROMPT":? "WITH
       OUT INPUT FOR MAIN ME
       NU"
HB 490 ? :? "PRESS RETURN AT
        ANY NEXT PROMPT":? "
       WITHOUT INPUT TO END
       ENTRY"
MF 500 ? :? "NAME";:INPUT SU
       B$
JE 510 IF LEN(SUB$)=0 THEN 2
       30
OC 520 IF LEN(FILE$)=0 THEN
       FILE$(LEN(FILE$)+1)=E
       OR$
BB 530 FILE$(LEN(FILE$)+1)=S
       UB$:FILE$(LEN(FILE$)+
       1)=CHR$(155)
KK 540 ? :? "NEXT LINE OF AD
       DRESS";:INPUT SUB$
JK 550 IF LEN(SUB$)=0 THEN F
       ILE$(LEN(FILE$)+1)=CH
       R$(155):GOTO 230
GM 560 GOTO 530
JB 570 REM *** DELETE A NAME
        ***
FC 580 ? CHR$(125):POKE 752,
       0:POKE 82,2:? :? PROM
       PT$
FM 590 ? :? "NAME TO DELETE"
       ;:INPUT SUB$:IF LEN(S
       UB$)=0 THEN 230
DL 600 START=1:INSTR=USR(ML,
       ADR(FILE$),LEN(FILE$)
       ,ADR(SUB$),LEN(SUB$),
       START)
CK 610 IF INSTR<>0 THEN 650
NJ 620 POKE 752,1:? CHR$(125
       ):POSITION 5,10:? "NA
       ME NOT FOUND":? :? PR
       OMPT$
DA 630 GET #1,A:IF A=155 THE
       N 230
GM 640 GOTO 630
LM 650 RECORD=INSTR:START=IN
       STR
AD 660 INSTR=USR(ML,ADR(FILE
       $),LEN(FILE$),ADR(EOR
       $),LEN(EOR$),START)
MC 670 ? CHR$(125):POKE 752,
       1:? :? FILE$(RECORD,I
       NSTR+1):? :? "PRESS S
       PACE BAR TO DELETE"
II 680 ? :? "PRESS RETURN FO
       R MAIN MENU"
OG 690 GET #1,A:IF A=155 THE
       N 230
NB 700 IF A=32 THEN 720
HA 710 GOTO 690
IH 720 GAP=INSTR-RECORD+2
OP 730 FILE$(RECORD-2,LEN(FI
       LE$))=FILE$(INSTR,LEN
       (FILE$))
IH 740 FILE$=FILE$(1,LEN(FIL
       E$)-GAP)
GK 750 GOTO 230
LN 760 REM *** LOAD FILE ***
BL 770 ? CHR$(125):POKE 752,
       0:POSITION 5,20:? PRO
       MPT$
OH 780 POSITION 1,10:? "DEVI
       CE:FILENAME TO LOAD";
       :INPUT FILENAME$
PF 790 IF LEN(FILENAME$)=0 T
       HEN 230
CF 800 TRAP 820:CLOSE #2:OPE
       N #2,4,0,FILENAME$:LE
       T READ=1:X=32:MAXLEN=
       FILELEN:SADR=ADR(FILE
       $):GOSUB 1180
QJ 810 CLOSE #2:FILE$(TRUELE
       N)=CHR$(155):TRAP 400
       00:GOTO 230
HE 820 ? CHR$(125):POKE 752,
       1:POSITION 5,10:? "I/
       O ERROR #";PEEK(195):
       POSITION 5,20:? PROMP
       T$:CLOSE #2:TRAP 4000
       0
OC 830 GET #1,A:IF A=155 THE
       N 230
HA 840 GOTO 830
MM 850 REM *** SAVE FILE ***
BL 860 POKE 752,0:? CHR$(125
       ):POSITION 5,20:? PRO
       MPT$
PG 870 POSITION 1,10:? "DEVI
       CE:FILENAME TO SAVE";
       :INPUT FILENAME$
PF 880 IF LEN(FILENAME$)=0 T
       HEN 230
KG 890 TRAP 910:CLOSE #2:OPE
       N #2,8,0,FILENAME$:LE
       T READ=0:X=32:MAXLEN=
       LEN(FILE$):SADR=ADR(F
       ILE$):GOSUB 1180
NB 900 CLOSE #2:TRAP 40000:G
       OTO 230
HE 910 POKE 752,1:? CHR$(125
       ):POSITION 5,10:? "I/
       O ERROR #";PEEK(195):
       POSITION 5,20:? PROMP
       T$:CLOSE #2:TRAP 4000
       0
OC 920 GET #1,A:IF A=155 THE
       N 230
HA 930 GOTO 920
CK 940 REM *** PRINT FILE **
       *
FL 950 POKE 82,2:POKE 752,0:
       ? CHR$(125)
OG 960 ? :? "BE SURE PRINTER
        IS ONLINE"
PE 970 ? :? PROMPT$:? :? "TO
       DAY'S DATE";:INPUT DA
       TE$
ND 980 IF LEN(DATE$)=0 THEN
       230
EP 990 TRAP 1000:CLOSE #2:OP
       EN #2,8,0,"P:":GOTO 1
       010
GA 1000 ? CHR$(125):? :? "I/
       O ERROR #";PEEK(195)
       :TRAP 40000:CLOSE #2
       :GOTO 960
AE 1010 ALPHA$(1)=CHR$(155):
       ALPHA$(2)=CHR$(155):
       START=1:TRAP 40000
II 1020 PRINT #2;BOOK$:PRINT
        #2;"UPDATED ";DATE$
       :X=65
ID 1030 ALPHA$(3)=CHR$(X):IF
        X>90 THEN CLOSE #2:
       GOTO 230
CM 1040 INSTR=USR(ML,ADR(FIL
       E$),LEN(FILE$),ADR(A
       LPHA$),LEN(ALPHA$),S
       TART)
EK 1050 IF INSTR>0 THEN 1070
HN 1060 X=X+1:START=1:GOTO 1
       030
EG 1070 RECORD=INSTR:START=I
       NSTR+2
DA 1080 INSTR=USR(ML,ADR(FIL
       E$),LEN(FILE$),ADR(E
       OR$),LEN(EOR$),START
       )
DP 1085 IF INSTR=0 THEN X=X+
       1:START=1:GOTO 1030
KC 1090 PRINT #2,FILE$(RECOR
       D+1,INSTR-1)
OM 1100 IF INSTR+2<=LEN(FILE
       $) THEN START=INSTR:
       GOTO 1030
HJ 1110 X=X+1:START=1:GOTO 1
       030
IE 1120 REM *** DISK DIRECTO
       RY ***
II 1130 TRAP 1140:? CHR$(125
       ):CLOSE #2:OPEN #2,6
       ,0,"D:*.*":FOR X=1 T
       O 10000:GET #2,A:? C
       HR$(A);:NEXT X
HF 1140 CLOSE #2:? PROMPT$:T
       RAP 40000
HN 1150 GET #1,A:IF A<>155 T
       HEN 1150
JG 1160 GOTO 230
AC 1170 REM *** CIO LOAD/SAV
       E ***
CP 1180 REM CIO LOAD/SAVE re
       quires file#2 opened
       , READ=0 for save, R
       EAD=1 for load
FG 1190 REM file#2,$20
GG 1200 ICCOM=834:ICBADR=836
       :ICBLEN=840:ICSTAT=8
       35
AO 1210 H=INT(SADR/256):L=SA
       DR-H*256:POKE ICBADR
       +X,L:POKE ICBADR+X+1
       ,H
FF 1220 H=INT(MAXLEN/256):L=
       MAXLEN-H*256:POKE IC
       BLEN+X,L:POKE ICBLEN
       +X+1,H
MG 1230 POKE ICCOM+X,11-4*RE
       AD:A=USR(ADR(CIO$),X
       )
LN 1240 TRUELEN=PEEK(ICBLEN+
       X)+256*PEEK(ICBLEN+X
       +1)
KI 1250 RETURN
DH 1260 REM *** CIO ML DATA
       ***
LK 1270 DATA 104,104,104,170
       ,76,86,228
```

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IBM Screen Swapping

Paul W. Carlson

If you've ever needed to temporarily store a graphics screen for later recall in a program, or load screens from disk and flash them on the monitor whenever you want, this article shows you how. The programs work on any IBM PC with color/graphics adapter and BASICA or Enhanced Model PCjr with Cartridge BASIC.

You can achieve many interesting effects, including animation, by rapidly switching between several graphics screens stored in memory. Unfortunately, this capability isn't a standard feature on the IBM PC. With help from two very short machine language subroutines, however, you can write programs that swap screens almost instantly. The subroutines copy the video bitmap to or from an array in about five thousandths of a second, much too fast for the eye to see. In fact, this is even faster than the video monitor can display a frame, so the effect is truly instantaneous.

To get started, type in Program 1 below. It creates two files, SCRNARRY.BAS and ARRYSCRN.BAS, which contain the two machine language subroutines. The first routine copies the video bitmap to an array, and the second copies the contents of an array to the video bitmap. The routines achieve their speed by treating the bitmap as a continuous string of 16,192 bytes.

For an example of how to use these routines in your own programs, type in Program 2 and save it on the same disk with SCRNARRY.BAS and ARRYSCRN.BAS. Before running Program 2, make sure the disk is in the active drive; it accesses the two routines as it runs. After typing RUN, don't press any keys until you want to halt the program.

You should see three multicolored spirals drawn on the screen. The first two disappear as soon as they're completed, and the third seems to rotate. The rotation, of course, is an illusion. Here's what happens: In the split-second between the time the first two spirals are completed and then erased, each screen is copied into an array by SCRNARRY.BAS. The third spiral is also copied into an array. Finally, the contents of all three arrays are repeatedly copied to the screen by ARRYSCRN.BAS to get the rotating effect. Actually, the program requires a time-delay loop to keep the screen-flipping from happening *too* fast.

See the figure below for an explanation of Program 2.

Computerized Slide Show

You can load a graphics screen from disk directly into an array the same way Program 2 loads the machine language into arrays. Why would you want to do this? Suppose you had saved graphics screens from three different programs on disk using statements such as this:

```
DEF SEG=&HB800:BSAVE"filename"
  ,0,16192
```

with filenames of PIC1, PIC2, and PIC3. You could then use Program 3 to display a "slide show" of your creations.

Explanation of Program 2

Line	Description
20,30	Loads the machine language subroutines into the STOA and ATOS arrays.
40–140	Draws and paints three spirals, each one with the colors shifted.
150	GETSCRN is the entry point for the subroutine that copies the screen to an array. *Important:* No new simple variables can be assigned from the point GETSCRN is computed to the point it is used in a CALL statement. Assigning simple variables causes array addresses to move.
160–200	Copies the screen to array SCRN1, SCRN2, or SCRN3 after each spiral is complete.
210	PUTSCRN is the entry point for the subroutine that copies an array to the screen. The same note for line 150 applies here also.
220–250	Repeatedly copies the arrays SCRN1, SCRN2, and SCRN3 to the screen until a key is pressed.

This interesting program displays one screen while loading another. Pressing the space bar (after giving the next screen time to load) displays the next picture. The program could be extended to accommodate any number of screens, even prompting you to change disks if necessary. It needs only one array to store the screens no matter how many you want to display, since it stores only one screen at any moment.

Notice that the statement LA=0 in line 10 of Program 3 prevents the address of the ATOS array from changing after it is assigned a value for PUTSCRN in line 30. (See the note for line 150 in the breakdown of Program 2.)

Programs 4 and 5 show the source code for the SCRNARRY and ARRYSCRN subroutines. They aren't required for use with Programs 1–3; they're listed so machine language programmers can observe the techniques involved. An assembler is required to enter these listings.

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

Program 1: Screen Swapping Routines

```
GH 10 DIM M(7),J(6):DEF SEG
FK 20 FOR N=0 TO 26:READ B
NI 30 POKE VARPTR(M(0))+N,B:NEXT
QO 40 BSAVE"SCRNARRY",VARPTR(M(0
      )),27
BN 50 FOR N=0 TO 22:READ B
KL 60 POKE VARPTR(J(0))+N,B:NEXT
BI 70 BSAVE"ARRYSCRN",VARPTR(J(0
      )),23:END
KE 80 DATA 6,30,7,30,139,236,184
      ,0
PD 90 DATA 184,142,216,185,160,3
      1,51,246
DH 100 DATA 139,126,8,252,243,16
       5,31,7
KN 110 DATA 202,2,0,6,139,236,18
       4,0
KF 120 DATA 184,142,192,185,160,
       31,51,255
DE 130 DATA 139,118,6,252,243,16
       5,7,202
BP 140 DATA 2,0
```

Program 2: Spiral Demo

```
MK 10 DIM SCRN1(4048),SCRN2(4048
      ),SCRN3(4048),STOA(7),ATOS
      (6)
GJ 20 DEF SEG:BLOAD"SCRNARRY",VA
      RPTR(STOA(0))
MK 30 BLOAD"ARRYSCRN",VARPTR(ATO
      S(0))
HJ 40 KEY OFF:SCREEN 1:COLOR 0,0
FJ 50 FOR C=1 TO 3:W=C:CLS
NM 60 TP=6.283185:F=80/TP:DA=TP/
      9:DB=TP/20:A=0
PM 70 FOR I=1 TO 9:B=0:A=A+DA:PS
      ET(160,100)
GJ 80 FOR J=1 TO 20:B=B+DB:R=F*B
LN 90 X=160+1.2*R*SIN(A+B):Y=100
      +R*COS(A+B)
LD 100 LINE -(X,Y),3:NEXT J,I
JK 110 CIRCLE(160,100),96,3:A=DA
       /2
PM 120 FOR I=1 TO 9:A=A+DA
FL 130 X=160+1.18*R*SIN(A):Y=100
       +.96*R*COS(A)
FA 140 C=C MOD 3+1:PAINT(X,Y),C,
       3:NEXT I
FN 150 GETSCRN=VARPTR(STOA(0))
GD 160 ON W GOTO 170,180,190
LC 170 CALL GETSCRN(SCRN1(0)):GO
       TO 200
NK 180 CALL GETSCRN(SCRN2(0)):GO
       TO 200
EC 190 CALL GETSCRN(SCRN3(0))
JM 200 NEXT C
BJ 210 PUTSCRN=VARPTR(ATOS(0))
NB 220 CALL PUTSCRN(SCRN1(0)):FO
       R J=0 TO 100:NEXT
PJ 230 CALL PUTSCRN(SCRN2(0)):FO
       R J=0 TO 100:NEXT
AB 240 CALL PUTSCRN(SCRN3(0)):FO
       R J=0 TO 100:NEXT
ME 250 IF INKEY$="" THEN 220
MO 260 CLS:SCREEN 0:WIDTH 80:KEY
       ON:END
```

Program 3: Slide Show Demo

```
FE 10 DIM SCRN(4048),ATOS(6):LA=
      0
HP 20 DEF SEG:BLOAD"ARRYSCRN",VA
      RPTR(ATOS(0))
DD 30 PUTSCRN=VARPTR(ATOS(0)):LA
      =VARPTR(SCRN(0))
NA 40 BLOAD"PIC1",LA
FD 50 KEY OFF:CLS:SCREEN 1:COLOR
       0,1
AB 60 CALL PUTSCRN(SCRN(0)):BLOA
      D"PIC2",LA
GB 70 IF INKEY$<>" " THEN 70
CG 80 CALL PUTSCRN(SCRN(0)):BLOA
      D"PIC3",LA
JD 90 IF INKEY$<>" " THEN 90
DG 100 CALL PUTSCRN(SCRN(0))
LI 110 IF INKEY$<>" " THEN 110
LF 120 CLS:SCREEN 0:WIDTH 80:KEY
       ON:END
```

Program 4: SCRNARRY Source Code

Note: This source code is provided for information only. It is not required for Programs 1–3. An assembler is required to enter this listing.

```
;  This subroutine copies 16192 bytes from the video display
;  into a BASIC array.
;
CSEG    SEGMENT
STOA    PROC    FAR
        ASSUME CS:CSEG
        PUSH    ES              ;Save extra segment
        PUSH    DS              ;Set the extra segment
        POP     ES              ;     eqaul to the data segment
        PUSH    DS              ;Save the data segment
        MOV     BP,SP           ;Make BP point to the stack
        MOV     AX,0B800H       ;Set data segment to beginning
        MOV     DS,AX           ;    of video RAM.
        MOV     CX,8096         ;Initialize move counter
        XOR     SI,SI           ;Initialize source index
        MOV     DI,8[BP]        ;Init. dest. index to array offset
        CLD                     ;Set direction flag
REP     MOVSW                   ;Move the display to the array
        POP     DS              ;Restore the data segment
        POP     ES              ;Restore the extra segment
        RET     2               ;Clean up the stack
STOA    ENDP
CSEG    ENDS
        END
```

Program 5: ARRYSCRN Source Code

Note: This source code is provided for information only. It is not required for Programs 1–3. An assembler is required to enter this listing.

```
;  This subroutine copies 16192 bytes from a BASIC array
;  to the video display.
;
CSEG    SEGMENT
ATOS    PROC    FAR
        ASSUME CS:CSEG
        PUSH    ES              ;Save extra segment
        MOV     BP,SP           ;Make BP point to stack
        MOV     AX,0B800H       ;Set extra segment to beginning
        MOV     ES,AX           ;    of video RAM.
        MOV     CX,8096         ;Initialize move counter
        XOR     DI,DI           ;Initialize destination index
        MOV     SI,6[BP]        ;Init. source index to array offset
        CLD                     ;Set direction flag
REP     MOVSW                   ;Move the array to the screen
        POP     ES              ;Restore extra segment
        RET     2               ;Clean up stack
ATOS    ENDP
CSEG    ENDS
        END
```

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Speedy Strings For Commodore

Tibor Friedman

Here's a fast machine language routine that lets you load large amounts of data into memory very quickly. You can use it without knowing anything about machine language, and the demonstration programs include two handy disk utilities. A disk drive is required, and a printer is optional.

In Commodore BASIC, the conventional ways to retrieve information from a disk are the GET# or INPUT# commands. Though GET# is the more flexible of the two, INPUT# is much faster, since it pulls in an entire string at once rather than reading one character at a time. Even with INPUT#, however, reading large files from BASIC can be a slow and tedious process.

"Speedy Strings" offers a faster alternative which you may find useful in a variety of applications. Here's the idea: First, you create a string array in memory, making every individual array element the same length. Then you load the array data from disk with a fast machine language (ML) routine, putting it directly into the already-established array elements. Don't worry if that sounds a bit confusing—the examples show you how much time the technique can save. And you don't need to understand machine language to use the routine in your own programs.

Type in and save Programs 1, 2, and 3 on disk before doing anything else. Then load and run Program 1, which demonstrates the speed difference between ordinary string retrieval and the Speedy Strings technique. The program begins by creating a 600-element string array and filling each element with a string that consists of 20 spaces (lines 100–120). Then it POKEs the ML routine into memory (line 130) and creates a disk file of string data (line 140). Then the program calls a subroutine that retrieves the data from disk and stores it in the string array using INPUT# statements within a conventional FOR-NEXT loop. After displaying the time elapsed during that operation, it retrieves the data using the Speedy Strings technique. As you'll see, the second method is considerably faster.

Before you can call the ML routine to load the data from disk, you must have created a string array in memory to receive the data. And the array elements must all be of equal length so the ML routine knows where to put each piece of data. When creating the array, you must make sure that every string begins with a space (character code 32) as shown in line 120 of Program 1. Otherwise the ML routine won't work properly.

Fast Disk Menu

Program 2, "Fast Disk Menu," demonstrates a practical application of this technique. Even if you're not interested in the technique itself, you may find this a valuable addition to your program library. It lets you quickly scan the directory of a disk, sort it alphabetically if you like, and quickly load any program shown on the screen.

When you run Fast Disk Menu, it reads the directory of the current disk and displays a screenful of information in much the same format as if you had entered LOAD "$0",8 followed by LIST. Each program is listed by name, with the familiar PRG, SEQ, or REL type indicator at the right. Non-PRG files are highlighted in a different color. At the left of each filename is a number. If the disk contains more programs than the screen can hold, you can press the space bar to view the rest of the directory.

To load and run a program from the directory, simply press the f1 key and enter the number of the program you want to run. It automatically loads and runs, replacing Fast Disk Menu in memory (note that this works only for conventional BASIC programs that you can start with LOAD and RUN). You can also dump the directory on a printer by pressing f5. Before doing this, you may want to sort the filenames into alphabetical order by pressing f3.

In its present form, Fast Disk Menu POKEs the ML code into memory every time you run it. By making some slight modifications, you can resave the program with the ML routine "pasted onto" the end of the BASIC program itself. The routine beginning at line 620 does most of the work for you. Execute this routine by typing GOTO 630 and pressing RETURN. Replace line 120 with 120 QQ=(PEEK(45)+256*PEEK(46)−73). Then delete every line from 560 to the end of the program and resave it as you would any other BASIC program. When you reload and run the program, it already includes the ML routine.

Fast Disk Catalog

Program 3 uses the same technique to speed up the process of cataloging a number of disk directories. It catalogs and alphabetizes as many as 600 filenames for you and prints the results on a printer, aligning all the information into three neat columns.

When you first run Program 3, it indicates that 600 records are available for storing directory information. To read a disk directory, simply place a disk in the drive and press R. Afterward, the program shows how many records are still available for storage; how many files have been recorded in total; how many files were found on the disk; and the disk ID.

You can continue this process, inserting new disks and pressing R to read their directories, as long as the display shows there is record space available (or until you run out of disks). If you need more than 600 entries, increase the value of MM in line 40. Be sure you have enough space allocated, since attempting to add entries when no more space is available will crash the program.

Once you've read as many directories as you want, press Q to exit this portion of the program and proceed to the next. Just as in Program 2, the filenames are displayed on the screen with non-PRG names highlighted in a different color. If the screen cannot hold all the filenames you've recorded, press the space bar to view the next screenful of names.

At this point you can print out the disk directory. Before doing so, you may want to press the f5 key to alphabetize the master directory. Then press f1 to dump the directory on a printer. The master catalog is printed in three columns, with the first column indented a few spaces so you can insert the printout in a three-ring binder.

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

Program 1: Speedy Strings Demonstration

```
100 MM=600:REM MAX. MEMORY
                              :rem 9
110 DIMF$(MM):PRINT"{CLR} SETT
    ING UP STRINGS IN BASIC"
                              :rem 69
120 FORI=0TOMM:F$(I)=CHR$(32)+
    "{19 SPACES}":NEXT:REM* 19
     SPACES=LEN 20     :rem 118
130 GOSUB600:REM LOAD ML
                              :rem 129
140 GOSUB300:REM CREATE A FILE
     OF STRINGS ON DISK:rem 98
150 GOSUB400:REM CONVENTIONAL
    {SPACE}RETRIEVAL AND TIME
                              :rem 8
160 GOSUB200:REM SPEEDY STRING
     METHOD               :rem 41
170 END                   :rem 111
200 PRINT"{2 DOWN} SPEEDY RETR
    IEVAL"                :rem 253
210 TI$="000000":OPEN15,8,15:O
    PEN1,8,0,"0:TEST 0,S,R":SY
    S(832):CLOSE1:CLOSE15
                          :rem 127
220 C=PEEK(980)+256*PEEK(981)
                           :rem 53
230 T$=TI$                 :rem 11
240 FORI=0TOC-1:PRINTI;F$(I):N
    EXT                    :rem 63
250 PRINT,MID$(T$,3,2)":"RIGHT
    $(T$,2)                :rem 27
260 RETURN                :rem 120
290 REM CREATE FILE       :rem 83
300 PRINT"{2 DOWN}CREATING A T
    EST FILE AND SAVING TO DIS
    K"                     :rem 221
310 FORI=0TOMM:F$(I)="*1234567
    890123456789":NEXT:REM * 2
    0 CHARACTERS           :rem 68
320 OPEN2,8,2,"@0:TEST 0,S,W"
                           :rem 71
330 FORI=0TOMM:PRINT#2,F$(I):N
    EXT:CLOSE2:RETURN      :rem 49
400 PRINT"{2 DOWN} CONVENTIONA
    L RETRIEVAL"           :rem 197
410 TI$="000000":OPEN15,8,15:O
    PEN2,8,0,"0:TEST 0,S,R":C=
    0                      :rem 78
420 IFST=64THEN440         :rem 58
430 INPUT#2,F$(C):C=C+1:GOTO42
    0                       :rem 8
440 CLOSE2:CLOSE15:T$=TI$
                            :rem 6
450 FORI=0TOC-1:PRINTI;F$(I):N
    EXT                    :rem 66
460 PRINT,MID$(T$,3,2)":"RIGHT
    $(T$,2)                :rem 30
480 RETURN                :rem 124
590 REM *M/L STRING UPLOAD*
    {2 SPACES}RELOCATABLE/*SET
     # OF CHARACTERS IN STRING
    *                      :rem 205
600 PRINT"{2 DOWN} LOADING ML"
                           :rem 32
610 AD=832:FORI=0TO79:READD:PO
    KEI+AD,D:NEXT:RETURN
                          :rem 223
620 DATA169,255,141,212,3,141,
    213,3,165,55           :rem 61
630 DATA133,252,165,56,133,253
    ,162,1,32,198,255      :rem 64
640 DATA174,212,3,232,142,212,
    3,208,3,238,213,3,216,56,1
    65,252,233             :rem 210
650 DATA21:REM STRING LEN+1
                           :rem 72
660 DATA133,252,176,5,166,253,
    202,134,253,32,207,255
                           :rem 52
670 DATA164,144,208,18,201,13,
    240,245,160,0,145,252,200,
    192                    :rem 122
680 DATA20:REM STRING LEN
                          :rem 238
690 DATA240,209,32,207,255,208
    ,244,32,204,255,96,0,0,0
                          :rem 138
```

Program 2: Fast Disk Menu

```
100 POKE53280,6:POKE53281,6
                          :rem 242
110 PRINTCHR$(14)CHR$(8):PRINT
    "{CLR}{BLK}{10 DOWN}{YEL}"
    SPC(12)"FAST DISK MENU
                          :rem 160
120 REM{2 SPACES}QQ=PEEK(45)+2
    56*PEEK(46)-73        :rem 158
130 GOSUB570:QQ=AD        :rem 78
140 DIMF$(120):FORI=0TO120
                          :rem 202
150 F$(I)=CHR$(32)+"
    {20 SPACES}":NEXT:Y$=CHR$(
    34):Z$=CHR$(190)       :rem 4
160 OPEN1,8,0,"$":SYSQQ:CLOSE1
                           :rem 10
170 C=PEEK(0):A=1         :rem 167
180 IFA=>CTHENA=1          :rem 5
190 PRINT"{CLR}{DOWN}
    {7 SPACES}{RVS}{8}"Y$LEFT$
    (F$(0),16)Y$"{3 SPACES}"MI
    D$(F$(0),18,2)         :rem 69
200 PRINT:FORI=ATOA+8:IFI=>CTH
    ENPRINT:GOTO270        :rem 230
210 IFLEFT$(F$(I),1)=Z$THENE=2
    :GOTO230               :rem 201
220 E=1:IFMID$(F$(I),18,3)<>"P
    RG"THENE=2:F$(I)=Z$+LEFT$(
    F$(I),20)              :rem 55
230 IFE=2THENPOKE646,3:GOTO250
                           :rem 63
240 POKE646,7             :rem 200
250 PRINTTAB(5)I;Y$MID$(F$(I),
    E,16)Y$;               :rem 145
260 PRINT"{3 SPACES}"MID$(F$(I
    ),17+E,3)              :rem 31
270 PRINT:NEXT            :rem 159
280 PRINT"{DOWN}{8}{5 SPACES}F
    1-LOAD{3 SPACES}F3-SORT
    {3 SPACES}F5-PRINT":POKE19
    8,0:WAIT198,1          :rem 211
290 IFPEEK(197)=4THEN340
                          :rem 120
300 IFPEEK(197)=5THEN390
                          :rem 118
310 IFPEEK(197)=6THEN460
                          :rem 118
320 IFPEEK(197)=60THENA=A+9:GO
    TO180                 :rem 60
330 PRINT"{3 UP}":GOTO280
                          :rem 39
340 INPUT"{DOWN}{5 SPACES}PROG
    RAM #";N$:N=VAL(N$):IFN<10
    RN>CTHEN190           :rem 12
350 F$=LEFT$(F$(N),16):rem 123
360 IFRIGHT$(F$,1)=" "THENF$=L
    EFT$(F$,LEN(F$)-1):GOTO360
                          :rem 115
370 PRINT"{CLR}LOAD"Y$F$Y$",8
                           :rem 8
380 POKE631,19:POKE632,13:POKE
    633,82:POKE634,117:POKE635
    ,13:POKE198,5:END      :rem 8
390 PRINT"{CLR}{5 DOWN}
    {8 SPACES}S{2 SPACES}O
    {2 SPACES}R{2 SPACES}T
    {2 SPACES}I{2 SPACES}N
    {2 SPACES}G           :rem 217
400 FORI=1TOC-2:IFF$(I)<F$(I+1
    )THEN450              :rem 168
410 Q$=F$(I+1)            :rem 167
420 FORJ=ITO1STEP-1:IFF$(J)<Q$
```

```
    THENF$(J+1)=Q$:GOTO450
                          :rem 136
430 F$(J+1)=F$(J):NEXT:rem 179
440 F$(1)=Q$              :rem 54
450 NEXTI:A=1:GOTO190     :rem 23
460 PRINT"{CLR} {DOWN}IS PRINT
    ER ON?":POKE198,0:WAIT198,
    1:GETMT$:IFMT$<>"Y"THEN190
                          :rem 77
470 OPEN4,4,7             :rem 196
480 PRINT#4,Y$LEFT$(F$(0),16)Y
    $"{3 SPACES}"MID$(F$(0),18
    ,2):PRINT#4,CHR$(20)CHR$(1
    5);                   :rem 38
490 U=C-1:V=INT(U/3)+1:rem 236
500 FORI=1TOV:FORJ=0TO3:Q=I+J*
    V:IFQ>UTHEN530        :rem 84
510 E=1:IFLEFT$(F$(Q),1)=Z$THE
    NE=2                  :rem 185
520 PRINT#4,Y$MID$(F$(Q),E,16)
    Y$;:IFE=2THENPRINT#4,Z$;
                          :rem 176
530 PRINT#4,"{5 SPACES}";:NEXT
    :PRINT#4              :rem 190
540 NEXT:CLOSE4:A=1:GOTO190
                          :rem 178
550 END                   :rem 113
560 REM LOAD ML           :rem 56
570 AD=830:FORI=0TO72:READD:PO
    KEI+AD,D:NEXT:RETURN
                          :rem 219
580 DATA169,255,133,0,165,55,1
    33,71,165,56,133,72,162,1,
    32,198,255,166,0,232
                          :rem 219
590 DATA134,0,216,56,165,71,23
    3,22,133,71,176,5,166,72,2
    02,134,72,32,207,255
                          :rem 207
600 DATA164,144,208,22,201,34,
    208,245,160,0,32,207,255,2
    01,34,240,249,145,71
                          :rem 187
610 DATA200,192,21,208,242,240
    ,207,32,204,255,96,0,0,0
                          :rem 117
620 REM *TO TACK M/L TO END OF
     THE PRGR.{8 SPACES}*
    {2 SPACES}FIRST: RUN 630
    {2 SPACES}*           :rem 49
630 POKE45,((PEEK(45)+73)AND25
    5):POKE46,PEEK(46)-(PEEK(4
    5)<72)                :rem 195
640 POKE47,PEEK(45):POKE48,PEE
    K(46):POKE49,PEEK(45):POKE
    50,PEEK(46)           :rem 219
650 AD=PEEK(45)+256*PEEK(46)-7
     3:RESTORE            :rem 3
660 FORI=0TO72:READD:POKEI+AD,
    D:NEXT                :rem 42
```

Program 3: Fast Disk Catalog

```
 10 POKE56,PEEK(56)-1:CLR:POKE5
    3281,6:POKE53280,6    :rem 28
 20 PRINTCHR$(14)CHR$(8):PRINT"
    {CLR}{8 DOWN}","{CYN} FAST
    {SPACE}DISK CATALOG":rem 57
 25 PRINT,"{8 DOWN}"TAB(14)"PLE
    ASE WAIT":GOSUB1010:rem 168
 30 A$="{DOWN}{CYN}{2 SPACES}
    {RVS}R{OFF}EAD A DISK OR
    {RVS}Q{OFF}UIT":X$="{UP}
    {24 SPACES}{2 UP}" :rem 151
 40 MM=600:REM MAX. MEM.-UP TO
    {SPACE}16000          :rem 124
 50 DIMF$(MM):A=0:EA=PEEK(45)+2
    56*PEEK(46):AD=EA-373
                          :rem 118
 60 FORI=0TOMM:F$(I)=CHR$(32)+"
    {20 SPACES}":NEXT     :rem 90
 70 PRINT,"{CLR}",,"{RVS}ROOM F
    OR"MM"{LEFT} RECORDS
                          :rem 180
 75 PRINT"{YEL}{2 @}ID{5 @}#COU
    NT{5 @}TOTAL{3 @}AVAIL.SPAC
    E{@}                  :rem 61
 80 PRINTA$:POKE198,0:WAIT198,1
    :IFPEEK(197)=62THEN130
                          :rem 119
 82 IFPEEK(197)<>17THENPRINTX$:
    GOTO80                :rem 5
 85 PRINT"{UP}{5 SPACES}READING
    {9 SPACES}"           :rem 73
 90 OPEN15,8,15,"I0"      :rem 190
100 OPEN1,8,0,"$0":SYS(AD):CLO
    SE1:CLOSE15           :rem 126
110 C=PEEK(980)+256*PEEK(981)
                          :rem 51
120 PRINTX$:PRINT"{CYN}
    {2 SPACES}"RIGHT$(F$(C-1),
    2),C-B,C,MM-C:B=C:AD=EA-35
    7:GOTO80              :rem 155
130 IFA=>CTHENA=.:IFC=ATHENPOK
    E198,0:END            :rem 244
140 PRINT"{CLR}":FORI=ATOA+16:
    IFI>=CTHENPRINT:GOTO149
                          :rem 244
143 PRINTTAB(5)"{CYN}";:IFMID$
    (F$(I),18,1)<>"P"THENPRINT
    "{YEL}";              :rem 149
145 PRINTCHR$(34)LEFT$(F$(I),1
    6)CHR$(34);           :rem 11
147 IFMID$(F$(I),18,1)<>"P"THE
    NPRINTTAB(25)MID$(F$(I),18
    ,2);                  :rem 74
148 PRINTTAB(31)RIGHT$(F$(I),2
    )                     :rem 11
149 NEXT                  :rem 221
150 PRINT,"{3 DOWN}{RVS}F5
    {OFF}-SORT{3 SPACES}{RVS}F
    1{OFF}-PRINT":POKE198,0:WA
    IT198,1               :rem 132
160 IFPEEK(197)=6ANDFL=0THEN19
    0                     :rem 75
170 IFPEEK(197)=4THEN260
                          :rem 118
180 A=A+17:GOTO130        :rem 242
190 FL=1:PRINT"{CLR}"SPC(250)"
    S{2 SPACES}O{2 SPACES}R
    {2 SPACES}T{2 SPACES}I
    {2 SPACES}N{2 SPACES}G
                          :rem 206
200 POKE987,70:POKE988,0:SYS(E
    A-261)                :rem 64
220 A=0:GOTO140           :rem 74
260 PRINT"{CLR} {CYN}{RVS}
    {2 SPACES}IS THE PRINTER O
    N?":POKE198,0:WAIT198,1
                          :rem 127
270 OPEN4,4,7             :rem 194
280 PRINT#4,"{5 SPACES}C A T A
     L O G":PRINT#4,CHR$(20)CH
    R$(15);               :rem 90
290 U=C:V=INT(U/3)+1      :rem 140
300 FORI=1TOV:FORJ=0TO3:Q=I+J*
    V                     :rem 222
305 IFQ>UORLEFT$(F$(Q),1)=" "T
    HEN320                :rem 250
310 PRINT#4,CHR$(34)LEFT$(F$(Q
    ),16)CHR$(34)" "RIGHT$(F$(
    Q),2)"{3 SPACES}";:rem 117
320 NEXT:PRINT#4          :rem 242
330 NEXT:PRINT#4:CLOSE4:A=.:GO
    TO140                 :rem 197
1000 REM ML LOADER        :rem 245
1010 AA=832:FORI=0TO110:READD:
     POKEAA+I,D:NEXT      :rem 12
1020 AD=PEEK(55)+256*PEEK(56)
                          :rem 56
1030 FORI=0TO255:READD:POKEAD+
     I,D:NEXT:RETURN      :rem 159
1040 REM{2 SPACES}*READ DISK*
                          :rem 68
1050 DATA169,0,141,212,3,141,2
     13,3,165,55,133,252,165,5
     6,133,253,234,162,1,32
                          :rem 231
1060 DATA198,255,160,26,32,207
     ,255,136,208,250,32,207,2
     55,133,254,32,207,255
                          :rem 213
1070 DATA133,255,32,207,255,16
     4,144,208,60,201,34,208,2
     45,174,212,3,232,142,212
                          :rem 81
1080 DATA3,208,3,238,213,3,216
     ,56,165,252,233,22,133,25
     2,176,5,166,253,202,134
                          :rem 40
1090 DATA253,160,0,32,207,255,
     201,34,240,249,145,252,20
     0,192,19,208,242 :rem 203
1100 DATA165,254,145,252,200,1
     65,255,145,252,192,0,208,
     189,32,204,255,96 :rem 17
1110 REM *SORT*           :rem 67
1120 DATA173,219,3,41,127,141,
     219,3,173,220        :rem 103
1130 DATA3,9,128,141,220,3,165
     ,47,133,254,165  :rem 208
1140 DATA48,133,255,160,0,177,
     254,205,219,3,208,8,200,1
     77,254,205,220,3,240,30
                          :rem 31
1150 DATA160,2,177,254,141,216
     ,3,200,177,254,141,217,3,
     24,165,254,109,216,3,133
                          :rem 83
1160 DATA254,165,255,109,217,3
     ,133,255,144,209,24,165,2
     54,105,7,141,216,3,165
                          :rem 3
1170 DATA255,105,0,141,217,3,5
     6,173,212,3,233,1,141,212
     ,3,173,213,3,233,0,141
                          :rem 207
1180 DATA213,3,174,213,3,208,7
     ,173,212,3,201,0,240,23,1
     73,216,3,133,254,173,217
                          :rem 66
1190 DATA3,133,255,169,0,141,2
     18,3,141,214,3,141,215,3,
     240,19,32,95,229,96,208
                          :rem 41
1200 DATA198,24,165,254,105,3,
     133,254,165,255,105,0,133
     ,255,160,1,177,254,133
                          :rem 249
1210 DATA218,200,177,254,133,2
     19,200,200,177,254,133,22
     8,200,177,254,133,229
                          :rem 201
1220 DATA160,0,177,218,209,228
     ,240,4,144,36,176,7,200,1
     92,16,240,29,144,239,160
                          :rem 96
1230 DATA1,165,228,145,254,200
     ,165,229,145,254,200,200,
     165,218,145,254,200,165
                          :rem 40
1240 DATA219,145,254,169,1,141
     ,218,3,238,214,3,208,3,23
     8,215,3,173,214,3,205
                          :rem 195
1250 DATA212,3,208,159,173,215
     ,3,205,213,3,208,151,174,
     218,3,240,140,208,142
                          :rem 184
```

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Introduction To AmigaDOS Part 2

Charles Brannon, Program Editor

Last month, Part 1 covered the conventions of AmigaDOS and explained its most useful commands. This month's article wraps up the reference guide to AmigaDOS's interactive commands. A future article will cover the use of batch files and batch programming in AmigaDOS.

After working with the powerful AmigaDOS commands covered last month, you may decide that you prefer working with the AmigaDOS Command Line Interface (CLI) instead of the Workbench. If so, you may want to do away with the Workbench altogether. It wastes time and memory to load the Workbench every session merely to open a CLI if all you want to use is AmigaDOS anyway.

Fortunately, it's fairly simple to create an AmigaDOS-only disk. This disk can be used whenever the system asks for a Workbench disk. You probably won't want to modify your original Workbench disk, however; it's better to modify a copy of it and set aside the original for safekeeping. You can make several copies of your AmigaDOS disk for future use, if you want. Just follow these steps:

A Custom DOS Disk

1. Open the System drawer on the Workbench disk. If you don't see the CLI icon—a small cube labeled with a 1> symbol—run Preferences. (Otherwise continue to step 2.) One of the settings on the first Preferences screen is labeled CLI [ON] [OFF]. Click it ON, then click on the Save box to save the change to disk. Return to the Workbench and reopen the System folder. You should now see the CLI icon.

2. Double-click on the CLI icon. A window titled "New CLI Window" appears. Click inside the window to make the CLI active.

3. At the 1> prompt, type ED S/Startup-Sequence and press RETURN. This loads a program called ED, a full-screen editor, and loads the file Startup-Sequence from the S subdirectory. Startup-Sequence is the batch file that makes AmigaDOS automatically start the Workbench when you boot the Workbench disk. After ED starts, you should see something like this on the screen:

```
ECHO "WorkBench Disk. Version 1.00"
ECHO " "
ECHO "Use Preferences tool to set date"
ECHO " "
LoadWb
endcli > nil:
```

These are the batch file commands that AmigaDOS executes each time you boot up the Workbench disk. The ECHO commands are similar to PRINT statements in BASIC; they merely display messages on the screen. It's the last two commands in this file that we're interested in changing.

4. Using the cursor keys, move the cursor to the line with the LoadWb command and press CTRL-B twice to erase the last two lines. The batch file should now consist of the four ECHO commands only. If you wish, you can change the text in the ECHO commands to give your boot disk that "personal touch."

5. Press the ESC key. An asterisk prompt (*) appears at the bottom of the screen. Type X at this prompt and press RETURN. This exits the ED program and saves the new Startup-Sequence file to disk. If you've made a mistake and would like to start over, press ESC-Q to quit the editor without changing the file.

6. After the disk busy light goes off, simultaneously press CTRL and both Amiga keys on each side of the space bar to reboot the system. This time, and from now on whenever you boot with this disk, AmigaDOS ends up in memory instead of the Workbench.

The Workbench Option

To conserve space on your new AmigaDOS disk, you may want to erase some files used by the Workbench, such as the LOADWB command in the C subdirectory, the Notepad, the clock, and all .INFO files. However, it's convenient to have the Workbench available when you need it. You could use the editor to create another batch file that includes LOADWB and ENDCLI > NIL:. You would then type EXECUTE WB at a CLI prompt to bring up the Workbench (assuming you named the batch file WB by typing ED WB to create the batch file). ED is useful for creating all kinds of simple batch files, in fact. We'll examine the editor in more detail in a future article on batch file programming.

Last month's article presented a tutorial on AmigaDOS along with a reference of the most often-used commands. Following is a reference to additional commands that, although useful, are not likely to be used casually. This list excludes commands such as ECHO that are

really useful only in batch files.

When experimenting with AmigaDOS commands, it's safest to use a copy of your DOS disk in case you accidentally erase a file or even the entire disk.

Advanced AmigaDOS Commands

< and > (Input/output redirection.) These symbols redirect the normal input/output flow of a command. For example, a program that normally accepts input from the keyboard and prints its output on the screen could be coerced into accepting input from a file or to send its output to the printer. The < and > symbols are used to point in the direction that I/O should flow; the less-than sign (<) redirects input, and the greater-than sign (>) redirects output. When using < to redirect input, you may need to use a question mark for the parameter that the redirection file is replacing.

Examples:

```
DIR > DIRFILE
```

This redirection of the DIR command sends the disk directory to the file DIRFILE instead of to the screen. To confirm this, you can enter TYPE DIRFILE to display the contents of DIRFILE.

```
STACK < BASIC.STACK ?
```

The stack command normally accepts a command line parameter. Here, a file (BASIC.STACK) containing the number 8000 can be substituted. In order for the file to replace the command line parameter, you must use a question mark to hold that parameter's position.

FILENOTE This command attaches a comment to a file. Although AmigaDOS's 30-character filenames let you be quite descriptive, an optional FILENOTE lets you attach an additional 80-character comment to a file. This comment is displayed beneath the filename when you use the LIST (not DIR) command. Follow FILENOTE with the name of the file you're describing, then the comment. You must enclose the comment in quotes if it includes spaces. The FILENOTE command also lets you include two optional keywords, FILE and COMMENT, presumably for the sake of readability.

Files have no comment by default. The comment is retained if the file is changed or overwritten. However, if you copy a file, its filenote does not get copied with it.

Examples:

```
FILENOTE waver.bas "Program lets you
  create sound waves."
```

After you attach this comment to the file waver.bas, LIST waver.bas yields this result:

```
waver.bas 2272 rwed 11-Oct-85 10:09:53
: Program lets you create sound waves
```

Second example:

```
FILENOTE FILE waver.bas COMMENT
  "Program lets you create sound
waves."
```

This is identical to the first example, except for the optional keywords FILE and COMMENT.

INFO This command shows a disk report. INFO displays the size of each mounted drive (normally 880K, except for the RAM disk), the number of sectors used, number of sectors free, percentage of capacity used, number of disk errors that have occurred, the read/write status, and the disk's name. INFO also separately displays the names of the currently inserted disks. INFO has no additional parameters. Use LIST to display information about a particular file or directory.

INSTALL This command makes a disk bootable. In other words, an INSTALLed disk can be inserted at the Workbench prompt to bring up the system. Just follow INSTALL with the optional keyword DRIVE and the drive number. If you want to be able to execute AmigaDOS commands after booting, you must copy the C subdirectory from your master disk onto the copy. (All AmigaDOS commands are extrinsic and contained in the C subdirectory.)

Example:

```
INSTALL DRIVE DF1:
```

This makes the disk currently mounted in the external drive bootable.

JOIN This command combines two or more files. Follow JOIN with up to ten filenames separated by spaces. The destination file, holding the conglomerate, is specified with the keyword AS. The original files are unchanged.

Example:

```
JOIN Checks/Oct Checks/Nov Checks/
  Dec AS "Checks/4th Quarter"
```

This combines the files Oct, Nov, and Dec from the subdirectory Checks into a single file called "4th Quarter" to be created in the Checks subdirectory. The destination filename is enclosed in quotes because it contains a space character.

PROMPT Defines a new CLI prompt. Follow PROMPT with a message, enclosing it in quotes if the message contains any spaces. The message is a replacement for the normal 1> or 2> prompt of AmigaDOS. You can imbed the characters %N to display the current task number.

Examples:

```
PROMPT "%N> "
```

Displays the default prompt.

```
PROMPT "Ready, Master:"
```

Displays Ready, Master: as the new AmigaDOS prompt.

SEARCH Finds text within files. This command searches for the target string through any directories you specify. Follow SEARCH with the optional keyword FROM, the pathname of the directories to be searched, the optional keyword SEARCH followed by the search string, and the optional keyword ALL, which forces SEARCH to look through all subdirectories contained in the specified directory. When SEARCH finds the target string, it displays the line containing the string as well as the line number of the line containing the string. If you're searching through a directory, SEARCH also displays the filename of each file it's searching through.

SEARCH is not case-sensitive; it matches regardless of upper- or lowercase. You can cancel the command with CTRL-C. To force SEARCH to abandon the current file and begin searching the next, press CTRL-D. During a search, you may see the message "Line xx truncated." This isn't anything to worry about; it just indicates that the line was too long to be searched, so if your search string was contained somewhere near the end of a too-long line, the search program could not find it.

Examples:

```
SEARCH FROM DF0: SEARCH LoadWb
  ALL
```

This looks for the phrase "LoadWb". The entire contents of the internal drive are searched, including all subdirectories, so this command takes a long time to finish.

```
SEARCH Progs/Tempfile LIBRARY
```

This looks for the word LIBRARY in the file Tempfile within the subdirectory Progs.

SORT This command alphabetically sorts a file you specify. Each record in the file to be sorted must end with a carriage return. Use SORT followed by the optional keyword FROM, the file to be sorted, the optional keyword TO, and the name of the file where the sorted output should be stored. SORT collates based on the entire line unless you include the keyword COLSTART and a column number. The sort comparison then starts by comparing two lines from that column to the end of the line. If that partial comparison succeeds, the first portion of the line is compared. This lets you specify two levels of sorting (see example).

Unless the file to be sorted is less than about 200 lines, increase the stack size with STACK to prevent a crash (see below). It's better to use too much stack space than too little.

Example:

If you have a list of first and last names, with the first name and initial in columns 1-19, and the last name always starting in column 20, you could use:

```
SORT FROM Route TO Sorted.Route
  COLSTART 20
```

The files are sorted by last name, and each group of identical last names is subsorted by first name.

STACK Sets the stack size. Follow STACK with the new stack size in bytes. The normal stack size is 4,000, sufficient for most commands. When using SORT, MetaComCo ABasiC, programs with lots of nested subroutines, or programs using flood-fill, you may need to increase the stack size to prevent a crash. A value from 8,000 to 10,000 is usually generous enough for these cases.

WAIT This makes AmigaDOS pause and do nothing for a span of time. Although this might seem like a dumb command, WAIT has certain advantages over walking away from the computer or simply turning the machine off. Only the current CLI is frozen; multitasked processes continue. WAIT by itself pauses for one second; you can follow WAIT with a number of seconds, followed by either SEC or SECS, and a number of minutes, followed by either MIN or MINS. You can optionally include the keyword UNTIL followed by a time of day, specified as HH:MM (as measured by the Amiga's internal clock, so make sure it's set correctly). WAIT is useful within batch files to allow time for a message to be read, or as a background task to wait until a particular time before executing another command.

Examples:

```
WAIT 10 MINS 20 SECS
```

Waits for 10 minutes, 20 seconds.

```
WAIT UNTIL 17:00
```

Waits until the current time is 5 p.m.

```
RUN WAIT 10 SECS +
DIR +
ECHO "All done."
```

Waits for ten seconds, calls a directory as a second CLI task, then prints the message "All done."

WHY This interesting command calls up an additional explanation of what caused the most recent error. When an AmigaDOS command fails, you'll usually get a terse error message. If you want a more detailed, technical description, ask WHY. However, many times WHY isn't any more helpful—it just explains in more detail why a command failed.

Example:

```
WAIT 10 SECONDS
```

AmigaDOS responds with the error message "Bad Args" because the correct notation is WAIT 10 SECS, not WAIT 10 SECONDS. If you type WHY, you get this answer:

```
Last command failed because argument
  line invalid or too long.
```

Although more descriptive, it still doesn't explain that SECS should be SECONDS—but it does point you in the right direction. ©

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Educational Software that Works

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MessageMaker 64

Erik Larsen

Create attractive, attention-grabbing displays for the Commodore 64 (or Commodore 128 in 64 mode) by choosing from eight different sets of oversize letters. The program even works with custom character sets and lets you dump the screens to a Commodore printer. It's easy to use and adds impact to virtually any BASIC application.

Have you ever wished that your Commodore 64 could display bigger screen characters? Though obviously handy for children's educational programs, jumbo characters are useful for many other purposes as well. Nearly every program starts with a title of some sort: Large letters can emphasize it. For anyone who's visually impaired, oversize characters are an invaluable aid to using and understanding computers. And if you have something to sell or trade, what better way to gain attention than by printing your message in giant script?

"MessageMaker 64" answers all of these needs by offering a set of eight different oversize character fonts, ranging from characters four times the normal size to characters that fill the entire screen. All the fonts can be used at any time, and the entire Commodore character set is available for enlargement. That includes all of the normal uppercase/graphics and lowercase/uppercase characters—alphabetic letters, numbers, punctuation, and graphics symbols—in reverse video as well as the normal form.

Using MessageMaker

The first thing to do is type in and save a copy of MessageMaker 64. Before you run the program, disable any programming aids or utilities that use the function keys (f1–f8). Since MessageMaker uses the function keys, this would only lead to conflicts.

As soon as you run MessageMaker, it blacks out the screen and waits for you to press a key. Though you don't see the familiar blinking cursor, the keyboard works as usual in most other respects. If you type A-B-C, it prints ABC on the screen. To print the heart-shaped graphics character, press SHIFT-S. You can activate reverse video with CTRL-9, turn the characters red by pressing CTRL-2, and so on. To select a new font, press one of the eight function keys as shown in the accompanying table.

The eight available fonts are described in terms of width and height. Thus, 4 × 4 characters are four times wider and four times higher than normal; 4 × 8 characters are four times wider and eight times higher. You can mix different fonts freely on the same screen. For instance, you might want to print 8 × 16 characters at the top of the screen, and 4 × 4 characters further down. Of course, the bigger the font, the fewer letters you'll be able to fit on the screen before it begins to scroll. Press CTRL-L to switch to lowercase/uppercase mode, or CTRL-U to switch to uppercase/graphics mode.

MessageMaker Function Keys

Font	Key
4 × 4	f1
4 × 8	f2 (SHIFT-f1)
4 × 16	f3
4 × 24	f4 (SHIFT-f3)
8 × 8	f5
8 × 16	f6 (SHIFT-f5)
8 × 24	f7
32 × 24	f8 (SHIFT-f7)

Note that the cursor keys move one normal character space at a time (not the width of an oversize character). If you accidentally print the wrong character, you must press CRSR-LEFT to back up to the beginning of the character, then replace it with a new one. You can create some interesting effects by printing a character, moving the cursor back near the same position, and printing the same character again.

Signs And Banners

MessageMaker lets you dump a screen to any printer that can handle Commodore graphics characters (specifically, the reverse video space character). This lets you record your screens for posterity, make signs and banners, and so on. Press CTRL-P to print the screen in normal width, or CTRL-X to print

in double-width characters. Since double width prints all the way to the margins, you may prefer this mode for signs. However, note that the symmetrical fonts (4 × 4 and 8 × 8) look squashed when printed in double width;use the taller fonts (4 × 8 and 8 × 16) to alleviate this problem.

The program works as published with the odd-numbered Commodore printers—the 1525, 801, and 803. To use the program with the even-numbered Commodore printers—the 1526 and 802—add the following new line 5:

```
5 OPEN 6,4,6:PRINT#6,CHR$(22):
  CLOSE 6
```

You also need to change the SI$=CHR$(15) in line 890 to SI$="" and the GR$=CHR$(8) in line 900 to GR$="" (in both cases, type the null string—nothing between the quotes).

MessageMaker also works with custom character sets. Of course, this assumes you have already designed the characters and stored their definitions in an appropriate memory area. Only one change is needed: Replace the value 53248 in line 30 with the memory location where your character definitions start.

Integrating MessageMaker Screens

The simplest way to add a MessageMaker screen to an existing program is with "Commodore 64 AutoPRINT," found on page 80 of the July 1985 issue of COMPUTE!. Load and run AutoPRINT, then answer the question about line increments as described in that article. Do *not* type SYS 51000 at this point. Instead, load and run MessageMaker, then create the screen you want. You can use the RETURN key as usual, since AutoPRINT is not yet active. However, you must leave enough blank screen space to enter a few direct-mode commands.

When your title screen is complete, press RUN/STOP to break out of MessageMaker, then erase the BREAK IN (line number) and READY messages. Now load the program to which you want to add the screen, and erase the SEARCHING and LOADING messages. At this point the screen should contain nothing but the screen you designed. Type SYS 51000 and press RETURN, then erase that message from the screen. Now press RETURN anywhere on the screen. AutoPRINT adds the screen to your program as a series of PRINT statements. At this time you can resave the program, renumber it, or modify it in any other way.

MessageMaker 64

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

```
10 GOSUB610                :rem 120
20 PRINT"{CLR}{DOWN}{BLU}";:PO
   KE53281,0:POKE53280,0
                           :rem 192
30 SE(1)=53248:SE(2)=SE(1)+102
   4:SE(3)=SE(1)+2048:SE(4)=SE
   (2)+2048                :rem 172
40 SO=SE(1):SR=SE(2):IS=SO
                           :rem 73
50 GETD$:IFD$=""THEN50:rem 243
60 AA=256:GOSUB130         :rem 16
70 IFAA=256THEN50          :rem 230
80 IFS(4)=1THENFORJJ=0TOS(1)ST
   EPS(2):FORII=1TOS(5):GOSUB2
   70:GOSUB320:NEXTII,JJ
                           :rem 232
90 IFS(4)=2THENFORJJ=0TO7:GOSU
   B270:FORII=1TOS(5):GOSUB390
   :NEXTII,JJ              :rem 65
100 GOSUB510               :rem 167
110 IFPEEK(211)>38THENGOSUB580
                           :rem 32
120 GOTO50                 :rem 49
130 REMARK-CHANGE ASCII TO POK
    E VALUE{14 SPACES}-OR- PRI
    NT SPECIAL CHAR        :rem 136
140 BB=ASC(D$):IFBB>143THEN230
                           :rem 205
150 IFBB=16THENGOSUB880 :RETUR
    N                      :rem 182
160 IFBB=24THENGOSUB1070:RETUR
    N                      :rem 222
170 IFBB=21THENSO=SE(1):SR=SE(
    2):IS=SO               :rem 95
180 IFBB=12THENSO=SE(3):SR=SE(
    4):IS=SO               :rem 100
190 IFBB>132THENIFBB<141THENGO
    SUB850:RETURN          :rem 251
200 IFBB=13ORBB=141THENGOSUB55
    0:RETURN               :rem 161
210 IFBB=18THENIS=SR:RETURN
                           :rem 19
220 IFBB=129THENPRINT"{13}";:RE
    TURN                   :rem 86
230 IFBB=146THENIS=SO:RETURN
                           :rem 68
240 IFBB<32THENPRINTMID$("
    {5 OFF}{WHT}{11 OFF}{DOWN}
    {OFF}{HOME}{8 OFF}{RED}
    {RIGHT}{GRN}{BLU}",BB+1,1)
    ;:RETURN               :rem 56
250 IFBB>=144 AND BB<160THENPR
    INTMID$("{BLK}{UP}{OFF}
    {CLR}{OFF}{2}{3}{4}{5}{6}
    {7}{8}{PUR}{LEFT}{YEL}
    {CYN}",BB-143,1);:RETURN
                           :rem 212
260 AA=(BBAND31)+0.5*(BBAND128
    ):IF(BBAND64)=0THENAA=AA+3
    2:RETURN               :rem 240
270 REMARK-FIND CHAR IN
    {27 SPACES}MEMORY      :rem 55
280 POKE56334,0:POKE1,51
                           :rem 86
290 KK=PEEK(IS+8*AA+JJ):LL=PEE
    K(IS+S(3)+8*AA+JJ)     :rem 63
300 POKE1,55:POKE56334,1
                           :rem 84
310 RETURN                 :rem 116
320 REMARK-PRINT BINARY REPRES
    ENTATION{13 SPACES}FOSR TI
    MES AS LARGE           :rem 196
330 NN=64:FORMM=0TO3       :rem 215
340 PP=1+8*INT(KK/NN)+2*INT(LL
    /NN)                   :rem 245
350 KK=KK-INT(KK/NN)*NN:LL=LL-
    INT(LL/NN)*NN          :rem 202
360 PRINTMID$("{OFF} {OFF}{D}
    {OFF}{F}{OFF}{I}{OFF}{C}
    {RVS}{K}{RVS}{B}{RVS}{V}
    {OFF}{V}{OFF}{B}{OFF}{K}
    {RVS}{C}{RVS}{I}{RVS}{F}
    {RVS}{D}{RVS} ",PP,2);
                           :rem 4
370 NN=INT(NN/4):NEXT MM
                           :rem 193
380 PRINT"{DOWN}{4 LEFT}";:RET
    URN                    :rem 70
390 REMARK-PRINT BINARY REPRES
    ENTATION{13 SPACES}EIGHT T
    IMES AS LARGE          :rem 2
400 SP$=RIGHT$("{5 SPACES}",S(
    10))                   :rem 0
410 XX=KK                  :rem 24
420 YY=256:FORX1=1TO8      :rem 21
430 YY=YY/2                :rem 153
440 IFXX>=YYTHENXX=XX-YY:PRINT
    "{RVS}"SP$"{OFF}";:GOTO460
                           :rem 177
450 PRINTSP$;              :rem 40
460 NEXTX1                 :rem 98
470 IFS(9)=0THENIFJJ=7THENIFS(
    10)=1THENGOTO490       :rem 112
480 PRINT"{DOWN}";         :rem 185
490 FORT=1TOLEN(SP$):PRINT"
    {8 LEFT}";:NEXTT       :rem 219
500 RETURN                 :rem 117
510 REMARK-ADVANCE TO NEXT POS
    ITION                  :rem 206
520 IFS(6)>0THENFORT=1TOS(6):P
    RINT"{UP}";:NEXTT      :rem 103
530 IFS(7)>0THENFORT=1TOS(7):P
    RINT"{RIGHT}";:NEXTT
                           :rem 246
540 RETURN                 :rem 121
550 REMARK-PRINT RETURN
                           :rem 246
560 IFS(8)>0THENFORT=1TOS(8):P
    RINT"{DOWN}":NEXTT:rem 180
570 RETURN                 :rem 124
580 REMARK-PRINT TO NEW LINE
                           :rem 206
590 IFS(9)>0THENFORT=1TOS(9):P
    RINT"{DOWN}":NEXTT:rem 185
600 RETURN                 :rem 118
610 REMARK-DATA FOR 4X4:rem 71
620 S(1)=6:S(2)=2:S(3)=1:S(4)=
    1:S(5)=0: S(6)=4:S(7)=4:S(
    8)=2:S(9)=1:S(10)=1
                           :rem 160
630 RETURN                 :rem 121
640 REMARK-DATA FOR 4X8:rem 78
650 S(1)=7:S(2)=1:S(3)=0:S(4)=
    1:S(5)=0: S(6)=8:S(7)=4:S(
    8)=4:S(9)=3:S(10)=1
                           :rem 170
660 RETURN                 :rem 124
```

```
670 REMARK-DATA FOR 4X16
                          :rem 128
680 S(1)=7:S(2)=1:S(3)=0:S(4)=
    1:S(5)=2:S(6)=16:S(7)=4:S(
    8)=4:S(9)=3:S(10)=1
                          :rem 222
690 RETURN                :rem 127
700 REMARK-DATA FOR 4X24
                          :rem 121
710 S(1)=6:S(2)=1:S(3)=0:S(4)=
    1:S(5)=3:S(6)=24:S(7)=4:S(
    8)=0:S(9)=0:S(10)=1
                          :rem 208
720 RETURN                :rem 121
730 REMARK-DATA FOR 8X8:rem 82
740 S(4)=2:S(5)=1: S(6)=8:S(7)
    =8:S(8)=4:S(9)=3:S(10)=1
                          :rem 49
750 RETURN                :rem 124
760 REMARK-DATA FOR 8X16
                          :rem 132
770 S(4)=2:S(5)=2:S(6)=16:S(7)
    =8:S(8)=8:S(9)=7:S(10)=1
                          :rem 108
780 RETURN                :rem 127
790 REMARK-DATA FOR 8X24
                          :rem 134
800 S(4)=2:S(5)=3:S(6)=24:S(7)
    =8:S(8)=0:S(9)=0:S(10)=1
                          :rem 87
810 RETURN                :rem 121
820 REMARK-DATA FOR 32X24
                          :rem 173
830 S(4)=2:S(5)=3:S(6)=32:S(7)
    =0:S(8)=0:S(9)=0:S(10)=4
                          :rem 84
840 RETURN                :rem 124
850 REMARK-CHANGE FONTS
                          :rem 188
860 ONBB-132GOSUB610,670,730,7
    90,640,700,760,820 :rem 12
870 RETURN                :rem 127
880 REMARK-PRINT SCREEN TO PRI
    NTER                  :rem 163
890 SI$=CHR$(15)          :rem 86
900 RV$=CHR$(18):RO$=CHR$(146)
    :GR$=CHR$(8)          :rem 68
910 VR=1024               :rem 70
920 OPEN4,4:PRINT#4       :rem 127
930 FORCL=0TO24:AS$=SI$:QF=0:F
    ORRO=0TO39            :rem 243
940 SC=PEEK(VR+40*CL+RO)
                          :rem 162
950 GOSUB1000             :rem 223
960 AS$=AS$+CHR$(AS)      :rem 93
970 NEXTRO                :rem 128
980 PRINT#4,SI$+AS$+RO$+GR$
                          :rem 44
990 NEXTCL:PRINT#4,SI$:CLOSE4:
    RETURN                :rem 120
1000 REMARK-CONVERT PEEK TO AS
     CII                   :rem 2
1010 IFSC>=128THENSC=SC-128:AS
     $=AS$+RV$             :rem 59
1020 IFSC<32ORSC>95THENAS=SC+6
     4:GOTO1050            :rem 208
1030 IFSC>31ANDSC<64THENAS=SC:
     GOTO1050              :rem 105
1040 IFSC>63ANDSC<96THENAS=SC+
     32                    :rem 203
1050 IFRIGHT$(AS$,1)<>RV$THENA
     S$=AS$+RO$            :rem 111
1060 RETURN                :rem 167
1070 REMARK-EXTENDED MODE
                           :rem 45
1080 SI$=CHR$(14):GOTO 900
                          :rem 137
                                  @
```

Commodore 64 Program Profiler

D.E. Walker

Interested in speeding up your Commodore 64 BASIC programs? This convenient utility tells you which program lines take the most time to execute so you can rewrite them to run faster. The utility is written entirely in machine language, but you don't need to understand machine language to use it.

BASIC 2.0, the version of BASIC used by the Commodore 64, is what purists call an *unstructured* programming language. While some other languages (like Pascal) force you to write every program in a predefined structure, BASIC gives you the freedom to create whatever structure you like. That can be an advantage, but it can also result in slow, inefficient code if the program spends a lot of time performing unnecessary GOTOs or GOSUBs or is otherwise poorly structured.

If you want to improve a program's efficiency, you could examine it line by line, looking for superfluous REMs, a group of single-statement lines that could be combined into one multiple-statement line, and so on. But that would probably produce uneven results. Many parts of the program are performed only once, or so infrequently that it doesn't matter whether they're efficient or not. What you want to look for are the heavily used routines—FOR-NEXT loops, subroutines that are called frequently with GOSUB, long sequences of IF-THEN tests, and so on—where the program itself spends the most time.

"64 Program Profiler" generates an automatic time report for any 64 BASIC program, making it easy to identify the areas where time savings may be possible. Though it's written in machine language, you can use it without knowing machine language at all. First, type in the program as shown below, then save it on disk or tape.

A Resident Efficiency Expert

When you run the BASIC loader program, it puts the Profiler ML code in memory beginning at location 49152. Now you're ready to put your built-in efficiency expert to work. Enter SYS 49152 and press RETURN. Profiler asks three questions. First, you can choose to print the profile information on the screen or the printer. Second, you can decide whether to output the report in numeric form or in graphic form as a simple bar chart. Finally, enter the sampling rate you want Profiler to use in evaluating your program. This value (a number

from 1–9) determines how frequently Profiler looks at your program as it runs. The lower the sampling rate, the more frequently the program is checked.

At this point you can load and run the BASIC program you want to profile. While the program is running, the Profiler keeps track of which line is being executed according to the sampling rate you selected. After the program ends, there will be a short delay. Then the Profiler prints out its report. In each case you'll see a series of line numbers, followed by numeric values (if you chose a numeric display) or a series of asterisks (if you chose the bar chart).

It's important to understand exactly what the report means. The Profiler doesn't merely count the number of times that a particular line executed. Instead, it tells you how many times it saw the line being executed at the designated sampling rate. Thus, program lines that execute very quickly may not show up on the report at all. That's fine: If a program line executes too fast to be detected, you don't need to worry that it's slowing down your program. What you're concerned with are the lines that show big time values—they mark the places where the program is doing most of its work.

Adjustable Sampling Rate

Depending on what your program does, you may need to adjust the sampling rate to get a useful report. The largest possible time value is 255. If nearly every line in the report shows a value of 255, then the sampling rate is too small (Profiler is looking at the program too frequently). Reactivate Profiler with SYS 49152, select a larger sample rate, and rerun the program. This time Profiler looks at the program less often, which results in smaller time values and a more useful basis for comparison.

On the other hand, if every line in the program has a time value under ten, and many important lines are missing altogether, the sampling rate is too large; you'll get a more meaningful report by using a smaller rate. Remember, the time values are meaningful only in relative terms. The most meaningful report is one that shows a wide distribution of values, rather than a cluster of extreme values at one end of the scale.

Of course, common sense comes into play as well. If you have a massive database program that takes six days to run, don't expect Profiler to report anything smaller than 255 for every line, even at the slowest sampling rate. However, you can call Profiler from within a program, just as you can from direct mode. Thus, you could profile an individual subroutine in a large program by inserting SYS 49152 at the beginning of the subroutine, and putting a STOP or END statement just before the subroutine terminates with RETURN. If you then activate the subroutine with an appropriate GOTO, Profiler treats it like a separate program.

Commodore 64 Program Profiler

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

```
100 PRINT"{CLR}{CYN}PROFILER":
    PRINT"{3 DOWN}PLEASE WAIT.
    .."                    :rem 174
110 A=49152:CS=0:FORI=ATOA+550
    :READB:POKEI,B:CS=CS+B:NEX
    T                      :rem 36
120 IFCS<>68166THENPRINT"ERROR
     IN DATA STATEMENTS.":STOP
                           :rem 46
130 DATA 169,131,160,192,32,30
    ,171,32,207,255    :rem 157
140 DATA 162,129,160,192,32,96
    ,192,176,237,169   :rem 237
150 DATA 179,160,192,32,30,171
    ,32,207,255,162    :rem 164
160 DATA 130,160,192,32,96,192
    ,176,218,169,209   :rem 232
170 DATA 160,192,32,30,171,?32
    207,255,201,13     :rem 99
180 DATA 240,10,201,48,144,200
    ,201,58,176,196    :rem 158
190 DATA 144,2,169,53,56,233,4
    8,10,141,126       :rem 18
200 DATA 192,120,169,234,141,2
    0,3,169,192,141    :rem 157
210 DATA 21,3,169,0,133,251,13
    3,253,169,195      :rem 62
220 DATA 133,252,133,254,88,96
    ,134,251,132,252   :rem 218
230 DATA 201,78,240,10,201,13,
    240,6,201,89       :rem 251
240 DATA 240,6,56,96,169,0,240
    ,2,169,1           :rem 75
250 DATA 160,0,145,251,24,96,0
    ,0,0,0             :rem 203
260 DATA 0,147,80,82,79,70,73,
    76,69,82           :rem 99
270 DATA 32,32,32,32,32,32,32,
    13,13,79           :rem 58
280 DATA 85,84,80,85,84,32,84,
    79,32,80           :rem 104
290 DATA 82,73,78,84,69,82,63,
    32,40,89           :rem 108
300 DATA 44,78,47,67,82,41,58,
    32,0,13            :rem 29
310 DATA 79,85,84,80,85,84,32,
    72,73,83           :rem 103
320 DATA 84,79,71,82,65,77,63,
    32,40,89           :rem 101
330 DATA 44,78,47,67,82,41,58,
    32,0,13            :rem 32
340 DATA 83,69,84,32,83,65,77,
    80,76,69           :rem 112
350 DATA 32,82,65,84,69,32,40,
    49,45,57           :rem 94
360 DATA 41,58,32,0,173,127,19
    2,208,78,173       :rem 27
370 DATA 126,192,141,127,?192,
    65,157,208,106,169 :rem 75
380 DATA 1,141,128,192,165,57,
    160,0,209,251      :rem 65
390 DATA 208,7,200,165,58,209,
    251,240,28,165     :rem 125
400 DATA 251,197,253,208,6,165
    ,252,197,254,240   :rem 228
410 DATA 42,24,165,251,105,3,1
    33,251,165,252     :rem 104
420 DATA 105,0,133,252,24,144,
    213,200,177,251    :rem 144
430 DATA 201,255,240,5,24,105,
    1,145,251,169      :rem 54
440 DATA 3,133,251,169,195,133
    ,252,206,127,192   :rem 221
450 DATA 76,49,234,24,165,253,
    105,3,133,253      :rem 72
460 DATA 165,254,105,0,133,254
    ,160,0,165,57      :rem 62
470 DATA 145,253,165,58,200,14
    5,253,200,169,1    :rem 167
480 DATA 145,253,24,144,210,17
    3,128,192,240,213  :rem 6
490 DATA 169,0,141,128,192,169
    ,131,141,2,3       :rem 16
500 DATA 169,193,141,3,3,169,1
    3,141,119,2        :rem 219
510 DATA 169,1,133,198,24,144,
    178,120,169,49     :rem 133
520 DATA 141,20,3,169,234,141,
    21,3,88,169        :rem 221
530 DATA 131,141,2,3,169,164,1
    41,3,3,173         :rem 160
540 DATA 129,192,208,103,160,0
    ,177,251,170,200   :rem 205
550 DATA 177,251,32,205,189,17
    3,130,192,208,66   :rem 230
560 DATA 169,32,32,210,255,56,
    32,240,255,160     :rem 115
570 DATA 6,24,32,240,255,160,2
    ,177,251,170       :rem 13
580 DATA 169,0,32,205,189,169,
    13,32,210,255      :rem 73
590 DATA 165,251,197,253,208,6
    ,165,252,197,254   :rem 244
600 DATA 240,16,24,165,251,105
    ,3,133,251,165     :rem 103
610 DATA 252,105,0,133,252,24,
    144,182,173,129    :rem 157
620 DATA 192,208,43,76,131,164
    ,169,32,32,210     :rem 117
630 DATA 255,160,2,177,251,170
    ,169,42,32,210     :rem 113
640 DATA 255,202,208,250,24,14
    4,194,169,4,170    :rem 170
650 DATA 160,255,32,186,255,32
    ,192,255,162,4     :rem 126
660 DATA 32,201,255,24,144,134
    ,32,204,255,76     :rem 113
670 DATA 131,164,0,0,255,255,0
    ,0,255,255,0       :rem 255
```

©

Atari Typo Tool

Patrick Dell'Era

Correcting typing mistakes is much easier with this multifunction utility. It lists your program a line at a time, and separately displays the items in critical DATA statements. It also contains a machine language subroutine that quickly deletes any range of lines from a BASIC program. For all 400/800, XL, and XE computers with at least 16K RAM (tape) or 24K RAM (disk).

How many times have you burned the midnight oil searching for a typo in a program you've typed in? Although COMPUTE!'s "Automatic Proofreader" greatly reduces the chances of typos, it won't catch transposition errors, and it can't be used with listings published in other magazines or user group newsletters. Now there's help—"Atari Typo Tool."

This program individually lists on the screen the lines of your freshly typed-in program, ignoring DATA statements and lines that begin with REM. Because DATA statements can be the most critical parts of a BASIC program—they often contain the decimal numbers of machine language subroutines—Typo Tool displays DATA elements one by one in large-size characters.

At any time, when you spot a typo, you can enter edit mode to make corrections, then continue where you left off. After you've weeded out all the typos in a program, you can tell Typo Tool that you're finished. It then erases itself from memory, leaving only your program in RAM.

Preparing Typo Tool

To get started, the first thing to do is type in Typo Tool and make sure *it* doesn't contain any typos. It can't be used to check itself. Use the Automatic Proofreader and be extra careful to avoid transposition errors (such as DATA 196 instead of DATA 169).

Store a copy of Typo Tool on disk or tape with the LIST command, not SAVE or CSAVE. That is, LIST"D:*filename.ext*" for disk or LIST"C:" for cassette. It's important to use the LIST format because this lets you merge Typo Tool in memory with the errant program you'll be checking. It's also vital to save a copy of Typo Tool before running it for the first time, because it erases part of itself when you type RUN.

Now you're ready. Type in or load the program you want to examine for typos. Make sure this program doesn't use line number 0 or line numbers from 32100 upward—Typo Tool uses these line numbers, and it will replace the lines in the other program if there's a conflict. Then load Typo Tool, using ENTER"D:*filename.ext*" for disk or ENTER"C:" for cassette. Finally, type RUN. There's a short pause as Typo Tool loads a machine language subroutine into memory. Then you'll see the main menu on the screen.

The menu offers three choices: Line Lister, Data Reader, and Finished. You need to type only the first letter of your choice. When you type L or D, you'll be asked for a starting line number. If you want to begin checking lines or data from the beginning of your program, just press RETURN. If, however, you want to start at another point, type in the appropriate line number and press RETURN.

In the Line Lister mode, Typo Tool displays a single line of the program you're checking. Pressing the cursor up-arrow (without CTRL) lists the next higher line number. Pressing the cursor down-arrow lists the next lower line number. Pressing RETURN brings you back to the main menu. And pressing E enters the edit mode.

You'll notice that at the bottom of each line listed on the screen is the command CONT. As we'll show in a moment, this lets you leave edit mode and continue with the Line Lister mode.

Making Corrections

When you press E to enter edit mode, the message STOPPED AT LINE 32180 appears. Disregard this. To fix a typo in the listed line, cursor up to the line as usual and make your corrections. Press RETURN on the line to enter it into memory. Then press RETURN on the CONT command to continue with the Line Lister mode. Typo Tool relists the corrected line on the screen so you can verify that it contains no additional errors.

Since typos in lines beginning with REM do not affect a program's operation, Typo Tool ignores these lines. However, it does list lines in which REM follows another statement.

The Line Lister mode also ignores DATA lines. Since DATA numbers are especially susceptible to typos, Typo Tool has a special mode for checking these important statements. Enter the Data Reader mode from the main menu by pressing D. In this mode, Typo Tool displays each individual DATA item in double-size (GRAPHICS 2) characters in the middle of the screen. Just below, it displays the DATA line number and DATA item number. If the DATA item is longer than eight characters, the item is broken into pairs and displayed one pair at a time. The pair number of the item is shown below the DATA item number.

Typo Tool automatically displays each DATA item in sequence for a few seconds so you can sit back with the source listing and check for mistakes. Each time Typo Tool advances to the next DATA item, it sounds a buzzer. If you want the display to pause, press any key except RETURN or E. The RETURN key exits the Data Reader mode and returns you to the main menu. The E key enters the Data Reader's edit mode.

This mode is similar to the Line Lister's edit mode. The DATA line you were checking is listed on the screen followed by a CONT command. Below that is the line number, DATA item number, and, if appropriate, the DATA pair number. You'll also see the message STOPPED AT LINE 32325, which you can disregard. To fix the typo, cursor up to the DATA line and make your corrections as usual, then press RETURN to enter the line into memory. Press RETURN over the CONT command to leave edit mode and continue with the Data Reader mode.

When Typo Tool has listed the last line of your program or read the last item in the DATA statements, it displays the message THAT'S ALL THERE IS! and returns to the main menu. If you have no further checking to do, press F to tell Typo Tool you're finished. Instantly, Typo Tool erases itself from memory, leaving your corrected program behind. You can then save the program and try running it. If everything works OK, your mission is accomplished. Otherwise, you may have to reENTER Typo Tool and search for further mistakes.

Squeezing Memory

If you have 16K RAM and a cassette drive, you'll find you can use Typo Tool with programs that are about twice as long as itself before running out of memory. On a 24K computer with a disk drive, you'll be able to work on programs about five times as long as Typo Tool. If you're having memory problems, there are a few things you can do to squeeze more room out of your available RAM.

Typo Tool includes a machine language subroutine that deletes blocks of BASIC lines (that's how it erases itself when you type F). Typo Tool also uses this routine to delete the block of DATA statements within it, freeing up a little more RAM. If you see an ERROR 2 (insufficient memory) message when you try to use Typo Tool with your program, follow these steps:

1. Type NEW to clear memory, LOAD the program to be checked, and LIST it to disk or cassette.

2. ENTER Typo Tool from disk or cassette and type RUN. After the menu appears, press BREAK. If you type LIST now, you'll see that all the DATA statements are gone, as are the lines that POKEd them into memory.

3. ENTER the program you want to check from disk or cassette. Type RUN. With any luck at all, everything should work.

4. If you still get an ERROR 2 message, you'll have to start over and LIST your program in two or more parts to disk or cassette. To do this, type LIST"D:*filename.ext*",FIRST-,LAST or LIST"C:",FIRST,LAST where FIRST is the first line number of the block to be saved and LAST is the last line number of the block. For each part of your program, type NEW and repeat steps 2 and 3 above. When you've corrected all the parts, you can reunite them by ENTERing each block of lines into RAM. Then save the whole program onto disk or tape.

Bonus Block Deleter

As mentioned above, Typo Tool includes a machine language subroutine that instantly deletes any range of BASIC lines. The routine is stored in memory page 6, beginning at location 1536 decimal. This memory area is not erased when you type NEW, although it's frequently used by other programs for storing machine language routines, which may cause a conflict.

To use the block deleter on any program in memory, type the following line and press RETURN:

```
A=USR(1536,FIRST,LAST)
```

where FIRST is the first line number of the block to be deleted, and LAST is the last line number of the block. Be sure of these numbers before you press RETURN.

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

Atari Typo Tool

```
FP 0 GOTO 32100
LD 32100 DIM A$(106),TITLE$(
         23),T$(4),BLANK$(20
         ):N7=0:NUL=1536:MRG
         =82:CURS=752
MO 32105 BLANK$=" ":BLANK$(2
         0)=" ":BLANK$(2)=BL
         ANK$:GOSUB 32380
DK 32110 GRAPHICS N7:OPEN #3
         ,4,N7,"K:":OPEN #2,
         4,N7,"E:":POKE MRG,
         15:POKE CURS,1
LJ 32115 POSITION 3,10:? "SE
         LECT:{5 SPACES}■ Li
         ne Lister":? :? "■
         Data Reader":? :? "
         ■ Finished{DOWN}"
CF 32120 POKE MRG,2:GET #3,A
         :IF A=76 THEN 32140
KD 32125 IF A=68 THEN 32250
JK 32130 IF A=70 THEN 32540
CP 32135 GOTO 32120
GP 32140 TITLE$="■INE LISTER
         ":GOSUB 32400
HH 32145 GOSUB 32210
PJ 32150 IF LINE<A THEN GOSU
         B 32205:GOSUB 32200
         :GOTO 32150
BE 32155 IF LINE=32100 THEN
         32240
IL 32160 IF LINE=N7 OR TYPE
         THEN 32195
LH 32165 ? "{CLEAR}":POSITIO
         N 2,10:LIST LINE:?
         "CONT":GOSUB 32505
CO 32170 GET #3,S:IF S<>45 A
         ND S<>61 AND S<>155
          AND S<>69 THEN 321
         70
KH 32175 IF S=61 THEN GOSUB
         32215:GOTO 32155
AB 32180 IF S=69 THEN STOP
MB 32185 IF S=69 THEN 32165
OI 32190 IF S=155 THEN 32245
KE 32195 GOSUB 32205:GOSUB 3
         2200:GOTO 32155
EO 32200 LINE=PEEK(PRGM)+PEE
         K(PRGM+1)*256:TYPE=
         PEEK(PRGM+4)<2:RETU
         RN
OO 32205 B=PEEK(PRGM+2):PRGM
```

```
        =PRGM+B:RETURN
EJ 32210 PRGM=PEEK(136)+PEEK
        (137)*256:GOSUB 322
        00:RETURN
MG 32215 PRGM=PRGM-B:GOSUB 3
        2200
FB 32220 A=LINE:GOSUB 32210
PP 32225 IF LINE<A THEN GOSU
        B 32205:GOSUB 32200
        :GOTO 32225
PH 32230 IF TYPE THEN 32215
NP 32235 RETURN
LJ 32240 GRAPHICS N7:POKE CU
        RS,1:POSITION 10,10
        :? "THAT'S ALL THER
        E IS!":FOR I=1 TO 5
        00:NEXT I
PG 32245 CLOSE #2:CLOSE #3:P
        OKE 188,N7:GOTO 321
        10
LH 32250 TITLE$="DATA READER
        ":GOSUB 32400:GOSUB
         32435:GOSUB 32505
MH 32255 RESTORE A:TRAP 3233
        5
OJ 32260 POKE 764,255:READ A
        $:DITEM=PEEK(182):D
        LINE=PEEK(183)+PEEK
        (184)*256:IF DLINE>
        32099 THEN 32240
MJ 32265 TYPE=LEN(A$):IF TYP
        E>8 THEN 32275
OH 32270 GOSUB 32440:POSITIO
        N INT(8-(LEN(A$)/2)
        +0.5),3:FOR I=N7 TO
         20:POKE 53279,N7:N
        EXT I:? #6;A$:GOSUB
         32295:GOTO 32260
LJ 32275 IF TYPE/2<>INT(TYPE
        /2) THEN A$(TYPE+1)
        =BLANK$(1,1)
BL 32280 GOSUB 32440:FOR A=1
         TO LEN(A$) STEP 2:
        POSITION 7,3:FOR I=
        N7 TO 20:POKE 53279
        ,N7:NEXT I:? #6;A$(
        A,A+1)
IN 32285 POSITION 12,9:? #6;
        INT(A/2+0.4)+1:GOSU
        B 32295:NEXT A:POSI
        TION 1,9:? #6;BLANK
        $:POSITION 12,9:? #
        6;BLANK$(1,3)
DG 32290 GOTO 32260
CI 32295 FOR I=N7 TO 200:ON
        PEEK(764)<>255 GOTO
         32305:NEXT I
AE 32300 POSITION N7,3:? #6;
        BLANK$:RETURN
MG 32305 POP :GET #3,B:IF B<
        >155 AND B<>69 THEN
         GET #3,B:IF B<>69
        THEN 32300
DD 32310 IF B=155 THEN POP :
        GOTO 32245
EN 32315 GRAPHICS 0:POSITION
         2,7:LIST DLINE:? "
        CONT":GOSUB 32440
EM 32320 IF TYPE>8 THEN POSI
        TION 13,16:? INT(A/
        2+0.4)+1
EF 32325 STOP
AG 32330 GOSUB 32435:GOSUB 3
        2505:GOSUB 32440:RE
        TURN
EB 32335 IF PEEK(195)=6 THEN
         32240
KH 32340 GRAPHICS N7:? "ERRO
        R-  ";PEEK(195):END

AN 32345 DATA 216,104,104,14
        1,185,6,104,141,184
        ,6,165,136,133,203,
        165,137,133,204,32,
        136,6,165,203,133,2
        05,165,204,133
LG 32350 DATA 206,104,141,18
        5,6,104,24,105,1,14
        1,184,6,144,3,238,1
        85,6,32,136,6,56,16
        5,144,229,203,141,1
        82,6,165,145
PJ 32355 DATA 229,204,141,18
        3,6,56,165,203,229,
        205,141,186,6,165,2
        04,229,206,141,187,
        6,160,0,174,183,6,2
        40,14,177,203
MJ 32360 DATA 145,205,200,20
        8,249,230,204,230,2
        06,202,208,242,204,
        182,6,240,7,177,203
        ,145,205,200,208,24
        4,162,0,160,4
IN 32365 DATA 56,181,138,237
        ,186,6,149,138,181,
        139,237,187,6,149,1
        39,232,232,136,208,
        236,96,160,2,177,20
        3,141,188,6,136
IG 32370 DATA 177,203,136,20
        1,128,240,30,205,18
        5,6,240,4,176,23,14
        4,7,177,203,205,184
        ,6,176,14,24,173,18
        8,6,101,203
CH 32375 DATA 133,203,144,21
        5,230,204,208,211,9
        6,0,0,0,0,0,0,0,0
PK 32380 IF PEEK(NUL)=216 TH
        EN 32390
KJ 32385 RESTORE 32345:FOR I
        =NUL TO 1724:READ A
        :POKE I,A:NEXT I
BD 32390 A=USR(NUL,32345,323
        90)
OG 32395 RETURN
AL 32400 POKE CURS,N7:? TITL
        E$;:FOR I=N7 TO 100
        :NEXT I:?
BA 32405 IF TITLE$(8)="D" TH
        EN RETURN
HC 32410 ? "{UP}Press RETURN
         t{DOWN}**OR**{UP}
        {6 LEFT}o start at
        first line"
NJ 32415 ? :? "Enter specifi
        c line number to st
        art.":? :? "=>> ";
JC 32420 TRAP 32425:INPUT #2
        ,A:TRAP 40000:GOTO
        32430
AD 32425 A=N7
NM 32430 RETURN
DI 32435 GRAPHICS 2:POKE 712
        ,148:POKE 708,154:R
        ETURN
LF 32440 Q=PEEK(87):B=2:B=B+
        (TYPE>8):FOR X=1 TO
         B:RESTORE 32485:RE
        AD TITLE$:POKE 182,
        X:READ T$:TITLE$(6,
        10)=T$
LD 32445 POSITION 1+(Q=0),6+
        X+((Q=0)*7)
MB 32450 IF Q THEN ? #6;TITL
        E$;
CD 32455 IF  NOT Q THEN ? TI
        TLE$;
OO 32460 GOSUB 32475+X+((Q=0
        )*10):NEXT X
FB 32465 RESTORE DLINE:POKE
        182,DITEM:RETURN
EO 32476 ? #6;BLANK$(1,3):PO
        SITION 12,7:? #6;DL
        INE:RETURN
FN 32477 ? #6;BLANK$(1,3):PO
        SITION 12,8:? #6;DI
        TEM:RETURN
OI 32478 RETURN
OE 32485 DATA DATA
        {6 SPACES}#,line,it
        em,pair
MM 32486 ? DLINE:RETURN
ME 32487 ? DITEM:RETURN
OJ 32488 RETURN
OE 32505 Q=PEEK(87):POKE CUR
        S,1:IF  NOT Q THEN
        POSITION 2,20
IE 32510 ? "{5 SPACES}{ESC}
        {TAB}","RETURN FOR
        MENU"
HL 32515 IF  NOT Q THEN ? "
        {5 SPACES}{ESC}
        {TAB}","{ESC}{UP} N
        EXT HIGHEST LINE":?
         "{5 SPACES}{ESC}
        {TAB}","{ESC}{DOWN}
         NEXT LOWEST LINE"
GO 32520 IF Q THEN ? "
        {5 SPACES}{ESC}
        {TAB}{3 SPACES}ANY
        KEY TO PAUSE/RESTAR
        T"
OG 32525 ? "{2 UP}PRESS
        {2 DOWN}{ESC}{TAB}
        {3 SPACES}E TO EDIT
        ";
DI 32530 IF  NOT Q THEN POSI
        TION 5,14
DJ 32535 POKE CURS,N7:RETURN
MN 32540 TITLE$="FINISHED":G
        OSUB 32400:GRAPHICS
         N7:CLR :X=USR(1536
        ,N7,N7):X=USR(1536,
        32100,32540)
```

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ST Doodler

D.W. Neuendorf

This short, simple drawing program for the Atari ST demonstrates how to write a Logo program that takes advantage of GEM's built-in features and user interface. It works on any Atari ST with Logo.

When Atari first started shipping the 520ST last summer, ST BASIC wasn't quite ready, so the only programming language supplied was Digital Research's Logo. While borrowing a friend's 520ST, I decided to put Logo to work in a drawing program. This version of Logo, however, was translated from Digital's Logo for the IBM PC and doesn't run particularly fast on the Atari ST. After some experimenting, I realized it was too slow to support a full-fledged drawing utility.

Not yet ready to write off the ST/Logo combination, I considered alternatives. Calls to the operating system were out, since there was only a limited memory map and no CALL statement. Furthermore, Logo restricts the areas of memory accessible to the EXAMINE and DEPOSIT commands (similar to BASIC's PEEK and POKE). Even hand-assembled machine language routines are useless without a way to call them.

Then I remembered GEM—Digital Research's Graphics Environment Manager, which sits as a shell on TOS, the ST's operating system. In Logo, GEM has a Settings menu that lets you change line-drawing colors, line-drawing widths, fill colors and patterns, and other parameters. There must have been some reason why Atari included all these settings in a drop-down menu, duplicating many of the Logo commands. One very good reason, I concluded, was to avoid forcing someone like me to code a complex user interface in Logo, which would bog down the program. After all, the Settings menu is quite similar to the menu I planned to include in my drawing program.

Therefore, I took a hard look at what's *really* needed to draw pictures on the ST. Letting GEM handle the fancy features via its Settings menu, all we need is an easy way to fill areas and draw lines, circles, and boxes. Providing these functions are well within the capabilities of Logo. "ST Doodler" is the result.

Drawing With Doodler

To use ST Doodler, run Logo and type in the listing below. Be sure to save at least one copy before you try to use Doodler for the first time. Next, you should decide which screen resolution mode you wish to use. The monochrome screen gives you the highest resolution—and thus the capability to draw finely detailed pictures—but allows only black and white. The low-resolution mode allows 16 different colors, but with the loss of some detail. The medium-resolution mode offers more detail than low resolution, with up to four colors. If you wish to draw in a mode other than the one currently selected, you must quit Logo and return to the GEM desktop, then select Set Preferences from the Options menu. After making your selection, run Logo again.

To begin drawing with Doodler, clear the Graphics window by typing CS and pressing RETURN at a Logo top-level ? prompt, then type SKETCH. You'll probably want to expand the Logo Graphics window to full-screen size to give yourself more room to work. Doodler's pen color can be altered at any time, along with the background color, line width, fill color, and fill pattern settings, by dropping down the Settings menu and selecting the Graphics option. Click the pointer on the setting you want to change, then type in the appropriate number and click on the OK box.

This picture was created by the author using "ST Doodler."

To draw with Doodler, you connect a series of lines end to end. Choose the beginning of a series of line segments by moving the mouse pointer to the first desired endpoint and pressing the left button. (For all button presses in ST Doodler, hold down the button for at least a second or two; Logo cannot detect a faster press. If a Doodler command doesn't respond, you're probably not holding down the button long enough.)

You can specify subsequent endpoints the same way. You can draw a continuous line by holding down the left button while moving the mouse. However, because Logo isn't too adept at reading the buttons, you must move the mouse very slowly to draw smooth lines. To end the series of connected line segments, move the pointer outside the drawing area and press the left button. If you're using a full-size Graphics window, the best place outside the drawing area is the upper-right corner of the screen beyond the menu bar.

To fill an area with color, place the mouse pointer inside the area and press the right button. Be sure

the area you're trying to fill is completely enclosed by lines. If there are any holes, the fill "spills out" and colors the entire background.

To draw circles or boxes, press the right button while the pointer is outside the drawing area. A prompt asks you to press the C or B keys for a circle or box, respectively. Pressing any other key exits the circle/box mode. After pressing C to choose a circle, point to the desired center and press the left button; then move the pointer to the desired radius and press the button again. If you pressed B to choose a box, point first to its lower-left corner and press the left button; then point to its upper-right corner and press the button again.

You can erase portions of your drawing by dropping down the Settings menu, selecting the Graphics option, changing the line color to match the background color, then drawing over the parts you want to erase. You may also want to widen the line setting for this purpose.

How It Works

The top-level procedure, SKETCH, does a little initializing before invoking the main procedure, PT, which executes repeatedly. PT stores the current mouse status in the variable T, then analyzes it for the state of the left and right mouse buttons. Each mouse button has two functions, depending on whether the pointer is inside or outside the drawing area when the button is pressed.

Pressing the left button (indicated in ITEM 3 of MOUSE) specifies the endpoints in a series of connected line segments. DRAW? sets a flag, depending on whether ITEM 5 of MOUSE is TRUE (pointer inside the drawing area) or FALSE (pointer outside the drawing area). This flag, in turn, controls whether DR draws another line segment or sets a new starting point.

Pressing the right button (indicated in ITEM 4 of MOUSE) fills an area with the current fill pattern if the pointer is within the Graphics window boundaries (ITEM 5 of MOUSE is TRUE), or initiates circle or box drawing if the pointer is outside the Graphics window (ITEM 5 of MOUSE is FALSE). The circle and box prompts are drawn in the pen-reversed mode, then selectively erased by redrawing them in the same place. Although it can be hard to read these prompts over existing screen graphics, the alternative—printing to the Dialog window—stops the program.

You can save your artwork using the Save Pic option in the File menu, and reload previous drawings with the Load Pic option in that menu. When reloading pictures, you must set the screen for the same resolution that was in effect when the picture was saved. For example, you cannot load a picture drawn on the low-resolution screen into a medium-resolution Graphics window.

The lesson for programmers here is that programming on the ST will be very different than programming on earlier computers with traditional operating systems. Whether you're using Logo or a very fast compiled language, it would be a mistake to ignore the high-level tools available in GEM and TOS. Not only is it a waste of effort to write everything from scratch, but it's also wise to stick to the user interface which is already thoroughly familiar to every ST owner.

ST Doodler in Logo

```
TO SKETCH
  HIDETURTLE
  PENUP
  MAKE "GFILL "TRUE
  MAKE "TF 0
  PT
END

TO PT
  MAKE "T MOUSE
  IF (ITEM 3 :T) [DRAW?]
  IF (ITEM 4 :T) [BCORF]
  PT
END

TO DRAW?
  IF (ITEM 5 :T) [DR] [MAKE "TF 0]
END

TO DR
  IF (:TF = 0)
    [PENUP SETPOS :T MAKE "TF 1]
    [PENDOWN SETPOS :T PENUP]
END

TO BCORF
  IF (ITEM 5 :T)
    SETPOS PIECE 1 2 :T FILL]
    [BORC]
END

TO BORC
  MAKE "PCOL ITEM 5 TURTLEFACTS
  BCMSG
  MAKE "CH READCHAR
  BCMSG
  SETPC :PCOL
  IF (:CH = "B) [BX]
  IF (:CH = "C) [CIRC]
  MAKE "TF 0
END

TO BCMSG
  SETPOS [-70 80]
  SETHEADING 0
  TMSG [Circle: Press C]
  TMSG [Box: Press B]
  TMSG [Abort: Press any]
  TMSG [# # # # other key]
END

TO TMSG :MESSAGE
  PENREVERSE
  TURTLETEXT :MESSAGE
  PENUP
  BACK 18
END

TO BX
  MAKE "GFILL "FALSE
  BOX MBP
  MAKE "GFILL "TRUE
END

TO CIRC
  MAKE "GFILL "FALSE
  CIRCLE MCP
  MAKE "GFILL "TRUE
END

TO MBP
  GETPOINTS
  MAKE "PAR3 ABS ((FIRST :PAR2) -
    (FIRST :PAR1))
  MAKE "PAR4 ABS ((LAST :PAR2) -
    (LAST :PAR1))
  OUTPUT (SENTENCE :PAR1 :PAR3
    :PAR4)
END

TO MCP
  GETPOINTS
  MAKE "PAR3 (ABS ((FIRST :PAR2) -
    (FIRST :PAR1))) ^ 2
  MAKE "PAR4 (ABS ((LAST :PAR2) -
    (LAST :PAR1))) ^ 2
  OUTPUT SENTENCE :PAR1 SQRT
    (:PAR3 + :PAR4)
END

TO GETPOINTS
  MAKE "PAR1 GETPOS
  DELAY
  MAKE "PAR2 GETPOS
END

TO GETPOS
  MAKE "T MOUSE
  IF (ITEM 3 :T) [OUTPUT PIECE 1 2 :T]
  GETPOS
END

TO DELAY
  REPEAT 10 [MAKE "JUNK SIN 5]
END
```

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Instant Apple Help Screens

Kent Brewster

With this short utility you can design and save your own custom help screens to disk, then quickly call them into BASIC programs. For all Apple II-series computers with DOS 3.3 or ProDOS.

As professional software designers have discovered, help screens are very popular features in all kinds of programs. Users don't have to fumble around with "handy" reference cards—they can just hit ESC or some other key and call up a screenful of instructions.

"Help Screen Editor," listed below, is a utility program that lets you create help screens of your own which are then saved to disk as binary files. Once saved, the file can be summoned back to the screen with a simple BLOAD command. If you BLOAD the file to an area of memory known as text page 2 with this statement:

```
BLOAD filename,A$800
```

your help screen can be viewed and swapped with text page 1 (the normal screen) with this statement:

```
POKE -16299,0
```

The following statement will switch back to the normal screen display (text page 1):

```
POKE -16300,0
```

By placing these lines in a loop, the screens can be swapped some 30 times per second. Pretty impressive for BASIC.

For even greater convenience, you can use the following statement, which displays your help screen until a key is pressed, then switches back to the normal screen:

```
POKE -16299,0:GET G$:POKE -16300,0
```

Other uses for BLOADed screens include interactive software demonstrations and adventure games that show a screen and offer several options, each leading to another screen.

Designing A Help Screen

Any BASIC program that uses text page 2 must reserve space for that memory with POKE 104,12 and POKE 3072,0. This is the purpose of Program 1, which changes the bottom of program memory and calls Program 2, Help Screen Editor. (Don't confuse this process with changing the value of LOMEM, which merely relocates the bottom of variable memory, not program memory.) If you want, you can save Program 1 on a new disk with the filename HELLO so it automatically boots the editor when the computer is turned on.

Type in and save Program 2 (use the filename SE if you want the program to work properly with Program 1). It's quite short for a full-featured editor.

The first time you run Help Screen Editor, obviously there will be no help screen on the disk for it to load. Your first project should be to create a help screen for the screen editor itself, so temporarily modify the program to skip loading a help screen by inserting this line:

```
15 GOTO 40
```

The help screen you make for Help Screen Editor should look something like the example in the accompanying screen photo. Here are the screen editor commands:

CTRL-I	cursor up
CTRL-J	cursor left (or use the left cursor key)
CTRL-K	cursor right (or use the right cursor key)
CTRL-M	cursor down
CTRL-N	normal text
CTRL-R	reversed text
CTRL-F	flashing text
CTRL-S	save screen
CTRL-L	load screen
CTRL-C	clear screen
CTRL-P	print screen
CTRL-T	change title
CTRL-Q	quit editor
ESC =	view help screen

Once you've created a help screen, save it to disk by pressing CTRL-S and specifying a filename. For the screen editor's help screen, use the filename SEHELP. (The program automatically appends the filename extender .SCR when saving or loading screen files.) Then delete the temporary line 15 we added above, and you're ready to go. From now on, you can call up this help screen of screen editor commands merely by pressing ESC. Press any key to switch from the help screen back to the editor.

"Help Screen Editor" lets you add custom help screens to your own programs. This sample screen was created for use with the editor program itself.

Programming Notes

To add help screens to your own programs, follow these steps:

1. Be sure your program reserves space for text page 2 just as Program 1 does, with POKE 104,12 and POKE 3072,0.
2. To load the help screen into memory, your program should execute the command BLOAD *filename*,A$800. Make sure the filename corresponds with the name of the screen file on the disk.
3. To swap text page 2 with text page 1 and make the help screen visible, your program should execute the statement POKE -16299,0.

To return to the original screen, your program should execute the statement POKE −16300,0. If you want to make the help screen visible until any key is pressed, use POKE −16299,0:GET G$:POKE −16300,0.

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

Program 1: Screen Editor Loader

```
74 10 HOME : POKE 104,12: POKE 3
      072,0: PRINT CHR$(4);"RUN
      SE"
```

Program 2: Help Screen Editor

```
9E 10 HOME :R = 1:C = 1
74 20 PRINT CHR$ (4);"BLOAD SEHE
      LP.SCR,A$800"
4A 30 POKE - 16299,0: GET G$: PO
      KE - 16300,0
62 40 ST$ = "NEW SCREEN"
DC 50 DIM LS(23): FOR I = 1 TO 2
      3: READ LS(I): NEXT : DATA
       1024,1152,1280,1408,1536,
      1664,1792,1920,1064,1192,1
      320,1448,1576,1704,1832,19
      60,1104,1232,1360,1488,161
      6,1744,1872
B9 60 DIM CV(3): FOR I = 1 TO 3:
       READ CV(I): NEXT : DATA 3
      ,6,27
57 70 D$ = CHR$ (4)
56 80 GOSUB 590
DE 90 VTAB R: HTAB C: GET G$:G =
       ASC (G$): IF G > 31 THEN
      560
83 100 FOR I = 1 TO 3: IF G = CV
       (I) THEN 120
88 110 NEXT I: GOTO 130
85 120 ON I GOSUB 150,170,180: G
      OTO 90
49 130 V = G - 7: IF V < 1 OR V
      > 14 THEN 90
E6 140 ON V GOSUB 190,210,230,24
      0,260,300,320,330,340,430
      ,470,480,510,550: GOTO 90
32 150 VTAB 24: HTAB 1: PRINT "C
      LEAR THE SCREEN? (Y/N)";:
       GET G$: IF G$ = "Y" THEN
       HOME
A6 160 GOSUB 590: RETURN
DB 170 M = 2: GOSUB 590: FLASH :
       RETURN
76 180 POKE - 16299,0: GET G$: P
      OKE - 16300,0: RETURN
77 190 C = C - 1: IF C = 0 THEN
      C = 40:R = R - 1: IF R =
      0 THEN R = 23:C = 40
12 200 RETURN
B3 210 R = R - 1: IF R = 0 THEN
      R = 23
16 220 RETURN
9D 230 GOSUB 190: RETURN
98 240 C = C + 1: IF C = 41 THEN
       C = 1:R = R + 1: IF R =
      24 THEN R = 1:C = 1
1C 250 RETURN
17 260 NORMAL :M = 0: GOSUB 580:
       VTAB 24: HTAB 1: POKE 34
      ,23: PRINT "TITLE TO LOAD
      ? <RET> = QUIT ";: INPUT
      "";T$
E6 270 IF LEN (T$) < 1 THEN 290
CB 280 ST$ = T$: PRINT D$"BLOAD
      ";ST$;".SCR"
83 290 POKE 34,0: GOSUB 580: GOS
      UB 590: RETURN
6A 300 R = R + 1: IF R = 24 THEN
       R = 1
15 310 RETURN
1B 320 M = 0: GOSUB 590: NORMAL
      : RETURN
19 330 RETURN
D6 340 POKE 34,23: VTAB 24: HTAB
       1: PRINT "PRESS <RET> TO
       PRINT, OTHER TO ABORT.";
A5 350 GET G$:G = ASC (G$): IF G
       = 13 THEN 370
8E 360 PRINT D$"PR#0": POKE 34,0
      : GOSUB 580: GOSUB 590: R
      ETURN
AF 370 GOSUB 580: POKE 34,23
45 380 PRINT D$"PR#1": FOR I = 1
       TO 23: FOR J = 0 TO 39:P
       = PEEK (LS(I) + J)
1B 390 IF P < 192 THEN P = P + 6
      4: GOTO 390
B6 400 P = P - 128: IF P > 94 TH
      EN P = P - 64
98 410 PRINT CHR$ (P);
AC 420 NEXT J: PRINT : NEXT I: G
      OTO 360
D3 430 GOSUB 580: POKE 34,23: VT
      AB 24: HTAB 1: PRINT "QUI
      T THE EDITOR? (Y/N)";
F1 440 GET G$: IF G$ = "Y" THEN
      POKE 34,0: HOME : END
66 450 IF G$ = "N" THEN GOSUB 58
      0: GOSUB 590: RETURN
1F 460 GOTO 440
C9 470 M = 1: GOSUB 590: INVERSE
       : RETURN
23 480 IF LEN (ST$) < 1 OR ST$ =
       "NEW SCREEN" THEN GOSUB
      510
27 490 NORMAL : GOSUB 580: VTAB
      24: HTAB 1: PRINT "SAVE "
      ;ST$;"? (Y/N)";: GET G$:
      IF G$ = "Y" THEN GOSUB 58
      0: PRINT D$"BSAVE ";ST$;"
      .SCR,A$400,L$400"
AF 500 GOSUB 580: GOSUB 590: RET
      URN
EE 510 NORMAL : GOSUB 580: HTAB
      1: VTAB 24: PRINT "TITLE?
       ( <= 10 CHAR ) ";: POKE
      34,23: INPUT T$: IF LEN (
      T$) > 10 THEN PRINT CHR$
      (7): GOTO 510
C3 520 IF LEN (T$) < 1 THEN 540
DE 530 ST$ = T$
B5 540 GOSUB 580: POKE 34,0: GOS
      UB 590:R = 1:C = 1:M = 0:
       RETURN
9B 550 GOSUB 240: RETURN
9D 560 PRINT G$;:C = C + 1: IF C
       > 40 THEN C = 1:R = R +
      1: IF R > 23 THEN R = 1
3F 570 GOTO 90
6E 580 POKE 34,23: VTAB 24: HTAB
       1: PRINT :R = 1:C = 1: P
      OKE 34,0: RETURN
03 590 NORMAL : VTAB 24: HTAB 1:
       ON M + 1 GOSUB 610,620,6
      30
CA 600 PRINT " EDITING ";: INVER
      SE : PRINT ST$;: NORMAL :
       VTAB 1: HTAB 1: PRINT CH
      R$ ( PEEK (1024)): RETURN
66 610 PRINT "NORMAL  ";: RETURN
D3 620 PRINT "REVERSED";: RETURN
C3 630 PRINT "FLASH   ";: RETURN
```

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IBM PrtSc Protector

Marc Sugiyama

If you've ever hit Shift-PrtSc by mistake and accidentally dumped a screen to the printer, you'll appreciate this short keyboard patch program. It works on any IBM PC with PC-DOS 2.0 or higher.

IBM has taken a good deal of flak over the years about the layout of the PC keyboard. One major complaint is the position of the PrtSc (Print Screen) key: It's next to the righthand Shift key. (This has been corrected on the PCjr and PC-AT.) If your finger goes astray and accidentally hits both Shift and PrtSc, the PC suddenly dumps the screen to the printer. It's particularly annoying when you're printing a long document or when you don't have a printer attached. If there's no printer, the PC locks up until it figures out that there's nothing to print to.

On the other hand, it's nice to have the screen dump capability handy when you need it. You wouldn't want to completely disable the function, but it would be nice if it were a little harder to call by accident.

"PrtSc Protector" offers a good compromise. It's a short machine language program that patches into the PrtSc function and distinguishes between the two Shift keys. If you press the *right* Shift key with PrtSc, nothing happens. If you press the *left* Shift key with PrtSc, you get the screen dump you really wanted.

The program below is a BASIC loader that creates the machine language file NOPRTSC.COM for PrtSc Protector directly on disk. If the BASIC loader detects any errors in the DATA (highly unlikely if you enter the program using COMPUTE!'s Automatic Proofreader"), it reports the mistake and erases the incorrect file. Because the file has the extension .COM, you can activate the program simply by typing the filename at a DOS prompt:

```
A> NOPRTSC
```

The resident portion of NOPRTSC.COM takes only about 320 bytes of memory. If you want to dump graphics screens to the printer, install NOPRTSC.COM after installing GRAPHICS. Don't try to install GRAPHICS more than once, or the computer will crash. Likewise, don't try to install NOPRTSC.COM more than once (why would you want to?). When NOPRTSC.COM is installed successfully, it returns a 'zero in the ERRORLEVEL variable; otherwise, it returns a one.

IBM PrtSc Protector

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

```
EF 100 CLS:LOCATE 10,10:PRINT"Wr
       iting file ..."
JA 110 OPEN "noprtsc.com" FOR OU
       TPUT AS #1
BP 120 FOR I=1 TO 279:READ BYTE:
       CKSUM=CKSUM+BYTE
GH 130 PRINT#1,CHR$(BYTE);
GO 140 NEXT I:CLOSE 1
OH 150 IF CKSUM <> 25301 THEN PR
       INT"** Error in DATA stat
       ements **":KILL "noprtsc.
       com":STOP
MK 160 PRINT:PRINT"File for nopr
       tsc.com has been created.
       ":END
NK 200 DATA 233,171,0,80,97,117
       ,108,80,83,81,82,86
KJ 210 DATA 87,85,180,2,205,22,
       168,2,116,6,156,154
HK 220 DATA 0,0,0,0,93,95,94,90
       ,89,91,88,207
LL 230 DATA 80,114,111,116,101,
       99,116,101,100,32,80,114
JB 240 DATA 116,83,99,32,105,11
       0,115,116,97,108,108,101
MM 250 DATA 100,46,32,32,83,104
       ,105,102,116,45,80,114
CL 260 DATA 116,83,99,32,117,11
       5,105,110,103,32,114,105
EI 270 DATA 103,104,116,45,115,
       104,105,102,116,32,100,10
       5
EG 280 DATA 115,97,98,108,101,1
       00,46,13,10,36,80,114
BF 290 DATA 111,116,101,99,116,
       101,100,32,80,114,116,83
LF 300 DATA 99,32,97,108,114,10
       1,97,100,121,32,105,110
AB 310 DATA 115,116,97,108,108,
       101,100,46,13,10,36,82
BN 320 DATA 101,113,117,105,114
       ,101,115,32,68,79,83,32
JE 330 DATA 50,46,48,32,111,114
       ,32,97,98,111,118,101
GE 340 DATA 46,13,10,36,0,0,180
       ,48,205,33,60,0
BG 350 DATA 117,9,186,143,1,180
       ,9,205,33,205,32,187
DJ 360 DATA 36,1,177,4,211,235,
       67,137,30,172,1,184
HB 370 DATA 5,53,205,33,137,30,
       24,1,140,6,26,1
EH 380 DATA 190,3,1,141,127,252
       ,185,4,0,252,243,166
LJ 390 DATA 131,249,0,116,33,18
       0,9,186,36,1,205,33
FK 400 DATA 184,5,37,186,7,1,20
       5,33,161,44,0,142
DD 410 DATA 192,180,73,205,33,1
       84,0,49,139,22,172,1
FO 420 DATA 205,33,186,106,1,18
       0,9,205,33,184,1,76
AB 430 DATA 205,33,0
```

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Apple Error-Trapping

Ann Baldridge

You can add the professional touch to your BASIC programs by checking for common user errors—such as mistyped filenames, attempts to save data files on write-protected disks, invalid input, and the like. This article shows how any Applesoft program can be improved with proper use of the ONERR statement. The techniques apply to all Apple II-series computers with either DOS 3.3 or ProDOS.

Computers can be impolite. If you make the tiniest little nit-picking mistake, they balk with an error message and interrupt what you were trying to do. Or worse, they sometimes decide to freeze up and challenge you to a staredown.

This is bad enough when it happens to you. But if you write software for other people to use, part of your job is to protect them against the computer's insistence on perfection. One tool you can employ is an Applesoft BASIC command that is underutilized and even mysterious to many Apple programmers: ONERR (*on error*).

Picture a typical user who has just spent a half-hour entering information into your program. The program asks, SAVE TO DISK?. He taps Y in response, watches the drive's busy light come on, and then reaches over and pops opens the drive to make sure he's saving to the right disk—thereby aborting the save. A dumb mistake? Not for a beginner.

Although you may think he *deserves* to hear the drive's angry clacking sound and the error beep, and see the I/O ERROR warning and the now-mindless blinking cursor, you *can* keep all this from happening. If you inserted just one instruction before the save routine—ONERR GOTO 500—your program could be recovering from this mistake in whatever way you planned in line 500 and beyond.

Just because computers can sometimes be impolite doesn't mean your programs must be, too.

ONERR Tools And Rules

To save you the trouble of plowing through piles of programming manuals and reference guides, not to mention the hours you might spend experimenting, I've compiled a list of rules to follow when trapping errors in Applesoft programs. These are the results of my own trial-and-error efforts.

1. The ONERR command must be paired with GOTO, not GOSUB. Here's the proper syntax:

```
10 ONERR GOTO 1000
```

assuming, of course, that your error-handling routine begins at line 1000. If you try pairing ONERR with GOSUB, you'll get a syntax error.

2. The ONERR command must *precede* the statement where you anticipate an error may occur. For instance, if you want to protect against the disk drive input/output error described above, the ONERR command must be executed before the save routine. ONERR can be included in a multiple-statement line, but must be the *last* statement in the line. (I discovered that rule when some other statements following the ONERR command evaporated. Took me a while, too, because none of the books I read mentioned it.) Most programmers isolate ONERR GOTO on its own line. Now you know why.

3. When an error happens, the computer places a code number identifying the error into memory location 222. So ERRNUM=PEEK (222) yields a number that helps you plan what to do next. For instance, the numbers between 1 and 15 indicate a disk operation error. Some of these error codes are listed in the table below.

4. The command RESUME returns the program to the *beginning* of the statement or instruction where the error occurred—but not necessarily to the beginning of the line. It acts kind of like RETURN, except that it doesn't come back to the statement or line after the statement which called it. Let's say your program contains a line like this:

```
10 PRINT A:PRINT B:PRINT C
```

and an error occurs while PRINT B is executed. RESUME returns to the

PRINT B statement—not PRINT A or PRINT C. You can determine the line number where the error happened with this statement:

```
LINERR=PEEK(218)+PEEK(219)*256
```

5. You can turn off the ONERR command with POKE 216,0. If you do this too soon after an error occurs, however, the error code won't be stored in memory location 222.

6. There are some problems with ONERR in Applesoft. You get into a bunch of trouble if the error happens within a subroutine or a FOR-NEXT loop or, heaven forbid, both. For instance, suppose your program encounters a few errors while executing a load or save routine within a nested FOR-NEXT loop that is inside a nested subroutine. Boom. Reset City. There is a very short machine language fix that avoids these and other troubles. The routine is included (in the form of DATA statements) in lines 3000–3020 of Program 1. You must call this routine *before* you POKE 216,0. (I spent two days chasing a phantom syntax error before discovering this rule.) To be safe, make POKE 216,0 the last command before returning from the error-handling routine.

7. You can set a variable to either zero or one depending on whether the ONERR routine has been called. Known as *setting a flag*, this technique uses an IF-THEN statement to direct the route of the program.

Not A Cure-All

The purpose of ONERR, by the way, is to trap system errors which may occur as a program runs. You should not rely on it to trap your BASIC programming mistakes—errors like OUT OF DATA, TYPE MISMATCH, SYNTAX ERROR, and so on. Those kinds of errors should be caught when you test and debug the program. Too many lazy programmers use ONERR to cover their inability or unwillingness to find and correct their *own* errors.

The types of errors you should trap with ONERR are those which can be anticipated but not predicted: a data disk that is left out of the drive; a drive door that's left open; a mistyped filename; or a data disk filled to capacity. In these cases, ONERR routines protect the user from himself.

Putting Theory To Practice

Program 1 shows how to apply these rules. Note that this program is for illustration only, not to be typed in and run. Notice these variables:

ER is the error flag. When set to zero, it means no error has occurred. The program resets the flag to one when a problem exists.

EC is the error code number PEEKed from location 222.

Here's how the program works:

Line 10 sets up D$ as the DOS selector code, which saves keystrokes later on.

Line 20 sets up the machine language fixer for ONERR. This subroutine is called only once.

Lines 100 and 200 set the error flag (ER) to zero and prepare the ONERR routine to be called if necessary. Tip: Put the ONERR GOTO command(s) into a REM statement (e.g., 100 ER=0:REM ONERR GOTO 2000) until you've fixed all of your *own* errors. Otherwise, simple typos and logic mistakes will trigger ONERR and call your error-handling routine. When you're satisfied the program works the way you intended, remove the REM to activate ONERR.

Lines 110 and 210 ask the user to enter a filename.

Lines 120 and 220 are the important ones. You *must* put your error flag and IF-THEN statements into the line where you expect trouble to occur. If no error routine is called, the line goes on to execute normally. If an error does occur, then line 2000 executes (ONERR GOTO 2000).

Line 2000 begins the error-handling routine. It sets the error flag to one (ER=1); examines the error code (EC=PEEK(222)); calls the machine language fixer routine at memory location 768 in case the error was within a subroutine or FOR-NEXT loop (CALL 768); and tells the program to continue execution at the beginning of the statement where the error happened (RESUME).

What happens next is the key. When the program goes back to the appropriate statement (in this case either line 120 or 220), the error flag (ER) no longer equals zero. So, when the program reaches a statement that tests IF ER=0, execution drops to the next line (either 130 or 230). Lines 250 and 260 show how to use the error flag method in a multistatement line. Remember, RESUME returns to the beginning of the *statement* where the error was detected. So the flag must be set flag in a second location, too.

When execution drops through to line 130 or 230, GOSUB statements call subroutines which print specific information depending on the problem encountered. Then the ONERR function is turned off with POKE 216,0 before returning to let the user try again. You may wish to carry out this step just before the RESUME statement in the error-handling routine. And you'll certainly want to include it at the end of each disk access routine to stay aware of any other problems which may crop up.

Eliminating Hostility

Program 2 shows the changes you could make to lines 200–240 of Program 1 if you wanted to save text rather than program files. The error flag appears in line 220, which writes to the disk, since a DISK FULL or similar error is more likely then. Note that you don't have to close the file when the program drops through to the next line. When the Apple detects an error, it clears all of its file buffers, which makes closing unnecessary.

You may want to add an error flag to line 15, too. When the file is opened, an error could result if there's no disk in the drive or if the drive door is open. You could also precede each WRITE command with a trap, since a DISK FULL error bounces the program back to BASIC.

The error-message routines at lines 2100 and 2200 help the user find out what happened so he can correct the mistake before continuing. Although brief, they are written in a friendly tone. Frankly, beeping the computer and flashing I/O ERROR is not only hostile, but gives beginners no clue about how

to proceed.

This approach to error-trapping is quite flexible and adds a professional touch to any program. Don't overdo it, though. ONERR is best used to help people with problems you can't handle via skilled and careful programming.

Important DOS Error Codes

Code	Error Description
4	Write-protected disk
6	File not found
8	I/O error
9	Disk full
10	File locked

Note: A complete list of error codes is commonly found in many Apple manuals and books.

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

Program 1: ONERR Demo

```
89 10 D$ = CHR$ (4): REM SET APP
      LE DOS SELECTOR
89 20 GOSUB 3000
9A 100 ER = 0: ONERR GOTO 2000
62 110 INPUT "WHAT FILE WOULD YO
      U LIKE TO SEE?";FILE$
F7 120 IF ER = 0 THEN PRINT D$;"
      LOAD "FILE$: GOTO 140
A9 130 GOSUB 2100: POKE 216,0: G
      OTO 100: REM GO BACK TO T
      RY AGAIN
9C 140 PRINT "HERE'S YOUR FILE."
D5 199 REM SAVE A FILE
9B 200 ER = 0: ONERR GOTO 2000
87 210 INPUT "WHAT FILENAME WOUL
      D YOU LIKE TO USE?";FILE$
EA 220 IF ER = 0 THEN PRINT D$;"
      SAVE "FILE$: GOTO 240
B4 230 GOSUB 2200: POKE 216,0: G
      OTO 200: REM GO BACK TO T
      RY AGAIN
87 240 PRINT "YOUR FILE HAS BEEN
       SAVED":GOTO 4000
7B 1999 REM ONERR ROUTINES
48 2000 ER = 1:EC = PEEK (222):
      CALL 768: RESUME
79 2099 REM LOADING ERROR MESSAG
      ES
E3 2100 IF EC = 6 THEN PRINT "UN
      ABLE TO LOCATE FILE BY T
      HAT NAME.      PLEASE CHE
      CK TO SEE IF YOU SPELLED
       IT   CORRECTLY."
0C 2110 IF EC = 8 THEN PRINT "EI
      THER YOUR DISK DRIVE DOO
      R IS OPEN OR  YOU DON'T
      HAVE A DISK IN THIS DRIV
      E."
75 2120 GOSUB 2300: RETURN
C2 2199 REM SAVING ERROR MESSAGE
      S
47 2200 IF EC = 4 THEN PRINT "TH
      IS DISK IS WRITE-PROTECT
      ED.          PLEASE REM
      OVE THE WRITE-PROTECT TA
      B OR  PUT IN A NON-PROTE
      CTED DISK."
42 2210 IF EC = 8 THEN PRINT "EI
      THER YOUR DISK DRIVE DOO
      R IS OPEN OR  YOUR DISK
      IS BAD."
40 2230 IF EC = 9 THEN PRINT "TH
      IS DISK IS FULL. PLEASE
      INSERT A       DIFFERENT
      DISK."
7F 2240 GOSUB 2300: RETURN
ED 2300 PRINT : PRINT "PRESS ANY
       KEY TO TRY AGAIN.": GET
       K$: PRINT K$: RETURN
CB 3000 FOR I = 0 TO 9: READ MT:
       POKE 768 + I,MT: NEXT I
5F 3010 DATA 104,168,104,166,223
      ,154,72,152,72,96
DB 3020 RETURN
C5 4000 END
```

Program 2: Text Save Routine

```
A8 215 PRINT D$;"OPEN "FILE$
6B 220 IF ER = 0 THEN PRINT D$;"
       WRITE "FILE$: GOTO 240
F3 230 GOSUB 2200: POKE 216,0: G
       OTO 200
C6 240 PRINT "OKAY, I'M SAVING Y
       OUR FILE NOW."
22 250 IF ER = 0 THEN PRINT A$:
       PRINT B$: PRINT C$: PRINT
        A: PRINT B: PRINT C: IF
       ER = 0 THEN 4000
F9 260 GOSUB 2200: POKE 216,0: G
       OTO 200
```

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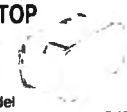

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News & Products

Tax, Telecommunications Programs

Arrays, Inc., has released the 1985 version of *Tax Advantage*, an income tax preparation program for the Commodore 64 and 128; Apple II, II+, IIe, and IIc; Atari 800, 800XL, and 130XE; and IBM PC, XT, and AT computers. The package aids in preparing forms 1040, 6251, 2106, 2441, 4562, and schedules A, B, C, D, E, G, SE, and W. All information can be printed directly onto IRS forms and schedules. In addition, *Tax Advantage* performs income averaging, line itemization, and minimun tax calculations. The program is planned for ease of use, even for users new to computers and tax preparation, and works with Arrays' *The Home Accountant*.

Suggested retail price is $69.95. For an additional $10 warranty fee, users can purchase next year's update at a substantial price reduction.

Placing and answering calls on the Commodore 64 can be done automatically with *PhoneCall*, a new telecommunications program also from Arrays. It can be used to access online databases such as The Source or Compuserve, as well as other micro and mainframe computers. The program can send and receive both text and program files, and can convert CompuServe files to Commodore ASCII files.

PhoneCall's macro capability can store numbers, log on codes and billing information. It also includes a small bulletin board, and has a 26K buffer. The program comes with a tutorial and quick reference manual. Suggested retail price is $59.95.

Arrays, Inc./Continental Software, 6711 Valjean Avenue, Van Nuys, CA 91406.

Circle Reader Service Number 190.

Filing Program For Atari ST

AtariSoft and Stoneware, creator of the original *DB Master* database management system for several different microcomputers, have introduced a filing system for the Atari 520ST that is easy enough for first-time computer users. Called *DB Master One*, the system enables users to create forms with different colors and typestyles, or engage ready-to-use templates. Reports can also be easily generated. The program can hold up to 320K files, with 100 fields per form, 3,000 characters per record, four report forms, and ten report designs. Suggested retail price, $49.

Atari Corp., 1196 Borregas Ave., P.O. Box 3427, Sunnyvale, CA 94088-3427

Circle Reader Service Number 191.

Star Gazing On The Mac

Halley's Comet has been included in the new 512K Macintosh version of *Tellstar*, Spectrum HoloByte's computer astronomy software package. The program can track the comet from any location and on any date and time from 1980 to 1991. Also included in the program are displays and astronomical data on solar bodies, constellations, and Messier objects. *Tellstar Level I* includes all basic functions and one star table and retails for $49.95; *Tellstar Level II* comprises three detailed star tables and retails for $79.95. Versions for IBM and Apple II computers are also available.

Orbiter, another new release from Spectrum HoloByte, is a space shuttle simulation and game with 3-D graphics and voice synthesis that puts the player at the helm of NASA operations. Players earn points based on missions completed and performance throughout the entire space flight. *Orbiter* runs on the 512K Macintosh and sells for $49.95.

Spectrum HoloByte Inc., 1050 Walnut, Suite 325, Boulder, CO 80302.

Circle Reader Service Number 192.

Commodore, Apple II Word Processor

Better Working, the home productivity software brand from Spinnaker Software, has announced its *Word Processor with Spellchecker* for the Commodore 64/128, the Apple II series, and the Atari ST computers. *Word Processor* is the third product in the Better Working line, joining *Spreadsheet* and *File and Report*.

The new package combines a full-featured word processor with the 50,000-word *American Heritage Dictionary Spellchecker*. The three Better Working programs are integrated. Suggested retail for *Word Processor with Spellchecker* is $59.95 for the Apple II and ST versions and $49.95 for the Commodore version.

Better Working, One Kendall Square, Cambridge, MA 02139.

Circle Reader Service Number 193.

Prime Printers

A new low cost dot-matrix printer has been released from the Japanese company Citizen America Corp. Called the 120D, it features 120 characters per second (cps) printing, graphics capability, switch selectable IBM and Epson compatibility; a 25 cps correspondence quality mode; and a standard 4K buffer. List price is $249.

Another new printer from Citizen America, the Premiere 35, is a letter-quality daisywheel printer with a 35 cps printing speed and a low operating noise level of 55 decibels. It also has an 8K buffer, an LCD display of print functions and error messages, and selectable proportional spacing for justified text. List price is $599.

Citizen America Corp., 2425 Colorado Ave., Santa Monica, CA 90404.

Circle Reader Service Number 194.

New From Learning Well

Know Logo, an educational program for grades one and up, has been released by Learning Well. In a series of 50 games and discovery-based activities, *Know Logo* provides practice in turtle moves and turns, estimating angles, screen distances and positioning, and commands for circles and arcs. It requires a basic knowledge of Logo commands.

Also new from Learning Well is *Typing Well*, a typing tutor for children and adults. Players gobble up letters, create word pictures, and play table tennis as they sharpen their touch typing skills. The word-per-minute speed is automatically adjusted for each player, so that the program challenges without going beyond individual capabilities.

Each program runs on the Apple II series and lists for $49.95

Learning Well, 200 S. Service Rd., Roslyn Heights, NY 11577.

Circle Reader Service Number 195.

Commodore 64 Talking Text

The Votalker C-64 speech synthesizer from Votrax offers three types of text vocalization: conversation mode, which reads text as it's spoken; verbatim mode, which reads text and pronounces symbols; and character mode, which spells each word and pronounces numbers and symbols. It also has a screen echo that allows all words, numbers, punctuation marks and other symbols to be automatically spoken as they are printed to the terminal screen.

The four-by-five inch unit plugs into the Commodore 64 expansion port and contains its own amplifier, speaker, and external speaker jack. Suggested retail price is $99; and for a limited time, those who purchase the Votalker C-64 will receive a free copy of *Trivia Talker II*, Votrax's talking trivia game.

Votrax, Inc., 1394 Rankin Rd., Troy, MI 48083.

Circle Reader Service Number 196.

The Votalker C-64 voice synthesizer speaks text automatically and sells for $99.95.

Modula-2 Programming Language

TDI Software has announced the release of *Modula-2/ST* programming language for the Atari ST, in addition to versions for the Amiga and Macintosh computers. TDI *Modula-2/ST* comes with a full screen editor linked to the compiler, and flags all errors during compilation. It also has a full GEM interface, which enables the user to access GEM routines including GEM DOS, windows, mice, menus, and graphics.

Suggested price is $69.95.

TDI Software Inc., 10410 Markison Rd., Dallas, TX 75238.

Circle Reader Service Number 197.

Transparent Technology For Commodore

Transparent utilities—programs that run concurrently with other programs but only appear when called upon—are now possible for the Commodore 64 through Cardco, which recently introduced *StealthTec*, a transparent program interrupt technology on a cartridge.

Cardco's first product to use this technology is *Freeze Frame*, a transparent screen dump utility. A couple of keystrokes will send whatever is displayed on the computer screen to the printer. *Freeze Frame* is compatible with all programs and languages, and supports any printer or interface which emulates the Commodore 1525, as well as Epson- and Okidata-compatible printers. It retails for $49.95.

A second program in this line (unnamed at press time) is similar to Borland's *Sidekick* for the IBM-PC. The product offers access to things like a calculator, appointment calendar, telephone directory/database, and a memo writer. Any of the functions can be called up while another program is running. Suggested retail price is $69.95.

Cardco plans to make the *StealthTec* technology available for licensing by other software vendors.

Cardco, Inc., 300 S. Topeka, Wichita, KS 67202

Circle Reader Service Number 198.

Hippopotamus Introduces 14 ST Products

Hippopotamus Software has announced an initial line of 14 programs for the Atari ST. The products take advantage of the ST's GEM environment, incorporating pull-down menus, windows, and online help screens.

The line includes *HippoWord*, a mouse-based word processor ($89.95); *Hippo Concept*, an idea organizer compatible with *HippoWord* ($89.95); *HippoSimple*, a database manager ($49.95); *Hippo Disk Utilities*, compatible with floppy and hard disks ($49.95); *HippoBackgammon*, using full-color animated graphics ($39.95); *Hippo Computer Almanac*, a combination game/reference tool that contains more than 35,000 facts ($34.95); and *HippoPixel*, which allows users to create their own sprites and fonts ($39.95).

Hippopotamus Software, Inc., 985 University Ave., Suite 12, Los Gatos, CA 95030

Circle Reader Service Number 199.

Classics On Computer For Apple II

An educational game based on the book *Treasure Island* has been introduced by Classics On Computer. Appropriate for either home or classroom use, the program contains a high-resolution graphics game board, a short review game, and a special manual for teachers.

Treasure Island is designed to improve reading skills and build vocabulary. It is recommended for grades 5-9. Available for the Apple II, II+, or Apple IIe with minimum 48K memory, the program retails for $39.95.

Classics On Computer, 5150 Wilshire Blvd., Suite 502, Los Angeles, CA 90036.

Circle Reader Service Number 200.

Low-Cost Word Processor For IBM-PC

Dac Software, has announced *Dac Easy Word*, a versatile word processor for the IBM-PC.

The program features the ability to work on four different documents simultaneously (using DAC Windows); automatic hyphenation; file merges; automatic search; page numbering; and word count. It requires 256K memory on the IBM-PC, and retails for $49.95.

Dac Software, Inc., 4801 Spring Valley Rd., Building 110B, Dallas, TX 75244

Circle Reader Service Number 201.

SpeedScript Enhancer For 64

Upstart Publishing has released *Speedpak*, an enhancement to COMPUTE!'s popular *SpeedScript* word processor (Commodore 64 versions 3.0–3.2). The program adds six new commands, three printer codes, and eight user-definable 31-character macro phrase keys.

Additional features include alternate screens, which enable switching between and editing two documents instantly; a help screen and onscreen font installer, 32-character encryption, code conversion to Commodore ASCII or screen codes; default selection to disk/tape storage, set printer device and secondary address; and a Dvorak keyboard option.

Speedpak comes with printed instructions and includes three disk-based tutorials and three sample files. Price, $15.

Upstart Publishing, Dept. SP-NP2, P.O. Box 22022, Greensboro, NC 27420

Circle Reader Service Number 202.

Word Munchers On The Apple

A world of Munchers and Troggles awaits the player of *Word Munchers*, a new educational game for grades one through five, from Minnesota Educational Computing Corporation (MECC). Players move their Word Muncher around a game screen and direct it to eat words that have a particular vowel sound, while avoiding the enemy Troggles. *Word Munchers* becomes progressively more difficult at higher levels. Teachers can determine which vowel sounds are used and can control the level of word difficulty. About 1700 words of varying difficulty

can be used.

Word Munchers runs on all Apple II computers with at least 64K memory. Use of a joystick is optional. A support manual is included. Suggested retail price, $49.

Minnesota Educational Computing Corporation, 3490 Lexington Ave. North, St. Paul, Minnesota 55126-8097

Circle Reader Service Number 203.

***HomePak, BatteryPak* For Mac**

Batteries Included's *HomePak* and *BatteryPak* programs have been developed for the Macintosh. *HomePak* is a three-in-one telecommunications/ word processing/database manager program with macro command capability. *BatteryPak* is a set of nine accessories: Calendar, with Daytimer, keeps track of appointments and deadlines; the 250-page Phonepad stores and retrieves phone numbers; Automatic Modem/ Phone Dialer automatically dials any number listed in Phonepad or Calendar; Scientific Calculator includes statistical, logarithmic and trigonometric functions; RPM Calculator is for everyday calculating; a 7-function disk utility includes Trash, Copy, and Rename commands; High-Speed Launcher transfers to and from any program; Print Text creates draft copies while continuing to use the Mac; Windows Listing brings any window to the front of the screen.

Suggested retail price of *HomePak* is $69.95; for *BatteryPak*, $49.95.

Batteries Included, 17875 Sky Park North, Suite P, Irvine, CA 92714

Circle Reader Service Number 204.

ST Telecommunications

Online databases and bulletin boards can be accessed from the Atari 520ST using Atari's *Fastcom* telecommunications software. The program features integrated ASCII, VT100, and Viewdata modes; GEM drop down menus; transmission of text and binary files; macro commands; multi-tasking; full Prestel functions; printing of both graphics and text; and autodial and auto answer modem support.

The program comes with user guide and reference manual, and lists for $69.

Atari Corp., 1196 Borregas Ave., P.O. Box 3427, Sunnyvale, CA 94088-3427

Circle Reader Service Number 205.

Electronic Word Book

Richard Scarry's Best Electronic Word Book Ever!, a new program from CBS Software, is a picture and word game from children's author and illustrator Richard Scarry. Word recognition, vocabulary building, and objects recognition are developed as players travel with Lowly Worm to six different colorful environments: a farm, a town, a park, a railroad yard, a construction site and a harbor. In each environment, players learn to identify objects and associate them with their printed names. Animated graphics and familiar childhood tunes are used in each of the game's four skill levels. For the Apple II family and the Commodore 64 and 128. Suggested retail price, $19.95.

CBS Software, One Fawcett Place, Greenwich, CT 06836

Circle Reader Service Number 206.

ST Software From Spinnaker

Spinnaker Software has released Atari 520ST versions of several of their more popular programs. *Homework Helper Math* and *Homework Helper Writing*, two educational programs, sell for $49.95 each; *Amazon, Dragonworld, Fahrenheit 451, Nine Princes in Amber,* and *Perry Mason: The Case of the Mandarin Murder*, all graphics-and-text adventure games also sell for $49.95 each; *Treasure Island* and *Wizard of Oz*, from the Windham Classics series, sell for $39.95 each; and *Kung Fu: The Way of the Exploding Fist* sells for $39.95.

Spinnaker Software, One Kendall Square, Cambridge, MA 02139

Circle Reader Service Number 207. ©

HOTWARE: Software Best Sellers

This Month	Last Month	Title	Publisher	Remarks	Systems: Apple	Atari	Commodore	IBM	Macintosh
Entertainment									
1.	1.	*F-15 Strike Eagle*	MicroProse	Air combat simulation	●	●	●	●	
2.	5.	*Karateka*	Brøderbund	Action karate game	●	●	●		
3.	3.	*Jet*	Sublogic	Flight simulation	●	●	●		
4.	2.	*Flight Simulator II*	SubLogic	Aircraft simulation	●	●	●		
5.		*Ultima IIII*	Origin Systems, Inc.	Fantasy game	●	●	●	●	
Education									
1.	1.	*Typing Tutor III*	Simon & Schuster	Typing instruction program	●		●	●	●
2.	2.	*Math Blaster!*	Davidson	Introductory math program, ages 6-12	●	●	●	●	
3.	3.	*New Improved MasterType*	Scarborough	Typing instruction program	●	●	●	●	●
4.	4.	*Music Construction Set*	Electronic Arts	Music composition program	●	●	●		
5.	5.	*Sky Travel*	Commodore	Astronomy learning program			●		
Home Management									
1.	1.	*Print Shop*	Brøderbund	Do-it-yourself print shop	●	●	●		
2.	2.	*The Newsroom*	Springboard	Do-it-yourself newspaper	●		●	●	
3.	4.	*Print Shop Graphics Library II*	Brøderbund	Upgraded graphics library	●	●	●		
4.	5.	*Print Shop Graphics Library*	Brøderbund	100 additional graphics	●	●	●		
5.		*Three-In-One Bundle*	Timeworks	Word processor, spreadsheet, database manager			●		

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SpeedCalc
For Apple II Computers

Kevin Martin

In response to popular request, COMPUTE! *presents this professional-quality spreadsheet program for all Apple II-series computers with either DOS 3.3 or ProDOS. Written completely in high-speed machine language, Apple* SpeedCalc *has all the important features you'd expect from a commercial spreadsheet program. In addition, its data files can be merged into text files created with the Apple* SpeedScript *word processor published last year in* COMPUTE!. *Apple* SpeedCalc *requires a disk drive, and a printer is optional but recommended.*

Have you ever planned a budget for your home or office? If so, you probably used some sort of worksheet divided into rows and columns. Perhaps you wrote the months of the year along the top of the sheet and listed categories for earnings and expenses along one side. After entering data for each category and month of the year, you could calculate total income figures by adding or subtracting numbers in each of the sheet's "cells."

That's a classic example of a worksheet. It lets you enter and organize data, then perform calculations that produce new information. A *spreadsheet* program is an electronic version of the familiar paper worksheet. Since it does all the calculations for you at lightning speed, an electronic spreadsheet is far more convenient than its paper counterpart. And spreadsheet programs also offer editing features that let you enter and manipulate large amounts of data with a minimum of effort.

Apple *SpeedCalc* is an all machine language spreadsheet program for Apple II computers with either DOS 3.3 or ProDOS. Though relatively compact in size, *SpeedCalc* is fast, easy to use, and has many of the features found in commercial spreadsheet programs. Even better, the "*SpeedScript* File Convertor" program lets you merge your *SpeedCalc* files into word processing documents created with *SpeedScript*, COMPUTE!'s popular word processor (see COMPUTE!, July 1985, or *SpeedScript: The Word Processor for Apple Personal Computers*, published by COMPUTE! Books).

Working together, *SpeedCalc* and *SpeedScript* make a powerful team. You can merge a chart of sales figures into a company report, create a table of scientific data for a term paper, and manipulate numeric information in many other ways. In a sense, a spreadsheet program brings to arithmetic all of the flexibility and power that a word processor brings to writing.

Preparing The Program

Although Apple *SpeedCalc* is small in comparison to similar commercial programs, it is one of the longest programs COMPUTE! has ever published. Fortunately, the "Apple MLX" machine language entry utility makes it easier to type a program of this size. Be sure to carefully read the Apple MLX article elsewhere in this issue before you begin.

We're publishing two separate versions of Apple *SpeedCalc*: Program 1 is for Apple computers with DOS 3.3, and Program 2 is for Apples with ProDOS. Be sure to type the correct version for your system, since the DOS 3.3 version doesn't work with ProDOS and vice versa.

Since the DOS 3.3 version of *SpeedCalc* resides in the same area of memory normally used by BASIC programs, you must relocate the BASIC program storage area *before* loading MLX to enter the data for *SpeedCalc*. If you're using DOS 3.3, enter the line below in direct mode (without a line number) and press RETURN:

```
POKE 104,38:POKE 9728,0:NEW
```

Then load and run MLX.

If you're using ProDOS, no special actions are required before loading and running MLX.

Here are the addresses you need to enter *SpeedCalc* with Apple MLX:

DOS 3.3:
Starting address: 07FA
Ending address: 24F9

ProDOS:
Starting address: 2000
Ending address: 3D67

After you finish typing, be sure to save at least one copy before attempting to run *SpeedCalc* for the first time. To start the DOS 3.3 version, first enter BLOAD SPEEDCALC (replace SPEEDCALC with the appropriate filename if you

From the publishers of *COMPUTE!*

February 1986 *COMPUTE!* Disk

All the exciting programs from the past three issues of *COMPUTE!* are on one timesaving, error-free floppy disk that is ready to load on your Apple II, II+, IIe, and IIc computers. The February 1986 *COMPUTE! Disk* contains the entertaining and useful Apple II programs from the December 1985 and January and February 1986 issues of *COMPUTE!*. This easy-to-use disk also features *SpeedCalc*, the spectacular new spreadsheet program written entirely in machine language for the Apple II-series, and the latest version of *SpeedScript*, the bestselling word processing program.

The February 1986 *COMPUTE! Disk* costs $12.95 plus $2.00 shipping and handling and is available only from COMPUTE! Publications.

For added savings and convenience, you may also subscribe to the *COMPUTE! Disk*. At a cost of only $39.95 a year (a $12.00 savings), you'll receive four disks, one every three months. Each disk will contain all the programs for your Apple II machine from the previous three issues of *COMPUTE!*.

This is an excellent way to build your software library while you enjoy the quality programs from *COMPUTE!*.

Disks and subscriptions are available for Apple, Atari, Commodore 64 and 128, and IBM personal computers. Call for details.

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used some other name when saving the program). After the program loads, simply type RUN as you would for a BASIC program. To start the ProDOS version of *SpeedCalc*, first boot ProDOS, then enter −SPEEDCALC (replace SPEEDCALC with the appropriate filename if you used some other name when saving the program). This removes the BASIC interpreter and lets *SpeedCalc* take over the system.

If you're using an Apple IIe or IIc, be sure the Caps Lock key is down: *SpeedCalc* doesn't accept lowercase text input.

The Apple *SpeedCalc* Screen

SpeedCalc uses the top line of the screen as the *command line*. This is where *SpeedCalc* displays messages and asks you questions.

Screen lines 2–4 are the *input buffer* area. This is the work area where you enter and edit data. As you'll see in a moment, the input buffer also displays the data contained in the current cell. The work area cursor is an inverse less-than symbol (<). When the cursor is solid (nonblinking), *SpeedCalc* is waiting for a command or for data to be entered. After a character of data has been entered, the cursor begins blinking. While the cursor is blinking, most *SpeedCalc* commands (except for the cursor movement keys) are deactivated until you press RETURN to enter the data into the worksheet.

The lower 20 screen lines are your window into the spreadsheet. Though the spreadsheet contains many rows and columns, only a few can fit on the screen at one time. By scrolling the screen back and forth with the cursor, you can move the display window to any part of the spreadsheet.

The *SpeedCalc* worksheet consists of 50 vertical columns labeled with letters (AA, AB ... BX) and 200 horizontal rows numbered from 1–200. The rectangle where a row and column intersect is called a *cell*. Cells are where you store data. With 50 columns and 200 rows, the *SpeedCalc* spreadsheet has a maximum of 10,000 (50*200) cells. Due to memory limitations, however, only about a third of these can actually contain data. But you may spread out the data over all 10,000 cells if necessary, depending on the format you need.

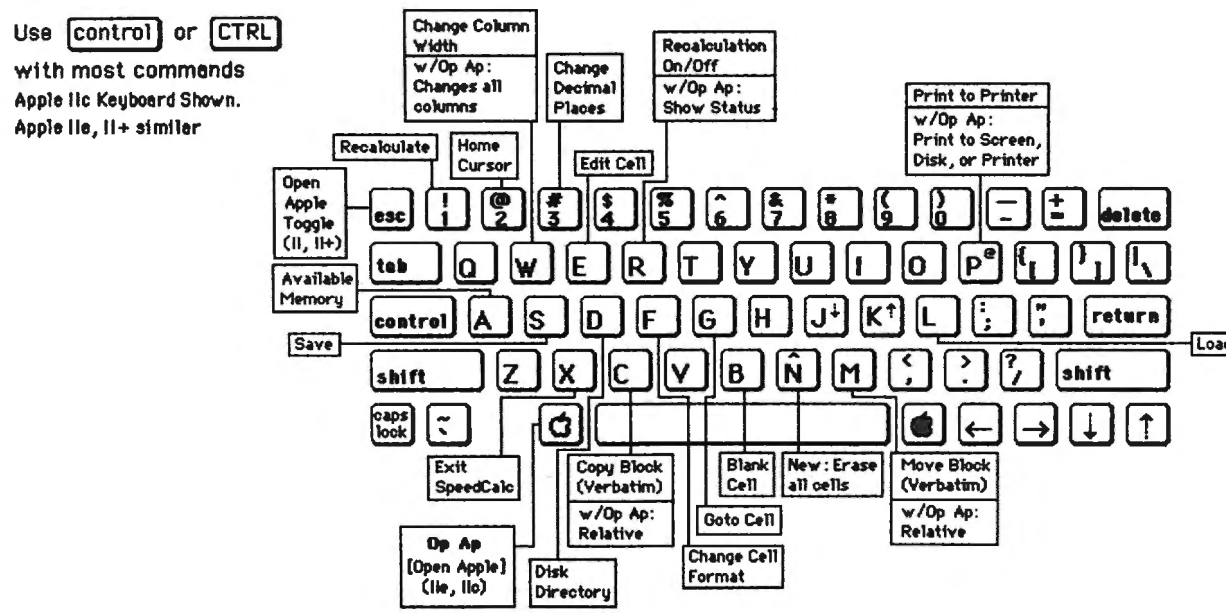
Moving The Cursor

Each cell is identified with the letters of its column and the number of its row. For example, the cell at the extreme upper-left corner of the sheet is called AA1, since it's in column AA and row 1. The cell below that is AA2. Moving one cell to the right from AA2 puts you in cell AB2, and so on.

Your current position in the spreadsheet is shown by the highlighted cursor. The simplest way to move around the sheet is with the cursor keys (on the Apple II or II+, use CTRL-K to move up and CTRL-J to move down). Another way to move the cursor is with CTRL-@ (CTRL-SHIFT-P for the Apple II or II+, or CTRL-2 for the Apple IIe and IIc.) Press CTRL-@ once to "home" the cursor on the current screen: The cursor moves to the upper-left cell. Press CTRL-@ twice in succession to move the cursor to cell AA1, the home position for the entire sheet.

SpeedCalc also has a *goto* command for moving the cursor over long distances. When you press CTRL-G, the command line displays GOTO: followed by an underline cursor. The underline cursor generally indicates that *SpeedCalc* is waiting for data—in this case it expects the name of the cell where you wish to go. If you enter **BA188** at this point, *SpeedCalc* moves the cursor to the cell at column BA in row 188, adjusting the screen window as needed. Take a few moments to practice moving around the spreadsheet with all three methods; you'll be using them a lot. In a later section, we'll discuss how to change the size and format of a cell.

SpeedCalc Keyboard Reference



Keyboard Commands

SpeedCalc offers many different commands, a few of which are entered by pressing one key. However, most commands are entered by pressing CTRL along with another key. CTRL-G, as you've seen, is the goto command. CTRL-A displays the amount of free memory available, and so on. The most drastic command is CTRL-X, which exits *SpeedCalc* and reboots the system. Since this effectively erases all data in memory, *SpeedCalc* prompts you with ARE YOU SURE Y/N? before it shuts down. To cancel the command, simply type N (or any key other than Y).

A few commands require you to press three keys at once. This sounds more awkward than it is in practice, since two of the three keys are Open Apple and CTRL. For instance, the *relative copy* command is performed by pressing Open Apple-CTRL-C (hold down Open Apple and CTRL, then press C).

The older Apple II and II+ models don't have an Open Apple key, so ESC is programmed to act as an Open Apple toggle. Pressing ESC once makes all following keypresses behave as if they were preceded by Open Apple. Pressing ESC again turns off this effect. In this article, wherever the instructions call for the Open Apple key, Apple II and II+ owners should instead precede the keypress with ESC, then use ESC again afterwards to disable the Open Apple toggle. For example, the command to check the recalculation status is Open Apple-CTRL-R; Apple II and II+ owners should instead press (and release) ESC, then press CTRL-R. There's no visible indication that the Open Apple toggle is in effect, so you must use ESC carefully or your keypresses will have unexpected results. For safety, always remember to press ESC again to toggle this function off after using a command that requires Open Apple. The table lists all the *SpeedCalc* commands, and the figure shows the keyboard layout with a description of what each key does. We'll be discussing each command in more detail below.

Three Data Types

Before entering any data, you must know what kind of data *SpeedCalc* accepts. There are three different types: numbers, text, and formulas. Let's look at each type in turn.

1. Numeric data consists of numbers—the basic stuff that spreadsheets work with. *SpeedCalc* has a few simple rules for numeric data: A number must be a decimal value (base 10, not hexadecimal) composed of one or more digits from 0–9, with an optional plus or minus sign. A decimal point is also optional. If you include any other characters in numeric input, *SpeedCalc* treats the entire input as text data (as explained below). Thus, the numbers 123, .001, and −65535 are valid numeric data. The number 65,535 is invalid because it includes a comma.

The allowable range for numbers in Apple *SpeedCalc* is the same as for Applesoft, roughly −1.7E38 to +1.7E38. If a calculation produces a number outside the allowable range, you'll see the message *ERROR* in the cell containing the formula. This doesn't happen very often, since *SpeedCalc* won't let you enter a number more than 36 digits long, and there's rarely a need to use such large numbers unless you're tracking the national debt.

Although an input value can be up to 36 digits long, numbers in *SpeedCalc* calculations are accurate only to nine digits. This must be taken into account when doing any calculation involving large values. For example, you can enter the value 1122334455.66 into a cell, and the cell holds the value with no rounding. However, if you use the value from that cell in a formula, the value is rounded to nine digits—1122334460.00—and the result of the calculation is accurate only for the first nine digits.

You can enter values in scientific notation by following a number with the letter E and the appropriate power of 10. For example, you can enter 1,234,000 as 1.234E06. However, *SpeedCalc* never uses scientific notation itself, no matter how big the number you enter. Scientific notation should generally be avoided, since values outside the Apple's maximum range will crash the program. (Press CTRL-RESET to recover.)

For example, let's enter the number 123 in cell AA1. No special commands are required to enter data: Just move the cursor to AA1 and begin typing. The blinking inverse < symbol shows the end of the data. While you're entering the number, it appears only in the input buffer near the top of the screen (the blinking underline shows your cursor position). As soon as you press RETURN, the number appears in AA1 and the letter N appears at the upper right of the screen. The N signifies *numeric*, meaning that *SpeedCalc* has accepted the entry as valid numeric data. Move the cursor to a vacant cell, then move it back to AA1. The input buffer displays whatever data is found in the cell under the cursor. When the current cell is empty, the buffer is empty as well.

If you want to change anything during data entry, press the ESC key. ESC always deletes the character before the cursor (or has no effect if the cell is empty). Later on, we'll explain how to edit existing data. Use ESC carefully; remember that when you're not editing (when the cursor is not blinking), ESC acts as an Open Apple toggle. On the Apple IIe and IIc, you can (and should) use DELETE instead of ESC.

As you've seen, pressing RETURN enters a data item into the current cell. You can also end the input by pressing a cursor key. The data is entered as if you had pressed RETURN, and the cursor moves in the indicated direction. This feature is handy for entering a lot of data: Simply type the entry, move the cursor to the next cell, enter more data, and so on.

2. Text data is not "data" in the strict sense, since *SpeedCalc* doesn't use it in calculations as it does numbers and formulas. Text data is there only to help people understand what the other data means. Text may consist of comments, titles, column headings, subheadings, or whatever you need to interpret the numbers and formulas. As an example, move the cursor to cell AA2 (just under AA1) and type the following line.

THIS IS A PIECE OF TEXT DATA.

You can use the ESC key (or DELETE on the Apple IIe and IIc) to erase mistakes while you're typing.

When you press RETURN, *SpeedCalc* displays T (for text) in the upper-right corner. In this example, the cell isn't long enough to accept all the text, so only the leftmost portion appears in AA2. But even though you can't see it, all of the text is there. Move the cursor to another cell, then move it back to AA2. As soon as you return to AA2, *SpeedCalc* displays all the text in the input buffer area.

3. Formula data is a mathematical expression or formula. It may be as simple as 2 + 2 or as complex as your imagination (and mathematical prowess) allows. The first character in a formula must always be an equal sign (=). If you omit this symbol, *SpeedCalc* either signals an error or treats the data as text.

The true power of a spreadsheet is that a formula in one cell can refer to another cell. This is easier to demonstrate than to explain. Move the cursor to cell AA3 and type the following line:

```
=AA1*25.01+@SQR(4)
```

As soon as you press RETURN, *SpeedCalc* displays F (for formula) in the upper-right corner and puts the *result* of the formula (not the formula itself) in AA3. If AA1 contains 123, the value 3078.23 appears in AA3. In plain English, this formula means "multiply the contents of cell AA1 by 25.01 and add the square root of 4." Before we examine the formula more closely, here's a quick demonstration of what makes a spreadsheet such a powerful tool. Move the cursor back to AA1 and press CTRL-R. The command line displays the message RECALCULATION IS ON, meaning *SpeedCalc* now automatically recalculates the entire sheet whenever you make a change. Now change the number in AA1 to 456 (simply move to the cell and start typing). The new result (11406.56) automatically appears in cell AA3. We'll explain more about automatic recalculation later.

Note that the referenced cell must contain data that *SpeedCalc* can evaluate: a number or another formula. If the formula refers to an empty cell, or one that contains text, *SpeedCalc* signals the error by printing *ERROR* in the cell containing the incorrect formula.

Mathematical Operators

These symbols can be used as *operators* in a formula:

Operator	Function
+	addition
−	subtraction
*	multiplication
/	division
^	exponentiation
=	equality

One factor that affects formulas is *precedence*, or the order in which mathematical operations are performed. In *SpeedCalc*, formula operators have the same precedence as in ordinary math.

The first operators to be evaluated—those with the highest precedence—are those enclosed in parentheses. Where one set of parentheses encloses another, the expression in the innermost set is evaluated first. The next operators to be evaluated are exponents. Multiplication and division have equal precedence; both operations are lower than exponentiation. Addition and subtraction have the lowest precedence of all. To take one example, *SpeedCalc* evaluates the formula =5*(8+3*−2)^2−10/+2 as the value 15, just as in ordinary math. Note how the result is affected by the plus and minus signs before the two 2's.

Functions

Formulas may also include any of the functions listed here:

@ABS( )	absolute value
@ATN( )	arctangent
@AVE( )	average of a block of cells
@COS( )	cosine
@EXP( )	natural exponent
@INT( )	integer
@LOG( )	natural logarithm
@SGN( )	sign
@SIN( )	sine
@SQR( )	square root
@SUM( )	sum of a block of cells
@TAN( )	tangent
PI	value of pi (3.14159265)

All the functions except PI begin with the @ symbol and are followed by parentheses. The parentheses of a function may contain a number or formula. For example, the formula =@SQR(4) generates the square root of 4. The formula =@SQR(AA1) returns the square root of whatever value cell AA1 contains. Note that the argument (value within parentheses) of the functions @TAN( ), @SIN( ) and @COS( ) must be expressed in radians; the result of the function @ARC( ) is expressed in radians. The function @INT( ) generates an integer (whole number) by truncating (discarding the fractional part of) a numeric value; note that this is different from rounding.

The function @AVE( ) calculates the mean average of the values in a block (group) of cells. The function @SUM( ) calculates the sum of a block. Both functions require you to define the block so *SpeedCalc* knows which cells to include in the calculation. This is done by putting two cell names separated by a colon in the parentheses. The first cell name defines the upper-left corner of the block, and the second defines the bottom-right corner. For instance, @AVE(AA1:AD20) calculates the average of all the cells from AA1 to AD20. The function @SUM (AA1:AD20) calculates the sum of AA1 through AD20, and so on. An error results if any cell in the block is blank or contains text data.

Editing The Sheet

Editing is a very important spreadsheet function. The simplest way to change what a cell contains is to move to it and start typing. The old data in that cell is replaced by whatever you enter. For instance, to replace the contents of cell AA1 with the number 456, move to that cell, type 456, and press RETURN or exit with a cursor key. Press CTRL-B (think of *blank*) to erase what's in the current cell. To erase everything in the sheet, press CTRL-N (think of *new*). Before carrying out this drastic operation, *SpeedCalc* asks you to confirm it by pressing Y or N.

In some cases, only a minor change is needed. *Edit mode* lets you change the data in a cell without retyping the entire entry. To activate edit mode, move to the desired cell and press CTRL-E. In this mode, up and down cursor movement is disabled, and the left/right cursor keys move within the input buffer. Erase unwanted characters with the ESC key (or the DELETE key on the Apple IIe and IIc). Typing in edit mode inserts new characters in the line: Everything to the right of the new character moves right one space (unless the buffer is already full). Since the cursor keys

have a different function in edit mode, you cannot use them to end the input. Press RETURN to enter the new data and escape from edit mode.

SpeedCalc displays *ERROR* in a cell when you enter an erroneous formula. Usually this means you've made a typing error in that cell, or the formula refers to text or an empty cell. A line of asterisks (**********) signals that a number is too large to be printed in the cell. Though these messages appear in the cell area, no data is lost. You may move to the affected cell, view its contents in the input buffer, and make whatever correction is needed.

Recalculation

This feature is the very core of a spreadsheet. As you know, entering or editing a piece of data makes *SpeedCalc* perform a calculation and put the result in the cell under the cursor. In most cases, the new data relates to data in other cells, so you'll ultimately want to recalculate the entire spreadsheet as well. This can be done manually or automatically.

To recalculate the spreadsheet manually, enter an exclamation point (SHIFT-1). *SpeedCalc* begins at AA1 and recalculates every cell that contains data, placing fresh results wherever needed. If you switch to automatic recalculation mode, *SpeedCalc* automatically recalculates the entire spreadsheet each time you enter new data or edit what exists. When you press CTRL-R, *SpeedCalc* changes the recalculation status and displays it at the top of the screen. If automatic recalculation was turned off before, it is now on (and vice versa). If you aren't sure which mode you're in, press Open Apple-CTRL-R; *SpeedCalc* displays the mode without changing it.

Automatic recalculation can be fun to watch in a large spreadsheet: Every time you make a change, new results appear everywhere on the screen. However, the more data your spreadsheet contains, the longer it takes to update the entire sheet. For this reason, you may want to turn off automatic recalculation most of the time, recalculating manually whenever you need to view results.

One problem with recalculation arises from the order in which cells are calculated. Because only one cell can be calculated at a time, you must sometimes recalculate the entire spreadsheet two or three times to get correct results in every cell (this is common to all spreadsheet programs). For instance, say you have a formula in AA1 which refers to a formula in AB15. When *SpeedCalc* calculates AA1, it must use the existing data from AB15—which is probably out of date, since the formula in AB15 hasn't been recalculated yet. To avoid this problem, you should always recalculate a sheet manually two or three times before printing or saving it to disk.

SpeedCalc offers a number of other features. Before experimenting with them, you should spend some time typing in a hypothetical spreadsheet—perhaps a fictitious yearly budget—to become thoroughly familiar with the basic commands covered so far. Most importantly, create formulas using all the operators in different combinations. Try doing things that you know will cause errors. Then correct the errors in edit mode, and so on. It takes a thorough grasp of the fundamentals to get the most out of *SpeedCalc*'s advanced features.

Change Format

The default (normal) format for numeric data is flush right with rounding to two decimal places. In other words, the number is displayed in the rightmost part of the cell, with two numbers after the decimal point. Text and formulas are also displayed flush right. *SpeedCalc* offers several commands for changing cell formats. (Apple II and II+ owners who are using the ESC toggle in place of the Open Apple key should be careful that ESC is not in effect when it's not desired; accidental global changes may be difficult to reverse.)

Change Format (CTRL-F). This command changes the location of data in the cell. When you press CTRL-F, the *SpeedCalc* command line displays the question FORMAT: LEFT, CENTER, OR RIGHT JUSTIFY?. Press L, C, or R to move the data to the left, center, or right of the cell.

Change Decimal Places (#). *SpeedCalc* also lets you change the number of decimal places for any cell. The default number of decimal places is 2, but you may change it to anything from 0–15. Press # (SHIFT-3) to change this value: *SpeedCalc* prompts you to enter a number from 0–15. If you choose zero decimal places, any number in that cell is rounded off to the nearest integer (whole number). If you choose 15, a number in that cell is not rounded off at all—*SpeedCalc* displays it exactly as you entered it or as it was calculated from a formula.

Width (CTRL-W). The width command changes the width of an entire column of cells. Move the cursor to any cell in the desired column, then press CTRL-W. When *SpeedCalc* displays the prompt WIDTH:, respond with a number from 4–36. The entire screen is redrawn to accommodate the new format, and may look very different depending on what value you chose. For instance, if you increase a column's width, the rightmost column of the former display may disappear: *SpeedCalc* only displays as many complete columns as it can fit on the screen. If you decrease the width of a column, you may see asterisks where numbers used to be (indicating the cell is now too small to display the entire number). To get rid of the asterisks, expand the column as necessary.

Global Format (Open Apple-CTRL-F). This is the same as the ordinary format command, but operates globally, changing every cell in the sheet instead of just one.

Global Width (Open Apple-CTRL-W). This is a global version of the width command. Every column in the sheet changes to the designated width.

Macro Editing

After typing in a large spreadsheet, you may decide to make a major change. You may want to add new data somewhere in the middle, delete a section, or move a group of cells from one location to another. *SpeedCalc*'s macro (large-scale) editing commands simplify such operations, affecting an entire block of cells at once. A *block* is simply a group of cells connected in rectangular fashion. You can define it as a single cell, a row or column, or any

rectangular area within the spreadsheet.

There are two ways macro commands work: *verbatim* or *relative*. To take a simple example, say that cell AA2 contains the formula =AA1*5 and you want to move its contents to cell AB2. When this is done in verbatim mode, AB2 contains an exact copy of what was in AA2 (=AA1*5). Note that the cell name used in the formula does not change: The formula still refers to AA1. If you perform the same operation in relative mode, the cell name in the formula is adjusted to fit the new location. In this case, AB2 would contain the formula =AB1*5. (Apple II and II+ owners who are using the ESC toggle in place of the Open Apple key should be careful that the toggle is not in effect when not desired; accidental relative changes can lead to problems that are difficult to detect and correct.)

Copy (CTRL-C). The copy command copies a block of cells into a different location without disturbing the original cells. Place the cursor on the upper-left corner of the block you want to copy, then press CTRL-C. *SpeedCalc* prompts you to move the cursor to the lower-right corner of the block you want to copy. Once the cursor is in place, press RETURN. Now *SpeedCalc* prompts you to move the cursor to the place where you want to put the block: This is the upper-left corner of the new position. Once the cursor is there, press RETURN again. The new data replaces whatever was contained in the designated cells. Note that if you define an impossible block (for instance, moving the cursor to the upper-left of the original position, rather than below and to the right), *SpeedCalc* does not copy any data. This provides a way to cancel the command if you press CTRL-C accidentally.

Move (CTRL-M). This command works like a copy, but it fills the original cells with blanks. Though *SpeedCalc* has no express insert command, you can use this command to make space for new data in the middle of a spreadsheet. Simply move everything below the insertion point down as far as you need.

Because RETURN generates the same character code as CTRL-M, you may find when you first begin using *SpeedCalc* that you accidentally invoke the move function by pressing RETURN when you shouldn't have. To cancel this, simply press RETURN twice more without moving the cursor.

Relative Copy (Open Apple-CTRL-C). This form of the copy command adjusts the cell names used in formulas within the copied block (see explanation above).

Relative Move (Open Apple-CTRL-M). This is the relative form of the move command. Cell names in formulas are adjusted to reflect the move.

Memory Management

The DOS 3.3 version of *SpeedCalc* makes about 12K (over 12,000 characters) of memory available for data; the ProDOS version provides approximately 17K. As noted earlier, *SpeedCalc* lets you spread your data out over a much larger number of cells than you can actually fill with data. The extra space is provided to give you full control over the final format of the spreadsheet and to leave some elbow room for move and copy operations.

Because memory is limited, you should keep careful track of how much is free while using the program. Press CTRL-A to display the amount of free memory. We suggest limiting your spreadsheets to 1,600 cells (equivalent to 40 rows by 40 columns) when using the DOS 3.3 version, or 2,500 cells (a 50 × 50 worksheet) when using the ProDOS version. If you've filled nearly all of free memory, you may have to break the spreadsheet into two smaller sheets.

Although *SpeedCalc* checks the amount of available memory and displays an error message if you run out, you should be careful not to exhaust free memory. Any move or copy operation in process will be aborted if sufficient memory is not available.

Disk Operations

SpeedCalc has three disk commands which allow you to save a spreadsheet to disk, load it, and display the disk directory. The directory command is the simplest to use: Simply press CTRL-D. The spreadsheet disappears and a directory of the disk in drive 1 is displayed. Press RETURN to return to the spreadsheet.

To save a spreadsheet to disk, press CTRL-S. *SpeedCalc* prints

SpeedCalc Commands

Command	Action
CTRL-A	available memory check
CTRL-B	blank (erase) current cell
CTRL-C	copy block verbatim
CTRL-D	disk directory
CTRL-E	edit current cell
CTRL-F	change cell format
CTRL-G	goto selected cell
CTRL-L	load *SpeedCalc file*
CTRL-M	move block verbatim
CTRL-N	new (erase entire sheet)
CTRL-P	print file on printer
CTRL-R	turn recalculation on/off
CTRL-S	save *SpeedCalc* file
CTRL-W	change column width
CTRL-X	exit *SpeedCalc*
CTRL-@	home cursor
Open Apple-CTRL-C	copy block relative
Open Apple-CTRL-M	move block relative
Open Apple-CTRL-P	print to screen, disk, or printer
Open Apple-CTRL-R	check recalculation status
Open Apple-CTRL-W	change width of all columns
! (SHIFT-1)	recalculate sheet
# (SHIFT-3)	change decimal places

Note: The Apple II and II+ have no Open Apple key, so ESC must be used as an Open Apple toggle. Pressing ESC once makes all following keypresses behave as if Open Apple were pressed. Press ESC again to turn off the Open Apple toggle.

SAVE: on the command line, followed by an underline cursor. Enter a valid Apple filename and press RETURN. (If you change your mind and decide not to save anything, press RETURN without typing a filename.) If no disk error occurs while the spreadsheet is being saved, *SpeedCalc* displays NO ERRORS in the command line and returns you to command mode. If there was an error, you'll hear a beep and see the message I/O ERROR in the command line.

To load a saved file from disk, press CTRL-L. Again, you can cancel the operation by pressing RETURN without entering a filename. *SpeedCalc* prompts you to enter the filename and displays the error status when the operation is complete.

When saving or loading *SpeedCalc* files with ProDOS, you must specify the prefix along with the name. If you don't want to type the prefix every time you enter a filename, simply call up a directory for the disk you want to use to save or load. This automatically sets the prefix to match the current disk, relieving you of the need to enter it with every name.

Printing

SpeedCalc lets you print data to three different devices: to the screen for previewing output, to a printer for permanent documentation, or to a disk file for integrating the data with a *SpeedScript* document.

To print a hardcopy of the spreadsheet to a printer in slot number 1, press CTRL-P. *Before using this command, you must position the cursor below and to the right of the block of cells you wish to print.* The upper-left corner of the printout starts at cell AA1.

To send output to a printer with a slot number other than 1, or to the screen or a disk, first position the cursor in the lower-right corner of the block you want to print. Then press Open Apple-CTRL-P (toggle ESC on the Apple II and II+). *SpeedCalc* asks if you want to print to the screen, to disk, or to the printer. Press S to preview output on the screen, D to print to disk, or P to select printer output. Pressing any other key cancels the command.

If you select the P option after pressing Open Apple-CTRL-P, *SpeedCalc* asks you specify a slot number by pressing one of the number keys from 1–7. This permits you to use a printer in any of those slots. If you change your mind at any point during this process, press RETURN without entering anything; *SpeedCalc* returns you to command mode.

You can also print *SpeedCalc* data to a disk file for use in a *SpeedScript* document. Select the D option after pressing Open Apple-CTRL-P, then enter a filename. The data is saved as a disk file of that name. Note that *printing* to disk creates a different type of file than *saving* to disk, and *SpeedCalc* cannot reload files in the print format. You should *save* files you wish to reload into *SpeedCalc*, and *print* files you wish to convert for *SpeedScript*. Unlike the *SpeedCalc* save and load commands, no error messages are provided if the spreadsheet cannot be printed to disk. Thus, you must ensure that the drive contains a write-enabled disk with sufficient space to hold the printed spreadsheet before you attempt to print to disk.

SpeedScript File Converter

SpeedCalc sends data to the printer in simple, plain vanilla form. That may be fine for personal use, but if you're creating a document for others to view, you may want special features such as boldface, underlining, etc. Since Apple *SpeedScript*—COMPUTE!'s popular word processor—already offers a way to access these features (and many more), no attempt has been made to include them in *SpeedCalc*. All that's needed is a simple program to convert *SpeedCalc* files into a form that *SpeedScript* can load. Then you can edit the file with *SpeedScript* as you would any other document—inserting printer control codes, reformatting the text, merging it with other text, and so on. The "*SpeedScript* File Converter" program published in the same issue as *SpeedScript* makes it easy to perform the conversion. Here are the steps to follow to convert a *SpeedCalc* file for *SpeedScript:*

1. After creating a spreadsheet with *SpeedCalc*, print it to disk as described above.

2. Exit *SpeedCalc*, then load and run *SpeedScript* File Converter. The program prompts you to enter the name of the *SpeedCalc* file you printed to disk. Then it asks you to enter the name of the *SpeedScript* file you want to create (of course, this name should be different from the first). The File Converter then constructs a *SpeedScript*-loadable disk file from the *SpeedCalc* file.

3. After the File Converter is finished, load and BRUN *SpeedScript*, then load the new *SpeedScript* file as you would any *SpeedScript* document. The data appears on the screen, ready to be edited in any way you wish. C

Program 1: Apple *SpeedCalc* For DOS 3.3

Please refer to the "MLX" article in this issue before entering the following listing.

```
START ADDRESS: 07FA
END ADDRESS:   24F9

07FA: 20 65 D6 4C D2 D7 00 0A 12
0802: 08 0A 00 A5 AB 33 30 00 7D
080A: 14 08 14 00 8C 32 30 38 6E
0812: 33 00 1E 08 1E 00 8C 32 3C
081A: 30 38 30 00 00 00 4C 4D 3C
0822: 22 20 58 FC AD 61 C0 8D 28
082A: 59 25 A9 00 8D F2 03 A9 4D
0832: 09 8D F3 03 49 A5 8D F4 C9
083A: 03 A9 FD 85 39 85 37 A9 46
0842: 1B 85 38 A9 F0 85 36 A9 96
084A: 25 18 69 01 8D F0 24 1B C0
0852: 69 4F 85 6C A9 00 8D EF BA
085A: 24 8D F1 24 85 6B 8D 69 BE
0862: 22 85 FF 8D 58 25 A9 A5 0E
086A: 8D F2 24 A9 09 20 61 09 B1
0872: 20 D9 0A A9 23 A0 46 20 2D
087A: 3E 09 20 88 0D 20 25 09 B4
0882: 48 20 7C 09 68 AE AC 08 3E
088A: DD AC 08 F0 0A CA D0 FB DA
0892: C9 20 90 E6 4C 37 0C CA 32
089A: BA 0A AA A9 08 48 A9 7B 92
08A2: 48 BD D3 08 48 BD D2 08 28
08AA: 48 60 17 0E 00 17 06 07 2A
08B2: 10 03 13 0C 18 0A 0B 15 C2
08BA: 08 02 05 21 01 12 04 0D 67
08C2: 1B 23 0D 31 32 33 34 35 D9
08CA: 36 37 38 39 30 2B 2D 2E 15
08D2: C4 0A DB 11 13 10 A8 0C 8A
08DA: 4E 11 32 14 ED 15 A2 19 FF
08E2: 40 1A D5 1E DD 10 F6 10 63
08EA: 0D 11 37 11 94 1C DB 1C A6
08F2: 08 1C 03 1E A7 1C CC 1B B2
08FA: C8 15 08 09 ED 0C 20 58 7E
0902: FC 20 22 0B 4C 75 08 AD 85
090A: 58 25 49 FF 8D 58 25 60 33
0912: 2C 00 C0 10 0B AD 00 C0 23
091A: 8D 10 C0 29 7F C9 FF 60 25
0922: A9 00 60 A5 FF F0 07 48 89
092A: A9 00 85 FF 68 60 20 12 D8
0932: 09 F0 FB 60 20 F2 EB A5 D4
093A: A0 A4 A1 60 85 FC 84 FB 25
0942: 20 6F 09 20 80 FE A9 00 B6
094A: 85 28 85 24 85 25 A9 04 34
0952: 85 29 A0 00 B1 FB F0 06 EA
095A: 20 ED FD C8 D0 F6 60 A2 0A
0962: 32 9D F6 24 CA D0 FA A9 4F
096A: 28 8D 29 25 60 A0 00 A9 9A
0972: 20 99 00 04 C8 C0 28 D0 A5
097A: F6 60 AD 01 04 C9 10 D0 1E
0982: 0A AD 0A 04 C9 02 F0 03 C1
```

```
098A: 4C 94 09 A9 23 A0 3C 20 D7
0992: 3E 09 38 20 C7 1F 90 03 ED
099A: 4C 32 0F 4C 40 0F 09 80 D6
09A2: BD 80 02 A9 3C BD 81 02 93
09AA: A2 76 A9 A0 9D 81 02 CA AC
09B2: D0 F8 A0 01 D0 02 A0 00 5F
09BA: B9 80 02 8D 3C 25 A9 DF 8C
09C2: 99 80 02 20 AB 0A 20 12 DB
09CA: 09 D0 16 EE 3B 25 10 08 DD
09D2: A9 DF 99 80 02 4C C5 09 C2
09DA: AD 3C 25 99 80 02 4C C5 7B
09E2: 09 09 80 8D 3B 25 AD 3C AA
09EA: 25 99 80 02 AD 3B 25 AE 79
09F2: 95 0A DD 95 0A F0 2C CA 9E
09FA: D0 F8 C9 A0 90 BA 8C 3C BB
0A02: 25 CE 3C 25 A2 77 BD 80 25
0A0A: 02 C9 3C F0 AB CA BD 80 AC
0A12: 02 9D 81 02 CA EC 3C 25 86
0A1A: D0 F4 AD 3B 25 99 80 02 CF
0A22: C8 D0 95 CA 8A 0A AA BD BD
0A2A: 9E 0A 48 BD 9D 0A 48 60 FA
0A32: A0 00 B9 80 02 C9 3C F0 76
0A3A: 08 29 7F 99 00 03 C8 D0 94
0A42: F1 A9 00 99 00 03 8C 2C A4
0A4A: 25 60 AD 6A 22 F0 20 C0 3B
0A52: 00 F0 01 88 4C BA 09 AD 58
0A5A: 6A 22 F0 13 B9 80 02 C9 19
0A62: 3C F0 F1 C8 4C BA 09 AD A8
0A6A: 6A 22 F0 03 4C BA 09 AD 97
0A72: 3B 25 29 7F 85 FF 4C 32 B1
0A7A: 0A C0 00 F0 D7 88 98 AA 8F
0A82: BD 81 02 9D 80 02 E8 C9 97
0A8A: 3C D0 F5 A9 A0 9D 80 02 C8
0A92: 4C BA 09 07 8D 9B 8A 8B 88
0A9A: 88 95 FF 31 0A 7A 0A 68 22
0AA2: 0A 68 0A 4B 0A 58 0A 7A 0C
0AAA: 0A A2 00 BD 80 02 9D 80 10
0AB2: 04 BD A8 02 9D 00 05 BD 22
0ABA: D0 02 9D 80 05 E8 E0 28 29
0AC2: D0 E9 60 A9 23 A0 60 20 DC
0ACA: 3E 09 20 25 09 C9 59 D0 89
0AD2: 03 20 D9 0A 4C 7C 09 20 D2
0ADA: FA 0A A9 09 20 61 09 20 6D
0AE2: 22 0B 20 88 0D A9 2C 8D 4C
0AEA: B4 22 A9 00 8D B3 22 A5 3C
0AF2: 6B 85 6F A5 6C 85 70 60 21
0AFA: AD EF 24 85 FB AD F0 24 5B
0B02: 85 FC A0 00 98 91 FB C8 F9
0B0A: D0 FB E6 FC A6 FC EC F2 2A
0B12: 24 D0 F2 A9 01 8D F4 24 B3
0B1A: 8D F5 24 85 1D 85 1E 60 EC
0B22: 20 28 0B 4C B0 0B A0 05 70
0B2A: 8C 3B 25 B9 83 22 85 28 6D
0B32: B9 6B 22 85 29 A0 00 AE 17
0B3A: F5 24 A9 00 8D 29 25 8D 72
0B42: 2A 25 F8 AD 29 25 18 69 28
0B4A: 01 8D 29 25 AD 2A 25 69 85
0B52: 00 8D 2A 25 CA D0 EC D8 AF
0B5A: A2 00 20 8D 0B FB AD 29 5F
0B62: 25 18 69 01 8D 29 25 AD 57
0B6A: 2A 25 69 00 8D 2A 25 D8 44
0B72: EE 3B 25 AC 3B 25 B9 83 A3
0B7A: 22 85 28 B9 6B 22 85 29 BB
0B82: A0 00 E8 E0 12 D0 D3 20 AF
0B8A: 8D 0B 60 AD 2A 25 18 69 90
0B92: 30 91 28 C8 AD 29 25 29 3C
0B9A: F0 4A 4A 4A 4A 18 69 30 5F
0BA2: 91 28 C8 AD 29 25 29 0F BE
0BAA: 18 69 30 91 28 60 A0 04 4E
0BB2: B9 83 22 85 28 B9 6B 22 44
0BBA: 85 29 A0 00 A9 20 91 28 0B
0BC2: C8 91 28 C8 91 28 C8 AE A0
0BCA: F4 24 A9 00 8D F3 24 8D DB
0BD2: F6 24 8E 29 25 4A 69 00 F6
0BDA: AA CA A9 20 91 28 C8 CA B9
0BE2: D0 FA AD 29 25 0A AA BD CC
0BEA: B5 22 29 3F 91 28 C8 BD F9
0BF2: B6 22 29 3F 91 28 C8 AE 73
0BFA: 29 25 BD F6 24 4A AA CA B0
0C02: CA A9 20 91 28 C8 CA 10 11
0C0A: FA AE 29 25 BD F6 24 18 EC
0C12: 6D F3 24 8D F3 24 E8 BD FA
0C1A: F6 24 18 6D F3 24 C9 25 79
0C22: 90 AD CA 8E 32 25 A9 20 C9
0C2A: C0 28 D0 01 60 91 28 C8 39
0C32: C0 28 D0 F9 60 20 A0 09 3C
0C3A: AD 00 03 F0 3F C9 3D F0 25
0C42: 26 AE C4 08 DD C4 08 F0 35
0C4A: 07 CA D0 F8 A9 01 D0 19 4E
0C52: AD 2C 25 C9 25 B0 25 A0 64
0C5A: 00 A9 03 20 B1 0C 20 B7 73
0C62: 00 D0 E9 A9 00 F0 02 A9 F7
0C6A: 02 8D 2B 25 AD B4 22 8D B0
0C72: 2D 25 18 20 C7 1F 20 27 91
0C7A: 20 20 03 1C 4C 7C 08 85 B6
0C82: B9 84 B8 20 B7 00 4C 4A 52
0C8A: EC A2 32 A9 00 8D 38 25 6E
0C92: 8D F6 24 18 6D 38 25 8D 71
0C9A: 38 25 C9 25 B0 03 CA D0 9B
0CA2: EF E8 E8 8E 3C 25 60 A9 D3
0CAA: 00 2C 59 25 30 03 AD 61 95
0CB2: C0 0D 58 25 8D 57 25 A0 80
0CBA: A5 A9 23 20 3E 09 20 25 F1
0CC2: 09 C9 4C F0 0F C9 43 F0 81
0CCA: 0F C9 52 F0 03 4C 85 0D 97
0CD2: A2 0C D0 06 A2 08 D0 02 92
0CDA: A2 04 AD B4 22 29 F0 8D 6B
0CE2: 3B 25 8A 0D 3B 25 8D 3B C8
0CEA: 25 4C 2F 0D A9 00 2C 59 5E
0CF2: 25 30 03 AD 61 C0 0D 58 65
0CFA: 25 8D 57 25 A0 CE A9 23 FC
0D02: 20 3E 09 20 76 10 F0 7B 30
0D0A: A0 00 A9 02 20 B1 0C 20 09
0D12: 36 09 C9 00 D0 6D C0 10 90
0D1A: B0 69 AD B4 22 29 0C 8D 43
0D22: 3B 25 98 0A 0A 0A 0A 0D 70
0D2A: 3B 25 8D 3B 25 AD 57 25 44
0D32: 10 41 AD 3B 25 8D B4 22 F8
0D3A: AD EF 24 85 1B AD F0 24 99
0D42: 85 1C A0 01 B1 1B F0 11 37
0D4A: 85 1A 88 B1 1B 85 19 B1 AC
0D52: 19 29 03 0D B4 22 91 19 DE
0D5A: C8 A5 1B 18 69 02 85 1B A0
0D62: A5 1C 69 00 85 1C A5 1C 87
0D6A: C5 6C D0 D8 38 20 C7 1F 1B
0D72: 4C 85 0D 38 20 C7 1F 90 28
0D7A: 0A A0 00 AD 3B 25 0D 2B 50
0D82: 25 91 19 4C 7C 09 A5 1D EB
0D8A: 8D 30 25 A5 1E 8D 31 25 25
0D92: A9 03 8D F3 24 AE F4 24 1D
0D9A: 86 1D AC F5 24 84 1E 98 3C
0DA2: 18 69 13 8D 2E 25 BD F6 D6
0DAA: 24 8D 38 25 A9 FF EC 30 EA
0DB2: 25 D0 07 CC 31 25 D0 02 03
0DBA: A9 3F 8D 33 25 98 18 69 83
0DC2: 05 38 ED F5 24 A8 B9 6B 2D
0DCA: 22 85 29 B9 83 22 85 28 EF
0DD2: 38 20 C7 1F B0 05 A9 A0 89
0DDA: 4C 67 0E AD 2B 25 F0 70 D1
0DE2: C9 02 F0 6C AD 38 25 38 18
0DEA: ED 2C 25 AA E8 30 32 E8 AB
0DF2: AD 2D 25 29 0C C9 08 F0 EE
0DFA: 28 B0 05 8A 4A F0 22 AA A3
0E02: 8E 34 25 A9 A0 2D 33 25 F6
0E0A: AC F3 24 91 28 C8 CA D0 E1
0E12: FA 8C 35 25 AD 38 25 38 98
0E1A: ED 34 25 AA A0 02 4C 2E 5D
0E22: 0E AE 38 25 AD F3 24 8D 5D
0E2A: 35 25 A0 02 B1 19 8C 34 9D
0E32: 25 AC 35 25 09 B0 2D 33 DC
0E3A: 25 91 28 AC 34 25 EE 35 66
0E42: 25 CA F0 09 C8 CC 2C 25 49
0E4A: D0 E2 20 A9 0E 4C 76 0E C2
0E52: 20 4E 0F AE 2C 25 CA CA 35
0E5A: CA EC 38 25 B0 03 4C E6 B1
0E62: 0D A9 2A 09 B0 2D 33 25 89
0E6A: AC F3 24 AE 38 25 91 28 EA
0E72: C8 CA D0 FA A4 1E A6 1D 77
0E7A: C8 CC 2E 25 F0 05 84 1E 09
0E82: 4C A8 0D AC F5 24 84 1E C2
0E8A: AD 38 25 18 6D F3 24 8D C2
0E92: F3 24 E8 86 1D E0 33 F0 FA
0E9A: 27 BD F6 24 18 6D F3 24 5D
0EA2: C9 28 B0 1C 4C A8 0D E0 85
0EAA: 00 F0 14 AD F3 24 18 6D 2E
0EB2: 38 25 A8 88 A9 A0 2D 33 2F
0EBA: 25 91 28 88 CA D0 FA 60 4B
0EC2: A9 28 38 ED F3 24 8D 38 27
0ECA: 25 A0 05 84 1E B9 6B 22 5B
0ED2: 85 29 B9 83 22 85 28 AC 8F
0EDA: F3 24 AE 38 25 A9 A0 91 F5
0EE2: 28 C8 CA D0 FA E6 1E A4 FF
0EEA: 1E C0 18 D0 E0 AD 30 25 99
0EF2: 85 1D AD 31 25 85 1E A0 FD
0EFA: 00 A9 A0 99 B0 02 C8 C0 8D
0F02: 78 D0 F8 38 20 C7 1F 90 22
0F0A: 35 A0 02 A2 00 AD 2B 25 87
0F12: C9 02 D0 09 AC 2C 25 B1 52
0F1A: 19 8D 2C 25 C8 B1 19 09 48
0F22: 80 9D B0 02 E8 C8 CC 2C 48
0F2A: 25 D0 F2 A9 3C 9D B0 02 63
0F32: AE 2B 25 BD B0 22 29 3F 92
0F3A: 8D 27 04 4C AB 0A A9 20 27
0F42: 8D 27 04 A9 3C 8D B0 02 27
0F4A: 20 AB 0A 60 A9 20 8D 00 93
0F52: 02 A0 02 B1 19 C9 2A F0 2A
0F5A: F2 AD 2D 25 4A 4A 4A 4A AF
0F62: 8D 36 25 A2 FF C9 0F F0 D9
0F6A: E2 B1 19 C9 2E D0 09 AE 9B
0F72: 36 25 F0 10 E8 8E 00 02 97
0F7A: 99 FF 01 C8 CC 2C 25 F0 64
0F82: 03 CA D0 E5 AD 36 25 F0 CE
0F8A: 1E E0 00 F0 1A AD 00 02 88
0F92: C9 20 D0 0A A9 2E 99 FF 91
0F9A: 01 C8 AE 36 25 E8 A9 30 F4
0FA2: 99 FF 01 C8 CA D0 F9 A9 71
0FAA: 20 8D 00 02 CC 2C 25 F0 AE
0FB2: 0C B0 3F B1 19 C9 2E F0 43
0FBA: 08 C9 35 B0 0C C8 4C F4 12
0FC2: 0F C8 B1 19 C9 35 90 2A D0
0FCA: 88 98 C8 AA CA CA BD 00 14
0FD2: 02 C9 2E F0 0B 90 0C C9 B5
0FDA: 39 D0 14 A9 30 9D 00 02 E0
0FE2: CA 10 EB CA 9D 00 02 58 6E
0FEA: A9 31 9D 00 02 D0 03 FE 36
0FF2: 00 02 88 8C 2C 25 AD 00 BC
0FFA: 02 C9 20 D0 09 A9 01 85 14
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100A: 85 1A A9 FE 85 19 EE 2C 33
1012: 25 60 A9 00 2C 59 25 30 53
101A: 03 AD 61 C0 0D 58 25 8D 01
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102A: 09 20 76 10 A0 00 A9 02 01
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103A: D0 33 C0 04 90 2F C0 25 CF
1042: B0 2B A5 1D 8D F4 24 AD 42
104A: 57 25 10 07 98 20 61 09 E2
1052: 4C 5B 10 98 A6 1D 9D F6 D6
105A: 24 20 8B 0C A5 1D CD 3C 40
1062: 25 90 07 AC 3C 25 88 8C F8
106A: F4 24 20 B0 0B 4C 7C 09 A8
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1082: A9 88 20 ED FD 20 25 09 40
108A: C9 0D F0 3F C9 08 F0 26 5B
1092: C9 7F F0 22 C9 20 90 ED 95
109A: AE 37 25 D0 08 C9 30 90 E9
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10BA: F0 CB A9 A0 20 ED FD A9 E3
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10CA: 4C 7D 10 A9 A0 20 ED FD 6C
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10DA: AD 00 02 60 A5 1E C9 C8 1A
10E2: F0 12 E6 1E AD F5 24 18 64
10EA: 69 12 C5 1E B0 06 EE F5 50
10F2: 24 20 2B 0B 60 A5 1E C9 82
10FA: 01 F0 10 C6 1E AC F5 24 F9
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110A: 20 28 0B 60 A5 1D C9 32 15
1112: F0 23 E6 1D AC 32 25 C4 61
111A: 1D B0 1A EE F4 24 AE F4 B3
1122: 24 A9 00 18 7D F6 24 E8 3B
112A: C9 25 90 F7 CA CA E4 1D 74
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113A: C9 01 F0 10 C6 1D AC F4 99
1142: 24 88 C4 1D 90 06 CE F4 32
114A: 24 20 B0 0B 60 A9 23 A0 DD
1152: B0 20 3E 09 20 72 10 A9 A9
115A: 01 85 B9 A9 FF 85 B8 20 D7
1162: B1 00 90 4E 38 E9 41 30 70
116A: 49 F0 06 C9 02 B0 43 A9 CD
1172: 1A 8D 3B 25 20 B1 00 90 17
117A: 39 38 E9 40 30 34 F0 32 EE
1182: C9 1B B0 2E 18 6D 3B 25 5B
118A: C9 33 B0 26 8D 3B 25 20 9A
1192: B1 00 B0 1E 20 4A EC 20 A9
119A: 36 09 C9 00 D0 14 C0 00 AB
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11AA: 90 0B A9 B6 8D F5 24 4C 51
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11BA: B4 1E 20 8B 0C AD 3B 25 16
11C2: CD 3C 25 90 0A AC 3C 25 29
11CA: 88 8C F4 24 4C D4 11 8D 9A
11D2: F4 24 85 1D 20 22 0B 4C E6
11DA: 7C 09 AD F4 24 C5 1D D0 C5
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11EA: A9 01 8D F4 24 85 1D 8D 22
11F2: E5 24 85 1E 20 22 0B 60 AB
11FA: AD F4 24 85 1D AD F5 24 BD
1202: 85 1E 60 20 B1 00 8D 4F 76
120A: 25 20 B1 00 8D 50 25 20 17
1212: B1 00 8D 51 25 20 B1 00 E2
121A: C9 28 F0 03 4C 4D 22 AE 06
1222: 6A 12 AD 4F 25 DD 6A 12 32
122A: F0 06 CA D0 F5 4C 4D 22 4C
1232: AD 50 25 DD 76 12 F0 02 A3
123A: D0 F0 AD 51 25 DD 82 12 85
1242: D0 E8 8E 29 25 E0 0B B0 E0
124A: 0C 8A 48 A9 00 48 4C 22 96
1252: 21 68 8D 29 25 20 B1 00 72
125A: AE 29 25 CA 8A 0A AA BD 01
1262: 90 12 48 BD 8F 12 48 60 ED
126A: 0C 41 41 43 45 49 4C 53 7C
1272: 53 53 54 53 41 42 54 4F DF
127A: 58 4E 4F 47 49 51 41 55 24
1282: 56 53 4E 53 50 54 47 4E 56
128A: 4E 52 4E 4D 45 AE EB 9D 63
1292: F0 E9 EF 08 EF 22 EC 40 4A
129A: E9 8F EB F0 EF 8C EE 39 EC
12A2: F0 A9 13 11 14 20 64 13 1A
12AA: 8E 52 25 8C 54 25 20 B7 47
12B2: 00 C9 3A D0 3F 20 B1 00 7B
12BA: 20 64 13 8E 53 25 8C 55 F0
12C2: 25 20 B7 00 C9 29 D0 2C 39
12CA: 20 B1 00 AE 52 25 CA EC FF
12D2: 53 25 90 03 4C 4D 22 AC B4
12DA: 54 25 88 CC 55 25 90 03 B3
12E2: 4C 4D 22 E8 C8 A5 1D 8D F7
12EA: 39 25 A5 1E BD 3A 25 86 B1
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12FA: 20 C7 1F 90 42 A0 00 B1 54
1302: 19 29 03 C9 01 F0 38 C8 01
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1312: B1 19 9D 00 02 E8 C8 CC 1D
131A: 3C 25 D0 F4 A5 B8 48 A5 57
1322: B9 48 A9 00 9D 00 02 A9 07
132A: 02 A0 00 20 B1 0C 68 85 0E
1332: B9 68 85 B8 A5 1D CD 53 1C
133A: 25 F0 15 E6 1D 18 60 AD F7
1342: 39 25 85 1D AD 3A 25 85 F6
134A: 1E 18 20 C7 1F 4C 4D 22 EC
1352: AD 52 25 85 1D A5 1E CD 6A
135A: 55 25 F0 04 E6 1E 18 60 13
1362: 38 60 A2 00 20 B7 00 C9 BA
136A: 41 F0 06 C9 42 D0 D0 A2 64
1372: 1A 8E 3B 25 20 B1 00 C9 94
137A: 41 90 C4 C9 5B B0 C0 38 F1
1382: E9 40 18 6D 3B 25 C9 33 BC
138A: B0 B5 8D 3B 25 20 B1 00 E8
1392: B0 AD 20 4A EC 20 36 09 82
139A: C9 00 D0 A3 C0 00 F0 9F 81
13A2: C0 C9 B0 9B AE 3B 25 60 78
13AA: A9 01 8D 29 25 A9 00 8D B7
13B2: 2A 25 20 A7 12 20 F9 12 CC
13BA: B0 47 20 72 EB A5 A2 48 B9
13C2: A5 A1 48 A5 A0 48 A5 9F 98
13CA: 48 A5 9E 48 A5 9D 48 EE F9
13D2: 29 25 D0 03 EE 2A 25 20 AB
13DA: F9 12 0B 68 8D 3B 25 68 16
13E2: 85 A5 68 85 A6 68 85 A7 24
13EA: 68 85 A8 68 85 A9 68 85 6B
13F2: AA 45 A2 85 AB A5 9D 20 BB
13FA: C1 E7 AD 3B 25 48 28 90 90
1402: B9 AD 39 25 85 1D AD 3A 22
140A: 25 85 1E 18 20 C7 1F 60 2A
1412: 20 AA 13 A2 06 B5 9C 95 57
141A: A4 CA D0 F9 AD 2A 25 AC 0E
1422: 29 25 20 F2 E2 A5 AA 45 A3
142A: A2 85 AB A5 9D 20 F3 21 4B
1432: 60 20 58 FC A9 01 8D 56 30
143A: 25 A9 00 2C 59 25 30 03 E4
1442: AD 61 C0 0D 58 25 30 03 3D
144A: 4C A9 14 A9 24 A0 91 20 07
1452: 3E 09 20 25 09 C9 53 F0 39
145A: 0B C9 44 F0 0E C9 50 F0 3B
1462: 28 4C B2 15 A9 03 8D 56 24
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1472: A0 B5 A9 24 20 3E 09 20 FB
147A: 72 10 A9 00 AA 20 0A 1B 1A
1482: F0 25 C9 06 F0 21 4C A5 50
148A: 15 A9 24 A0 8A 20 3E 09 90
1492: 20 25 09 38 E9 30 C9 00 5C
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14A2: 03 4C B2 15 8D 56 25 A9 C0
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14B2: FE AD 56 25 F0 14 C9 03 51
14BA: D0 0D AD 05 C3 18 6D 07 F4
14C2: C3 C9 50 D0 05 A9 03 20 4B
14CA: 95 FE A5 1D 8D 53 25 8D 95
14D2: 30 25 A5 1E 8D 55 25 8D 8C
14DA: 31 25 A9 01 85 1D 85 1E F3
14E2: A9 8D 20 BB 15 A6 1D BD 3E
14EA: F6 24 8D 38 25 AA A9 00 F3
14F2: 9D 00 03 CA A9 20 9D 00 FF
14FA: 03 CA 10 FA 38 20 C7 1F F9
1502: 90 58 AD 2B 25 C9 01 D0 16
150A: 23 AD 38 25 38 ED 2C 25 81
1512: AA E8 30 14 E8 AD 2D 25 90
151A: 29 0C C9 08 F0 0A B0 27 CD
1522: 8A 4A F0 04 AA 4C 49 15 B0
152A: A2 00 F0 1B 20 4E 0F AE 7C
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153A: 90 CF AE 38 25 A9 2A 9D BB
1542: FF 02 CA D0 FA F0 13 A0 B5
154A: 02 B1 19 9D 00 03 E8 C8 85
1552: EC 38 25 F0 05 CC 2C 25 8D
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1562: 08 09 80 20 BB 15 E8 D0 B9
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1572: E6 1D 4C E7 14 A5 1E CD A0
157A: 55 25 F0 0E E6 1E A9 01 9B
1582: 85 1D A9 8D 20 BB 15 4C 2B
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1592: 56 25 C9 03 D0 03 20 25 92
159A: 09 A9 00 20 95 FE AD 56 10
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15AA: 25 85 1D AD 31 25 85 1E 8E
15B2: 20 58 FC 20 22 0B 4C 7C F6
15BA: 09 48 AD 56 25 F0 04 68 F3
15C2: 4C ED FD 68 4C 95 1B A9 6D
15CA: 00 2C 59 25 30 03 AD 61 C7
15D2: C0 0D 58 25 8D 3F 25 A9 5B
15DA: 00 8D 40 25 A5 1D 8D 41 C0
15E2: 25 A5 1E 8D 42 25 4C 0D F1
15EA: 16 4C 7C 09 A9 00 2C 59 52
15F2: 25 30 03 AD 61 C0 0D 58 77
15FA: 25 8D 3F 25 A9 01 8D 40 02
1602: 25 A5 1D 8D 41 25 A5 1E AE
160A: 8D 42 25 20 48 16 AD 30 5A
1612: 25 8D 45 25 AD 31 25 8D 39
161A: 46 25 20 52 16 AE 41 25 EE
1622: CA EC 45 25 B0 13 AE 42 5B
162A: 25 CA EC 46 25 B0 0A A9 47
1632: 23 A0 FA 20 3E 09 20 44 14
163A: 18 AD 43 25 85 1D AD 44 D8
1642: 25 85 1E 4C 7C 09 A9 24 6A
164A: A0 59 20 3E 09 4C 59 16 47
1652: A9 24 A0 31 20 3E 09 20 AF
165A: 88 0D 20 25 09 AE 8D 16 98
1662: DD 8D 16 F0 06 CA D0 F8 A8
166A: 4C 59 16 CA 8A 0A AA A9 FD
1672: 16 48 A9 58 48 BD 95 16 F0
167A: 48 BD 94 16 48 60 68 68 2B
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168A: 44 25 60 06 00 0B 0A 08 D6
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16B2: 1D AD 48 25 85 1E 38 20 69
16BA: C7 1F 90 45 A0 02 AD 2B 8C
16C2: 25 C9 02 D0 09 AC 2C 25 B9
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16D2: B1 19 9D 00 03 E8 C8 CC EB
16DA: 2C 25 D0 F4 A9 00 9D 00 58
16E2: 03 8E 2C 25 20 25 17 AD 7D
16EA: 40 25 D0 03 20 13 17 AD F3
16F2: 49 25 85 1D AD 4A 25 85 F5
16FA: 1E 18 20 C7 1F 20 27 20 A4
1702: 60 AD 49 25 85 1D AD 4A 8D
170A: 25 85 1E 18 20 C7 1F 90 60
1712: EF 20 33 1E 18 20 C7 1F 78
171A: A9 00 A8 91 1B C8 91 1B 85
1722: 4C 02 17 AD 3F 25 30 01 A4
172A: 60 AD 2B 25 C9 02 F0 01 E4
1732: 60 AD 49 25 38 ED 47 25 A4
173A: 8D 4D 25 AD 4A 25 38 ED 47
1742: 48 25 8D 4E 25 A2 00 8E B6
174A: 2A 25 BD 00 03 9D 80 02 20
1752: E8 EC 2C 25 D0 F4 A9 00 B5
175A: 9D 80 02 A9 80 85 B8 A9 B7
1762: 02 85 B9 A9 00 85 FB A9 7C
176A: 03 85 FC 20 B7 00 20 37 52
1772: 18 20 B1 00 C9 00 D0 03 DD
177A: 4C 2C 18 C9 40 D0 03 4C 11
1782: 17 18 90 EA C9 43 B0 E6 A6
178A: A2 00 C9 42 D0 02 A2 1A 55
1792: 8E 29 25 20 B1 00 C9 41 5B
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17A2: 40 18 6D 29 25 C9 33 B0 9E
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17B2: 1B 90 05 A2 42 38 E9 1A 3E
17BA: 18 69 40 8D 29 25 8A 20 43
17C2: 37 18 AD 29 25 20 37 18 0B
17CA: 20 B1 00 B0 33 20 4A EC 1C
17D2: 20 36 09 C9 00 D0 29 C0 B2
17DA: 00 F0 25 C0 C9 B0 21 98 E1
17E2: 18 6D 4E 25 A8 A9 00 20 A0
17EA: F2 E2 20 34 ED A2 00 BD 4A
17F2: 00 01 F0 06 20 37 18 E8 D6
17FA: D0 F5 20 B7 00 4C 76 17 C3
1802: A2 00 BD 80 02 F0 06 9D C0
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1812: 00 03 4C 36 18 20 37 18 B7
181A: 20 B1 00 20 37 18 20 B1 D4
1822: 00 20 37 18 20 B1 00 4C D6
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1832: A9 00 91 FB 60 AC 2A 25 58
183A: C0 78 F0 05 91 FB EE 2A DB
1842: 25 60 AD 45 25 38 ED 41 4E
184A: 25 18 6D 30 25 8D 48 25 DE
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185A: 6D 31 25 8D 4C 25 AD 42 9F
1862: 25 CD 31 25 B0 03 4C 07 42
186A: 19 AD 41 25 CD 30 25 90 17
1872: 4A AD 41 25 8D 47 25 AD 2F
187A: 42 25 8D 48 25 AD 30 25 B0
1882: 8D 49 25 AD 31 25 8D 4A CE
188A: 25 20 A0 16 AD 47 25 CD 6D
1892: 45 25 F0 08 EE 47 25 EE 1B
189A: 49 25 D0 ED AD 48 25 CD 58
18A2: 46 25 F0 14 EE 48 25 EE 70
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18B2: AD 30 25 8D 49 25 D0 D1 95
18BA: 4C A0 19 AD 45 25 8D 47 58
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18EA: 25 CD 46 25 F0 CA EE 48 15
18F2: 25 EE 4A 25 AD 45 25 8D 67
18FA: 47 25 AD 4B 25 8D 49 25 99
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190A: CD 30 25 90 4A AD 41 25 8D
1912: 8D 47 25 AD 46 25 8D 48 86
191A: 25 AD 30 25 8D 49 25 AD 2C
1922: 4C 25 8D 4A 25 20 A0 16 1B
192A: AD 47 25 CD 45 25 F0 08 2F
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193A: AD 48 25 CD 42 25 F0 14 73
1942: CE 48 25 CE 4A 25 AD 41 03
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197A: F0 08 CE 47 25 CE 49 25 91
1982: D0 ED AD 48 25 CD 42 25 DC
198A: F0 14 CE 48 25 CE 4A 25 B6
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19B2: A2 00 A9 08 20 0A 1B F0 3C
19BA: 07 C9 06 F0 03 4C B7 1B 86
19C2: A9 FF 20 95 1B A9 FF 20 C6
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19D2: 70 20 95 1B A0 32 B9 F6 E1
19DA: 24 20 95 1B 88 D0 F7 AD B0
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19FA: 1B 88 B1 1B 20 95 1B C8 1B
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1A12: 85 1C A5 1C C5 6C D0 D1 D9
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1A22: 1B A5 6C 85 1C A0 00 B1 48
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1B12: 8D C0 B5 A9 00 8D BD B5 F7
1B1A: 8D BE B5 8D BF B5 A9 06 84
1B22: 8D C1 B5 A0 3C A9 A0 99 B3
1B2A: 74 AA 88 D0 FA A0 00 B9 77
1B32: 00 02 F0 08 09 80 99 75 7A
1B3A: AA C8 D0 F3 A9 AA 8D C4 29
1B42: B5 A9 75 8D C3 B5 20 60 DA
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1B5A: A2 01 20 D6 03 60 A9 00 80
1B62: 8D C7 B5 8D C9 B5 8D CB EC
1B6A: B5 A0 A6 8C CC B5 C8 8C 9C
1B72: CA B5 C8 8C C8 B5 60 8D C8
1B7A: C3 B5 98 48 8A 48 A9 03 63
1B82: 8D BB B5 A9 01 8D BC B5 2D
1B8A: 20 60 1B A2 01 20 D6 03 AF
1B92: 4C AE 1B 8D C3 B5 98 48 45
1B9A: 8A 48 A9 04 8D BB B5 A9 0E
1BA2: 01 8D BC B5 20 60 1B A2 0B
1BAA: 01 20 D6 03 AD C5 B5 F0 55
1BB2: 12 68 68 68 68 AD C5 B5 DA
1BBA: 48 20 52 1B 68 8D C5 B5 D3
1BC2: 4C CD 1A 68 AA 68 A8 AD 52
1BCA: C3 B5 60 20 58 FC 20 84 D9
1BD2: FE A9 06 8D BB B5 8D C1 1E
1BDA: B5 A9 01 8D C0 B5 20 60 CC
1BE2: 1B A2 01 20 D6 03 A9 23 AA
1BEA: 85 FC A9 EC 85 FB 20 54 D7
1BF2: 09 20 12 09 C9 0D D0 F9 A6
1BFA: 20 58 FC 20 22 0B 4C 7C 4B
1C02: 09 AD B3 22 D0 01 60 A9 B7
1C0A: 24 A0 C9 20 3E 09 A5 1D 36
1C12: 8D 30 25 A5 1E 8D 31 25 CA
1C1A: A9 01 85 1D 85 1E AD EF D9
1C22: 24 85 1B AD F0 24 85 1C 4B
1C2A: A0 01 B1 1B F0 35 85 1A 5C
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1C3A: 03 C9 02 D0 26 38 20 C7 CD
1C42: 1F A2 00 AC 2C 25 B1 19 EF
1C4A: 8D 2C 25 C8 B1 19 9D 00 B2
1C52: 03 E8 C8 CC 2C 25 D0 F4 B8
1C5A: A9 00 9D 00 03 8E 2C 25 EA
1C62: 20 27 20 A5 1B 18 69 02 E0
1C6A: 85 1B 90 02 E6 1C E6 1E F1
1C72: A5 1E C9 C9 D0 B2 A9 01 80
1C7A: 85 1E E6 1D A5 1D C9 33 14
1C82: D0 A6 AD 30 25 85 1D AD AC
1C8A: 31 25 85 1E 38 20 C7 1F 2B
1C92: 4C 7C 09 20 33 1E 18 20 95
1C9A: C7 1F A9 00 A8 91 1B C8 3E
1CA2: 91 1B 20 03 1C 60 A9 23 77
1CAA: A0 86 20 3E 09 A9 00 2C D7
1CB2: 59 25 30 03 AD 61 C0 0D 98
1CBA: 58 25 30 08 AD B3 22 49 B8
1CC2: FF 8D B3 22 AD B3 22 C9 41
1CCA: 00 F0 06 A9 CE 20 ED FD 6B
1CD2: 60 A9 C6 20 ED FD 20 ED 16
1CDA: FD 60 EE 6A 22 20 B8 09 BA
1CE2: CE 6A 22 AD 00 03 F0 4E 78
1CEA: C9 3D F0 27 AE C4 08 DD 5E
1CF2: C4 08 F0 08 CA D0 F8 A9 63
1CFA: 01 4C 17 1D AD 2C 25 C9 AD
1D02: 25 B0 33 A0 00 A9 03 20 38
1D0A: B1 0C 20 B7 00 D0 E8 A9 46
1D12: 00 F0 02 A9 02 8D 2B 25 25
1D1A: 18 20 C7 1F B0 09 AD B4 0D
1D22: 22 8D 2D 25 4C 32 1D A0 CE
1D2A: 00 B1 19 29 FC 8D 2D 25 24
1D32: 20 27 20 20 03 1C 60 AE 44
1D3A: 36 25 CA CA CA CA BD 00 DB
1D42: 02 C9 45 D0 78 E8 BD 00 88
1D4A: 02 8D 3B 25 E8 BD 00 02 E2
1D52: 38 E9 30 8D 2A 25 E8 BD 77
1D5A: 00 02 38 E9 30 AE 2A 25 70
1D62: F0 06 18 69 0A CA D0 FA 48
1D6A: 8D 29 25 AD 3B 25 C9 2D 64
1D72: F0 4C A2 00 A0 00 BD 00 0D
1D7A: 02 C9 45 F0 08 E8 C9 2E 85
1D82: F0 F4 C8 D0 F1 88 8C 3B 9E
1D8A: 25 AD 29 25 3B ED 3B 25 4F
1D92: 8D 29 25 A2 01 A0 01 BD F6
1D9A: 00 02 E8 C9 2E F0 F8 C9 FF
1DA2: 45 F0 06 99 00 02 C8 D0 80
1DAA: EE A9 30 AE 29 25 99 00 C8
1DB2: 02 C8 CA D0 F9 A9 00 99 96
1DBA: 00 02 8C 36 25 60 CE 29 DB
1DC2: 25 A2 00 A0 00 BD 00 02 3B
1DCA: E8 C9 2E F0 F8 C9 45 F0 2B
1DD2: 06 99 80 02 C8 DC EE A9 B7
1DDA: 00 99 80 02 A9 2E 8D 00 CC
1DE2: 02 AE 29 25 A9 30 9D 00 8A
1DEA: 02 CA D0 FA A2 00 AC 29 3A
1DF2: 25 C8 BD 80 02 99 00 02 2A
1DFA: F0 04 E8 C8 D0 F4 8C 36 02
1E02: 25 60 20 6F 09 A9 04 85 60
1E0A: 29 A9 00 85 28 85 24 AD EA
1E12: F1 24 38 E5 6F A8 AD F2 22
1E1A: 24 E5 70 20 21 1E 60 20 54
1E22: F2 E2 20 34 ED A9 01 85 75
1E2A: FC A9 00 85 FB 20 54 09 B9
1E32: 60 A0 01 B1 1B F0 E7 A9 18
1E3A: 00 91 1B 88 91 1B B1 19 3C
1E42: 29 03 C9 02 D0 09 C8 B1 1B
1E4A: 19 A8 B1 19 4C 54 1E C8 BD
1E52: B1 19 85 FB 18 65 19 8D 34
1E5A: 76 1E A5 19 8D 79 1E A5 D3
1E62: 1A 8D 7A 1E 69 00 8D 77 1E
1E6A: 1E A5 70 38 ED 77 1E AA E4
1E72: E8 A0 00 B9 FF FF 99 FF 1A
1E7A: FF C8 D0 F7 EE 77 1E EE 03
1E82: 7A 1E CA D0 EE A5 6F 38 0F
1E8A: E5 FB 85 6F A5 70 E9 00 23
1E92: 85 70 AD EF 24 85 FD AD 43
1E9A: F0 24 85 FE A0 01 B1 FD 63
1EA2: F0 22 38 88 B1 FD E5 19 D9
1EAA: 8D 29 25 C8 B1 FD E5 1A 94
1EB2: 0D 29 25 90 0F 88 B1 FD 69
1EBA: 38 E5 FB 91 FD C8 B1 FD 99
1EC2: E9 00 91 FD C8 F0 03 C8 DE
1ECA: D0 D4 E6 FE C8 A5 FE C5 12
1ED2: 6C D0 CB 60 A9 23 A0 22 36
1EDA: 20 3E 09 20 25 09 C9 59 14
1EE2: D0 03 4C 00 C6 4C 7C 09 3B
1EEA: AD 39 25 85 1D AD 3A 25 82
1EF2: 85 1E 18 20 C7 1F AD 3B CF
1EFA: 25 8D 2B 25 AD 3D 25 8D 1F
1F02: 2D 25 AD 3C 25 8D 2C 25 76
1F0A: 4C 4D 22 48 A5 1D 8D 39 80
1F12: 25 A5 1E 8D 3A 25 AD 2B D5
1F1A: 25 8D 3B 25 AD 2D 25 8D 02
1F22: 3D 25 AD 2C 25 8D 3C 25 BD
1F2A: 68 E9 41 30 BB F0 06 C9 B9
1F32: 02 B0 B5 A9 1A 85 1D 20 30
1F3A: B1 00 E9 40 30 AA F0 AB 49
1F42: C9 1B B0 A4 18 65 1D C9 E6
1F4A: 33 B0 9D 85 1D 20 B1 00 27
1F52: B0 96 20 4A EC 20 36 09 94
1F5A: C9 00 D0 8C C0 00 F0 88 D0
1F62: C0 C9 B0 84 84 1E 38 20 FE
1F6A: C7 1F 90 07 AD 2B 25 C9 05
1F72: 01 D0 03 4C EA 1E A0 02 9D
1F7A: A2 00 B1 19 C9 2A F0 F3 9E
1F82: B1 19 9D 00 02 C8 E8 CC 65
1F8A: 2C 25 D0 F4 A9 00 9D 00 1A
1F92: 02 A5 B8 48 A5 B9 48 A0 1C
1F9A: 00 A9 02 20 B1 0C 68 85 18
1FA2: B9 68 85 B8 AD 39 25 85 36
1FAA: 1D AD 3A 25 85 1E 18 20 71
1FB2: C7 1F AD 3B 25 8D 2B 25 E0
1FBA: AD 3D 25 8D 2D 25 AD 3C 32
1FC2: 25 8D 2C 25 60 08 A6 1D 5C
1FCA: CA 86 1B A9 C8 85 1C 18 BA
1FD2: A9 00 A2 08 6A 66 1B 90 6E
1FDA: 03 18 65 1C CA 10 F5 85 17
1FE2: 1C A6 1E CA 8A 18 65 1B E3
1FEA: 85 1B A5 1C 69 00 85 1C 9B
1FF2: 06 1B 26 1C A5 1C 6D F0 EA
1FFA: 24 85 1C A0 01 B1 1B D0 10
2002: 03 28 18 60 AA 88 B1 1B CC
200A: 85 19 86 1A 28 90 14 B1 23
2012: 19 29 03 8D 2B 25 B1 19 CC
201A: 29 FC 8D 2D 25 C8 B1 19 7B
2022: 8D 2C 25 38 60 20 33 1E 64
202A: AD 2B 25 C9 02 F0 32 EE 74
2032: 2C 25 EE 2C 25 A0 00 A5 C3
203A: 6F 91 1B C8 A5 70 91 1B B3
2042: 88 AD 2B 25 0D 2D 25 91 E2
204A: 6F C8 AD 2C 25 91 6F C8 04
2052: A2 00 BD 00 03 91 6F C8 A1
205A: E8 CC 2C 25 D0 F4 4C B6 C3
2062: 20 20 F2 20 EE 36 25 EE A4
206A: 36 25 38 AD 36 25 6D 2C 3E
2072: 25 8D 2C 25 AC 36 25 AD B6
207A: 2C 25 91 6F A2 00 C8 BD A7
2082: 00 03 91 6F C8 E8 CC 2C 5C
208A: 25 D0 F4 A0 00 A5 6F 91 41
2092: 1B C8 A5 70 91 1B 88 AD 06
209A: 2B 25 0D 2D 25 91 6F C8 45
20A2: AD 36 25 91 6F C8 A2 02 EA
20AA: BD FE 01 91 6F C8 E8 EC 20
20B2: 36 25 D0 F4 A5 6F 18 6D 49
20BA: 2C 25 90 06 A5 70 C9 A4 F3
20C2: F0 0F A5 6F 18 6D 2C 25 DE
20CA: 85 6F A5 70 69 00 85 70 2C
20D2: 60 A9 00 A8 91 1B C8 91 54
20DA: 1B A9 24 A0 13 20 3E 09 40
20E2: A5 1D 8D F4 24 A5 1E 8D BF
20EA: F5 24 A2 FD 9A 4C 7C 08 6A
20F2: BA 8E 3E 25 A2 00 A0 00 A4
20FA: BD 00 03 C9 28 D0 01 C8 66
2102: C9 29 D0 01 88 9D 00 03 5B
210A: E8 EC 2C 25 D0 EA C0 00 B7
2112: F0 03 4C 4D 22 A9 00 48 EB
211A: A9 00 85 B8 A9 03 85 B9 8B
2122: 20 B1 00 90 51 C9 2D F0 E6
212A: 4D C9 2B F0 49 C9 2E F0 B8
2132: 45 C9 50 F0 25 C9 28 F0 34
213A: 15 C9 41 F0 0B C9 42 F0 A5
2142: 07 C9 40 F0 0F 4C 4D 22 F7
214A: 20 0D 1F 4C 7B 21 A9 01 3D
2152: 48 4C 22 21 20 05 12 4C A7
215A: 7B 21 20 B1 00 C9 49 F0 6C
2162: 03 4C 4D 22 A9 73 A0 21 82
216A: 20 F9 EA 20 B1 00 4C 7B 3C
2172: 21 82 49 0F DA A1 20 4A E7
217A: EC 20 B7 00 F0 78 A2 02 E2
2182: C9 2B F0 35 E8 C9 2D F0 9F
218A: 30 E8 C9 2A F0 2B E8 C9 CA
2192: 2F F0 26 E8 C9 5E F0 21 C6
219A: C9 29 F0 03 4C 4D 22 68 9E
21A2: F0 14 C9 01 F0 07 48 20 FF
21AA: 19 22 4C A1 21 E6 B8 D0 8C
21B2: 02 E6 B9 4C 7B 21 4C 53 F7
21BA: 12 86 06 68 48 A8 B9 9B E2
21C2: 22 DD 9B 22 90 10 20 19 41
21CA: 22 A6 06 68 48 A8 B9 9B 03
21D2: 22 DD 9B 22 B0 F0 20 72 2F
21DA: EB A5 A2 48 A5 A1 48 A5 3F
21E2: A0 48 A5 9F 48 A5 9E 48 94
21EA: A5 9D 48 A5 06 48 4C 22 D6
21F2: 21 F0 58 4C 69 EA 68 48 E1
21FA: F0 06 20 19 22 4C F8 21 22
2202: 68 20 34 ED A0 00 B9 00 60
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220A: 01 99 00 02 F0 03 C8 D0 4B
2212: F5 8C 36 25 4C 39 1D 68 77
221A: 85 FB 68 85 FC 68 85 07 21
2222: 68 85 A5 68 85 A6 68 85 54
222A: A7 68 85 A8 68 85 A9 68 AC
2232: 85 AA 45 A2 85 AB A5 07 E3
223A: 0A A8 A5 FC 48 A5 FB 48 4B
2242: B9 A3 22 48 B9 A2 22 48 F9
224A: A5 9D 60 AE 3E 25 9A A9 25
2252: 07 8D 36 25 A0 00 B9 1B 2A
225A: 23 99 00 02 C8 C0 07 D0 DE
2262: F5 A9 00 99 00 02 60 00 6E
226A: 00 04 04 05 05 06 06 07 D3
2272: 07 04 04 05 05 06 06 07 5F
227A: 07 04 04 05 05 06 06 07 67
2282: 07 00 80 00 80 00 80 00 5F
228A: 80 28 A8 28 A8 28 A8 28 10
2292: A8 50 D0 50 D0 50 D0 50 18
229A: D0 00 01 02 02 03 03 04 AD
22A2: 01 22 01 22 C0 E7 A9 E7 13
22AA: 81 E9 F2 21 96 EE 4E 54 FB
22B2: 46 00 2C 40 40 41 41 41 6E
22BA: 42 41 43 41 44 41 45 41 DF
22C2: 46 41 47 41 48 41 49 41 92
22CA: 4A 41 4B 41 4C 41 4D 41 45
22D2: 4E 41 4F 41 50 41 51 41 F7
22DA: 52 41 53 41 54 41 55 41 AA
22E2: 56 41 57 41 58 41 59 41 5D
22EA: 5A 42 41 42 42 42 43 42 1D
22F2: 44 42 45 42 46 42 47 42 C2
22FA: 48 42 49 42 4A 42 4B 42 75
2302: 4C 42 4D 42 4E 42 4F 42 29
230A: 50 42 51 42 52 42 53 42 DB
2312: 54 42 55 42 56 42 57 42 8E
231A: 58 2A 45 52 52 4F 52 2A 83
2322: C5 D8 C9 D4 BA A0 C1 D2 B6
232A: C5 A0 D9 CF D5 A0 D3 D5 62
2332: D2 C5 A0 AB D9 AF CE A9 C6
233A: BF 00 D3 D0 C5 C5 C4 C3 7A
2342: C1 CC C3 00 D3 D0 C5 C5 48
234A: C4 C3 C1 CC C3 A0 C2 D9 E8
2352: A0 CB C5 D6 C9 CE A0 CD 9A
235A: C1 D2 D4 C9 CE 00 CE C5 47
2362: D7 BA A0 C1 D2 C5 A0 D9 3C
236A: CF D5 A0 D3 D5 D2 C5 A0 85
2372: A8 D9 AF CE A9 BF 00 D7 8A
237A: C9 C4 D4 C8 BA 00 C7 CF 33
2382: D4 CF BA 00 D2 C5 C3 C1 75
238A: CC C3 D5 CC C1 D4 C9 CF 74
2392: CE A0 C9 D3 A0 CF 00 D3 F6
239A: C1 D6 C5 BA 00 CC CF C1 70
23A2: C4 BA 00 C6 CF D2 CD C1 8D
23AA: D4 BA A0 A0 CC C5 C6 D4 08
23B2: AC A0 C3 C5 CE D4 C5 D2 74
23BA: AC A0 CF D2 A0 D2 C9 C7 52
23C2: C8 D4 A0 CA D5 D3 D4 C9 D4
23CA: C6 D9 BF 00 C6 CF D2 CD CB
23D2: C1 D4 BA A0 A0 A3 A0 CF 35
23DA: C6 A0 C4 C5 C3 C9 CD C1 44
23E2: CC A0 D0 CC C1 C3 C5 D3 1B
23EA: BA 00 8D D0 D2 C5 D3 D3 76
23F2: A0 D2 C5 D4 D5 D2 CE 00 DB
23FA: D0 D2 CF C3 C5 D3 D3 C9 83
2402: CE C7 A0 C4 C1 D4 C1 A0 89
240A: D4 D2 C1 CE D3 C6 C5 D2 AE
2412: 00 CE CF D4 A0 C5 CE CF DE
241A: D5 C7 C8 A0 D2 CF CF CD A5
2422: A0 D4 CF A0 C5 CE D4 C5 CC
242A: D2 A0 C4 C1 D4 C1 00 CD 34
2432: CF D6 C5 A0 C3 D5 D2 D3 C9
243A: CF D2 A0 D4 CF A0 D4 CF FA
2442: D0 A0 CC C5 C6 D4 A0 CF AB
244A: C6 A0 CE C5 D7 A0 D0 CF 07
2452: D3 C9 D4 C9 CF CE 00 CD B5
245A: CF D6 C5 A0 C3 D5 D2 D3 F1
2462: CF D2 A0 D4 CF A0 C2 CF FE
246A: D4 D4 CF CD A0 D2 C9 C7 D4
2472: C8 D4 A0 CF C6 A0 C2 CC 70
247A: CF C3 CB 00 D0 D2 C9 CE 49
2482: D4 C9 CE C7 AE AE AE 00 8B
248A: D3 CC CF D4 A0 A3 00 D0 9B
2492: D2 C9 CE D4 A0 D4 CF BA 90
249A: A0 A0 D3 C3 D2 C5 C5 CE 1A
24A2: AC A0 C4 C9 D3 CB A0 CF 7D
24AA: D2 A0 D0 D2 C9 CE D4 C5 C4
24B2: D2 BF 00 C6 C9 CC C5 CE 9C
24BA: C1 CD C5 BA 00 CE CF A0 37
24C2: C5 D2 D2 CF D2 D3 00 D2 B2
24CA: C5 C3 C1 CC C3 D5 CC C1 BC
24D2: D4 C9 CE C7 AE AE AE 00 DB
24DA: CE CF D4 A0 C1 A0 D3 D0 2C
24E2: C5 C5 C4 C3 C1 CC C3 A0 BD
24EA: C6 C9 CC C5 00 00 00 00 FE
24F2: 00 00 00 00 00 00 00 00 3B
```

Program 2: Apple *Speed-Calc* for ProDOS

Please refer to the "MLX" article in this issue before entering the following listing.

```
START ADDRESS: 2000
END ADDRESS:   3D67

2000: 4C A7 3A 00 0A 08 0A 00 1C
2008: A5 AB 33 30 00 14 08 14 E3
2010: 00 8C 32 30 38 33 00 1E 69
2018: 08 1E 00 8C 32 30 38 30 9F
2020: 00 00 00 4C 88 22 20 58 8A
2028: FC AD 61 C0 8D C9 25 A9 12
2030: 00 8D F2 03 A9 09 8D F3 E2
2038: 03 49 A5 8D F4 03 A9 FD DE
2040: 85 39 85 37 A9 1B 85 38 B2
2048: A9 F0 85 36 A9 25 18 69 29
2050: 01 8D 60 25 18 69 4F 85 5D
2058: 6C A9 00 8D 5F 25 8D 61 1E
2060: 25 85 6B 8D D1 22 85 FF FC
2068: 8D C8 25 A9 B9 8D 62 25 CE
2070: A9 09 20 61 09 20 D9 0A 68
2078: A9 23 A0 AE 20 3E 09 20 81
2080: 88 0D 20 25 09 48 20 7C C4
2088: 09 68 AE AC 08 DD AC 08 21
2090: F0 0A CA D0 F8 C9 20 90 F1
2098: E6 4C 37 0C CA 8A 0A AA 46
20A0: A9 08 48 A9 7B 48 BD D3 A7
20A8: 08 48 BD D2 08 48 60 17 1D
20B0: 0E 00 17 06 07 10 03 13 CC
20B8: 0C 18 0A 0B 15 08 02 05 C8
20C0: 21 01 12 04 0D 1B 23 0D 7C
20C8: 31 32 33 34 35 36 37 38 01
20D0: 39 30 2B 2D 2E C4 0A DB 66
20D8: 11 13 10 A8 0C 4E 11 32 E0
20E0: 14 E6 15 9B 19 31 1A 10 13
20E8: 1F DD 10 F6 10 0D 11 37 AF
20F0: 11 CF 1C 16 1D 43 1C 3E FE
20F8: 1E E2 1C 8B 1B C1 15 08 4F
2100: 09 ED 0C 20 58 FC 20 22 DE
2108: 0B 4C 75 08 AD C8 25 49 36
2110: FF 8D C8 25 60 2C 00 C0 95
2118: 10 0B AD 00 C0 8D 10 C0 F7
2120: 29 7F C9 FF 60 A9 00 60 1A
2128: A5 FF F0 07 48 A9 00 85 3A
2130: FF 68 60 20 12 09 F0 FB 2D
2138: 60 20 F2 EB A5 A0 A4 A1 6A
2140: 60 85 FC 84 FB 20 6F 09 44
2148: 20 80 FE A9 00 85 28 85 21
2150: 24 85 25 A9 04 85 29 A0 6E
2158: 00 B1 FB F0 06 20 ED FD 20
2160: C8 D0 F6 60 A2 32 9D 66 9F
2168: 25 CA D0 FA A9 28 8D 99 5C
2170: 25 60 A0 00 A9 20 99 00 72
2178: 04 C8 C0 28 D0 F6 60 AD 5A
2180: 01 04 C9 10 D0 0A AD 0A 92
2188: 04 C9 02 F0 03 4C 94 09 0A
2190: A9 23 A0 A4 20 3E 09 38 13
2198: 20 02 20 90 03 4C 32 0F 35
21A0: 4C 40 0F 09 80 8D 80 02 C8
21A8: A9 3C 8D B1 02 A2 76 A9 C9
21B0: A0 9D B1 02 CA D0 FB A0 27
21B8: 01 D0 02 A0 00 B9 80 02 E3
21C0: 8D AC 25 A9 DF 99 80 02 9C
21C8: 20 AB 0A 20 12 09 D0 16 B5
21D0: EE AB 25 10 08 A9 DF 99 5B
21D8: 80 02 4C C5 09 AD AC 25 3F
21E0: 99 80 02 4C C5 09 09 80 F9
21E8: 8D AB 25 AD AC 25 99 80 0A
21F0: 02 AD AB 25 AE 95 0A DD 25
21F8: 95 0A F0 2C CA D0 F8 C9 BE
2200: A0 90 BA BC AC 25 CE AC 1D
2208: 25 A2 77 BD 80 02 C9 3C 2E
2210: F0 AB CA BD 80 02 9D 81 B5
2218: 02 CA EC AC 25 D0 F4 AD 7C
2220: AB 25 99 80 02 C8 D0 95 29
2228: CA BA 0A AA BD 9E 0A 48 25
2230: BD 9D 0A 48 60 A0 00 B9 BF
2238: 80 02 C9 3C F0 08 29 7F B3
2240: 99 00 03 C8 D0 F1 A9 00 DF
2248: 99 00 03 8C 9C 25 60 AD 6A
2250: D2 22 F0 20 C0 00 F0 01 8F
2258: 88 4C BA 09 AD D2 22 F0 C9
2260: 13 B9 80 02 C9 3C F0 F1 DF
2268: C8 4C BA 09 AD D2 22 F0 F9
2270: 03 4C BA 09 AD AB 25 29 C0
2278: 7F 85 FF 4C 32 0A C0 00 DD
2280: F0 D7 88 98 AA BD 81 02 1F
2288: 9D 80 02 E8 C9 3C D0 F5 61
2290: A9 A0 9D 80 02 4C BA 09 4D
2298: 07 8D 9B 8A 8B 88 95 FF 89
22A0: 31 0A 7A 0A 68 0A 68 0A 36
22A8: 4B 0A 58 0A 7A 0A A2 00 02
22B0: BD 80 02 9D 80 04 BD A8 46
22B8: 02 9D 00 05 BD D0 02 9D 88
22C0: 80 05 E8 E0 28 D0 E9 60 6A
22C8: A9 23 A0 C8 20 3E 09 20 77
22D0: 25 09 C9 59 D0 03 20 D9 65
22D8: 0A 4C 7C 09 20 FA 0A A9 FF
22E0: 09 20 61 09 20 22 0B 20 2E
22E8: 88 0D A9 2C BD 1C 23 A9 79
22F0: 00 8D 1B 23 A5 6B 85 08 1C
22F8: A5 6C 85 09 60 AD 5F 25 0A
2300: 85 FB AD 60 25 85 FC A0 9D
2308: 00 98 91 FB C8 D0 FB E6 CE
2310: FC A6 FC EC 62 25 D0 F2 29
2318: A9 01 8D 64 25 8D 65 25 BA
2320: 85 1D 85 1E 60 20 28 0B E1
2328: 4C B0 0B A0 05 8C AB 25 03
2330: B9 EB 22 85 28 B9 D3 22 DC
2338: 85 29 A0 00 AE 65 25 A9 9E
2340: 00 8D 99 25 8D 9A 25 F8 B9
2348: AD 99 25 18 69 01 8D 99 F5
2350: 25 AD 9A 25 69 00 8D 9A 3B
2358: 25 CA D0 EC D8 A2 00 20 3E
2360: 8D 0B F8 AD 99 25 18 69 25
2368: 01 8D 99 25 AD 9A 25 69 A3
2370: 00 8D 9A 25 D8 EE AB 25 BE
2378: AC AB 25 B9 EB 22 85 28 5B
2380: B9 D3 22 85 29 A0 00 E8 E9
2388: E0 12 D0 D3 20 8D 0B 60 C8
2390: AD 9A 25 18 69 30 91 28 D1
2398: C8 AD 99 25 29 F0 4A 4A 20
23A0: 4A 4A 18 69 30 91 28 C8 19
23A8: AD 99 25 29 0F 18 69 30 3F
23B0: 91 28 60 A0 04 B9 EB 22 E0
23B8: 85 28 B9 D3 22 85 29 A0 5A
23C0: 00 A9 20 91 28 C8 91 28 3E
23C8: C8 91 28 C8 AE 64 25 A9 64
23D0: 00 8D 63 25 8D 66 25 8E 99
23D8: 99 25 4A 69 00 AA CA A9 FE
23E0: 20 91 28 C8 CA D0 FA AD 6A
23E8: 99 25 0A AA BD 1D 23 29 03
23F0: 3F 91 28 C8 BD 1E 23 29 A2
23F8: 3F 91 28 C8 AE 99 25 BD B8
2400: 66 25 4A AA CA CA A9 20 AD
2408: 91 28 C8 CA 10 FA AE 99 4C
2410: 25 BD 66 25 18 6D 63 25 DB
2418: 8D 63 25 E8 BD 66 25 18 1D
2420: 6D 63 25 C9 25 90 AD CA CA
2428: 8E A2 25 A9 20 C0 28 D0 C4
2430: 01 60 91 28 C8 C0 28 D0 30
2438: F9 60 20 A0 09 AD 00 03 A5
2440: F0 3F C9 3D F0 26 AE C4 20
2448: 08 DD C4 08 F0 07 CA D0 2F
2450: F8 A9 01 D0 19 AD 9C 25 8A
2458: C9 25 B0 25 A0 00 A9 03 92
2460: 20 B1 0C 20 B7 00 D0 E9 E5
2468: A9 00 F0 02 A9 02 8D 9B CF
2470: 25 AD 1C 23 8D 9D 25 18 B1
2478: 20 02 20 20 62 20 20 3E 69
2480: 1C 4C 7C 08 85 B9 84 B8 CE
2488: 20 B7 00 4C 4A EC A2 32 11
2490: A9 00 8D A8 25 8D 66 25 FB
2498: 18 6D A8 25 8D A8 25 C9 D2
24A0: 25 B0 03 CA D0 EF E8 E8 B5
24A8: 8E AC 25 60 A9 00 2C C9 7D
24B0: 25 30 03 AD 61 C0 0D C8 C3
24B8: 25 8D C7 25 A0 0D A9 24 F2
24C0: 20 3E 09 20 25 09 C9 4C F8
24C8: F0 0F C9 43 F0 0F C9 52 64
24D0: F0 03 4C B5 0D A2 0C D0 10
24D8: 06 A2 0B D0 02 A2 04 AD 2B
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24E0: 1C 23 29 F0 8D AB 25 8A 24
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24F8: AD 61 C0 0D C8 25 8D C7 17
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2538: AB 25 8D 1C 23 AD 5F 25 C8
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2568: 00 85 1C A5 1C C5 6C D0 93
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2598: 63 25 AE 64 25 86 1D AC 24
25A0: 65 25 84 1E 98 18 69 13 64
25A8: 8D 9E 25 BD 66 25 8D A8 6D
25B0: 25 A9 FF EC A0 25 D0 07 09
25B8: CC A1 25 D0 02 A9 3F 8D 46
25C0: A3 25 98 18 69 05 38 ED 78
25C8: 65 25 A8 B9 D3 22 85 29 1B
25D0: B9 EB 22 85 28 38 20 02 F3
25D8: 20 B0 05 A9 A0 4C 67 0E AD
25E0: AD 9B 25 F0 70 C9 02 F0 3C
25E8: 6C AD A8 25 38 ED 9C 25 14
25F0: AA E8 30 32 E8 AD 9D 25 52
25F8: 29 0C C9 08 F0 28 B0 05 23
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2620: AA A0 02 4C 2E 0E AE A8 9E
2628: 25 AD 63 25 8D A5 25 A0 1F
2630: 02 B1 19 8C A4 25 AC A5 8E
2638: 25 09 80 2D A3 25 91 28 39
2640: AC A4 25 EE A5 25 CA F0 E7
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2658: AE 9C 25 CA CA CA EC A8 78
2660: 25 B0 03 4C E6 0D A9 2A 79
2668: 09 80 2D A3 25 AC 63 25 01
2670: AE A8 25 91 28 C8 CA D0 C6
2678: FA A4 1E A6 1D C8 CC 9E DD
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26C0: 88 CA D0 FA 60 A9 28 38 FF
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2720: 25 C8 B1 19 09 80 9D 80 01
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2780: C8 CC 9C 25 F0 03 CA D0 46
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2790: F0 1A AD 00 02 C9 20 D0 DB
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27A0: A6 25 E8 A9 30 99 FF 01 2C
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27B8: B1 19 C9 2E F0 08 C9 35 B2
27C0: B0 0C C8 4C F4 0F C8 B1 6F
27C8: 19 C9 35 90 2A 88 98 C8 33
27D0: AA CA CA BD 00 02 C9 2E 26
27D8: F0 0B 90 0C C9 39 D0 14 1E
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27E8: CA 9D 00 02 E8 A9 31 9D 12
27F0: 00 02 D0 03 FE 00 02 88 8E
27F8: 8C 9C 25 AD 00 02 C9 20 EF
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2820: C0 0D C8 25 8D C7 25 A9 FE
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2830: 10 A0 00 A9 02 20 81 0C EA
2838: 20 36 09 C9 00 D0 33 C0 4E
2840: 04 90 2F C0 25 B0 2B A5 90
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2850: 07 98 20 61 09 4C 5B 10 A4
2858: 98 A6 1D 9D 66 25 20 8B AF
2860: 0C A5 1D CD AC 25 90 07 C2
2868: AC AC 25 88 8C 64 25 20 C7
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2888: ED FD 20 25 09 C9 0D F0 20
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28D8: 00 02 8C A6 25 AD 00 02 87
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28E8: 1E AD 65 25 18 69 12 C5 03
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28F8: 0B 60 A5 1E C9 01 F0 10 C1
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2910: 60 A5 1D C9 32 F0 23 E6 BE
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2980: 40 30 34 F0 32 C9 1B B0 34
2988: 2E 18 6D AB 25 C9 33 B0 C7
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2A40: C1 25 DD 82 12 D0 E8 8E D6
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2A50: A9 00 48 4C 5D 21 68 8D 15
2A58: 99 25 20 B1 00 AE 99 25 F4
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2A68: BD 8F 12 48 60 0C 41 41 3D
2A70: 43 45 49 4C 53 53 53 54 88
2A78: 53 41 42 54 4F 58 4E 4F 1C
2A80: 47 49 51 41 55 56 53 4E 02
2A88: 53 50 54 47 4E 4E 52 4E 38
2A90: 4D 45 AE EB 9D F0 E9 EF E5
2A98: 08 EF 22 EC 40 E9 8F EB B4
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2AB8: D0 3F 20 B1 00 20 64 13 C0
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2B28: 00 9D 00 02 A9 02 A0 00 9C
2B30: 20 81 0C 68 85 B9 68 85 68
2B38: B8 A5 1D CD C3 25 F0 15 7E
2B40: E6 1D 18 60 AD A9 25 85 3E
2B48: 1D AD AA 25 85 1E 18 20 35
2B50: 02 20 4C 88 22 AD C2 25 34
2B58: 85 1D A5 1E CD C5 25 F0 10
2B60: 04 E6 1E 18 60 38 60 A2 FE
2B68: 00 20 B7 00 C9 41 F0 06 F8
2B70: C9 42 D0 D0 A2 1A 8E AB A9
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2B80: C9 5B B0 C0 38 E9 40 18 B6
2B88: 6D AB 25 C9 33 B0 B5 8D 17
2B90: AB 25 20 B1 00 B0 AD 20 63
2B98: 4A EC 20 36 09 C9 00 D0 F6
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2C28: F2 E2 A5 AA 45 A2 85 AB 7D
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2C38: FC A9 01 8D C6 25 A9 00 90
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2C48: 0D C8 25 30 03 4C A2 14 A3
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2C58: 25 09 C9 53 F0 0B C9 44 7F
2C60: F0 0E C9 50 F0 21 4C AB 43
2C68: 15 A9 03 8D C6 25 D0 35 90
2C70: A9 00 8D C6 25 A0 1D A9 4B
2C78: 25 20 3E 09 20 72 10 20 CE
2C80: E6 1A 90 21 4C 9E 15 A9 A7
2C88: 24 A0 F2 20 3E 09 20 25 F6
2C90: 09 38 E9 30 C9 00 B0 03 6E
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2D08: A8 25 38 ED 9C 25 AA E8 9D
2D10: 30 14 E8 AD 9D 25 29 0C 5F
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2D38: AE A8 25 A9 2A 9D FF 02 1D
2D40: CA D0 FA F0 13 A0 02 B1 73
2D48: 19 9D 00 03 E8 C8 EC A8 B3
2D50: 25 F0 05 CC 9C 25 D0 EF F1
2D58: A2 00 BD 00 03 F0 08 09 B0
2D60: 80 20 B4 15 E8 D0 F3 A5 03
2D68: 1D CD C3 25 F0 05 E6 1D 16
2D70: 4C E0 14 A5 1E CD C5 25 DE
2D78: F0 0E E6 1E A9 01 85 1D 07
2D80: A9 8D 20 B4 15 4C E0 14 12
2D88: A9 8D 20 B4 15 AD C6 25 7C
2D90: C9 03 D0 03 20 25 09 A9 2C
2D98: 00 20 95 FE AD C6 25 D0 41
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2DA8: 1D AD A1 25 85 1E 20 58 C0
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2DE8: 7C 09 A9 00 2C C9 25 30 FB
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2E10: B5 25 AD A1 25 8D B6 25 52
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2E20: B5 25 B0 13 AE B2 25 CA 3D
2E28: EC B6 25 B0 0A A9 24 A0 38
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2E50: A0 99 20 3E 09 20 88 0D 32
2E58: 20 25 09 AE 86 16 DD 86 E8
2E60: 16 F0 06 CA D0 F8 4C 52 C6
2E68: 16 CA 8A 0A AA A9 16 48 E4
2E70: A9 51 48 BD 8E 16 48 BD F5
2E78: 8D 16 48 60 68 68 A5 1D 7D
2E80: 8D B3 25 A5 1E 8D B4 25 45
2E88: 60 06 00 0B 0A 08 15 0D EE
2E90: DB 11 F6 10 DD 10 37 11 AD
2E98: 0D 11 78 16 AD B9 25 C9 98
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2F70: B1 00 C9 00 D0 03 4C 25 31
2F78: 18 C9 40 D0 03 4C 10 18 EB
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2FF8: 20 B7 00 4C 6F 17 A2 00 37
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3018: 00 20 30 18 20 B1 00 20 EF
3020: 30 18 20 B1 00 4C 69 17 D8
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3048: 6D A0 25 8D BB 25 AD B6 89
3050: 25 38 ED B2 25 18 6D A1 40
3058: 25 8D BC 25 AD B2 25 CD E8
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3068: B1 25 CD A0 25 90 4A AD 5C
3070: B1 25 8D B7 25 AD B2 25 8A
3078: 8D B8 25 AD A0 25 8D B9 BB
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30E0: B9 25 D0 ED AD B8 25 CD C8
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3288: 1E 1B A0 01 91 1B 4C 6F E7
3290: 1A A5 6B 85 1B A5 6C 85 FE
3298: 1C A0 00 20 1E 1B 91 1B D0
32A0: C8 D0 F8 E6 1C A5 1C C5 A0
32A8: 09 90 F0 F0 EE 20 17 1B 24
32B0: 4C BB 1A 20 17 1B A9 25 0D
32B8: A0 4A 4C 3E 09 60 B0 08 A0
32C0: A9 25 A0 27 20 3E 09 60 36
32C8: 8D 00 02 20 6F 09 A9 00 29
32D0: 85 24 85 28 A9 04 85 29 C5
32D8: 20 80 FE A9 25 A0 31 20 16
32E0: 3E 09 AD 00 02 20 DA FD A0
32E8: 60 20 04 1B 20 00 BF C1 F9
32F0: 62 1B 20 00 BF C0 65 1B 38
32F8: B0 0C 4C FD 1A 20 04 1B 96
3300: 20 00 BF C8 71 1B 60 AC 60
3308: A6 25 B9 00 02 99 01 02 BC
3310: 88 10 F7 AD A6 25 8D 00 7D
3318: 02 60 20 00 BF CC 7F 1B E6
3320: 60 98 48 8A 48 20 00 BF 11
3328: CA B1 1B 4C 38 1B 8D 00 C5
3330: 02 98 48 8A 48 20 00 BF F1
3338: CB 77 1B 90 0F AA 68 68 2B
3340: 68 68 8A 8D 00 02 20 17 7E
3348: 1B 4C C8 1A 68 AA 68 A8 71
3350: AD 00 02 60 02 60 00 BE 24
3358: 01 00 02 04 01 00 B9 00 3B
3360: 02 00 00 01 01 01 00 02 E5
3368: 07 00 02 C3 04 00 00 01 EF
3370: 00 00 00 00 03 00 02 00 F2
3378: BB 00 04 01 00 02 01 00 57
3380: 00 00 01 01 04 01 00 02 3D
3388: 01 00 00 00 4C C5 1A 20 3D
3390: 58 FC 20 84 FE 20 00 BF E6
3398: C5 51 1B B0 EF A0 00 AD 54
33A0: 00 BE 29 0F 8D 00 02 B9 F6
33A8: 01 BE 99 02 02 C8 CC 00 5F
33B0: 02 D0 F4 C8 8C 00 02 A9 89
33B8: 2F 8D 01 02 20 00 BF C6 A1
33C0: 55 1B B0 C8 20 00 BF C8 84
33C8: 71 1B B0 C0 A9 AF 20 ED 0B
33D0: FD 20 00 BF CA 58 1B B0 D8
33D8: B3 A9 B9 85 FC A9 04 85 2F
33E0: FB A0 00 B1 FB D0 08 C8 84
33E8: B1 FB F0 34 4C 09 1C 8D D4
33F0: 99 25 29 0F AA E8 8E A6 40
33F8: 25 C8 B1 FB 09 80 20 ED 92
3400: FD C8 CC A6 25 D0 F3 A9 9B
3408: 8D 20 ED FD A9 27 18 65 5C
3410: FB 85 FB A5 FC 69 00 85 C4
3418: FC C9 BB F0 B4 4C DE 1B A7
3420: 20 00 BF CC 60 1B A9 24 44
3428: 85 FC A9 54 85 FB 20 54 BD
3430: 09 20 12 09 C9 0D D0 F9 16
3438: 20 58 FC 20 22 0B 4C 7C BA
3440: 09 AD 1B 23 D0 01 60 A9 23
3448: 25 A0 39 20 3E 09 A5 1D 13
3450: 8D A0 25 A5 1E 8D A1 25 36
3458: A9 01 85 1D 85 1E AD 5F B7
3460: 25 85 1B AD 60 25 85 1C B9
3468: A0 01 B1 1B F0 35 85 1A CA
3470: 88 B1 1B 85 19 B1 19 29 30
3478: 03 C9 02 D0 26 38 20 02 76
3480: 20 A2 00 AC 9C 25 B1 19 62
3488: 8D 9C 25 C8 B1 19 9D 00 3D
3490: 03 E8 C8 CC 9C 25 D0 F4 AA
3498: A9 00 9D 00 03 8E 9C 25 3A
34A0: 20 62 20 A5 1B 18 69 02 1E
34A8: 85 1B 90 02 E6 1C E6 1E 60
34B0: A5 1E C9 C9 D0 B2 A9 01 EE
34B8: 85 1E E6 1D A5 1D C9 33 82
34C0: D0 A6 AD A0 25 85 1D AD 22
34C8: A1 25 85 1E 38 20 02 20 44
34D0: 4C 7C 09 20 6E 1E 18 20 DD
34D8: 02 20 A9 00 A8 91 1B C8 0A
34E0: 91 1B 20 3E 1C 60 A9 23 99
34E8: A0 EE 20 3E 09 A9 00 2C 60
34F0: C9 25 30 03 AD 61 C0 0D 3F
34F8: C8 25 30 08 AD 1B 23 49 FE
3500: FF 8D 1B 23 AD 1B 23 C9 4D
3508: 00 F0 06 A9 CE 20 ED FD DA
3510: 60 A9 C6 20 ED FD 20 ED 85
3518: FD 60 EE D2 22 20 B8 09 B0
3520: CE D2 22 AD 0U 03 F0 4E 02
3528: C9 3D F0 27 AE C4 08 DD CD
3530: C4 08 F0 08 CA D0 F8 A9 D2
3538: 01 4C 52 1D AD 9C 25 C9 46
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3540: 25 B0 33 A0 00 A9 03 20 A6
3548: B1 0C 20 B7 00 D0 E8 A9 B4
3550: 00 F0 02 A9 02 8D 9B 25 74
3558: 18 20 02 20 B0 09 AD 1C 3A
3560: 23 8D 9D 25 4C 6D 1D A0 B8
3568: 00 B1 19 29 FC 8D 9D 25 73
3570: 20 62 20 20 3E 1C 60 AE 5B
3578: A6 25 CA CA CA CA B0 00 82
3580: 02 C9 45 D0 78 E8 BD 00 F6
3588: 02 8D AB 25 E8 BD 00 02 5F
3590: 38 E9 30 8D 9A 25 E8 BD 69
3598: 00 02 38 E9 30 AE 9A 25 BF
35A0: F0 06 1B 69 0A CA D0 FA B6
35A8: 8D 99 25 AD AB 25 C9 2D 72
35B0: F0 4C A2 00 A0 00 BD 00 7B
35B8: 02 C9 45 F0 08 E8 C9 2E F3
35C0: F0 F4 C8 D0 F1 88 8C AB 7D
35C8: 25 AD 99 25 38 ED AB 25 AC
35D0: 8D 99 25 A2 01 A0 01 BD 81
35D8: 00 02 E8 C9 2E F0 F8 C9 6E
35E0: 45 F0 06 99 00 02 C8 D0 EE
35E8: EE A9 30 AE 99 25 99 00 BA
35F0: 02 C8 CA D0 F9 A9 00 99 05
35F8: 00 02 8C A6 25 60 CE 99 C1
3600: 25 A2 00 A0 00 BD 00 02 AA
3608: E8 C9 2E F0 F8 C9 45 F0 9A
3610: 06 99 80 02 C8 D0 EE A9 27
3618: 00 99 80 02 A9 2E 8D 00 3C
3620: 02 AE 99 25 A9 30 9D 00 08
3628: 02 CA D0 FA A2 00 AC 99 1A
3630: 25 C8 BD 80 02 99 00 02 99
3638: F0 04 E8 C8 D0 F4 8C A6 E1
3640: 25 60 20 6F 09 A9 04 85 CE
3648: 29 A9 00 85 28 85 24 AD 59
3650: 61 25 38 E5 08 A8 AD 62 BC
3658: 25 E5 09 20 5C 1E 60 20 30
3660: F2 E2 20 34 ED A9 01 85 E3
3668: FC A9 00 85 FB 20 54 09 28
3670: 60 A0 01 B1 1B F0 E7 A9 86
3678: 00 91 1B 88 91 1B B1 19 AA
3680: 29 03 C9 02 D0 09 C8 B1 89
3688: 19 A8 B1 19 4C 8F 1E C8 19
3690: B1 19 85 FB 18 65 19 8D A2
3698: B1 1E A5 19 8D B4 1E A5 CC
36A0: 1A 8D B5 1E 69 00 8D B2 2F
36A8: 1E A5 09 38 ED B2 1E AA 53
36B0: E8 A0 00 B9 FF FF 99 FF 88
36B8: FF C8 D0 F7 EE B2 1E EE 5E
36C0: B5 1E CA D0 EE A5 08 38 4C
36C8: E5 FB 85 08 A5 09 E9 00 7D
36D0: 85 09 AD 5F 25 85 FD AD D6
36D8: 60 25 85 FE A0 01 B1 FD C9
36E0: F0 22 38 88 B1 FD E5 19 48
36E8: 8D 99 25 C8 B1 FD E5 1A 1F
36F0: 0D 99 25 90 0F 88 B1 FD F3
36F8: 38 E5 FB 91 FD C8 B1 FD 08
3700: E9 00 91 FD C8 F0 03 C8 4E
3708: D0 D4 E6 FE C8 A5 FE C5 B1
3710: 6C D0 CB 60 A9 23 A0 8A 0E
3718: 20 3E 09 20 25 09 C9 59 83
3720: D0 03 4C 00 C6 4C 7C 09 AA
3728: AD A9 25 85 1D AD AA 25 EE
3730: 85 1E 18 20 02 20 AD AB 85
3738: 25 8D 9B 25 AD AD 25 8D 5E
3740: 9D 25 AD AC 25 8D 9C 25 05
3748: 4C 88 22 48 A5 1D 8D A9 2E
3750: 25 A5 1E 8D AA 25 AD 9B 38
3758: 25 8D AB 25 AD 9D 25 8D 40
3760: AD 25 AD 9C 25 8D AC 25 4C
3768: 68 E9 41 30 BB F0 06 C9 28
3770: 02 B0 B5 A9 1A 85 1D 20 9E
3778: B1 00 E9 40 30 AA F0 A8 B7
3780: C9 1B B0 A4 18 65 1D C9 55
3788: 33 B0 9D 85 1D 20 B1 00 95
3790: B0 96 20 4A EC 20 36 09 03
3798: C9 00 D0 8C C0 00 F0 88 3F
37A0: C0 C9 B0 84 84 1E 38 20 6D
37A8: 02 20 90 07 AD 9B 25 C9 92
37B0: 01 D0 03 4C 25 1F A0 02 E1
37B8: A2 00 B1 19 C9 2A F0 F3 0D
37C0: B1 19 9D 00 02 C8 E8 CC D3
37C8: 9C 25 D0 F4 A9 00 9D 00 C0
37D0: 02 A5 B8 48 A5 B9 48 A0 8A
37D8: 00 A9 02 20 81 0C 68 85 86
37E0: B9 68 85 B8 AD A9 25 85 66
37E8: 1D AD AA 25 85 1E 18 20 ED
37F0: 02 20 AD AB 25 8D 9B 25 94
37F8: AD AD 25 8D 9D 25 AD AC B0

3800: 25 8D 9C 25 60 08 A6 1D D9
3808: CA 86 1B A9 C8 85 1C 18 2A
3810: A9 00 A2 08 6A 66 1B 90 DD
3818: 03 18 65 1C CA 10 F5 85 86
3820: 1C A6 1E CA 8A 18 65 1B 53
3828: 85 1B A5 1C 69 00 85 1C 0B
3830: 06 1B 26 1C A5 1C 6D 60 C9
3838: 25 85 1C A0 01 B1 1B D0 FF
3840: 03 28 18 60 AA 88 B1 1B 3B
3848: 85 19 86 1A 28 90 14 B1 91
3850: 19 29 03 8D 9B 25 B1 19 BE
3858: 29 FC 8D 9D 25 C8 B1 19 F0
3860: 8D 9C 25 38 60 20 6E 1E 65
3868: AD 9B 25 C9 02 F0 32 EE FE
3870: 9C 25 EE 9C 25 A0 00 A5 71
3878: 08 91 1B C8 A5 09 91 1B D0
3880: 88 AD 9B 25 0D 9D 25 91 21
3888: 08 C8 AD 9C 25 91 08 C8 F6
3890: A2 00 BD 00 03 91 08 C8 41
3898: E8 CC 9C 25 D0 F4 4C F1 7B
38A0: 20 20 2D 21 EE A6 25 EE 2C
38A8: A6 25 38 AD A6 25 6D 9C D8
38B0: 25 8D 9C 25 AC A6 25 AD F4
38B8: 9C 25 91 08 A2 00 C8 BD D7
38C0: 00 03 91 08 C8 E8 CC 9C C4
38C8: 25 D0 F4 A0 00 A5 08 91 E0
38D0: 1B C8 A5 09 91 1B 88 AD FD
38D8: 9B 25 0D 9D 25 91 08 C8 24
38E0: AD A6 25 91 08 C8 A2 02 3A
38E8: BD FE 01 91 08 C8 E8 EC 53
38F0: A6 25 D0 F4 A5 08 18 6D 52
38F8: 9C 25 90 06 A5 09 C9 B8 11
3900: F0 0F A5 08 18 6D 9C 25 B8
3908: 85 08 A5 09 69 00 85 09 E3
3910: 60 A9 00 A8 91 1B C8 91 C3
3918: 1B A9 24 A0 7B 20 3E 09 F2
3920: A5 1D 8D 64 25 A5 1E 8D 2E
3928: 65 25 A2 FD 9A 4C 7C 08 D1
3930: BA 8E AE 25 A2 00 A0 00 22
3938: BD 00 03 C9 28 D0 01 C8 D5
3940: C9 29 D0 01 88 9D 00 03 C9
3948: E8 EC 9C 25 D0 EA C0 00 04
3950: F0 03 4C 88 22 A9 00 48 0E
3958: A9 00 85 B8 A9 03 85 B9 F9
3960: 20 B1 00 90 51 C9 2D F0 55
3968: 4D C9 2B F0 49 C9 2E F0 27
3970: 45 C9 50 F0 25 C9 28 F0 A2
3978: 15 C9 41 F0 0B C9 42 F0 14
3980: 07 C9 40 F0 0F 4C 88 22 DC
3988: 20 48 1F 4C B6 21 A9 01 54
3990: 48 4C 5D 21 20 05 12 4C 7D
3998: B6 21 20 B1 00 C9 49 F0 78
39A0: 03 4C 88 22 A9 AE A0 21 45
39A8: 20 F9 EA 20 B1 00 4C B6 E5
39B0: 21 82 49 0F DA A1 20 4A 56
39B8: EC 20 B7 00 F0 78 A2 02 51
39C0: C9 2B F0 35 E8 C9 2D F0 0E
39C8: 30 E8 C9 2A F0 2B E8 C9 39
39D0: 2F F0 26 E8 C9 5E F0 21 35
39D8: C9 29 F0 03 4C 88 22 68 F9
39E0: F0 14 C9 01 F0 07 48 20 6E
39E8: 54 22 4C DC 21 E6 B8 D0 4C
39F0: 02 E6 B9 4C B6 21 4C 53 40
39F8: 12 86 06 68 48 A8 B9 03 B8
3A00: 23 DD 03 23 90 10 20 54 69
3A08: 22 A6 06 68 48 A8 B9 03 D9
3A10: 23 DD 03 23 B0 F0 20 72 1C
3A18: EB A5 A2 48 A5 A1 48 A5 AE
3A20: A0 48 A5 9F 48 A5 9E 48 04
3A28: A5 9D 48 A5 06 48 4C 5D 81
3A30: 21 F0 58 4C 69 EA 68 48 51
3A38: F0 06 20 54 22 4C 33 22 BA
3A40: 68 20 34 ED A0 00 B9 00 CE
3A48: 01 99 00 02 F0 03 C8 D0 B9
3A50: F5 8C A6 25 4C 74 1D 68 E0
3A58: 85 FB 68 85 FC 68 85 07 8F
3A60: 68 85 A5 68 85 A6 68 85 C2
3A68: A7 68 85 A8 68 85 A9 68 1B
3A70: 85 AA 45 A2 85 AB A5 07 52
3A78: 0A A8 A5 FC 48 A5 FB 48 B9
3A80: B9 0B 23 48 B9 0A 23 48 02
3A88: A5 9D 60 AE AE 25 9A A9 17
3A90: 07 8D A6 25 A0 00 B9 83 0F
3A98: 23 99 00 02 C8 C0 07 D0 4D
3AA0: F5 A9 00 99 00 02 60 A9 86
3AA8: 00 85 FB A9 03 85 FD A9 6C
3AB0: 08 85 FC A9 20 85 FE A0 7A

3AB8: 00 B1 FD 91 FB C8 D0 F9 11
3AC0: E6 FC E6 FE A5 FC C9 26 8F
3AC8: D0 EF A9 00 85 F2 20 65 74
3AD0: D6 4C D2 D7 00 00 04 04 A7
3AD8: 05 05 06 06 07 07 04 04 92
3AE0: 05 05 06 06 07 07 04 04 9A
3AE8: 05 05 06 06 07 07 00 80 17
3AF0: 00 80 00 80 00 80 28 A8 88
3AF8: 28 A8 28 A8 28 A8 50 D0 90
3B00: 50 D0 50 D0 50 D0 00 01 B0
3B08: 02 02 03 03 04 3C 22 3C 22
3B10: 22 C0 E7 A9 E7 81 E9 2D A5
3B18: 22 96 EE 4E 54 46 00 2C EF
3B20: 40 40 41 41 41 42 41 43 DB
3B28: 41 44 41 45 41 46 41 47 B9
3B30: 41 48 41 49 41 4A 41 4B 17
3B38: 41 4C 41 4D 41 4E 41 4F 74
3B40: 41 50 41 51 41 52 41 53 D1
3B48: 41 54 41 55 41 56 41 57 2F
3B50: 41 58 41 59 41 5A 42 41 74
3B58: 42 42 42 43 42 44 42 45 E9
3B60: 42 46 42 47 42 48 42 49 47
3B68: 42 4A 42 4B 42 4C 42 4D A4
3B70: 42 4E 42 4F 42 50 42 51 02
3B78: 42 52 42 53 42 54 42 55 5F
3B80: 42 56 42 57 42 58 2A 45 78
3B88: 52 52 4F 52 2A C5 D8 C9 AF
3B90: D4 BA A0 C1 D2 C5 A0 D9 19
3B98: CF D5 A0 D3 D5 D2 C5 A0 E3
3BA0: A8 D9 AF CE A9 BF 00 D3 E4
3BA8: D0 C5 C5 C4 C3 C1 CC C3 80
3BB0: 00 D3 D0 C5 C5 C4 C3 C1 1D
3BB8: CC C3 A0 C2 D9 A0 CB C5 75
3BC0: D6 C9 CE A0 CD C1 D2 D4 E8
3BC8: C9 CE 00 CE C5 D7 BA A0 68
3BD0: C1 D2 C5 A0 D9 CF D5 A0 F9
3BD8: D3 D5 D2 C5 A0 A8 D9 AF 70
3BE0: CE A9 BF 00 D7 C9 C4 D4 65
3BE8: C8 BA 00 C7 CF D4 CF BA 1B
3BF0: 00 D2 C5 C3 C1 CC C3 D5 AF
3BF8: CC C1 D4 C9 CF CE A0 C9 42
3C00: D3 A0 CF 00 D3 C1 D6 C5 9D
3C08: BA 00 CC CF C1 C4 BA 00 0B
3C10: C6 CF D2 CD C1 D4 BA A0 8E
3C18: A0 CC C5 C6 D4 AC A0 C3 97
3C20: C5 CE D4 C5 D2 AC A0 CF 80
3C28: D2 A0 D2 C9 C7 C8 D4 A0 D4
3C30: CA D5 D3 D4 C9 C6 D9 BF 28
3C38: 00 C6 CF D2 CD C1 D4 BA 63
3C40: A0 A0 A3 A0 CF C6 A0 C4 4F
3C48: C5 C3 C9 CD C1 CC A0 D0 FD
3C50: CC C1 C3 C5 D3 BA 00 8D 8B
3C58: D0 D2 C5 D3 D3 A0 D2 C5 70
3C60: D4 D5 D2 CE 00 D0 D2 CF B8
3C68: C3 C5 D3 D3 C9 CE C7 A0 A5
3C70: C4 C1 D4 C1 A0 D4 D2 C1 32
3C78: CE D3 C6 C5 D2 00 CE CF 86
3C80: D4 A0 C5 CE CF D5 C7 C8 5F
3C88: A0 D2 CF CF CD A0 D4 CF 67
3C90: A0 C5 CE D4 C5 D2 A0 C4 71
3C98: C1 D4 C1 00 CD CF D6 C5 80
3CA0: A0 C3 D5 D2 D3 CF D2 A0 66
3CA8: D4 CF A0 D4 CF D0 A0 CC B0
3CB0: C5 C6 D4 A0 CF C6 A0 CE 0C
3CB8: C5 D7 A0 D0 CF D3 C9 D4 61
3CC0: C9 CF CE 00 CD CF D6 C5 0D
3CC8: A0 C3 D5 D2 D3 CF D2 A0 8E
3CD0: D4 CF A0 C2 CF D4 D4 CF 33
3CD8: CD A0 D2 C9 C7 C8 D4 A0 03
3CE0: CF C6 A0 C2 CC CF C3 CB 2C
3CE8: 00 D0 D2 C9 CE D4 C9 CE B8
3CF0: C7 AE AE AE 00 D3 CC CF 72
3CF8: D4 A0 A3 00 D0 D2 C9 CE AC
3D00: D4 A0 D4 CF BA A0 A0 D3 12
3D08: C3 D2 C5 C5 CE AC A0 C4 5D
3D10: C9 D3 CB A0 CF D2 A0 D0 C3
3D18: D2 C9 CE D4 C5 D2 BF 00 8E
3D20: C6 C9 CC C5 CE C1 CD C5 45
3D28: BA 00 CE CF A0 C5 D2 D2 6B
3D30: CF D2 D3 00 C5 D2 D2 CF B0
3D38: D2 A0 A3 00 D2 C5 C3 C1 AF
3D40: CC C3 D5 CC C1 D4 C9 CE 5D
3D48: C7 AE AE AE 00 CE CF D4 C2
3D50: A0 C1 A0 D3 D0 C5 C5 C4 CA
3D58: C3 C1 CC C3 A0 C6 C9 CC 7B
3D60: C5 00 FE FE FE FE BA FE F5
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Arlan R. Levitan

Gadgets For Better Telecomputing

I've got a confession to make. I'm a hopeless gadget freak. Every time I see a new piece of equipment that I suspect will make my telecomputing time more productive, I go for it.

Friends who drop in for the first time invariably comment on the number of phones in our computer room. So did the phone company technician who installed them. I still remember the puzzled look on her face. "Four phone lines? " she asked. "I don't mean to be nosy, but what are you going to do with them?"

"One for me and three for the computers," I kidded. "They get kinda lonely during the day and like to call their friends. You saw *WarGames*, didn't you?"

"Uh...sure," she replied, probably wondering if I was a bookie, a psychopathic telephone solicitor, or just a plain nut.

All kidding aside, a dedicated phone line for your computer can be a real plus, especially if you want to receive ordinary phone calls while you're online. It can also help segregate billing for your computer-related calls from your regular phone use.

If you do take voice calls during your online sessions, jamming the phone handset between your shoulder and tilted head while hunched over a keyboard for an hour may leave you looking like a computerized Quasimodo. The solution? A gadget, of course. A hands-free phone device, such as a speakerphone or lightweight NASA-style headset, allows comfortable conversation while you pound away at your keyboard.

Surges And Spikes

Practically everyone knows about surge protectors and the potential dangers of power-line spikes. Yet, although many hobbyists have taken steps to protect their equipment against surges from AC power outlets, the danger of surges traveling over telephone lines into computer equipment is usually ignored. Telephone line surges are relatively rare, but my buddy Fred discovered that all of his AC surge protection was for naught when a nearby lightning strike sent some particularly nasty spikes into his modem, which was connected to his Atari system. Every piece of equipment in the loop was damaged.

At $12.95, Radio Shack's telephone line surge protector (Part #43-102) is reasonably priced insurance. It installs between your modular wall plug and modem. For those who wish to add another level of surge isolation, Data Spec (20120 Plummer Street, Chatsworth, CA 91311), a manufacturer of telecomputing-related goodies, also sells an RS-232 surge protector (Part #RS232SP-300) that installs between your modem and computer using a standard 25-pin RS-232 connector.

Many terminal programs provide a printer on/off feature for those who wish to keep a paper record of their telecomputing sessions. This feature is of limited value if you use transmission speeds faster than 300 baud. Not many printers can keep up with sustained data rates of 120 characters a second or more. When the printer gets behind, the terminal program usually sends an XOFF (CTRL-S) character to the remote system, halting the flow of incoming data until the printer catches up. Then it sends an XON (CTRL-Q) character to resume data transmission. The XON/XOFF cycle goes on ad nauseum, putting a damper on effective transmission speed.

A printer buffer sitting between your system and printer will happily gobble up all the data intended for posterity and control the printer. Printer buffers are available with varying amounts of memory ranging from 8K to 2 megabytes. The most cost-effective approach, for those handy with a screwdriver, is to buy an 8K buffer that is user-expandable to at least 128K. The chips to upgrade from 8K to 128K can be bought for less than $15. Even if you prefer to save the incoming data to disk first and print it out later, a printer buffer can cut the amount of time that your computer is tied up by 90 percent or more.

Hi, BOBs

People who own several computers often use RS-232 switch boxes to toggle modems between machines and transport data between systems with incompatible disk formats. A carefully thought-out switching system can eliminate the drudgery of manually swapping multiple RS-232 cables, allowing changes in cabling with a flick of the wrist. There are dozens of different switch boxes of varying complexity and function. The catalogs of Black Box Corporation (Box 12800, Pittsburgh, PA 15241), MFJ Enterprises (921 Louisville Road, Starkville, MS 39759), and Data Spec will give those who'd rather switch than fight a good idea of what's available.

If you like to make your own cables, these companies also sell some handy diagnostic tools called Break Out Boxes (BOBs). BOBs are typically installed in an RS-232 cable link that is having problems. The best BOBs have Light Emitting Diodes (LEDs) to indicate the electrical status of each line in the link, plus jumpers for testing the effect of wiring changes before whipping out the soldering iron. ©

The Beginners Page

Tom R Halfhill, Editor

The Hidden Numbers Behind Strings

We dropped a tidbit in last month's column that we promised to explain later—that the alphabetic characters on a monitor screen are merely an outward illusion displayed by computers for our convenience. Internally, computers deal with numbers and *only* with numbers. This has some important implications when you work with character strings in BASIC.

Consider a short routine that asks a user to answer either "yes" or "no" to a question, and which then branches to another part of the program depending on the response. Here's how it might look:

```
10 DIM A$(1):REM This line for Atari
   only
20 PRINT "DO YOU WISH TO
   CONTINUE (Y/N)";
30 INPUT A$
40 IF A$="Y" THEN GOTO 60
50 IF A$="N" THEN END
60 PRINT "Program continues here..."
```

There are a couple of problems with this routine that aren't immediately apparent. At first glance, it seems solid enough: Line 20 asks the question; line 30 fetches and stores the keypress in the string variable A$; line 40 branches to line 60 if the keypress was the letter Y; and line 50 ends the program if the keypress was the letter N.

One problem is a design flaw that doesn't have anything to do with character strings per se: The routine doesn't check for any keypresses besides Y or N. If the user types another key by mistake—or on purpose, just to be mischievous—both IF-THEN tests fail and the program drops through to line 60 as if Y were pressed. There are various approaches to this problem, but one quick solution is to insert line 55 GOTO 20 so the question repeats after each invalid response.

The Computer Is Blind

The main problem we're concerned about, however, has to do with the way computers interpret alphabetic characters. Lines 40 and 50 check for Y or N. But what happens if the user presses a *lowercase* y or n? This can easily happen if the CAPS LOCK key or its equivalent isn't pressed when the program runs. Since this routine doesn't check for y or n, both IF-THEN tests fail and the program drops through to line 60 as if Y were pressed—which may not have been the user's intention at all. Or, if you inserted line 55, the routine keeps pestering the user for a response even though he's frantically pressing what seems to be the right key.

Now, practically anybody who has satisfactorily completed first grade can tell a big Y from a small y or a big N from a small n. But since a computer can't actually see these characters, it can't tell them apart by sight. Instead, it tells characters apart by assigning each one a unique number. Therefore, to a computer, the characters Y and y are as different as A and Z.

To see this for yourself, type PRINT ASC("Y") and press RETURN. The computer should print the number 89 on the screen. This is the *ASCII value* for the uppercase Y character. ASCII stands for American Standard Code for Information Interchange. It's a code developed in the days of teletype terminals which assigns a unique number to each character; the uppercase alphabet from A–Z is numbered 65–90. The ASC() function in BASIC lets you determine any character's ASCII value.

Now type PRINT ASC("y") and press RETURN. Since the lowercase ASCII alphabet is numbered 96–122, the ASCII value of y is 121 on nearly all computers. Exceptions are the Apple II+ and most Commodore computers (save for the Amiga). You can't type this statement on the Apple II+ because it lacks lowercase characters. And on the Commodore computers, you can't type lowercase characters without switching to the alternate character set (press SHIFT-Commodore key). In the standard character set, the ASCII value of uppercase Y is 89, as usual; but when you switch to the alternate set, the ASCII value of the *lowercase* y is 89, and the ASCII value of the *uppercase* Y becomes 217.

Despite these exceptions, you can see the point: Computers handle everything in terms of numbers, so you have to take this into account when writing programs. One way to fix the branching routine above is to substitute these lines:

```
40 IF A$="Y" OR A$="y" THEN
   GOTO 60
50 IF A$="N" OR A$="n" THEN END
```

Censored Characters?

There's another function in BASIC which is the opposite of ASC()—it takes a number and tells you the corresponding ASCII character. Try entering the statement PRINT CHR$(89). The result is the uppercase Y.

Interestingly, some ASCII values represent characters which we can't print here—not because they're obscene and COMPUTE! is a family magazine, but because these "characters" perform a function rather than displaying a letter, number, or symbol. For instance, PRINT CHR$(125) clears the screen on an Atari 400, 800, XL, or XE. PRINT CHR$(147) does the same thing on a Commodore 64, 128, VIC, or PET/CBM. PRINT CHR$(7) rings the internal bell on a Commodore 128 or PET/CBM, Apple, IBM, or Atari ST.

To discover other things you can do by printing these unprintable characters, look for a table of ASCII values in the back of your computer manual or almost any book on BASIC programming.

Computers and Society

David D Thornburg, Associate Editor

The Human Side Of Telecommuting

Several years ago I wrote in this column about *The Network Nation*, a book on human communication via computer written by Starr Hiltz and Murray Turoff (Addison-Wesley, 1978). The authors made several predictions in the book, including the speculation that computerized conferencing would be a prominent form of communication in most organizations by the mid-1980s; would make it possible for a large percentage of the labor force to work at home during at least half of the normal work week; and would indirectly conserve sizable amounts of energy by substituting communication for travel.

Of 14 predictions made by these authors, I want to focus on just these three—not because they haven't yet happened, but because they were very reasonable predictions in 1978.

If these predictions were reasonable then, what has kept them from coming true? Based on the price of gasoline and the high quality of our computer and communications technology, telecommuting seems ripe for development. Some companies have expressed great interest in this style of working, especially since it allows workers to function as independent contractors, thus reducing the employer's overhead.

One company which has conducted an experiment in this field is Avco Lycoming, one of the world's leading manufacturers of gas turbine engines. Given the highly technical nature of this company's business, many of their employees (software designers, for example) are information workers who would be suitable candidates for telecommuting.

In September 1984, one of these employees, Lee Jacko, had asked to take part in a six-month telecommuting experiment. The company worked out the details and arranged for it to be monitored and evaluated by Drs. Herb Spirer and Al Katz from the University of Connecticut.

Water Cooler Conversation

Jacko's reason for trying this experiment was that she planned to be a mother some day, and she wanted to see if she could work effectively in her home. The fact that commuting to work took one hour each way probably contributed to her interest as well. As a software designer and programmer, Jacko is comfortable with computers, and the company set up an IBM PC-XT in her home.

Early in the experiment it was found that she needed to show up at the office one day a week just to stay in touch with her colleagues. In retrospect, this is easy to understand. We don't often think about it, but much of our information-gathering is informal. We join a conversation at the water cooler that leads to a better way to solve a problem, or we hear of a new job opening in another division, and so on. An amazing amount of valuable information is exchanged informally. Many years ago when I worked for a Fortune 500 company, I found that one of the best ways to spread information was to "accidentally" leave it in the office copier!

Jacko also quickly realized that she was missing the benefits of regularly scheduled group meetings. As soon as this problem was identified, a speakerphone was set up in the conference room so she could participate from home.

Jacko is not a loner. She likes being where the action is, and was afraid that this experiment might hurt her career. By being out of sight, she was afraid of being out of mind as well. But in fact, her colleagues were quite supportive and she found that telecommuting didn't hurt her career at all.

She cautions that telecommuting isn't for everyone, however. It takes discipline to work without supervision. Even though she had clearly set goals, it was her own work habits that insured her diligence on the job. To help maintain this discipline, she rose at the same time as her husband each morning, and got dressed just as though she were leaving the house for work. She worked from 8 a.m. to 6 p.m., and her only concession to being at home was an occasional two-hour lunch to compensate for her longer work day. Both Jacko and her supervisor were very happy with the quality of her work.

Social Animals

At the end of the six-month experiment, Jacko was ready to come back to the office. The experience of working at home was good, but she missed being with her colleagues. Now she believes she'd be happy spending four days a week at home for six months, followed by a two-month stint in the office.

The researchers who studied her during this experiment expected to see morale problems, but none appeared. In fact, Jacko maintains that people who work well in isolation would really blossom as telecommuters.

The benefits of telecommuting seem to be great, yet it still is not popular. The reasons probably have more to do with human nature than with technology. We are social animals and seek the company of our peers. Whether it is a collection of aborigines gathering around a water hole, or a gathering of executives around the water cooler, we need face to face contact with other humans on a regular basis. Perhaps one day a week is enough time to socialize in the office. More research needs to be done. We understand the technology; it is human nature that we need to focus on now. ©

Arjan Singh Khalsa: A Prophet Of Bionic Man

Bionic man.

What do these words bring to mind? They make me think of science fiction, a TV show called *The Six Million Dollar Man*, and Lee Majors. Majors starred as the bionic man we are most familiar with—more machine, really, than human. Humans as machines.

But a bionic man can also be a blind person using a talking word processor, or a victim of cerebral palsy blowing into a puff switch to activate a computerized wheelchair or robotic arm. Here, technology doesn't make a person more machinelike. Instead, it enables him or her to be more fully human.

One person with this view of bionic man is Arjan Singh Khalsa, of Berkeley, California. From the tip of his toes to the top of his white turban, Khalsa is a man with a mission: To shape technology in a human image so it can become a prosthetic extension of the human mind and body. He is a proponent of a new man/machine symbiosis—a prophet of bionic man.

The Elegance Of Technology

On the one hand, Khalsa is an evangelist for technology and for its potential to help people. On the other hand, he is an arch-critic of technology who condemns its disruptive effects on people's lives. He is also the founder and president of Educational Software Review, a "technology watchdog" company that tests new educational software from large corporations. And he is producing his own products which embody his goals to make technology more elegant.

"Elegant" is a word he uses a lot. According to Khalsa, technology is elegant when it is a simple, natural extension of a person's mind or body; when it is immediately useful; and when it is being stretched to its limit—in the service of human beings. Khalsa doesn't believe a product is truly elegant unless it can be used by both "enabled" and disabled people.

For example, Educational Software Review is marketing a program called *The Magic Music Teacher* (a $69.95 two-sided disk for the Apple, and soon, for the Commodore 64). Two key features of *The Magic Music Teacher* are that it can be operated by pressing only two keys—or two switches, for a disabled person; and when equipped with an Echo/Cricket speech synthesizer, it talks—so it can be used by a blind person. These features have made the program immensely popular with everyone from the California School for the Blind to the Boston Retarded Children's Choir.

The Magic Music Teacher teaches the children in the choir by using the Suzuki method of hearing a melody, then learning to repeat it. The children quickly master the two switches, and they begin "playing" a musical instrument. According to Khalsa, "The kids laugh and rejoice when they use the program. They are learning that they can succeed at something. Technology and music are increasing the joy in their lives."

It's no surprise that *The Magic Music Teacher* is also a hit with enabled children and adults. "Nobody who has begun using the program has ever used it for less than a half hour," says Khalsa. "It is too easy, and too much fun."

Restoring The Sound

Educational Software Review's other product is the flip side of this same philosophy. After observing dozens of children using computers in classrooms, he noticed that many good educational programs which use sound are muted so other children won't be disturbed. "It's a shame," says Khalsa. "The computer is one of our most powerful learning tools, partly because it reinforces learning with sound as well as images. Then we turn off the sound."

Khalsa thinks this is an example of not properly fitting technology to human beings. With the flick of a switch, technology is disabling hearing children and rendering them deaf. His solution is a computer headset, the LittleJack ($24.95, with a volume control and a connector that allows up to ten children to listen together if they plug their own headsets into an adapter).

Khalsa is looking for licenses to convert more existing products into products appropriate for the 35 million disabled and handicapped people in the U.S. In addition, he's trying out new inventions, like a talking word processor. Khalsa says his word processor is "like a huge Speak 'N' Spell, only it can interface with a computer and is completely programmable. For example, Vietnamese kids can crayon pictures in squares on regular paper, then slip the paper on the word processor's large, flat pad. When they press the pictures, the word processor will print out the words in English describing the pictures; and it will say the words aloud—in English and in Vietnamese."

For Khalsa, a disability can be physical, mental, emotional, cultural—or technological. Machines should never be allowed to disable a person. Instead, they should enable people and help them lead richer, more human lives.

(To contact Arjan Singh Khalsa, write Educational Software Review, 1400 Shattuck Avenue, Suite 774, Berkeley, CA 94709.) ©

INSIGHT: Atari

Bill Wilkinson

Avoiding Memory Confusion In Atari BASIC

After a couple of months of standing on my soap box, I've decided to step off and get back to business again. Before I do, though, here's one more little rant and rave: I can now express my opinion of Atari's new BASIC for the 520ST. In a word: disappointing. Neither ST Logo nor ST BASIC are viable production languages, which means you can't write commercial applications with them. Since even the C compiler included in Atari's $300 software developer's package doesn't support double-precision arithmetic, limiting you to six decimal digits of precision, you'd better be ready to purchase some language from an outside vendor if you're serious about doing any programming on the ST machines.

Several months ago, I asked all you loyal readers to send me a postcard or letter giving ratings to the best or worst Atari-oriented books. Although I was a little underwhelmed by the response, I did get enough ballots to at least select the three favorites. Among these three, however, there was no clear-cut winner. And I happen to feel that is appropriate, since each addresses a different part of the knowledge an Atari programmer needs. Anyway, according to my readers, the best books are (drum roll...the envelope please): *The ABC's of Atari Computers*, by Dave Mentley, published by Datamost; *Your Atari Computer*, by Lon Poole et al, published by Osborne/McGraw Hill; and *Mapping the Atari*, by Ian Chadwick, published by COMPUTE! Books. (Incidentally, you may have noticed that COMPUTE! Books has been shipping the new, revised version of *Mapping the Atari*, which has several appendices and notes devoted to the XL and XE machines.)

The rest of this column responds to a number of reader requests. Although the topic has been covered in COMPUTE! before (at least in part), there are many newcomers out there. And even if you aren't a newcomer, maybe I can provide more insight into the concepts involved.

Finding Free Memory

Q: Where in memory can a programmer put machine language routines, character sets, player/missile graphics, and the like?

A: There is no simple answer, because it depends on which language you're using, which DOS, etc. A couple of years ago, I did an entire series on relocatable machine language which was related to this problem. So this time, let's tackle a simpler and more specific question: Where can I put a custom character set? The following techniques will also work for many other uses, including player/missile graphics.

When allocating memory, Atari BASIC—as well as BASIC XL and BASIC XE—looks at and believes the contents of two memory locations, LOMEM and HIMEM (located at $2E7, decimal 743, and $2E5, decimal 741, respectively). BASIC always starts your program where LOMEM tells it to and lets it grow as high as the value in HIMEM. Remember that this "growing" includes not just your BASIC code, but also the strings and arrays dimensioned by your program. Let's consider LOMEM first.

The fact that a program always starts at LOMEM implies that if we increase the value of LOMEM and then load a program, the memory between the old value and the new one is available for whatever purposes we have in mind. On the other hand, once a BASIC program is loaded into memory, it ignores changes to LOMEM. This means we can have one program change the contents of LOMEM and then chain to another program. The first program is unaffected by the change, but the second will be loaded at the new LOMEM. Programs 1 and 2 demonstrate this technique.

Examine Program 1, which ensures that the memory we wish to reserve starts on a particular boundary. Remember that full character sets (128 characters) must start on 1K memory boundaries, and half sets must start on 512-byte boundaries. There are similar rules for player/missile graphics (see "Atari Animation With P/M Graphics," a three-part series starting in the September 1985 issue of COMPUTE!). If you actually type in and run the programs below, you'll be in for a little surprise. But *do not* omit the REMark statements from Program 2, or you'll miss half the fun. Feel free to omit them from Program 1. For the programs to function properly, you must save Program 2 with the filename PROGRAM2.BAS (see line 900 of Program 1). If you're using cassette instead of disk, change line 900 in Program 1 to RUN "C:" and make sure the tape is cued to Program 2 before you run Program 1.

A minor caution: The reason we base the changes to LOMEM on the contents of locations 128 and 129 (BASIC's internal MEMLO pointer) instead of the actual LOMEM contents is complex. I have discussed it in this column before, but the heart of the problem is that some Atari device drivers (including the 850 Interface Module's R: handler) do not correctly restore LOMEM when the SYSTEM RESET button is pressed. After a reset, BASIC's pointer is more reliable. For the same reason, and for safety's sake, programs bumping LOMEM should always bump it higher than the top of the BASIC program currently in memory. And one last piece of advice: If you run Program

1 over and over again, it keeps raising LOMEM higher and higher. Eventually you'll run out of memory. You probably need some sort of flag elsewhere in memory (Page 6?) which tells the program not to raise LOMEM again.

Modifying HIMEM

Enough about LOMEM; what about HIMEM? Truthfully, if you know how big your program is and what it's going to use in the system, you can put anything you want (character sets, machine language, player/missile shape data, etc.) in the memory between the top of your program and the bottom of screen memory. The only time the contents of HIMEM are used is when BASIC checks to ensure that APPMHI (location 14, $0E) hasn't collided with it. APPMHI is essentially BASIC's high water mark. It keeps track of the top of the run-time stack, which is always above the string and array space, which in turn is always above your program. So, if you *know* that your program, its data, and its stack will never grow too large, you could ignore HIMEM altogether. It's much cleaner, though, to tell the system what you're using by modifying HIMEM.

How and why does HIMEM change if you don't do this? The most usual cause is a change in the graphics mode. For example, while ordinary text screen graphics (GRAPHICS 0) occupy less than 1K of memory, several graphics modes (such as modes 8, 9, 10, 11, and 15) require 8K of screen memory. To demonstrate this, type in and run the following line, preferably after hitting the SYSTEM RESET button:

```
GO=FRE(0):GR.8:PRINT GO,FRE(0),GO-FRE(0)
```

This displays three numbers: memory available for your program(s) in text mode, usable memory in mode 8, and the extra amount used by mode 8 graphics.

Generally, the best method is to always put your own goodies below the area occupied by the most memory-intensive graphics mode you plan to use. So either look in a memory map book to find out how much room a certain graphics mode will take, or simply change modes before using the memory.

For an example, try Program 3. It's essentially the same as Program 2. The difference is simply where we move the character set. The REMarks explain where you should insert your own graphics mode declaration. ©

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

Program 1: MEMLO Bumper

```
HF 100 REM
DS 110 REM THIS PROGRAM IS U
       SED TO
BH 120 REM RESERVE SIZE"PAGE
       S" OF
IB 130 REM MEMORY FOR PROGRA
       M2.BAS
HJ 140 REM
AE 150 REM (A "PAGE" IS 256
       BYTES
HL 160 REM
CA 170 REM THIS PROGRAM ALSO
        ENSURES
FL 180 REM THAT THE RESERVED
        SPACE
LK 190 REM STARTS ON THE GIV
       EN BOUNDARY
JD 200 REM (TO INSURE,FOR EX
       AMPLE, THAT
OK 210 REM CHARACTER SETS ST
       ART ON 1K
MB 220 REM BYTE BOUNDARIES)
HJ 230 REM
KB 500 SIZE=4:REM MUST BE AT
        LEAST 4 PAGES (1024
       BYTES)!
DI 510 BOUNDARY=4:REM ALSO G
       IVEN IN PAGES
OC 520 IF PEEK(128)<>0 THEN
       POKE 128,0:POKE 743,0
       :SIZE=SIZE+1
MH 530 MEMLO=PEEK(129)+SIZE
GF 540 MEMLO=INT((MEMLO+BOUN
       DARY-1)/BOUNDARY)*BOU
       NDARY
AO 550 POKE 744,MEMLO
AM 560 POKE 129,MEMLO
JO 900 RUN "D:PROGRAM2.BAS"
```

Program 2: Character Set Mover, Version 1

```
DG 150 REM JUST AS A DEMO, T
       HIS PROGRAM
KM 160 REM CHANGES THE CHAR
       SET POINTER,
JJ 170 REM COPIES THE CHARAC
       TER SET
GG 180 REM TO THE RESERVED M
       EMORY,
BF 190 REM AND THEN RADOMLY
       DESTROYS
FI 200 REM THE CHARACTERS!
HM 210 REM
HJ 220 REM HIT RESET TO QUIT
        AND GET
LA 230 REM NORMAL CHARACTERS
        AGAIN.
HK 240 REM
BI 250 GRAPHICS 0
JM 260 SIZE=4:REM SHOULD BE
       THE SAME AS PROGRAM 1
BF 270 POKE 756,PEEK(129)-SI
       ZE:REM CHBAS IS CHANG
       ED
HA 280 BUFFER=PEEK(756)*256
FI 290 POKE 752,1:PRINT :REM
        NO MORE CURSOR
MK 300 FOR ADDR=BUFFER TO BU
       FFER+1023
NA 310 POKE ADDR,0:REM FIRST
        CHANGE ALL CHARS
DO 320 NEXT ADDR:REM TO SAME
        REPEATED PATTERN
CA 330 LIST 150,240:REM JUST
        SOMETHING TO SHOW
IL 340 REM READY TO MOVE THE
        CHARACTERS
HA 350 FOR ADDR=0 TO 1023
LH 360 POKE BUFFER+ADDR,PEEK
       (57344+ADDR)
PE 370 NEXT ADDR
CB 380 REM MOVED...SLOWLY DE
       STROYED
NG 390 POKE INT(RND(0)*1024)
       +BUFFER,INT(RND(0)*25
       6)
```

Program 3: Character Set Mover, Version 2

```
DG 150 REM JUST AS A DEMO, T
       HIS PROGRAM
IA 160 REM CHANGES THE CHAR
       SET POINTER
JJ 170 REM COPIES THE CHARAC
       TER SET
GG 180 REM TO THE RESERVED M
       EMORY,
GD 190 REM AND THEN RANDOMLY
        DESTROYS
FI 200 REM THE CHARACTERS!
HM 210 REM
HJ 220 REM HIT RESET TO QUIT
        AND GET
LA 230 REM NORMAL CHARACTERS
        AGAIN.
HK 240 REM
BG 250 GRAPHICS 7:REM JUST T
       O CLEAR ABOUT 4K OF M
       EMORY!
HP 260 GRAPHICS 0:REM OR OTH
       ER MODE
EF 270 SIZE=4
OM 280 REM ALWAYS DO FOLLOWI
       NG AFTER THE GRAPHICS
        STATEMENT
HJ 290 POKE 741,255:REM ENSU
       RE END-OF-PAGE BOUND
MG 300 MEMHI=INT(PEEK(742)/S
       IZE)*SIZE-SIZE
HB 310 POKE 742,MEMHI-1:REM
       LOWER HIMEM
AH 320 POKE 756,MEMHI:REM CH
       BAS IS CHANGED
GM 330 BUFFER=PEEK(756)*256
FE 340 POKE 752,1:PRINT :REM
        NO MORE CURSOR
CC 350 LIST 150,240:REM JUST
        SOMETHING TO SHOW
IN 360 REM READY TO MOVE THE
        CHARACTERS
HC 370 FOR ADDR=0 TO 1023
LJ 380 POKE BUFFER+ADDR,PEEK
       (57344+ADDR)
PG 390 NEXT ADDR
BK 400 REM MOVED...SLOWLY DE
       STROYED
MP 410 POKE INT(RND(0)*1024)
       +BUFFER,INT(RND(0)*25
       6)
GE 420 GOTO 410
```

©

Programming the TI

C. Regena

Computerized Messages

With the abundance of home computers, people are having fun with computerized messages and electronic communication. For instance, you can program your TI to play "Happy Birthday" to a friend. My December columns for the last few years have contained programs for the TI that can be used for Christmas greetings.

The recent birth of our baby was another occasion for computerized messages. My spouse put a system message on the mainframe computer at work so fellow employees would know our news. Electronic mail carried the message to other colleagues. Some of our relatives and friends have TI computers, so I wrote a birth-announcement program and sent them copies. We mailed printed announcements, complete with graphics, to other friends who don't have computers. We're such proud parents that I decided to include the program here. You can use this general idea to create your own computerized messages.

The music for this program is Brahm's "Lullaby." Line 140 defines a tempo in the variable T. The value of T represents an eighth note, and all the CALL SOUND statements express duration in terms of T. Lines 120 and 130 define sound frequencies for the melody notes. Notice that the DATA statement has eight numbers which correspond to the eight variable names in the READ statements. By the way, these frequencies actually represent the flats for each named note except F.

Line 150 changes the screen color. I had planned to use color 8 (cyan) or 5 (dark blue) for a baby boy, or color 7 (dark red) for a baby girl.

Lines 160–600 combine CALL SOUND statements with CALL CHAR statements to define graphic characters while playing music. Lines 610–650 define the colors for the graphics. Line 620 defines a light-blue color for the stork's hat and part of the baby (try color 10 for a baby girl). Lines 630–650 define the colors for the stork. If you prefer white lettering instead of black, you could change line 630 to FOR N=2 TO 11.

Lines 660–1000 play music while printing the announcement. It displays the graphics on the screen with PRINT instead of CALL HCHAR or CALL VCHAR because the PRINT method is quicker. The CHR$ statement specifies a certain character number to be printed. Most of the stork is composed of characters that are redefined lowercase letters. Release the ALPHA LOCK key to type these letters in the statements.

Lines 1010–1420 continue playing the music. Lines 1430–1450 keep the announcement on the screen until a key is pressed. A keypress clears the screen and ends the program.

If you prefer to save typing, you can obtain a copy of "Announcement" by sending a blank cassette or disk, a stamped, self-addressed mailer, and $3 to:

C. Regena
P.O. Box 1502
Cedar City, UT 84720

```
100 REM ANNOUNCEMENT
110 CALL CLEAR
120 READ BG,BA,BB,C,D,E,F
    ,G
130 DATA 185,208,233,247,
    277,311,349,370
140 T=350
150 CALL SCREEN(8)
160 CALL SOUND(T,BB,5)
170 CALL CHAR(123,"000000
    00003C7CFE")
180 CALL CHAR(97,"00070C0
    80810101")
190 CALL SOUND(T,BB,6)
200 CALL CHAR(98,"FC0201"
    )
210 CALL CHAR(99,"0000008
    08040404")
220 CALL SOUND(2*T,D,4)
230 CALL CHAR(100,"000E11
    1070888484")
240 CALL CHAR(101,"003057
    8989898909")
250 CALL CHAR(102,"080808
    0808040404")
260 CALL CHAR(103,"040E0E
    00312E2222")
270 CALL SOUND(2*T,D,4,13
    9,8)
280 CALL CHAR(104,"404080
    808040404")
290 CALL CHAR(105,"828140
    7C8380403F")
300 CALL CHAR(106,"5152D4
    A89063FC38")
310 CALL CHAR(107,"E02020
    4080000F3")
320 CALL SOUND(T,BB,5,139
    ,8)
330 CALL CHAR(108,"040404
    020202FC04")
340 CALL CHAR(109,"111110
    0808040404")
350 CALL SOUND(T,BB,4,139
    ,8)
360 CALL CHAR(110,"2020A0
    9050502828")
370 CALL CHAR(111,"372834
    2B2824231")
380 CALL SOUND(2*T,D,4)
390 CALL CHAR(112,"C00000
    807F00008")
400 CALL CHAR(113,"040404
    0CF40808C")
410 CALL CHAR(114,"040404
    0404040404")
420 CALL CHAR(115,"140C0C
    12122141C1")
430 CALL SOUND(2*T,139,8,
    185,8)
440 CALL CHAR(116,"101008
    040201")
450 CALL CHAR(117,"7F0000
    000000C03F")
460 CALL CHAR(118,"C00000
    0000000FF")
470 CALL CHAR(119,"080911
    1222C20201")
480 CALL SOUND(T,BB,5)
490 CALL CHAR(120,"800000
    00000000FF")
500 CALL CHAR(121,"844448
    30202020C")
510 CALL SOUND(T,D,4)
520 CALL CHAR(122,"000000
    0000003844")
530 CALL CHAR(128,"010204
    08103F")
540 CALL SOUND(2*T,G,3,D,
    7,BB,9)
550 CALL CHAR(129,"808080
    87F982808")
560 CALL CHAR(130,"000000
    C0804")
```

```
570 CALL CHAR(131,"808080
    808080808")
580 CALL SOUND(3*T,F,2,D,
    8,BB,8)
590 CALL CHAR(132,"000003
    ")
600 CALL CHAR(133,"808060
    808")
610 CALL COLOR(13,11,1)
620 CALL COLOR(12,6,1)
630 FOR N=9 TO 11
640 CALL COLOR(N,16,1)
650 NEXT N
660 CALL SOUND(T,E,2,BB,7
    ,BG,9)
670 PRINT TAB(5);CHR$(123
    )
680 CALL SOUND(2*T,E,3,BA
    ,7,175,9)
690 PRINT TAB(4);"abcCHAN
    DLER AND"
700 PRINT "de fghCHERYL R
    EGENA WHITELAW"
710 PRINT "ijklmn"
720 CALL SOUND(2*T,D,4,BA
    ,7,175,9)
730 PRINT " opqrszANNOUNC
    E THE BIRTH OF"
740 PRINT " tuvwxy"
750 PRINT TAB(3);CHR$(128
    );CHR$(129);CHR$(130)
760 CALL SOUND(T,BA,4)
770 PRINT TAB(4);CHR$(131
    );"{4 SPACES}BRETT LY
    NN WHITELAW"
780 CALL SOUND(T,BB,4)
790 PRINT TAB(3);CHR$(132
    );CHR$(133)
800 CALL SOUND(T,C,3)
810 PRINT : :
820 CALL SOUND(T,C,3,BG,8
    )
830 CALL SOUND(2*T,BA,3,1
    39,8)
840 PRINT "BORN:  OCTOBER
     19, 1985"
850 PRINT :"TIME:  2:48 A
    .M."
860 CALL SOUND(T,BA,2)
870 PRINT :"WEIGHT:  8 PO
    UNDS 10 OUNCES"
880 CALL SOUND(T,BB,2)
890 PRINT :"LENGTH:  22 I
    NCHES"
900 CALL SOUND(T,C,2)
910 CALL SOUND(T,C,2,BG,8
    )
920 CALL SOUND(T,139,8)
930 CALL SOUND(T,175,8)
940 CALL SOUND(T,BA,3)
950 CALL SOUND(T,C,2)
960 CALL SOUND(T,F,1)
970 CALL SOUND(T,E,1,BG,6
    )
980 CALL SOUND(2*T,D,2,17
    5,7)
990 PRINT : :"ALSO WELCOM
    ED BY CHERY,"
1000 PRINT "RICHARD, CIND
     Y, BOB, RANDY"
1010 CALL SOUND(2*T,F,2,C
     ,6,BA,8)
1020 CALL SOUND(T,G,2,BB,
     5)
1030 CALL SOUND(T,G,2,BB,
     5,BG,8)
1040 CALL SOUND(T,G,2,BB,
     5,139,7)
1050 CALL SOUND(T,G,2,BB,
     5)
1060 CALL SOUND(T,BG,4)
1070 CALL SOUND(T,BG,3)
1080 CALL SOUND(2*T,G,2,E
     ,5)
1090 CALL SOUND(2*T,G,2,E
     ,5,BG,8)
1100 CALL SOUND(T,E,3,BG,
     8)
1110 CALL SOUND(T,C,4,BG,
     8)
1120 CALL SOUND(4*T,D,3,B
     B,6,BG,8)
1130 CALL SOUND(T,BB,4,13
     9,8)
1140 CALL SOUND(T,BG,4,13
     9,8)
1150 CALL SOUND(T,C,3,BA,
     6)
1160 CALL SOUND(T,C,3,BA,
     6,139,9)
1170 CALL SOUND(T,D,2,BB,
     5)
1180 CALL SOUND(T,D,2,BB,
     5,139,9)
1190 CALL SOUND(T,E,1,C,4
     )
1200 CALL SOUND(T,E,1,C,4
     ,139,9)
1210 CALL SOUND(T,BB,1)
1220 CALL SOUND(T,D,2)
1230 CALL SOUND(T,D,2,BG,
     8)
1240 CALL SOUND(T,D,2,139
     ,8)
1250 CALL SOUND(T,BG,4)
1260 CALL SOUND(T,BG,3)
1270 CALL SOUND(2*T,G,1,E
     ,4)
1280 CALL SOUND(2*T,G,1,E
     ,4,BG,8)
1290 CALL SOUND(T,E,2,BG,
     6)
1300 CALL SOUND(T,C,3,BG,
     6)
1310 CALL SOUND(4*T,D,4,B
     B,8,BG,9)
1320 CALL SOUND(T,BB,4,13
     9,8)
1330 CALL SOUND(T,BG,3,13
     9,8)
1340 CALL SOUND(T,C,3,BA,
     7)
1350 CALL SOUND(T,C,3,139
     ,8)
1360 CALL SOUND(50,D,4)
1370 CALL SOUND(50,C,4)
1380 CALL SOUND(T,BB,3)
1390 CALL SOUND(T,E,4)
1400 CALL SOUND(T,BA,5)
1410 CALL SOUND(T,F,5,C,9
     )
1420 CALL SOUND(4*T,G,5,B
     B,9,BG,12)
1430 CALL KEY(0,K,S)
1440 IF S<1 THEN 1430
1450 CALL CLEAR
1460 END
```

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IBM Personal Computing

Donald B. Trivette

Compiling BASIC

This month's issue has a couple of articles about the Motorola 68000, the super-fast microprocessor chip that powers the Apple Macintosh, Atari ST, and Commodore Amiga. IBM users aren't left out of this contest. Intel Corporation has its own super-fast microprocessor, the 80286, which is found in the IBM AT, the AT&T PC 6300+, and several AT compatibles. But if you don't want to buy a new computer just now, there's another way to make some of your programs run faster.

Consider the following three-statement BASIC program we'll call PROG1.BAS:

```
10 FOR I=1 TO 2000
20 J=I*I
30 NEXT I
```

It finds the squares of the numbers from 1 to 2,000. It takes eight seconds on a PC or PCjr, three seconds on an IBM AT with its faster microprocessor, and two seconds on AT&T's 6300+. Now, let's see if we can get the speed of the AT&T computer out of a PC or PCjr.

IBM BASIC is an *interpretive* language. This means the computer must translate each statement into machine language instructions before execution. Because PROG1.BAS consists of a loop, BASIC must translate and execute a total of 6,000 statements (three statements 2,000 times). Although the overhead to interpret a single instruction is very small, the overall time adds up. Think how much faster the program could run if each BASIC instruction could be translated into machine language just once, rather than each time it is executed. Basically, that's what a *compiler* does.

Compiling a program is usually a two-step process. First, the source program—that's your BASIC program—is processed by the compiler. The output from the compiler is then processed by a *link* program. The output from the linker is the compiled BASIC program in the form of an .EXE file.

New & Improved Compiler

Last summer, IBM released Version 2.0 of its BASIC Compiler. It incorporates all the new features added to interpreter BASIC since the first version of the BASIC Compiler was released in 1982. These include VIEW, WINDOW, PAINT, SHELL, hard disk commands, and all of the advanced features of the PCjr, such as multivoice music and user-defined palettes. In addition, IBM has added some features to Compiled BASIC that are not available in the interpreter. These include named subprograms, user-defined multiline functions, and separately compiled subprograms. Also, the Compiler manual has been enlarged to two volumes: *BASIC Compiler Fundamentals* and *BASIC Compiler Language Reference.*

There's a price to pay for all these goodies. The old version sold for $300; the new version carries a retail price of $495. And there's another factor to consider: Version 2.0 generates larger .EXE files than Version 1.0.

Unless you need some of the compiler's advanced features, it's easy to use; in fact, it's easier to run than most word processing programs. First, you save the BASIC program on disk with the ASCII option (SAVE "PROG1.BAS",A). Next, you run the compiler by typing its name: BASCOM. It asks for the name of the input file (PROG1.BAS) and any other options you might want to select.

If the input file is PROG1.BAS, the compiler's output goes to a file called PROG1.OBJ. This is known as the *object module* or *object file.* At this point, the program is compiled but not executable. There are still some things the program must know before it can run. To resolve these unknowns (technically known as external references), the object file must be processed by the link program on the compiler disk. Output from the link program is the final program ready to execute—in this case, PROG1.EXE.

PROG1.EXE is known as an *executable module* or a *run module.* To run it, simply type the filename as if it were a DOS command: PROG1. As the table indicates, a compiled program runs three to four times faster than an interpreted one. (The run module produced by the new version of the compiler is no faster than that produced by the old version.) The price to pay for speed is size. The interpreter version uses only 56 bytes of disk space, while the compiled version takes more than 23,000 bytes. ©

Size in Bytes	Compiler 1.0		Compiler 2.0
PROG1.BAS	56		56
PROG1.BAS (ASCII)	74		74
PROG1.OBJ	875		980
PROG1.EXE	18,304		23,334
Compiling Time			
PROG1.BAS	:02		:02
Linking Time			
PROG1.OBJ	1:35		:59
Execution Time	**IBM PC**	**IBM AT**	**AT&T 6300+**
Interpreted PROG1.BAS	:08	:03	:02
Compiled PROG1.BAS	:02	:01	:00.5

Memo Diary

You may have noticed that the year value behaves strangely in this program from the December 1985 issue (p. 65). To solve this, add the following two lines, which were accidentally omitted from Program 1 (Atari and TI owners should add line 1030 *only*):

```
1030 IF D8$ <= D9$ THEN 1050
1040 Y$="/" + RIGHT$ (STR$ (100 +
  Y8), 2)
```

The article failed to mention that you should enter only two digits for the year when you first run the program (for example, 86 for 1986). Entering all four digits results in incorrect days of the week for the dates you select.

The Atari and TI versions (Programs 3 and 6) each have additional corrections. In both versions, the month can only be entered as a number, not as a word. Also, in the TI version, incorrect menu choices crash the program. Make the following changes, suggested by reader David Wentzel:

Atari version:

```
1695 IF LEN(MM$) > 2 THEN 1710
1770 IF MM$<>M$((J-1) * 3 + 1, J * 3)
  THEN 1790
```

TI version:

```
815 IF (A<1) + (A>5) THEN 730
1695 IF LEN(MM$) > 2 THEN 1710
```

Balloon Crazy For TI And IBM

The IBM version (Program 4, p. 59) of this game from the December 1985 issue has a minor bug. When a new screen is drawn after clearing all balloons from a previous screen, the display always shows three clowns remaining regardless of how many are actually left. To correct this, reader Matthew Pomeroy suggests the following change to line 190:

```
190 FOR I=158 TO 158 + (LIVES - 2) *
  8 STEP 8: PUT(I,0), TINY: NEXT:
  GOSUB 350
```

Part of line 390 is missing in the TI version of this game (Program 5, p. 60). The line should read as follows:

```
390 CALL SPRITE(#3,124,14
    ,118,MCOL):: GOSUB 56
    0 :: CALL DELSPRITE(#
    3):: CALL SPRITE(#1,1
    36,14,150,MCOL)
```

Apple ProDOS Disk Menu

This utility program from the December 1985 issue (p. 108) gives a BAD SUBSCRIPT ERROR in line 20 when run because its first line is missing. Add the following:

```
5 DIM A$(24), L$(52)
```

Also, David Mariotti suggests the following improvements which cause the selector bar to skip blank lines when there are fewer than 16 items in the directory display:

```
4115 IF CR > LIM + 2 THEN CR = 3
4210 IF CR = 4 THEN CR = LIM + 4
```

Atari Reset Controller

Errors were accidentally introduced in Program 2 for this article from the January 1986 issue (p. 110) when REM statements were deleted. The GOTO 340 in line 300 should be changed to GOTO 360, and the GOTO 180 in line 320 should be changed to GOTO 200. A good programming rule to help avoid such problems is never GOTO a REM statement.

Apple ML Addresses

In the December 1985 "Reader's Feedback" column, there is an error in line 20 of the ProDOS routine for finding the starting address of machine language programs (p. 18). The statement GOTO 15 should be GOTO 20.

Atari Lightning Renumber

The author of this program from the October 1985 issue (p. 103) has provided a fix for a bug that causes the program to sometimes miss internal line number references in program lines. Line 810 should be changed to read as follows:

```
810 DATA 200,177,203,201,22,240,10,
  201,155,240
```

Skyscape

In addition to the small correction published in last month's "Capute!" column, there are a number of corrections required for the Atari version, and additional changes to the Commodore 64, Apple, and TI versions. In the Atari version, the following lines need to be corrected as shown:

```
FN 520 FOR ZZ=1 TO 40:PRINT
       CHR$(RF+32);:NEXT ZZ:
       GOTO 540
EI 1000 IF ABS(LL)>90 THEN P
        RINT OO$:GOTO 980
HB 1730 IF P(X,6)<K1 AND P(X
        ,6)>MS THEN 1760
IF 2590 IF ABS(LL)>90 THEN P
        RINT OO$:GOTO 2580
CE 2600 GOSUB 2260:IF Z$="N"
         THEN 2560
NG 2610 GOSUB 2510:Q$="S":GO
        TO 1950
```

In the Commodore 64 version, the reinput option of the latitude change feature does not work correctly. Change the THEN 2480 at the end of line 2570 to THEN 2530.

In the Apple version, the day of the week is incorrect after the date is first entered. To correct this, add GOSUB 1670 between the HTAB 5 and the GOSUB 1295 in line 800.

In the TI-99/4A version, the reinput option of the change latitude feature does not work correctly. Change the THEN 2410 at the end of line 2490 to THEN 2460. Also, the DOWN-S in the string in line 500 should read DOWN-N. The TI version states that Extended BASIC is required, but does not mention that expansion memory is also required. TI readers who are interested in modifications necessary to use the progrm without memory expansion should write to COMPUTE! for details. C

COMPUTE's Author Guide

Most of the following suggestions serve to improve the speed and accuracy of publication. COMPUTE! is primarily interested in new and timely articles on the Commodore 64/128, Atari, Apple, IBM PC/PCjr, Amiga, and Atari ST. We are much more concerned with the content of an article than with its style, but articles should be clear and well-explained.

The guidelines below will permit your good ideas and programs to be more easily edited and published:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to one make of computer, please state the brand name and, if applicable, the BASIC or ROM or DOS version(s) involved. In addition, *please indicate the memory requirements of programs.*

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. All lines within the text of the article must be double- or triple-spaced. A one-inch margin should be left at the right, left, top, and bottom of each page. No words should be divided at the ends of lines. And please do not justify. Leave the lines ragged.

6. Standard typing paper should be used (no erasable, onionskin, or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).

7. Sheets should be attached together with a paper clip. Staples should not be used.

8. If you are submitting more than one article, send each one in a separate mailer with its own tape or disk.

9. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* If your article was written with a word processor, we also appreciate a copy of the text file on the tape or disk. Please use high-quality 10 or 30 minute tapes with the program recorded on both sides. The tape or disk should be labeled with the author's name, the title of the article, and, if applicable, the BASIC/ROM/DOS version(s). Atari tapes should specify whether they are to be LOADed or ENTERed. We prefer to receive Apple programs on disk rather than tape. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

10. A good general rule is to spell out the numbers zero through ten in your article and write higher. numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

11. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. Articles can be of any length—from a single-line routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.

13. If you want to include photographs, they should be either 5×7 black and white glossies or color slides.

14. We do not consider articles which are submitted simultaneously to other publishers. If you wish to send an article to another magazine for consideration, please do not submit it to us.

15. COMPUTE! pays between $70 and $800 for published articles. In general, the rate reflects the length and quality of the article. Payment is made upon acceptance. Following submission (Editorial Department, COMPUTE! Magazine, P.O. Box 5406, Greensboro, NC 27403) it will take from four to eight weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. *Rejected manuscripts are returned to authors who enclose a self-addressed, stamped envelope.*

16. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing, "Revision" on the envelope and the article.

17. COMPUTE! does not accept unsolicited product reviews. If you are interested in serving on our panel of reviewers, contact the Review Coordinator for details.

COMPUTE!'s Guide To Typing In Programs

Before typing in any program, you should familiarize yourself with your computer. Learn how to use the keyboard to type in and correct BASIC programs. Read your manuals to understand how to save and load BASIC programs to and from your disk drive or cassette unit. Computers are precise—take special care to type the program *exactly* as listed, including any necessary punctuation and symbols, except for special characters as noted below. To help you with this task, we have implemented a special listing convention as well as a program to help check your typing—the "Automatic Proofreader." Please read the following notes before typing in any programs from COMPUTE!. They can save you a lot of time and trouble.

Commodore, Apple, and Atari programs can contain some hard-to-read (and hard-to-type) special characters, so we have developed a listing system that indicates the function of these control characters. (There are no special control characters in our IBM or TI-99/4A listings.) You will find Commodore and Atari special characters within curly braces; *do not type the braces.* For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. For Commodore, Apple, and Atari, a symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CTRL key and press A. This will produce a reverse video character on the Commodore (in quote mode), a graphics character on the Atari, and an invisible control character on the Apple. Commodore computers also have a special control key labeled with the Commodore logo. Graphics characters entered with the Commodore logo key are enclosed in a special bracket that looks like this: [<A>]. In this case, you would hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S. One exception is {SHIFT-SPACE}. When you see this, hold down SHIFT and press the space bar. If a number precedes a symbol, such as {5 RIGHT}, {6 S}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (printed in white on black) should be entered after pressing the inverse video key.

Since spacing is sometimes important, any more than two spaces will be listed. For example, {6 SPACES} means to press the space bar six times. Our listings never leave a space at the end of a line, instead moving it to the next printed line as {SPACE}. For your convenience, we have prepared this quick-reference chart for the Commodore and Atari special characters:

Atari 400/800/XL/XE

When you see	Type	See
{CLEAR}	ESC SHIFT <	Clear Screen
{UP}	ESC CTRL -	Cursor Up
{DOWN}	ESC CTRL =	Cursor Down
{LEFT}	ESC CTRL +	Cursor Left
{RIGHT}	ESC CTRL *	Cursor Right
{BACK S}	ESC DELETE	Backspace
{DELETE}	ESC CTRL DELETE	Delete character
{INSERT}	ESC CTRL INSERT	Insert character
{DEL LINE}	ESC SHIFT DELETE	Delete line
{INS LINE}	ESC SHIFT INSERT	Insert line
{TAB}	ESC TAB	TAB key
{CLR TAB}	ESC CTRL TAB	Clear tab
{SET TAB}	ESC SHIFT TAB	Set tab stop
{BELL}	ESC CTRL 2	Ring buzzer
{ESC}	ESC ESC	ESCape key

Commodore PET/CBM/VIC/64/128/16/+4

When You Read:	Press:	See:	When You Read:	Press:	See:
{CLR}	SHIFT CLR/HOME		[<1>]	COMMODORE 1	
{HOME}	CLR/HOME		[<2>]	COMMODORE 2	
{UP}	SHIFT ↑ CRSR ↓		[<3>]	COMMODORE 3	
{DOWN}	↑ CRSR ↓		[<4>]	COMMODORE 4	
{LEFT}	SHIFT ← CRSR →		[<5>]	COMMODORE 5	
{RIGHT}	← CRSR →		[<6>]	COMMODORE 6	
{RVS}	CTRL 9		[<7>]	COMMODORE 7	
{OFF}	CTRL 0		[<8>]	COMMODORE 8	
{BLK}	CTRL 1		{ F1 }	f1	
{WHT}	CTRL 2		{ F2 }	SHIFT f1	
{RED}	CTRL 3		{ F3 }	f3	
{CYN}	CTRL 4		{ F4 }	SHIFT f3	
{PUR}	CTRL 5		{ F5 }	f5	
{GRN}	CTRL 6		{ F6 }	SHIFT f5	
{BLU}	CTRL 7		{ F7 }	f7	
{YEL}	CTRL 8		{ F8 }	SHIFT f7	
			4	←	

The Automatic Proofreader

We have developed a series of simple, yet effective programs that can help check your typing. Type in the appropriate Proofreader program listed below, then save it for future use. On the VIC, 64, or Atari, run the Proofreader to activate it, then enter NEW to erase the BASIC loader (the Proofreader remains active, hidden in memory, as a machine language program). Pressing RUN/STOP–RESTORE or SYSTEM RESET deactivates the Proofreader. You can use SYS 886 to reactivate the VIC/64 Proofreader, or PRINT USR(1536) to reenable the Atari Proofreader. On the Apple, the Proofreader automatically erases the BASIC portion of itself after you activate it by typing RUN, leaving only the machine language portion in memory. It works with either DOS 3.3 or ProDOS. Disable the Apple Proofreader by pressing CTRL-RESET before running another BASIC program. The IBM Proofreader is a BASIC program that simulates the IBM BASIC line editor, letting you enter, edit, list, save, and load programs that you type. Type RUN to activate.

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a decimal number (on the Commodore), a hexadecimal number (on the Apple), or a pair of letters (on the Atari or IBM) appears. The number or pair of letters is called a *checksum*. Try making a change in the line, and notice how the checksum changes.

All you need to do is compare the value provided by the Proofreader with the checksum printed in the program listing in the magazine. In Commodore listings, the checksum is a number from 0 to 255. It is set off from the rest of the line with *rem*. This prevents a syntax error if the checksum is typed in, but the REM statements and checksums need *not* be typed in. It is just there for your information.

In Atari, Apple, and IBM listings, the checksum is given to the left of each line number. Just type in the program one line at a time (without the printed checksum) and compare the checksum generated by the Proofreader to the checksum in the listing. If they match, go on to the next line. If not, check your typing: You've made a mistake. On the Commodore, Atari, and Apple Proofreaders, spaces are not counted as part of the checksum, so be sure you type the right number of spaces between quote marks. The Commodore and Atari Proofreaders do not check to see that you've typed the characters in the right order, so if characters are transposed, the checksum still matches the listing. Because of the checksum method used, do not type abbreviations, such as ? for PRINT. The IBM Proofreader is the pickiest of all; it *will* detect errors in spacing and transposition. Be sure to leave Caps Lock on, except when typing lowercase characters.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you type NEW, the Proofreader prompts you to press Y to be sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program in BASIC as usual (this replaces the Proofreader in memory). You can now run the program, but you may want to resave it to disk. The version of your program that you resave from BASIC will take up less space on disk and will load faster, but it can no longer be edited with the Proofreader. If you want to convert a program to Proofreader format, save it to disk with SAVE *"filename"*,A.

Special Proofreader Notes For Commodore Cassette Users

The Proofreader resides in a section of memory called the cassette buffer, which is used during tape LOADs and SAVEs. Therefore, be sure to press RUN/STOP–RESTORE to get the Proofreader out of the way before saving or loading a program. If you want to use the Proofreader with tape, run the Proofreader, then enter these two lines *exactly* as shown, pressing RETURN after each one:

```
A$="PROOFREADER.T":B$="{10
 SPACES}":FOR X=1 TO 4:A$=A$
 +B$:NEXT
FOR X=886 TO 1018:A$=A$+CHR$
 (PEEK(X)):NEXT:OPEN 1,1,1,A$:
 CLOSE1
```

Then insert a blank tape and press RECORD and PLAY to save a special version of the Proofreader. Anytime you need to reload the Proofreader after it has been erased—for example, after you reload a paritally completed program—just rewind the tape, type OPEN1:CLOSE1, then press PLAY. You'll see the message FOUND PROOFREADER.T, but not the familiar LOADING message. Don't worry; the Proofreader is in memory. When READY comes back, enter SYS 886.

Program 1: VIC/64 Proofreader

By Charles Brannon, Program Editor

```
10 PRINT"{CLR}PLEASE WAIT...":
   FORI=886TO1018:READA:CK=CK+
   A:POKEI,A:NEXT
20 IF CK<>17539 THEN PRINT"
   {DOWN}YOU MADE AN ERROR":PR
   INT"IN DATA STATEMENTS.":EN
   D
30 SYS886:PRINT"{CLR}{2 DOWN}P
   ROOFREADER ACTIVATED.":NEW
40 DATA 173,036,003,201,150,20
   8,001,096,141,151,003,173
50 DATA 037,003,141,152,003,16
   9,150,141,036,003,169,003
60 DATA 141,037,003,169,000,13
   3,254,096,032,087,241,133
70 DATA 251,134,252,132,253,00
   8,201,013,240,017,201,032
80 DATA 240,005,024,101,254,13
   3,254,165,251,166,252,164
90 DATA 253,040,096,169,013,03
   2,210,255,165,214,141,251
100 DATA 003,206,251,003,169,0
    00,133,216,169,019,032,210
110 DATA 255,169,018,032,210,2
    55,169,58,032,210,255,166
120 DATA 254,169,000,133,254,1
    72,151,003,192,087,208,006
130 DATA 032,205,189,076,235,0
    03,032,205,221,169,032,032
140 DATA 210,255,032,210,255,1
    73,251,003,133,214,076,173
150 DATA 003
```

Program 2: Atari Proofreader

By Charles Brannon, Program Editor

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:RE
    AD A:POKE I,A:CK=CK+A
    :NEXT I
120 IF CK<>19072 THEN ? "
    Error in DATA Stateme
    nts.  Check Typing.":
    END
130 A=USR(1536)
140 ? :? "Automatic Proof
    reader Now Activated.
    "
150 END
160 DATA 104,160,0,185,26
    ,3,201,69,240,7
170 DATA 200,200,192,34,2
    00,243,96,200,169,74
180 DATA 153,26,3,200,169
    ,6,153,26,3,162
190 DATA 0,189,0,228,157,
    74,6,232,224,16
200 DATA 208,245,169,93,1
    41,78,6,169,6,141
210 DATA 79,6,24,173,4,22
    8,105,1,141,95
```

```
220 DATA 6,173,5,228,105,
    0,141,96,6,169
230 DATA 0,133,203,96,247
    ,238,125,241,93,6
240 DATA 244,241,115,241,
    124,241,76,205,238
250 DATA 0,0,0,0,0,32,62,
    246,8,201
260 DATA 155,240,13,201,3
    2,240,7,72,24,101
270 DATA 203,133,203,104,
    40,96,72,152,72,138
280 DATA 72,160,0,169,128
    ,145,88,200,192,40
290 DATA 208,249,165,203,
    74,74,74,74,24,105
300 DATA 161,160,3,145,88
    ,165,203,41,15,24
310 DATA 105,161,200,145,
    88,169,0,133,203,104
320 DATA 170,104,168,104,
    40,96
```

Program 3: IBM Proofreader

By Charles Brannon, Program Editor

```
MC 10 'Automatic Proofreader Ver
      sion 3.0 (Lines 205,206 ad
      ded/190 deleted/470,490 ch
      anged from V2.0)
LD 100 DIM L$(500),LNUM(500):COL
       OR 0,7,7:KEY OFF:CLS:MAX=
       0:LNUM(0)=65536!
PK 110 ON ERROR GOTO 120:KEY 15,
       CHR$(4)+CHR$(70):ON KEY(1
       5) GOSUB 640:KEY (15) ON:
       GOTO 130
BE 120 RESUME 130
BJ 130 DEF SEG=&H40:W=PEEK(&H4A)
IH 140 ON ERROR GOTO 650:PRINT:P
       RINT"Proofreader Ready."
KB 150 LINE INPUT L$:Y=CSRLIN-IN
       T(LEN(L$)/W)-1:LOCATE Y,1
CA 160 DEF SEG=0:POKE 1050,30:PO
       KE 1052,34:POKE 1054,0:PO
       KE 1055,79:POKE 1056,13:P
       OKE 1057,28:LINE INPUT L$
       :DEF SEG:IF L$="" THEN 15
       0
BC 170 IF LEFT$(L$,1)=" " THEN L
       $=MID$(L$,2):GOTO 170
NN 180 IF VAL(LEFT$(L$,2))=0 AND
        MID$(L$,3,1)=" " THEN L$
       =MID$(L$,4)
ND 200 IF ASC(L$)>57 THEN 260 'n
       o line number, therefore
       command
JB 205 BL=INSTR(L$," "):IF BL=0
       THEN BL$=L$:GOTO 206 ELSE
        BL$=LEFT$(L$,BL-1)
GH 206 LNUM=VAL(BL$):TEXT$=MID$(
       L$,LEN(STR$(LNUM))+1)
OG 210 IF TEXT$="" THEN GOSUB 54
       0:IF LNUM=LNUM(P) THEN GO
       SUB 560:GOTO 150 ELSE 150
MB 220 CKSUM=0:FOR I=1 TO LEN(L$
       ):CKSUM=(CKSUM+ASC(MID$(L
       $,I))*I) AND 255:NEXT:LOC
       ATE Y,1:PRINT CHR$(65+CKS
       UM/16)+CHR$(65+(CKSUM AND
        15))+" "+L$
JE 230 GOSUB 540:IF LNUM(P)=LNUM
        THEN L$(P)=TEXT$:GOTO 15
       0 'replace line
CL 240 GOSUB 580:GOTO 150 'inser
       t the line
AD 260 TEXT$="":FOR I=1 TO LEN(L
       $):A=ASC(MID$(L$,I)):TEXT
       $=TEXT$+CHR$(A+32*(A>96 A
       ND A<123)):NEXT
LP 270 DELIMITER=INSTR(TEXT$," "
       ):COMMAND$=TEXT$:ARG$="":
       IF DELIMITER THEN COMMAND
       $=LEFT$(TEXT$,DELIMITER-1
       ):ARG$=MID$(TEXT$,DELIMIT
       ER+1) ELSE DELIMITER=INST
       R(TEXT$,CHR$(34)):IF DELI
       MITER THEN COMMAND$=LEFT$
       (TEXT$,DELIMITER-1):ARG$=
       MID$(TEXT$,DELIMITER)
FC 280 IF COMMAND$<>"LIST" THEN
       410
ID 290 OPEN "scrn:" FOR OUTPUT A
       S #1
LH 300 IF ARG$="" THEN FIRST=0:P
       =MAX-1:GOTO 340
IJ 310 DELIMITER=INSTR(ARG$,"-")
       :IF DELIMITER=0 THEN LNUM
       =VAL(ARG$):GOSUB 540:FIRS
       T=P:GOTO 340
BP 320 FIRST=VAL(LEFT$(ARG$,DELI
       MITER)):LAST=VAL(MID$(ARG
       $,DELIMITER+1))
EC 330 LNUM=FIRST:GOSUB 540:FIRS
       T=P:LNUM=LAST:GOSUB 540:I
       F P=0 THEN P=MAX-1
GD 340 FOR X=FIRST TO P:N$=MID$(
       STR$(LNUM(X)),2)+" "
KA 350 IF CKFLAG=0 THEN A$="":GO
       TO 370
PF 360 CKSUM=0:A$=N$+L$(X):FOR I
       =1 TO LEN(A$):CKSUM=(CKSU
       M+ASC(MID$(A$,I))*I) AND
       255:NEXT:A$=CHR$(65+CKSUM
       /16)+CHR$(65+(CKSUM AND 1
       5))+" "
DO 370 PRINT #1,A$+N$+L$(X)
JJ 380 IF INKEY$<>"" THEN X=P
OF 390 NEXT :CLOSE #1:CKFLAG=0
CA 400 GOTO 130
PD 410 IF COMMAND$="LLIST" THEN
       OPEN "lpt1:" FOR OUTPUT A
       S #1:GOTO 300
BM 420 IF COMMAND$="CHECK" THEN
       CKFLAG=1:GOTO 290
KA 430 IF COMMAND$<>"SAVE" THEN
       450
CL 440 GOSUB 600:OPEN ARG$ FOR O
       UTPUT AS #1:ARG$="":GOTO
       300
DE 450 IF COMMAND$<>"LOAD" THEN
       490
PG 460 GOSUB 600:OPEN ARG$ FOR I
       NPUT AS #1:MAX=0:P=0
KA 470 WHILE NOT EOF(1):LINE INP
       UT #1,L$:BL=INSTR(L$," "
       ):BL$=LEFT$(L$,BL-1):LNUM(
       P)=VAL(BL$):L$(P)=MID$(L$
       ,LEN(STR$(VAL(BL$)))+1):P
       =P+1:WEND
KK 480 MAX=P:CLOSE #1:GOTO 130
GJ 490 IF COMMAND$="NEW" THEN IN
       PUT "Erase program - Are
       you sure";L$:IF LEFT$(L$,
       1)="y" OR LEFT$(L$,1)="Y"
        THEN MAX=0:LNUM(0)=65536
       !:GOTO 130:ELSE 130
CL 500 IF COMMAND$="BASIC" THEN
       COLOR 7,0,0:ON ERROR GOTO
        0:CLS:END
MC 510 IF COMMAND$<>"FILES" THEN
        520
IH 515 IF ARG$="" THEN ARG$="A:"
        ELSE SEL=1:GOSUB 600
IO 517 FILES ARG$:GOTO 130
DD 520 PRINT"Syntax error":GOTO
       130
BD 540 P=0:WHILE LNUM>LNUM(P) AN
       D P<MAX:P=P+1:WEND:RETURN
KM 560 MAX=MAX-1:FOR X=P TO MAX:
       LNUM(X)=LNUM(X+1):L$(X)=L
       $(X+1):NEXT:RETURN
BK 580 MAX=MAX+1:FOR X=MAX TO P+
       1 STEP -1:LNUM(X)=LNUM(X-
       1):L$(X)=L$(X-1):NEXT:L$(
       P)=TEXT$:LNUM(P)=LNUM:RET
       URN
BA 600 IF LEFT$(ARG$,1)<>CHR$(34
       ) THEN 520 ELSE ARG$=MID$
       (ARG$,2)
EE 610 IF RIGHT$(ARG$,1)=CHR$(34
       ) THEN ARG$=LEFT$(ARG$,LE
       N(ARG$)-1)
LA 620 IF SEL=0 AND INSTR(ARG$,"
       .")=0 THEN ARG$=ARG$+".BA
       S"
DD 630 SEL=0:RETURN
MM 640 CLOSE #1:CKFLAG=0:PRINT"S
       topped.":RETURN 150
II 650 PRINT "Error #";ERR:RESUM
       E 150
```

Program 4: Apple Proofreader

By Tim Victor, Editorial Programmer

```
10 C = 0: FOR I = 768 TO 768 +
   68: READ A:C = C + A: POKE I
   ,A: NEXT
20 IF C < > 7258 THEN PRINT "ER
   ROR IN PROOFREADER DATA STAT
   EMENTS": END
30 IF PEEK (190 * 256) < > 76 T
   HEN POKE 56,0: POKE 57,3: CA
   LL 1002: GOTO 50
40 PRINT CHR$ (4);"IN#A$300"
50 POKE 34,0: HOME : POKE 34,1:
    VTAB 2: PRINT "PROOFREADER
   INSTALLED"
60 NEW
100 DATA 216,32,27,253,201,141
110 DATA 208,60,138,72,169,0
120 DATA 72,189,255,1,201,160
130 DATA 240,8,104,10,125,255
140 DATA 1,105,0,72,202,208
150 DATA 238,104,170,41,15,9
160 DATA 48,201,58,144,2,233
170 DATA 57,141,1,4,138,74
180 DATA 74,74,74,41,15,9
190 DATA 48,201,58,144,2,233
200 DATA 57,141,0,4,104,170
210 DATA 169,141,96
```

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MLX Machine Language Entry Program For Commodore 64 and Apple

Ottis Cowper, Technical Editor and Tim Victor, Editorial Programmer

"MLX" is a labor-saving utility that allows almost fail-safe entry of machine language programs. The Apple version runs on the II, II+, IIe, and IIc, with either DOS 3.3 or ProDOS.

"MLX" is a new way to enter long machine language (ML) programs without a lot of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter invalid characters or let you continue if there's a mistake in a line. It won't even let you enter a line or digit out of sequence. For the Commodore 64, this new version of MLX was first introduced in the December 1985 issue. No version of 64 MLX published before that date can be used to enter the MLX-format listings in this issue.

Using MLX

Type in and save some copies of whichever version of MLX is appropriate for your computer (you'll want to use it to enter future ML programs from COMPUTE!). Program 1 is for the Commodore 64, and Program 2 is for the Apple. For Apple MLX, it doesn't matter whether you save the program on a disk formatted for DOS 3.3 or ProDOS. Programs entered with Apple MLX, however, must be saved to a disk formatted with the same operating system as MLX itself. If you have an Apple IIe or IIc, make sure that the key marked *Caps Lock* is in the down position.

When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing. If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, the 64 version will offer you the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session. In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. In the 64 version, if you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" machine language listings you may be accustomed to, the extra checksum number on the end allows MLX to check your typing. (Apple users *can* enter the data from an MLX listing using the built-in monitor if the rightmost column of data is omitted, but we recommend against it. It's much easier to let MLX do the proofreading and error checking for you.)

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, the data is added to the workspace area, and the prompt for the next line of data appears (the 64 version gives a pleasant beep to indicate that the line was entered correctly). But if MLX detects a typing error, you'll be notified of the mistake. The 64 version will sound a low buzz and display an error message, then redisplay the line for editing. Apple MLX sounds a beep to alert you of the error and then erases the incorrect line and prompts you to reenter it correctly.

After you have entered the last number on the last line of the listing, the Apple version will return to the command menu. At this point you should immediately choose the option S to save your data. The 64 version automatically moves to the Save option after the last number is entered.

Invalid Characters Banned

In 64 MLX, only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; the new MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; the new MLX automatically enters and checks the line after you type the last digit.

Apple MLX is fairly flexible about how you type in the numbers. You can put extra spaces between numbers or leave the spaces out entirely, compressing a line into 18 keypresses. But be careful not to put a space between two digits in the middle of a number. MLX will read two single-digit numbers instead of one two-digit number (F 6 means F *and* 6, not F6). You must press RETURN to enter the line.

Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), nothing happens (the 64 version gives a warning buzz to indicate an invalid keypress). Even better, MLX checks for transposed characters. If you're supposed to type in *A0* and instead enter *0A*, MLX will catch your mistake.

Editing Features

To correct typing mistakes before finishing a line in the 64 version, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line number prompt.

More editing features are available when correcting lines in which 64 MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the

screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Apple MLX also includes some editing features. The left- and right-arrow keys allow you to back up and go forward on the line you're entering so that you can retype data. Pressing the CONTROL (CTRL) and D keys at the same time (*delete*) removes the character under the cursor, shortening the line by one character. Pressing CONTROL-I (*insert*) puts a space under the cursor and shifts the rest of the line to the right, making the line one character longer. If the cursor is at the right end of the line, neither CONTROL-D nor CONTROL-I has any effect. To leave Enter mode, press the RETURN key when MLX prompts you with a new line address.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. With Apple MLX, you can stop the display and return to the menu by pressing any key. The 64 version allows you to stop the display and get back to the menu by pressing RETURN, or to pause the display by pressing the space bar (press space again to restart the display).

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE (SAVE DATA in the 64 version) and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. The 64 version will follow this by asking you to press either D or T to select disk or tape.

Those using the 64 version will notice the disk drive starting and stopping several times during a load or save. Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands. Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750), so this should *not* be included when entering the name. (This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name.)

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports any errors detected during the save or load. For the 64 version, the standard disk or tape error messages will be displayed. (Tape users should bear in mind that the Commodore 64 is never able to detect errors when saving to tape.) The 64 version also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The Apple version simply displays the message DISK ERROR if a problem is detected during a Save or Load. If you're not sure why a disk error has occurred, check the drive. Make sure there's a formatted disk in the drive and that it was formatted by the same operating system you're using for MLX (ProDOS or DOS 3.3). If you're trying to save a file and see an error message, the disk might be full. Either save the file on another disk or quit MLX (by pressing the Q key), delete an old file or two, then run MLX again. Your typing should still be safe in memory. If the error message appears during a Load, you may have specified a filename that doesn't exist on the disk.

The Quit menu option has the obvious effect—it stops MLX and enters BASIC. In the 64 version the RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP–RESTORE for the 64 or CONTROL-RESET for the Apple also gets you out.) The 64 version will ask for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option in 64 MLX.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some Commodore 64 ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk or LOAD *"filename"* for tape, and then RUN. (Such programs usually have 0801 as their MLX starting address.) Others must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. (On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000.) In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program. For the Apple, you need to BRUN the program, or you may BLOAD and start the program with a CALL. Again, refer to the article accompanying the machine language program for instructions.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you'll have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

In the Apple version, line 100 traps all errors to line 610. If MLX is typed in correctly, then only disk errors should normally be encountered. A disk error

message when you're not trying to access the drive—for example, when you first start entering data—indicates a typing error in the MLX program itself. If this occurs, hit CONTROL-RESET to break out of MLX and carefully compare your entry against the printed listing.

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

Program 1: MLX For Commodore 64

Version by Ottis Cowper, Technical Editor

```
100 POKE 56,50:CLR:DIM IN$,I,J
    ,A,B,A$,B$,A(7),N$ :rem 34
110 C4=48:C6=16:C7=7:Z2=2:Z4=2
    54:Z5=255:Z6=256:Z7=127
                       :rem 238
120 FA=PEEK(45)+Z6*PEEK(46):BS
    =PEEK(55)+Z6*PEEK(56):H$="
    0123456789ABCDEF" :rem 118
130 R$=CHR$(13):L$="{LEFT}":S$
    =" ":D$=CHR$(20):Z$=CHR$(0
    ):T$="{13 RIGHT}" :rem 173
140 SD=54272:FOR I=SD TO SD+23
    :POKE I,0:NEXT:POKE SD+24,
    15:POKE 788,52     :rem 194
150 PRINT"{CLR}"CHR$(142)CHR$(
    8):POKE 53280,15:POKE 5328
    1,15               :rem 104
160 PRINT T$" {RED}{RVS}
    {2 SPACES}{8 @}{2 SPACES}"
    SPC(28)"{2 SPACES}{OFF}
    {BLU} MLX II {RED}{RVS}
    {2 SPACES}"SPC(28)"
    {12 SPACES}{BLU}" :rem 121
170 PRINT"{3 DOWN}{3 SPACES}CO
    MPUTE!'S MACHINE LANGUAGE
    {SPACE}EDITOR{3 DOWN}"
                       :rem 135
180 PRINT"{BLK}STARTING ADDRES
    S{4}";:GOSUB300:SA=AD:GOSU
    B1040:IF F THEN180:rem 113
190 PRINT"{BLK}{2 SPACES}ENDIN
    G ADDRESS{4}";:GOSUB300:EA
    =AD:GOSUB1030:IF F THEN190
                       :rem 173
200 INPUT"{3 DOWN}{BLK}CLEAR W
    ORKSPACE [Y/N]{4}";A$:IF L
    EFT$(A$,1)<>"Y"THEN220
                       :rem 9
210 PRINT"{2 DOWN}{BLU}WORKING
    ...";:FORI=BS TO BS+EA-SA+
    7:POKE I,0:NEXT:PRINT"DONE
    "                  :rem 139
220 PRINTTAB(10)"{2 DOWN}{BLK}
    {RVS} MLX COMMAND MENU
    {DOWN}{4}":PRINT T$"{RVS}E
    {OFF}NTER DATA"    :rem 62
230 PRINT T$"{RVS}D{OFF}ISPLAY
     DATA":PRINT T$"{RVS}L
    {OFF}OAD DATA"     :rem 19
240 PRINT T$"{RVS}S{OFF}AVE FI
    LE":PRINT T$"{RVS}Q{OFF}UI
    T{2 DOWN}{BLK}"    :rem 238
250 GET A$:IF A$=N$ THEN250
                       :rem 127
260 A=0:FOR I=1 TO 5:IF A$=MID
    $("EDLSQ",I,1)THEN A=I:I=5
                       :rem 42
270 NEXT:ON A GOTO420,610,690,
    700,280:GOSUB1060:GOTO250
                       :rem 97
280 PRINT"{RVS} QUIT ":INPUT"
    {DOWN}{4}ARE YOU SURE [Y/N
    ]";A$:IF LEFT$(A$,1)<>"Y"T
    HEN220             :rem 189
290 POKE SD+24,0:END   :rem 95
300 IN$=N$:AD=0:INPUTIN$:IFLEN
    (IN$)<>4THENRETURN :rem 31
310 B$=IN$:GOSUB320:AD=A:B$=MI
    D$(IN$,3):GOSUB320:AD=AD*2
    56+A:RETURN        :rem 225
320 A=0:FOR J=1 TO 2:A$=MID$(B
    $,J,1):B=ASC(A$)-C4+(A$>"@
    ")*C7:A=A*C6+B     :rem 143
330 IF B<0 OR B>15 THEN AD=0:A
    =-1:J=2            :rem 132
340 NEXT:RETURN        :rem 240
350 B=INT(A/C6):PRINT MID$(H$,
    B+1,1);:B=A-B*C6:PRINT MID
    $(H$,B+1,1);:RETURN:rem 42
360 A=INT(AD/Z6):GOSUB350:A=AD
    -A*Z6:GOSUB350:PRINT":";
                       :rem 32
370 CK=INT(AD/Z6):CK=AD-Z4*CK+
    Z5*(CK>Z7):GOTO390:rem 131
380 CK=CK*Z2+Z5*(CK>Z7)+A
                       :rem 168
390 CK=CK+Z5*(CK>Z5):RETURN
                       :rem 159
400 PRINT"{DOWN}STARTING AT{4}
    ";:GOSUB300:IF IN$<>N$ THE
    N GOSUB1030:IF F THEN400
                       :rem 75
410 RETURN             :rem 117
420 PRINT"{RVS} ENTER DATA ":G
    OSUB400:IF IN$=N$ THEN220
                       :rem 85
430 OPEN3,3:PRINT      :rem 34
440 POKE198,0:GOSUB360:IF F TH
    EN PRINT IN$:PRINT"{UP}
    {5 RIGHT}";        :rem 6
450 FOR I=0 TO 24 STEP 3:B$=S$
    :FOR J=1 TO 2:IF F THEN B$
    =MID$(IN$,I+J,1)   :rem 226
460 PRINT"{RVS}"B$L$;:IF I<24T
    HEN PRINT"{OFF}";  :rem 15
470 GET A$:IF A$=N$ THEN470
                       :rem 135
480 IF(A$>"/"ANDA$<":")OR(A$>"
    @"ANDA$<"G")THEN540
                       :rem 100
490 IF A$=R$ AND((I=0)AND(J=1)
    OR F)THEN PRINT B$;:J=2:NE
    XT:I=24:GOTO550    :rem 46
500 IF A$="{HOME}" THEN PRINT
    {SPACE}B$:J=2:NEXT:I=24:NE
    XT:F=0:GOTO440     :rem 66
510 IF(A$="{RIGHT}")ANDF THENP
    RINT B$L$;:GOTO540:rem 107
520 IF A$<>L$ AND A$<>D$ OR((I
    =0)AND(J=1))THEN GOSUB1060
    :GOTO470           :rem 232
530 A$=L$+S$+L$:PRINT B$L$;:J=
    2-J:IF J THEN PRINT L$;:I=
    I-3                :rem 12
540 PRINT A$;:NEXT J:PRINT S$;
                       :rem 2
550 NEXT I:PRINT:PRINT"{UP}
    {5 RIGHT}";:INPUT#3,IN$:IF
     IN$=N$ THEN CLOSE3:GOTO22
    0                  :rem 106
560 FOR I=1 TO 25 STEP3:B$=MID
    $(IN$,I):GOSUB320:IF I<25
    {SPACE}THEN GOSUB380:A(I/3
    )=A                :rem 81
570 NEXT:IF A<>CK THEN GOSUB10
    60:PRINT"{BLK}{RVS} ERROR:
     REENTER LINE {4}":F=1:GOT
    O440               :rem 161
580 GOSUB1080:B=BS+AD-SA:FOR I
    =0 TO 7:POKE B+I,A(I):NEXT
                       :rem 245
590 AD=AD+8:IF AD>EA THEN CLOS
    E3:PRINT"{DOWN}{BLU}** END
     OF ENTRY **{BLK}{2 DOWN}"
    :GOTO700           :rem 207
600 F=0:GOTO440        :rem 84
610 PRINT"{CLR}{DOWN}{RVS} DIS
    PLAY DATA ":GOSUB400:IF IN
    $=N$ THEN220       :rem 146
620 PRINT"{DOWN}{BLU}PRESS:
    {RVS}SPACE{OFF} TO PAUSE,
    {SPACE}{RVS}RETURN{OFF} TO
     BREAK{4}{DOWN}"   :rem 241
630 GOSUB360:B=BS+AD-SA:FORI=B
    TO B+7:A=PEEK(I):GOSUB350:
    GOSUB380:PRINT S$; :rem 56
640 NEXT:PRINT"{RVS}";:A=CK:GO
    SUB350:PRINT       :rem 144
650 F=1:AD=AD+8:IF AD>EA THENP
    RINT"{DOWN}{BLU}** END OF
    {SPACE}DATA **":GOTO220
                       :rem 170
660 GET A$:IF A$=R$ THEN GOSUB
    1080:GOTO220       :rem 65
670 IF A$=S$ THEN F=F+1:GOSUB1
    080                :rem 28
680 ONFGOTO630,660,630:rem 224
690 PRINT"{DOWN}{RVS} LOAD DAT
    A ":OP=1:GOTO710   :rem 31
700 PRINT"{DOWN}{RVS} SAVE FIL
    E ":OP=0           :rem 32
710 IN$=N$:INPUT"{DOWN}FILENAM
    E{4}";IN$:IF IN$=N$ THEN22
    0                  :rem 229
720 F=0:PRINT"{DOWN}{BLK}{RVS}
    T{OFF}APE OR {RVS}D{OFF}IS
    K: {4}";           :rem 66
730 GET A$:IF A$="T"THEN PRINT
    "T{DOWN}":GOTO880  :rem 90
740 IF A$<>"D"THEN730  :rem 90
750 PRINT"D{DOWN}":OPEN15,8,15
    ,"I0:":B=EA-SA:IN$="0:"+IN
    $:IF OP THEN810    :rem 163
760 OPEN 1,8,8,IN$+",P,W":GOSU
    B860:IF A THEN220  :rem 66
770 AH=INT(SA/256):AL=SA-(AH*2
    56):PRINT#1,CHR$(AL);CHR$(
    AH);               :rem 221
780 FOR I=0 TO B:PRINT#1,CHR$(
    PEEK(BS+I));:IF ST THEN800
                       :rem 171
790 NEXT:CLOSE1:CLOSE15:GOTO94
    0                  :rem 230
800 GOSUB1060:PRINT"{DOWN}
    {BLK}ERROR DURING SAVE:{4}
    ":GOSUB860:GOTO220 :rem 61
810 OPEN 1,8,8,IN$+",P,R":GOSU
    B860:IF A THEN220  :rem 57
820 GET#1,A$,B$:AD=ASC(A$+Z$)+
    256*ASC(B$+Z$):IF AD<>SA T
    HEN F=1:GOTO850    :rem 155
830 FOR I=0 TO B:GET#1,A$:POKE
     BS+I,ASC(A$+Z$):IF ST AND
    (I<>B)THEN F=2:AD=I:I=B
                       :rem 180
840 NEXT:IF ST<>64 THEN F=3
                       :rem 20
850 CLOSE1:CLOSE15:ON ABS(F>0)
    +1 GOTO960,970     :rem 12
860 INPUT#15,A,A$:IF A THEN CL
    OSE1:CLOSE15:GOSUB1060:PRI
    NT"{RVS}ERROR: "A$:rem 114
870 RETURN             :rem 127
880 POKE183,PEEK(FA+2):POKE187
    ,PEEK(FA+3):POKE188,PEEK(F
    A+4):IFOP=0THEN920:rem 178
890 SYS 63466:IF(PEEK(783)AND1
    )THEN GOSUB1060:PRINT"
    {DOWN}{RVS} FILE NOT FOUND
```

```
    ":GOTO690          :rem 34
900 AD=PEEK(829)+256*PEEK(830)
    :IF AD<>SA THEN F=1:GOTO97
    0                  :rem 201
910 A=PEEK(831)+256*PEEK(832)-
    1:F=F-2*(A<EA)-3*(A>EA):AD
    =A-AD:GOTO930      :rem 75
920 A=SA:B=EA+1:GOSUB1010:POKE
    780,3:SYS 63338    :rem 107
930 A=BS:B=BS+(EA-SA)+1:GOSUB1
    010:ON OP GOTO950:SYS 6359
    1                  :rem 38
940 GOSUB1080:PRINT"{BLU}** SA
    VE COMPLETED **":GOTO220
                       :rem 139
950 POKE147,0:SYS 63562:IF ST<
    >64 THEN970        :rem 39
960 GOSUB1080:PRINT"{BLU}** LO
    AD COMPLETED **":GOTO220
                       :rem 126
970 GOSUB1060:PRINT"{BLK}{RVS}
    ERROR DURING LOAD:{DOWN}
    {4}":ON F GOSUB980,990,100
    0:GOTO220          :rem 233
980 PRINT"INCORRECT STARTING A
    DDRESS (";:GOSUB360:PRINT"
    )":RETURN          :rem 145
990 PRINT"LOAD ENDED AT ";:AD=
    SA+AD:GOSUB360:PRINT D$:RE
    TURN               :rem 159
1000 PRINT"TRUNCATED AT ENDING
     ADDRESS":RETURN   :rem 166
1010 AH=INT(A/256):AL=A-(AH*25
    6):POKE193,AL:POKE194,AH
                       :rem 95
1020 AH=INT(B/256):AL=B-(AH*25
    6):POKE174,AL:POKE175,AH:
    RETURN             :rem 122
1030 IF AD<SA OR AD>EA THEN105
    0                  :rem 135
1040 IF(AD>511 AND AD<40960)OR
    (AD>49151 AND AD<53248)TH
    EN GOSUB1080:F=0:RETURN
                       :rem 104
1050 GOSUB1060:PRINT"{RVS} INV
    ALID ADDRESS {DOWN}{BLK}"
    :F=1:RETURN        :rem 224
1060 POKE SD+5,31:POKE SD+6,20
    8:POKE SD,240:POKE SD+1,4
    :POKE SD+4,33      :rem 19
1070 FOR S=1 TO 100:NEXT:GOTO1
    090                :rem 90
1080 POKE SD+5,8:POKE SD+6,240
    :POKE SD,0:POKE SD+1,90:P
    OKE SD+4,17        :rem 182
1090 FOR S=1 TO 100:NEXT:POKE
    {SPACE}SD+4,0:POKE SD,0:P
    OKE SD+1,0:RETURN  :rem 8
```

Program 2: MLX For Apple

Version by Tim Victor, Editorial Programmer

```
100 N = 9: HOME : NORMAL : PRIN
    T "APPLE MLX": POKE 34,2: O
    NERR  GOTO 610
110 VTAB 1: HTAB 20: PRINT "STA
    RT ADDRESS";: GOSUB 530: IF
     A = 0 THEN  PRINT  CHR$ (7
    ): GOTO 110
120 S = A
130 VTAB 2: HTAB 20: PRINT "END
     ADDRESS  ";: GOSUB 530: IF
     S >  = A OR A = 0 THEN  PR
    INT  CHR$ (7): GOTO 130
140 E = A
150 PRINT : PRINT "CHOOSE: (E)NT
    ER DATA";: HTAB 22: PRINT "
    (D)ISPLAY DATA": HTAB 8: PR
    INT "(L)OAD FILE  (S)AVE FI
    LE  (Q)UIT": PRINT
160 GET A$: FOR I = 1 TO 5: IF
    A$ < > MID$ ("EDLSQ",I,1) T
    HEN  NEXT : GOTO 160
170 ON I GOTO 270,220,180,200:
    POKE 34,0: END
180 INPUT "FILENAME: ";A$: IF A
    $ <  > "" THEN  PRINT  CHR$
     (4);"BLOAD";A$;",A";S
190 GOTO 150
200 INPUT "FILENAME: ";A$: IF A
    $ <  > "" THEN  PRINT  CHR$
     (4);"BSAVE";A$;",A";S;",L"
    ;E - S
210 GOTO 150
220 GOSUB 590: IF B = 0 THEN 15
    0
230 FOR B = B TO E STEP 8:L = 4
    :A = B: GOSUB 580: PRINT A$
    ;": ";:L = 2
240 FOR F = 0 TO 7:V(F + 1) = P
    EEK (B + F): NEXT : GOSUB 5
    60:V(9) = C
250 FOR F = 1 TO N:A = V(F): GO
    SUB 580: PRINT A$" ";: NEXT
     : PRINT : IF  PEEK (49152)
     < 128 THEN  NEXT
260 POKE 49168,0: GOTO 150
270 GOSUB 590: IF B = 0 THEN 15
    0
280 FOR B = B TO E STEP 8
290 HTAB 1:A = B:L = 4: GOSUB 5
    80: PRINT A$;": ";: CALL 64
    668:A$ = "":P = 0: GOSUB 33
    0: IF L = 0 THEN 150
300 GOSUB 470: IF F < > N THEN
    PRINT CHR$ (7);: GOTO 290
310 IF N = 9 THEN GOSUB 560: IF
     C < > V(9) THEN PRINT CHR$
     (7);: GOTO 290
320 FOR F = 1 TO 8: POKE B + F
    - 1,V(F): NEXT : PRINT : NE
    XT : GOTO 150
330 IF LEN (A$) = 33 THEN A$ =
    0$:P = 0: PRINT CHR$ (7);
340 L = LEN (A$):0$ = A$:0 = P:
    L$ = "": IF P > 0 THEN L$ =
      LEFT$ (A$,P)
350 R$ = "": IF P < L - 1 THEN
    R$ =  RIGHT$ (A$,L - P - 1)
360 HTAB 7: PRINT L$;: FLASH :
    IF P < L THEN PRINT MID$ (A
    $,P + 1,1);: NORMAL : PRINT
    R$;
370 PRINT " ";: NORMAL
380 K = PEEK (49152): IF K < 12
    8 THEN 380
390 POKE 49168,0:K = K - 128
400 IF K = 13 THEN HTAB 7: PRIN
    T A$;" ";: RETURN
410 IF K = 32 OR K > 47 AND K <
     58 OR K > 64 AND K < 71 TH
    EN A$ = L$ + CHR$ (K) + R$:
    P = P + 1
420 IF K = 4 THEN A$ = L$ + R$
430 IF K = 9 THEN A$ = L$ + " "
     +  MID$ (A$,P + 1,1) + R$
440 IF K = 8 THEN P = P - (P >
    0)
450 IF K = 21 THEN P = P + (P <
     L)
460 GOTO 330
470 F = 1:D = 0: FOR P = 1 TO L
    EN (A$):C$ = MID$ (A$,P,1):
     IF F > N AND C$ < > " " TH
    EN  RETURN
480 IF C$ < > " " THEN  GOSUB 5
    20:V(F) = J + 16 * (D = 1)
    * V(F):D = D + 1
490 IF D > 0 AND C$ = " " OR D
    = 2 THEN D = 0:F = F + 1
500 NEXT : IF D = 0 THEN F = F
    - 1
510 RETURN
520 J = ASC (C$):J = J - 48 - 7
     * (J > 64): RETURN
530 A = 0: INPUT A$:A$ = LEFT$
    (A$,4): IF LEN (A$) = 0 THE
    N RETURN
540 FOR P = 1 TO LEN (A$):C$ =
    MID$ (A$,P,1): IF C$ < "0"
    OR C$ > "9" AND C$ < "A" OR
     C$ > "Z" THEN A = 0: RETUR
    N
550 GOSUB 520:A = A * 16 + J: N
    EXT : RETURN
560 C = INT (B / 256):C = B - 2
    54 * C - 255 * (C > 127):C
    = C - 255 * (C > 255)
570 FOR F = 1 TO 8:C = C * 2 -
    255 * (C > 127) + V(F):C =
    C - 255 * (C > 255): NEXT :
     RETURN
580 I = FRE (0):A$ = "": FOR I
    = 1 TO L:T =  INT (A / 16):
    A$ =  MID$ ("0123456789ABCD
    EF",A - 16 * T + 1,1) + A$:
    A = T: NEXT : RETURN
590 PRINT "FROM ADDRESS ";: GOS
    UB 530: IF S > A OR E < A O
    R A = 0 THEN B = 0: RETURN
600 B = S + 8 * INT ((A - S) /
    8): RETURN
610 PRINT "DISK ERROR": GOTO 15
    0
```

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MLX Machine Language Entry Program For Atari

Charles Brannon, Program Editor

MLX is a labor-saving utility that allows almost fail-safe entry of machine language programs published in COMPUTE!. *You need to know nothing about machine language to use MLX—it was designed for everyone.*

"MLX" is a new way to enter long machine language (ML) programs with a minimum of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter illegal characters when you should be typing numbers. It won't let you enter numbers greater than 255 (forbidden in ML). It won't let you enter the wrong numbers on the wrong line. In addition, MLX creates a ready-to-use tape or disk file.

Using MLX

Type in and save MLX (you'll want to use it in the future). When you're ready to type in an ML program, run MLX. MLX asks you for three numbers: the starting address, the ending address, and the run/init address. These numbers are given in the article accompanying the ML program presented in MLX format. You must also choose one of three options for saving the file: as a boot tape, as disk binary file, or as boot disk. The article with the ML program should specify which formats may be used.

When you run MLX, you'll see a prompt corresponding to the starting address. The prompt is the current line you are entering from the listing. It increases by six each time you enter a line. That's because each line has seven numbers—six actual data numbers plus a checksum number. The checksum verifies that you typed the previous six numbers correctly. If you enter any of the six numbers wrong, or enter the checksum wrong, the computer rings a buzzer and prompts you to reenter the line. If you enter it correctly, a bell tone sounds and you continue to the next line.

MLX accepts only numbers as input. If you make a typing error, press the DEL/BACK SPACE; the entire number is deleted. You can press it as many times as necessary back to the start of the line. If you enter three-digit numbers as listed, the computer automatically prints the comma and goes on to accept the next number. If you enter fewer than three digits, you can press the comma key, the space bar, or the RETURN key to advance to the next number. The checksum automatically appears in inverse video for emphasis.

MLX Commands

When you finish typing an ML listing (assuming you type it all in one session), you can then save the completed program on tape or disk. Follow the screen instructions. If you get any errors while saving, you probably have a bad disk, or the disk is full, or you've made a typo when entering the MLX program itself.

You don't have to enter the whole ML program in one sitting. MLX lets you enter as much as you want, save it, and then reload the file from tape or disk later. MLX recognizes these commands:

CTRL-S	**Save**
CTRL-L	**Load**
CTRL-N	**New Address**
CTRL-D	**Display**

To issue a command, hold down the CTRL key (CONTROL on the XL models) and press the indicated key. When you enter a command, MLX jumps out of the line you've been typing, so we recommend you do it at a new prompt. Use the Save command (CTRL-S) to save what you've been working on. It will save on tape or disk, as if you've finished, but the tape or disk won't work, of course, until you finish the typing. Remember to make a note of what address you stop at. The next time you run MLX, answer all the prompts as you did before—regardless of where you stopped typing—then insert the disk or tape. When you get to the line number prompt, press CTRL-L to reload the partly completed file into memory. Then use the New Address command to resume typing.

To use the New Address command, press CTRL-N and enter the address where you previously stopped. The prompt will change, and you can then continue typing. Always enter a New Address that matches up with one of the line numbers in the MLX-format listing, or else the checksum won't work. The Display command lets you display a section of your typing. After you press CTRL-D, enter two addresses within the line number range of the listing. You can break out of the listing display and return to the prompt by pressing any key.

Atari MLX: Machine Language Entry

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

```
DA 100 GRAPHICS 0:DL=PEEK(56
       0)+256*PEEK(561)+4:PO
       KE DL-1,71:POKE DL+2,
       6
NJ 110 POSITION 8,0:? "MLX":
       POSITION 23,0:? "fast
       safe entry":POKE 710,
       0:?
JK 120 ? "Starting Address";
       :INPUT BEG:? "  Endin
       g Address";:INPUT FIN
       :? "Run/Init Address"
       ;:INPUT STARTADR
DD 130 DIM A(6),BUFFER$(FIN-
       BEG+127),T$(20),F$(20
       ),CIO$(7),SECTOR$(128
       ),DSKINV$(6)
JJ 140 OPEN #1,4,0,"K:":? :?
       ,"Tape or Disk:";
BM 150 BUFFER$=CHR$(0):BUFFE
       R$(FIN-BEG+30)=BUFFER
       $:BUFFER$(2)=BUFFER$:
       SECTOR$=BUFFER$
GC 160 ADDR=BEG:CIO$="hhh":C
       IO$(4)=CHR$(170):CIO$
       (5)="LV":CIO$(7)=CHR$
       (228)
EJ 170 GET #1,MEDIA:IF MEDIA
       <>84 AND MEDIA<>68 TH
       EN 170
PO 180 ? CHR$(MEDIA):? :IF M
       EDIA<>ASC("T") THEN B
       UFFER$="":GOTO 250
PL 190 BEG=BEG-24:BUFFER$=CH
       R$(0):BUFFER$(2)=CHR$
       (INT((FIN-BEG+127)/12
       8))
KF 200 H=INT(BEG/256):L=BEG-
       H*256:BUFFER$(3)=CHR$
       (L):BUFFER$(4)=CHR$(H
       )
EC 210 PINIT=BEG+8:H=INT(PIN
       IT/256):L=PINIT-H*256
       :BUFFER$(5)=CHR$(L):B
       UFFER$(6)=CHR$(H)
PB 220 FOR I=7 TO 24:READ A:
       BUFFER$(I)=CHR$(A):NE
       XT I:DATA 24,96,169,6
       0,141,2,211,169,0,133
       ,10,169,0,133,11,76,0
       ,0
DP 230 H=INT(STARTADR/256):L
       =STARTADR-H*256:BUFFE
       R$(15)=CHR$(L):BUFFER
       $(19)=CHR$(H)
XL 240 BUFFER$(23)=CHR$(L):B
       UFFER$(24)=CHR$(H)
HI 250 IF MEDIA<>ASC("D") TH
       EN 360
DO 260 ? :? "Boot Disk or Bi
       nary File:";
LI 270 GET #1,DTYPE:IF DTYPE
```

```
      <>68 AND DTYPE<>70 TH
      EN 270
GM 280 ? CHR$(DTYPE):IF DTYP
      E=70 THEN 360
PJ 290 BEG=BEG-30:BUFFER$=CH
      R$(0):BUFFER$(2)=CHR$
      (INT((FIN-BEG+127)/12
      8))
KG 300 H=INT(BEG/256):L=BEG-
      H*256:BUFFER$(3)=CHR$
      (L):BUFFER$(4)=CHR$(H
      )
HH 310 PINIT=STARTADR:H=INT(
      PINIT/256):L=PINIT-H*
      256:BUFFER$(5)=CHR$(L
      ):BUFFER$(6)=CHR$(H)
AO 320 RESTORE 330:FOR I=7 T
      O 30:READ A:BUFFER$(I
      )=CHR$(A):NEXT I
GA 330 DATA 169,0,141,231,2,
      133,14,169,0,141,232,
      2,133,15,169,0,133,10
      ,169,0,133,11,24,96
OB 340 H=INT(BEG/256):L=BEG-
      H*256:BUFFER$(8)=CHR$
      (L):BUFFER$(15)=CHR$(
      H)
DO 350 H=INT(STARTADR/256):L
      =STARTADR-H*256:BUFFE
      R$(22)=CHR$(L):BUFFER
      $(26)=CHR$(H)
JP 360 GRAPHICS 0:POKE 712,1
      0:POKE 710,10:POKE 70
      9,2
JK 370 ? ADDR;":";:FOR J=1 T
      O 6
NF 380 GOSUB 570:IF N=-1 THE
      N J=J-1:GOTO 380
BF 390 IF N=-19 THEN 720
DI 400 IF N=-12 THEN LET REA
      D=1:GOTO 720
AI 410 TRAP 410:IF N=-14 THE
      N ? :? "New Address";
      :INPUT ADDR:? :GOTO 3
      70
JD 420 TRAP 32767:IF N<>-4 T
      HEN 480
AJ 430 TRAP 430:? :? "Displa
      y:From";:INPUT F:? ,"
      To";:INPUT T:TRAP 327
      67
ML 440 IF F<BEG OR F>FIN OR
      T<BEG OR T>FIN OR T<F
       THEN ? CHR$(253);"At
       least ";BEG;", Not M
      ore Than ";FIN:GOTO 4
      30
HH 450 FOR I=F TO T STEP 6:?
       :? I;":";:FOR K=0 TO
       5:N=PEEK(ADR(BUFFER$
      )+I+K-BEG):T$="000":T
      $(4-LEN(STR$(N)))=STR
      $(N)
MA 460 IF PEEK(764)<255 THEN
       GET #1,A:POP :POP :?
       :GOTO 370
FM 470 ? T$;",";:NEXT K:? CH
      R$(126);:NEXT I:? :?
      :GOTO 370
GA 480 IF N<0 THEN ? :GOTO 3
      70
HH 490 A(J)=N:NEXT J
JM 500 CKSUM=ADDR-INT(ADDR/2
      56)*256:FOR I=1 TO 6:
      CKSUM=CKSUM+A(I):CKSU
      M=CKSUM-256*(CKSUM>25
      5):NEXT I
KK 510 RF=128:SOUND 0,200,12
      ,8:GOSUB 570:SOUND 0,
      0,0,0:RF=0:? CHR$(126
      )
CN 520 IF N<>CKSUM THEN ? :?
       "Incorrect";CHR$(253
      );:? :GOTO 370
EK 530 FOR W=15 TO 0 STEP -1
      :SOUND 0,50,10,W:NEXT
       W
FL 540 FOR I=1 TO 6:POKE ADR
      (BUFFER$)+ADDR-BEG+I-
      1,A(I):NEXT I
HB 550 ADDR=ADDR+6:IF ADDR<=
      FIN THEN 370
GM 560 GOTO 710
FI 570 N=0:Z=0
PH 580 GET #1,A:IF A=155 OR
      A=44 OR A=32 THEN 670
FB 590 IF A<32 THEN N=-A:RET
      URN
EB 600 IF A<>126 THEN 630
ML 610 GOSUB 690:IF I=1 AND
      T=44 THEN N=-1:? CHR$
      (126);:GOTO 690
GN 620 GOTO 570
GJ 630 IF A<48 OR A>57 THEN
      580
AN 640 ? CHR$(A+RF);:N=N*10+
      A-48
EB 650 IF N>255 THEN ? CHR$(
      253);:A=126:GOTO 600
EH 660 Z=Z+1:IF Z<3 THEN 580
JH 670 IF Z=0 THEN ? CHR$(25
      3);:GOTO 570
KC 680 ? ",";:RETURN
NO 690 POKE 752,1:FOR I=1 TO
       3:? CHR$(30);:GET #6
      ,T:IF T<>44 AND T<>58
       THEN ? CHR$(A);:NEXT
       I
PI 700 POKE 752,0:? " ";CHR$
      (126);:RETURN
KM 710 GRAPHICS 0:POKE 710,2
      6:POKE 712,26:POKE 70
      9,2
FF 720 IF MEDIA=ASC("T") THE
      N 890
OJ 730 REM DISK
OK 740 IF READ THEN ? :? "Lo
      ad File":?
IG 750 IF DTYPE<>70 THEN 104
      0
AE 760 ? :? "Enter AUTORUN.S
      YS for automatic use"
      :? :? "Enter filename
      ":INPUT T$
GF 770 F$=T$:IF LEN(T$)>2 TH
      EN IF T$(1,2)<>"D:" T
      HEN F$="D:":F$(3)=T$
NJ 780 TRAP 870:CLOSE #2:OPE
      N #2,8-4*READ,0,F$:?
      :? "Working..."
JK 790 IF READ THEN FOR I=1
      TO 6:GET #2,A:NEXT I:
      GOTO 820
PO 800 PUT #2,255:PUT #2,255
DJ 810 H=INT(BEG/256):L=BEG-
      H*256:PUT #2,L:PUT #2
      ,H:H=INT(FIN/256):L=F
      IN-H*256:PUT #2,L:PUT
       #2,H
NF 820 GOSUB 970:IF PEEK(195
      )>1 THEN 870
IF 830 IF STARTADR=0 OR READ
       THEN 850
FD 840 PUT #2,224:PUT #2,2:P
      UT #2,225:PUT #2,2:H=
      INT(STARTADR/256):L=S
      TARTADR-H*256:PUT #2,
      L:PUT #2,H
HH 850 TRAP 32767:CLOSE #2:?
       "Finished.":IF READ
      THEN ? :? :LET READ=0
      :GOTO 360
HF 860 END
FO 870 ? "Error ";PEEK(195);
      " trying to access":?
       F$:CLOSE #2:? :GOTO
      760
MC 880 REM BOOT TAPE
HN 890 IF READ THEN ? :? "Re
      ad Tape"
HI 900 ? :? :? "Insert, Rewi
      nd Tape.":? "Press PL
      AY ";:IF  NOT READ TH
      EN ? "& RECORD"
LP 910 ? :? "Press RETURN wh
      en ready:";
JH 920 TRAP 960:CLOSE #2:OPE
      N #2,8-4*READ,128,"C:
      ":? :? "Working..."
NH 930 GOSUB 970:IF PEEK(195
      )>1 THEN 960
HH 940 CLOSE #2:TRAP 32767:?
       "Finished.":? :? :IF
       READ THEN LET READ=0
      :GOTO 360
HF 950 END
CD 960 ? :? "Error ";PEEK(19
      5);" when reading/wri
      ting boot tape":? :CL
      OSE #2:GOTO 890
MB 970 REM CIO Load/Save Fil
      e#2 opened  READ=0 fo
      r write, READ=1 for r
      ead
EA 980 X=32:REM File#2,*20
EF 990 ICCOM=834:ICBADR=836:
      ICBLEN=840:ICSTAT=835
MD 1000 H=INT(ADR(BUFFER$)/2
      56):L=ADR(BUFFER$)-H
      *256:POKE ICBADR+X,L
      :POKE ICBADR+X+1,H
FH 1010 L=FIN-BEG+1:H=INT(L/
      256):L=L-H*256:POKE
      ICBLEN+X,L:POKE ICBL
      EN+X+1,H
MD 1020 POKE ICCOM+X,11-4*RE
      AD:A=USR(ADR(CIO$),X
      )
BG 1030 POKE 195,PEEK(ICSTAT
      ):RETURN
KA 1040 REM SECTOR I/O
GC 1050 IF READ THEN 1100
HE 1060 ? :? "Format Disk In
       Drive 1? (Y/N):";
FC 1070 GET #1,A:IF A<>78 AN
      D A<>89 THEN 1070
EC 1080 ? CHR$(A):IF A=78 TH
      EN 1100
CP 1090 ? :? "Formatting..."
      :XIO 254,#2,0,0,"D:"
      :? "Format Complete"
      :?
AC 1100 NR=INT((FIN-BEG+127)
      /128):BUFFER$(FIN-BE
      G+2)=CHR$(0):IF READ
       THEN ? "Reading..."
      :GOTO 1120
LE 1110 ? "Writing..."
LI 1120 FOR I=1 TO NR:S=I
IO 1130 IF READ THEN GOSUB 1
      220:BUFFER$(I*128-12
      7)=SECTOR$:GOTO 1160
PL 1140 SECTOR$=BUFFER$(I*12
      8-127)
AM 1150 GOSUB 1220
DN 1160 IF PEEK(DSTATS)<>1 T
      HEN 1200
FB 1170 NEXT I
GM 1180 IF  NOT READ THEN EN
      D
DH 1190 ? :? :LET READ=0:GOT
      O 360
JJ 1200 ? "Error on disk acc
      ess.":? "May need fo
      rmatting.":GOTO 1040
KI 1210 REM
```

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```
BL 1220 REM SECTOR ACCESS S
        UBROUTINE
IB 1230 REM Drive ONE
IH 1240 REM Pass buffer in S
        ECTOR$
HP 1250 REM sector # in vari
        able S
EG 1260 REM READ=1 for read,
KJ 1270 REM READ=0 for write
BN 1280 BASE=3*256
GL 1290 DUNIT=BASE+1:DCOMND=
        BASE+2:DSTATS=BASE+3
NL 1300 DBUFLO=BASE+4:DBUFHI
        =BASE+5
AI 1310 DBYTLO=BASE+8:DBYTHI
        =BASE+9
JA 1320 DAUX1=BASE+10:DAUX2=
        BASE+11
PN 1330 REM DIM DSKINV$(4)
CA 1340 DSKINV$="hLS":DSKINV
        $(4)=CHR$(228)
PF 1350 POKE DUNIT,1:A=ADR(S
        ECTOR$):H=INT(A/256)
        :L=A-256*H
BP 1360 POKE DBUFHI,H
CO 1370 POKE DBUFLO,L
PD 1380 POKE DCOMND,87-5*REA
        D
AA 1390 POKE DAUX2,INT(S/256
        ):POKE DAUX1,S-PEEK(
        DAUX2)*256
KJ 1400 A=USR(ADR(DSKINV$))
KG 1410 RETURN
```

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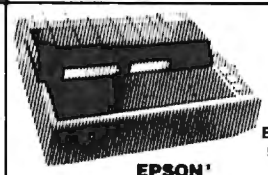

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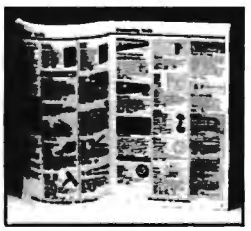

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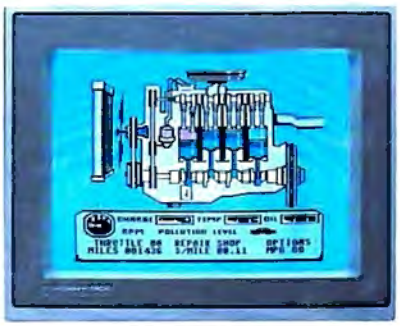

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