```
330 POKE 1439+I*3+1,143+16*(V-1):PO
    KE 1471+I*3+1,143+16*(V-1)
340 POKE 1439+I*3+2,143+16*(V-1):PO
    KE 1471+I*3+2,143+16*(V-1):SOUN
    D 128,3:NEXT I
350 FOR I=1 TO 2000:NEXT I:GOTO 190
360 REM PLAY A TUNE
370 FOR I=1 TO Y:SOUND 133,6
380 SOUND 159,6:SOUND 176,3:SOUND 1
    76,3:SOUND 159,6
390 NEXT I:SOUND 133,6:RETURN
400 X=1167:GOSUB 540:ON K+1 GOSUB 4
    20,440,450,460,470,480,490,500,
    510,520:REM DRAW NUMBERS
410 RETURN
420 POKE X,142:POKE X+1,141:POKE X+
    32,138:POKE X+33,133
430 POKE X+64,140:POKE X+65,140:RET
    URN
440 POKE X,133:POKE X+1,138:POKE X+
    32,133:POKE X+33,138:POKE X+64,
    132:POKE X+65,136:RETURN
450 POKE X,140:POKE X+1,143:POKE X+
    33,140:POKE X+32,143:POKE X+64,
    140:POKE X+65,140:RETURN
460 POKE X,140:POKE X+32,140:POKE X
    +64,140:POKE X+65,140:POKE X+1,
    143:POKE X+33,143:RETURN
470 POKE X,138:POKE X+32,140:POKE X
    +1,130:POKE X+33,142:POKE X+64,
    128:POKE X+65,136:RETURN
480 POKE X,143:POKE X+32,140:POKE X
    +64,140:POKE X+1,140:POKE X+33,
    143:POKE X+65,140:RETURN
490 POKE X,143:POKE X+32,143:POKE X
    +64,140:POKE X+1,140:POKE X+33,
    141:POKE X+65,140:RETURN
500 POKE X,140:POKE X+32,129:POKE X
    +64,132:POKE X+65,128:POKE X+1,
    141:POKE X+33,138:RETURN
510 POKE X,142:POKE X+32,142:POKE X
    +64,140:POKE X+65,140:POKE X+1,
    141:POKE X+33,141:RETURN
520 POKE X,142:POKE X+32,140:POKE X
    +64,140:POKE X+1,141:POKE X+33,
    141:POKE X+65,140:RETURN
530 REM DRAW BLOCK
540 FOR I=110 TO 236 STEP 32:PRINT
    @I,CHR$(128)+CHR$(128)+CHR$(128
    )+CHR$(128);:NEXT I:RETURN
```

Program 7: PC/PCjr Number Game

```
10 KEY OFF:WIDTH 40
20 GOSUB 280
30 CLS:DEF SEG=0:POKE 1047,PEEK(1047) OR
 32
40 COLOR 2
50 B1$=STRING$(3,219):B2$=B1$:B3$=B1$
60 R=INT(RND(1)*10):IF R=OLD THEN 60
70 OLD = R
80 GOSUB 180:COLOR 7
90 LOCATE 12,13:PRINT"Press This Key"
100 POKE 1050,PEEK(1052)
110 C$ = INKEY$:POKE 1050,PEEK(1052):Z =
 RND(1):IF C$ = "" THEN 110
120 IF C$=" " THEN CLS:END
130 IF VAL(C$)<>R THEN SOUND 80,7:GOTO 1
10
140 GOSUB 520
150 GOSUB 400
160 CLS
170 GOTO 60
180 CO=CO+1:IF CO=16 THEN CO=2
190 IF CO=8 THEN CO=9
200 FOR I=1 TO 6
210 X=A(R,I)
220 FOR J= 1 TO 8
230 COLOR 0:X=X*2
240 IF X>255 THEN X=X-256:COLOR CO
250 LOCATE I+3,J+16:PRINT CHR$(219)
260 NEXT J,I
270 RETURN
280 CLS:LOCATE 2,11:PRINT"Learn The Numb
ers"
290 LOCATE 5,2:PRINT"  This is a pre-sch
ool number recogni-";
300 PRINT "tion game. The computer displ
ays a"
310 PRINT "number, and you must find and
 press thatkey on your keyboard."
320 PRINT:PRINT"  If correct, that numbe
r of blocks is  drawn, and you are given
 another number.";
330 PRINT"If not correct, the computer w
ill ask  you for another answer."
340 PRINT:PRINT"  To stop the program, p
ress the space  bar whe asked for an ans
wer."
350 GOSUB 520
360 GOSUB 610
370 PRINT:PRINT"        hit any key to c
ontinue ";
380 V$ = INKEY$:Z=RND(1):IF V$ = "" THEN
 380
390 RETURN
400 IF R=0 THEN RETURN
410 X=1:X1=1:X2=R:H=1
420 FOR I= X1 TO X2 STEP X
430 CO=CO+1:IF CO=16 THEN CO=2
440 IF CO=8 THEN CO=9
450 COLOR CO*H:SOUND I*40+130,3
460 LOCATE 16,I*4-2:PRINT B1$:LOCATE 17,
I*4-2:PRINT B2$:LOCATE 18,I*4-2:PRINT B3$
470 NEXT I
480 IF X= -1 THEN RETURN
490 FOR U=1 TO 500*R:NEXT U
500 X=-1:X1=R:X2=1:H=0
510 GOTO 420
520 RESTORE
530 FOR I= 1 TO 8
540 READ B
550 SOUND B,7
560 SOUND 32767,2
570 NEXT I
580 RETURN
590 DATA 174.61,174.61,174.61,174.61
600 DATA 220,130.81,220,174.61
610 FOR I = 0 TO 9:FOR J = 1 TO 6:READ B
:A(I,J) = B:NEXT J,I:RETURN
620 DATA 60,102,110,118,102,60,24,56,24,
24,24,126
630 DATA 60,102,12,24,48,126,126,12,24,1
2,102,60
640 DATA 12,28,60,108,126,12,126,96,124,
6,102,60
650 DATA 60,96,124,102,102,60,126,6,12,2
4,48,48
660 DATA 60,102,60,102,102,60,60,102,62,
6,12,56
```

©

Dragonriders Of Pern For Commodore 64 And Atari

Shay Addams

Dragonriders mixes the plot line of Anne McAffrey's science fiction novels into a menu-driven, all-text adventure that incorporates a hi-res action sequence. The scenario unfolds on Pern, a faraway planet threatened by silvery alien life forms (Thread) drifting across space from a nearby red star to destroy everything they touch.

Only the flying dragons bred for centuries in the Weyrs of Pern's volcanic heights can incinerate the Thread before it hits the ground. In addition to a half-dozen Weyrs, the planet's fate is influenced by various Holds, which are guided by Lord Holders and Crafts Masters. Ultimate success hinges on forming alliances with these individuals and groups—so politicking, learning to figure out and manipulate people and events, is more important than hand-eye coordination. The computer moves for the other Weyrs in the solitaire game, and always controls the other Weyrs when more than one person is playing.

Negotiations And Intrigue

Gameplay consists of two phases, negotiation/intrigue and Thread fighting. Most of the time you'll be involved with the former. During this phase, an all-text "event screen" reveals exactly what's happening around Pern at the moment, with details on which Weyrs, Holds, or Craftsmen are currently engaged in negotiation or attempts to form alliances. The day on which these events will be settled is noted, and the current date is posted at the bottom right of the screen. When an event reaches its settlement date, the results are displayed at the bottom of the screen. Weddings (preceded with a flourish of trumpets), baby lizard hatchings, plagues, and other random events that can affect the outcome of the game also appear here.

To jump into the fray, press the fire button (or function key). You will see an "action menu." The menu offers a list of eight options that include description, negotiate, attempt alliance, invite to wedding or hatching, dragonrider or Lord Holder conclave, or duel. Below the menu, information on the status of your Weyr names your three strongest supporters among the Holds and Craftsmen, and other useful information. After choosing an option, you're presented with a list of the various Holds and Craftsmen and prompted to pick one.

Forming Alliances

The description option returns you to the event screen, where a terse paragraph on the individual tells his attitude toward you and drops other hints that will help determine the best way to convince him to form an alliance with your Weyr. If you've decided to negotiate or try to form an alliance, you get to choose up to three Holds or Craftsmen to assist you. (You cannot select to deal with anyone already engaged in a meeting.) Then you must pick from a menu of negotiating attitudes: pleading, conciliatory, amiable, forceful, or threatening.

Now you're returned to the event screen. No other actions are possible while awaiting the results of the meeting, so you're limited to reading the events of the day and plotting new strategies based on these happenings. If Sea Cliff Hold rejects an alliance with Telgar Weyr, for instance, you'll know that, depending on other variables, you should negotiate with Sea Cliff next. To enliven the gameplay, a vividly colored map of Pern occasionally takes over the screen and pinpoints the area where Thread is falling. A prompt asks who will send dragons, and the first player to respond can dispatch as few or as many dragons as he has on hand. It's important to defend the areas allied or bound to you,

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because other Holds will be more likely to form alliances with you.

A Turn (Pern year) takes two to seven minutes, depending on which of three speed settings is chosen, and you can choose to play games from 1 to 99 Turns long. Following each Turn, a victory status screen awards two points for each Hold and one for each Craft Hall you've allied with. You need 20 points to win.

Hi-Res Panorama

The Thread-fighting sequence is played on a colorful, hi-res panorama of Pern's countryside that's complete with a castle. As wisps of Thread drift slowly toward the surface, you maneuver a flying dragon that burns them up with its fiery breath while avoiding their deadly touch. It's vital to do well in this phase, in order to convince the Holds of your capability to defend them.

In flight, the dragon wraps around to the other side of the screen. Sprites are employed for a 3-D effect—you can point the dragon at the horizon and hit the stick to watch him shrink in size as he flies into the distance and vaporizes Thread that's falling further away. Before starting, you can set the level (0–3) at which Thread falls, and this sense of depth adds an effective new dimension to action games.

The screen flashes red when your dragon dies, and it's replaced by another until your supply of dragons is depleted. After all players have completed this phase, a results screen shows how many dragons were killed and which Holds are Thread-infested. At this point, you can save the game in progress to disk or continue with the next Turn of 240 days. One positive feature of the program is that it is entirely RAM-resident, so you never have to wait for it to access the disk for more data the way most adventures do.

The Agreeable Pern

Pern is unusual in its gameplay and structure, and even more so in its victory requirements—winning depends on getting characters to *agree* with you, not on the number *killed* by you. And if too many Holds get infested, no one wins. Much of the fun emerges from recognizing the traits of various characters, predicting and exploiting how they react to certain actions and persuasions, and ultimately being drawn into the day-to-day life and culture of Pern. If you're tired of shooting up the same retreaded space ships, weary of typing "look under rock," this one-of-a-kind game may offer the offbeat kind of entertainment you're seeking. *Dragonriders of Pern* is also an intriguing forerunner of the next generation of computer games, more than a few of which will also be based on established novels.

Dragonriders of Pern
Epyx
1043 Kiel Court
Sunnyvale, CA 94086
$39.95
Disk: C-64, Atari
Cassette: C-64

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Magic Voice Speech For The 64

Charles Brannon, Program Editor

Computers have been talking for a long time. When you dial a wrong number, you probably have heard AT&T's computer reciting the incorrect number. However, speech synthesis for microcomputers has only recently become affordable as a consumer item.

You can buy a disk drive to quickly load and save programs and files. A modem opens up

the world of on-line data bases and services. Add a printer to your system and you can process words, list programs, and print computer graphics. You can pick from a bevy of light pens, joysticks, graphics tablets, and other low-cost peripherals. But few peripherals have as dramatic an effect as giving your computer the power of speech.

A Natural Voice

Some synthesizers build words out of phonemes, the basic sounds that are inherent to speech, such as consonants and vowels. Since all the components of speech are available to phoneme-based synthesizers, they can speak any word, but they do sound metallic, inhuman, somewhat robotic. No one would mistake it for a natural voice.

Commodore uses a different technique. A limited vocabulary is spoken by a person and recorded on a mainframe computer. The digitized speech is then analyzed, compacted, and reconstructed. Because of the compacting, a minimum amount of memory is used. This enables Commodore to pack a lot of words into a small amount of memory.

Installation

The *Magic Voice* cartridge plugs into the Commodore 64 cartridge port. If you are using a TV, the *Magic Voice* module also has a plug that goes into the audio/video socket on your computer. The SID chip mixes its own sound with the voice, then drives it through the TV speaker. If you use a monitor or stereo for sound, you plug the audio out from the audio/video socket into the *Magic Voice* module. An output from the module is then attached to your monitor or stereo. In theory, this should work fine. But these two wires are usually molded together so it's difficult to plug the audio jack into *Magic Voice* and the video into your monitor. It's impossible if you use the rear connections on a Commodore monitor. The cable isn't long enough. Fortunately, you can buy an RCA phono extension cord to get the extra length.

Magic Voice knows 235 words. The vocabulary covers a wide variety of common words and a list of computer-specific terms such as *cursor* and *disk.* The cartridge automatically adds commands to BASIC without using any of the BASIC memory space. Machine language programmers, however, will have to live without the memory at $C000–$C3FF, which is used by *Magic Voice.*

To program speech, you use the command SAY. SAY "HI" will do just that. The female voice is remarkably pure and natural. In fact, you can actually mistake the voice for that of a real person. You can also use variables, such as SPEAK A$. One limitation of SAY is that you must use a separate statement for each word. You cannot SAY "YOU ARE CORRECT", but must SAY "YOU":SAY "ARE":SAY "CORRECT".

When a voice is playing, the 64 does not wait for it to finish. This lets your program run quickly, since the speech doesn't slow it down. The computer will wait for the word to be finished if you send another word while it is speaking. A system variable called RDY is added to BASIC to let you detect when the box is through talking.

No Chipmunks

You can speed up or slow down the rate of speech, but not dramatically. The RATE command accepts a number from one to ten. Rate #4 is the normal, default setting. Rate #1 speaks 0.65 times slower than normal, and rate #10 is 1.4 times faster. Changing the rate doesn't change the pitch. You won't get a chipmunk sound. The remaining command, VOC, is only used when you've loaded additional words into memory (more on that later).

These new BASIC commands make programming speech easy. You can also refer to words by their number in the dictionary. For example, SAY 157 will utter "YES." This is the most memory-efficient technique, but it makes your program hard to read.

The biggest problem is trying to find the words you need to communicate. Since there are only 235 words, you cannot say everything that comes to mind. The manual includes two vocabulary listings, one of them in alphabetical order to help you quickly find the available words. There are no basic phonemes, so there is no way to construct words not in the vocabulary.

This problem can be alleviated by adding additional speech cartridges that expand the vocabulary. Commodore has promised variations on the voice such as male and child voices. There are also two Commodore games that can use *Magic Voice—Gorf* and *Wizard of Wor.* When your ship is destroyed, Gorf laughs, "HA-HA-HA SPACE CADET." Psychological warfare, with the computer challenging and taunting you, adds an extra dimension to game play. Curiously, this voice is computery and hard to understand, following the example set by the arcade versions of the games.

The manual gives an adequate explanation on how to use the module, and has many example BASIC programs that use speech, such as a program that can say any number up to 999,999,999 by stringing together words like "two - million - one - hundred - thousand - four - hundred - thirty-two." There is also good documentation for using *Magic Voice* Kernal routines in machine language programs. There is no documen-

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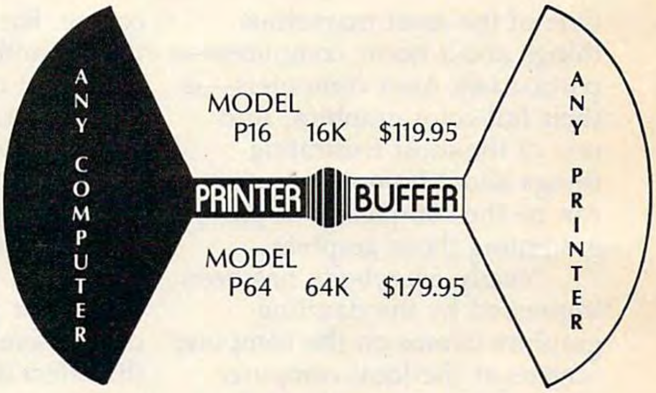

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tation on how you can digitize and create new words. That would require expensive equipment in any case.

Applications

What can you do with *Magic Voice?* Games that speak set up a better computer-human rapport. Talking prompts and instructions allow youngsters who cannot yet read to more easily interact with the computer. This is ideal for educational applications. Word processing programs can use spoken messages when a displayed prompt might be overlooked. And for the handicapped, the *Magic Voice* can read for the blind and talk for the speech-impaired. As you type, each letter can be pronounced, which can also help teach touch typing. Also, Commodore has announced plans to support *Magic Voice* in future software offerings.

Commodore Business Machines, Inc.
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West Chester, PA 19380
Price not yet announced.
Expected to be around $50. ©

Atari Touch Tablet And Light Pen

Tom R. Halfhill, Staff Editor

One of the most marvelous things about home computers—particularly Atari computers—is their full-color graphics. And one of the most frustrating things about home computers can be the complexity of programming those graphics.

Nearly everybody has been impressed by the dazzling graphics demos on the computer screens at the local computer shop or department store. But when you first bring the computer home, unwrap it, set it up, and plug it in, the screen is forbiddingly blank—all it says is READY.

The computer may be ready, but you aren't. Where do you start? How can you learn to create those wonderful graphics which helped sell you on the computer in the first place?

If you're ambitious, you might start tackling the BASIC programming manual, plus other books and magazines. But it could require hours of study before your first crude graphics even begin to appear on the screen. And by then you'll be yearning for a better way.

There *are* better ways, of course. For instant results, there's nothing like plugging in some sort of input device which lets you draw and paint using skills you've been developing since your first scribbles in kindergarten. Ideally, this input device should feel to your fingers like a traditional pencil, crayon, or paintbrush; its effect on the screen should resemble the effect of these conventional tools on paper; and it should insulate you from the extensive programming.

Some graphics-drawing programs use joysticks or paddle controllers as input devices. These are not traditional drawing implements, but they aren't hard to master—particularly if you've played videogames. Still, it would be nice if the years you spent learning how to manipulate pencils, pens, and paintbrushes could be wedded directly to an input device which *acts* like a pencil, pen, or paintbrush, and which also eliminates the need to program the computer on its own level. Such a device would also make the computer much more accessible to youngsters. They're still struggling to develop basic skills and don't need anything extra to confuse them.

Generally, two solutions have been invented: light pens and touch tablets (also called graphics tablets). Examined objectively, they are technically similar—both translate the position of a stylus into coordinates which the computer understands as a point on the screen. Therefore, both devices bypass a major step in programming.

But in other, more subjective ways, light pens and touch tablets are quite different. Each device has its own "feel," and the ultimate choice must depend on your own preferences. It's analogous to the differences between drawing in chalk or in pen-and-ink. When choosing between a light pen and a touch tablet, your best bet is to try your hand at both before deciding. However, there are a few objective differences which might sway your decision one way or the other. Fortunately, two recent products from Atari, Inc., give Atari users a wider choice between these two types of drawing tools.

Compatible With Almost Any System

The Atari Light Pen package includes a stylus with a touch-sensitive tip that plugs into a joystick port with a 46-inch cord; *AtariGraphics* software on a snap-in ROM cartridge; and a 20-page manual. The package works on any Atari computer, but at least 48K RAM is recommended (and required to save screen images on disk). To save screens on tape, at least 16K RAM is required.

The Atari Touch Tablet package includes a graphics tablet with two fire buttons that plugs into a joystick port with a 48-inch cord; a plastic stylus with a tiny fire button that plugs into the tablet via a 27-inch cord; *AtariArtist* software on a ROM cartridge; a DOS 3.0 diskette; and a 21-page manual.

The package works on any Atari computer with at least 16K RAM.

Getting started with either package is quick and easy. You just plug in the light pen or touch tablet, insert the ROM cartridge, and switch on the computer. If you have a disk drive, you insert a system disk with DOS before booting up. Both packages seem to work equally well with all versions of Atari and OS/A+ DOS.

Light pens require calibration, so the first thing the *AtariGraphics* software asks you to do is point the pen at a certain spot on the screen. If nothing happens, it probably means the brightness on your TV or monitor is too low. Remember, a light pen contains a photosensor that actually reads the light emitted by the screen. If there isn't enough light, the computer can't determine where the pen is pointing.

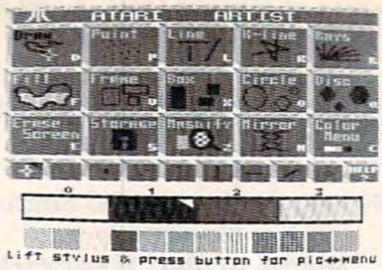
Proper calibration is the Achilles heel of light pens, and the Atari Light Pen is no exception. Response can vary from screen to screen, static electricity can interfere with the readings, and generally you'll have to turn up the brightness until the colors are partially washed out. In fact, some dark colors won't register a reading at all. One solution is to draw with bright colors and then change them into the darker colors you really want after the work is finished. Fortunately, because the Atari is the only home computer besides the IBM PCjr with color indirection, this is very easy to do. After the light pen is calibrated, the main drawing screen appears.

The touch tablet, of course, requires no calibration, so after a title screen, the main menu screen appears.

Two Types Of Menus

Although the *AtariGraphics* (light pen) and *AtariArtist* (touch tablet) programs share many similarities, they have different

An example of two pull-out menus with the Atari Light Pen's AtariGraphics *software. They slide across your picture when you touch the pen to one of the tiny tabs along the left side of the screen.*



Instead of pull-out menus, the Atari Touch Tablet's AtariArtist *software has this separate menu screen, available by pressing a button.*

This screen picture—a TV station logo—was created by slipping a bumper sticker beneath the touch tablet's plastic surface and tracing the design with the stylus.

kinds of menus. The *AtariGraphics* software was obviously influenced by the philosophy exemplified by the Apple Macintosh. Along the left side of the screen are four tiny white tabs; pressing the light pen to any of them causes a menu to slide over your drawing. The four menus allow you to choose drawing modes, colors, patterns, and storage options. When you point to the tab again, the menu slides back off the screen, leaving your drawing intact. You can even make the tabs themselves disappear by pressing the TAB key on the keyboard.

In contrast to this pull-out menu approach, the *AtariArtist* software has the more conventional alternate menu screen. Pressing either fire button on the touch tablet or the button on the stylus instantly flips between the drawing screen and the menu.

With either program, selecting menu options requires only two steps. All the options are represented on the screen as icons—small self-explanatory pictures. With the light pen, you point to the option icon you want and then softly push the pen against the screen. The pen's pressure-sensitive tip registers your choice. When using the tablet, you move a pointer around the screen by gently touching the tablet's surface with the stylus or your finger. When the pointer indicates the function you want, you press either fire button on the tablet or the button on the stylus. Again, this confirms your choice. (With three buttons to choose from, lefties aren't left out.)

The menu options available in *AtariArtist* and *AtariGraphics* are quite similar. With either system you can draw freehand; automatically draw circles, rectangles, and straight lines connecting any two points; automatically fill any shape with a wide variety of colors and patterns; change your selection of colors and patterns; magnify a picture for fine detail work; draw in two-way or four-way mirror modes, in which each stroke on one part of the screen is mirrored on the opposite part; and, of course, save/load screens using disk or tape.

Color Tradeoffs

But there are important differences between the two programs, too. For instance, the *AtariGraphics* light pen software has three major functions missing from *AtariArtist*: You can enter text on the screen from the keyboard; superimpose a grid of dots over your picture as a guide for drawing straight lines or proportioning; and draw any kind of parallelogram, not just squares and rectangles.

On the other hand, the *AtariArtist* touch tablet software has options that *AtariGraphics* lacks: you can draw discs (solid circles) and boxes (solid rectangles); you can draw "rays" (numerous lines emanating from a single point); and you can vary the brush stroke of the stylus from fine to broad, or even simulate drawing with two or three styli at once.

Of course, there are ways around each program's limitations. You could make discs and boxes with the light pen by drawing a circle or rectangle, then filling it; you could draw parallelograms with the touch tablet by connecting straight lines; and you could produce rays with the light pen by drawing each radiating line separately. It's probably safe to say that any screen which could be created with one system could be duplicated with the other.

Both *AtariGraphics* and *AtariArtist* let you work with a palette of 128 possible colors, of which only four can be displayed on the screen simultaneously. At first this might seem like an odd limitation, since Atari computers are capable of 256 colors. The explanation is that Atari had to compromise to keep the packages compatible with *all* Atari computers, past and present. Ataris manufactured before early 1982 have the CTIA graphics chip instead of the more recent GTIA. The CTIA chip displays only half as many luminances—eight for each of the 16 colors, instead of the GTIA's 16 luminances.

The limit of four simultaneous colors is another compromise. Some Atari graphics modes can display more than four colors, but at lower resolutions. *AtariArtist* and *AtariGraphics* both employ a graphics mode of 160 by 192 pixels (screen dots), sometimes referred to as GRAPHICS 7-1/2. It can be accessed on Atari XLs in BASIC, but not on previous Ataris without special programming. The Atari's maximum resolution is 320 × 192 pixels (GRAPHICS 8), but that mode offers only two colors. So Atari traded less resolution for more colors.

Interestingly, though, the pointer on the *AtariArtist* color mode steps twice for each luminance level—as if the 16-luminance, 256-color capabilities were built-in, but dormant.

Canvas Vs. Sketchbook

The drawing possibilities offered by the *AtariGraphics* and *AtariArtist* programs are so much alike that a purchase decision will probably be based on the hardware: light pen versus touch tablet (unfortunately, the light pen software won't work with the touch tablet or vice versa). This is where your personal sense of each device's "feel" is all-important.

The idea of a light pen might seem more natural. After all, it's like moving a paintbrush across a canvas or a crayon across paper. It's the way you've always created paintings or drawings.

The touch tablet, in contrast, might seem unnatural. Unlike any traditional art medium, it separates the mechanical action from the artwork. It's sort of like drawing by remote control.

But all is not as it seems. Light pens can be finicky as mentioned above. Also—and don't underestimate this—light pens can strain your arm and eyes, because you have to reach up to the screen and sit very close.

The touch tablet lets you relax at a comfortable distance from the computer, but it also takes some getting used to. The separation of manipulation from creation is analogous to word processing. When writing, you're supposed to look at the screen instead of the keyboard; likewise, when drawing you're supposed to look at the screen instead of the tablet. Most people catch on fairly quickly.

The touch tablet does have several advantages which are more tangible. It's probably more suitable for small children, since it responds better and can be manipulated with fingers instead of a stylus. You can copy small pictures with it by slipping the picture beneath the removable plastic surface and then tracing it with the stylus.

The *AtariArtist* color menu includes a spectacular option that lets you temporarily replace any of the four screen colors with a scrolling 128-color rainbow. Another option calls up a help screen for confused beginners. The magnify option is by far more versatile—you can perform virtually any function available in the normal mode, while the light pen software merely lets you change the colors of pixels. And finally, pictures made with the tablet take up much less room on tape or disk than pictures made with the light pen, thanks to a data-compaction scheme.

Before buying one of these packages, at least give the other a fair test. Either way it's hard to go wrong. Both are high-quality, well-designed products.

Atari Touch Tablet $89.95
Atari Light Pen $99.95
Atari, Inc.
1265 Borregas Avenue
P.O. Box 427
Sunnyvale, CA 94086

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Questions Beginners Ask

Tom R. Halfhill, Staff Editor

Are you thinking about buying a computer for the first time, but you don't know much about computers? Or maybe you recently purchased a computer and are still a bit baffled. Each month in this column, COMPUTE! *will answer questions often asked by beginners.*

Q I am interested in purchasing a printer to go along with my computer. Several questions come to mind. First of all, what is meant by *parallel* and *serial* as related to printers? Do most new printers have a built-in interface of one type or another? I know the Atari printers do (I own an Atari 800XL), but what about third-party printers? What type of peripheral port does Atari use? The RS-232C or the Centronics standard? Numerous advertisements for printers in your publication claim compatibility with one brand or another. Does that mean the printer can be directly connected without an extra interface device? Most of the ads for printers do not specify the brand of computer that they are compatible with. Is it because the appropriate interface can be purchased separately? I'm sure there are plenty more folks out there who, like me, need answers to these questions.

A Welcome to the world of personal computing, where frequently used terms often have ambiguous meanings and few things are as simple as they should be.

There are indeed plenty of folks out there who would like answers to those questions. Similar questions are asked by practically everybody who starts shopping for a printer for the first time. Let's tackle them one by one.

The terms *serial* and *parallel* refer to the two general types of computer interfaces. They apply to all computer devices, not just printers. (An interface is simply a connection between two parts of a computer system.)

A serial interface transfers information one bit at a time, one after the other. Since it takes eight bits to represent one character, a computer hooked up with a serial interface to a printer must send a stream of eight signals each time a character is to be printed.

A parallel interface, on the other hand, transfers information eight bits at a time, all at once. A computer hooked up with a parallel interface to a printer can send the eight signals simultaneously for every character to be printed. Therefore, when all other things are equal, a parallel interface is much faster than a serial interface.

Here's an analogy: Think of a multiplex movie theater at a shopping mall, one with eight separate screens showing eight different movies. If the ticket booth is staffed by only one person (as they frequently are), everyone has to wait in one very long line, no matter which movie they want to see. The line moves relatively slowly. But if the ticket booth is staffed by eight people, one for each screen, the lines move about eight times faster. That's the difference between serial and parallel.

So, you might conclude that a printer with a parallel interface is preferable to one with a serial interface. But in practice, the printer interface's speed isn't too important for average home users. Under-$1000 printers are generally limited by the speed of their own printing mechanisms, not by the speed at which the interface can transmit data. Instead, your decision should be based on which interface is more readily available for less money.

Nearly all printers come with one type of interface built-in, either parallel or serial. Some have both. Some have neither. So you can order them with the one you want. And some printers have one interface plus the option of adding a second. If this information is not in the advertisement, you'll have to contact the manufacturer, distributor, or dealer.

There are many different kinds of serial and parallel interfaces, but over the years two have become accepted as de facto standards for personal computer printers. The most common serial interface is called the RS-232C, and the most common parallel interface is called the Centronics standard (named after the manufacturer which made it popular). Probably 90 percent of the printers you see will have one interface or the other, especially printers made by *third-party companies* (independent firms which are not connected with a computer manufacturer).

Many personal computers—including the Atari, Commodore 64, VIC-20, Apple II/IIe, TI-99/4A, and IBM PC—do not include an RS-232C or Centronics interface as standard equipment. This means you either have to buy a printer made to plug directly into the computer, or buy an interface that will connect your computer to an RS-232C or Centronics-standard printer.

Atari computers do have a built-in serial interface, but it's not RS-232C standard. The Atari 600XL and 800XL also have a built-in parallel interface, but it's not Centronics standard. Both interfaces are unique to Atari, and they're made for plugging in Atari-compatible disk drives, cassette recorders, and other peripherals. The serial interface—that large socket on the right-hand side of the computer—works directly with the new line of Atari printers, including the 1025 dot-matrix printer, the 1020 color printer, and the 1027 letter-quality printer. No extra interface is required.

Although the computer manufacturer's own printers are usually the safest bet for full compatibility, you may want to buy a third-party printer for certain features or for a lower price. To hook up an RS-232C or Centronics-standard printer to your Atari, you'll need the Atari 850 Interface Module. It has one Centronics port and four RS-232C ports. Unfortunately, these modules cost about $175, and they're hard to find. Fortunately, equivalent interfaces are available from third-party companies for less money, and at least one third-party Atari-compatible disk drive has such an interface built-in.

Also, Atari planned to introduce something called the 1090XL Expansion System for the 600XL and 800XL. This is a box which plugs into the rear parallel expansion port found only on the 600XL/800XL, adding five expansion slots. The slots would accept more memory and various types of interface cards. However, Atari's recent sale and massive layoffs might affect future plans for such new products.

Anyway, once you add an RS-232C or Centronics interface to your computer, all you need is a compatible printer and a cable. When an advertisement states that a certain printer is "compatible" with your computer, it can mean two things: Either the printer is directly compatible (no extra interface required), or it's compatible with your computer only if you already have the RS-232C or Centronics interface. It's up to you to determine which. Always check before you buy, and make sure the proper cable is available, too. Strange as it may seem, not all RS-232C or Centronics ports take the same plugs. Sometimes the pins are wired differently. Specify the exact configuration of your system so the dealer can steer you to the printer, interface, and cable which will match together correctly.

Of course, everything we've discussed so far is limited to *hardware* compatibility. If you're planning to use the printer with a certain program—such as a word processor—you should also think about *software* compatibility. Certain programs can't take advantage of all the special features built into certain printers, and vice versa. But that's a topic for another column. For more information on matching printers and word processors, see "Questions Beginners Ask," COMPUTE!, March 1984. ©

It all adds up...

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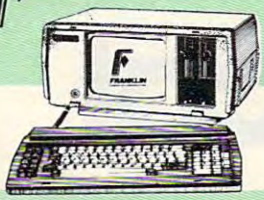

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Robert Alonso, Assistant Editor

Logical Dreams

"If" is one of the most useful words in our vocabulary; it allows us to test situations and make appropriate decisions based on the test. Likewise, the BASIC command IF is one of the most useful words in the computer's vocabulary, and for the same reasons. Computer programs always rely on logical decisions to produce a result. Everything from data processing applications to arcade-style games relies on IF-THEN testing. The format is pretty simple: *if* something is true, *then* do something in response. For example, IF *joystick is pushed up*, THEN *move spaceship up*.

Using The Right IF

The IF-THEN statement can often be replaced with the statement IF-GOTO. Before mixing the statements or replacing one with the other in your programs, you must first understand the nature of each. IF-THEN is the most convenient and safest to use of the two. The reason for this is that almost any instruction placed after the THEN will be executed without any problems. You can place a line number after the THEN and the program will go to that line number, or you can place an expression such as A=A+1 and the program will execute it. The IF-THEN statement can thus be a very powerful and useful part of your programs. IF-GOTO is not as versatile as IF-THEN because it can only execute line numbers after the GOTO. If you tried placing an expression such as the previously mentioned A=A+1, the computer would flag it as an error.

IBM's Double GOTO

The Apple, Atari, and Commodore computers all flagged Program 1 as having an error in the line containing the IF-GOTO. The only two computers tested that did not flag it as an error were the IBM PC and PCjr. The IBM computers allowed the expression A=A+1 after an IF-GOTO and also allowed the following line:

```
20 IF A=1 GOTO GOTO 40
```

The double GOTO was allowed only if a line 40 had been entered and only after the IF statement. A program with a line number followed by double GOTOs and a target line number resulted in an error. This kind of rule bending is atypical of IBM. Just for reference you should know that the second edition (May 1982) of the BASIC manual by IBM and Microsoft states: "If the expression is true (not zero), the THEN or GOTO clause is executed. THEN may be followed by either a line number for branching or one or more statements to be executed. GOTO is always followed by a line number."

Although IBM may let you get away with an expression after an IF-GOTO, you should try to avoid such a construction within your programs. It is not standard and can produce errors and plenty of confusion. It is probably better to use only the IF-THEN statement because it allows either an expression or a line number and works the same on all the tested computers.

Sometimes an IF-THEN construction alone is not enough. In some situations, a structure called IF-THEN-ELSE can be useful. This structure is quite similar, but allows you to specify two THEN outcomes (one that's triggered by the IF and one that's triggered by an implied "IF NOT"). In other words, if the condition following the IF is true, whatever follows the THEN is carried out. If it is false, whatever follows the ELSE is carried out.

The Missing ELSE

However, this IF-THEN-ELSE construction is almost never used in programs published in magazines and books. The reason for this is not that there is something better, but that many home computers (Apple, Atari, and Commodore) do not have an ELSE command as part of their BASIC. IBM is one of the few that do allow IF-THEN-ELSE. The TI *Extended BASIC* cartridge also allows it.

There is a way to mimic IF-THEN-ELSE. Let's say that you want to test if a variable is equal to 100 and you want the THEN to end the program if it is. Otherwise, you want an ELSE to add 1 to the variable and let the program continue. Program 2 is an example of a routine that will do just that, without the ELSE command.

Imitating IF-THEN-ELSE

The IF-THEN-ELSE construction is in lines 30 and 40. The reason this works is that if the IF-THEN in line 30 is false, program execution "falls through" to line 40. The line following an IF-THEN can thus be used for the ELSE. There are some extra precautions that you should take. If the IF-THEN in line 30 had an expression (like A=A+1) instead of the END instruction, the program would execute the expression and then go to the next line and execute the line which you are using as an ELSE. This must be avoided or your program will not work properly. Program 3 is an example of how to properly mimic an IF-THEN-ELSE.

Take a look at the differences between Programs 2 and 3. The GOTO 50 in line 30 of Program 3 prevents the program from going on to line 40 when the IF condition is true. You should always include a GOTO with a target line number at the end of your IF-THEN if you are going to create the IF-THEN-ELSE construction. It is the only way to insure that the ELSE condition will not be executed haphazardly.

Program 1: IF-GOTO Error Demo

```
10 A=1
20 IF A=1 GOTO A=A+1
30 PRINT A
```

Program 2: IF-THEN-ELSE Construction

```
10 A=0: B=0: REM INITIALIZE
20 B=B+A: REM EXPRESSION
30 IF A=100 THEN END: REM IF THEN
40 A=A+1: GOTO 20: REM ELSE
```

Program 3: Better IF-THEN-ELSE

```
10 A=0: B=0: REM INITIALIZE
20 B=B+A: REM EXPRESSION
30 IF A=100 THEN PRINT B: GOTO 50: REM IF THEN
40 A=A+1: GOTO 20: REM ELSE
50 END
```

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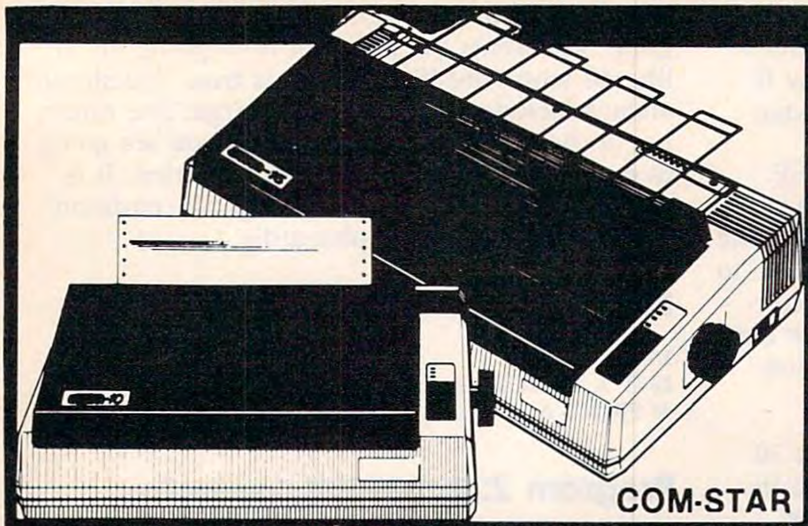

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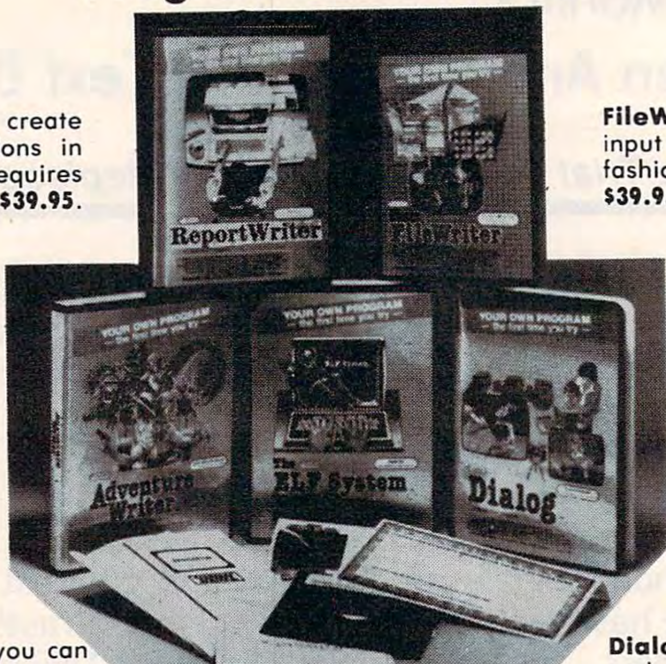

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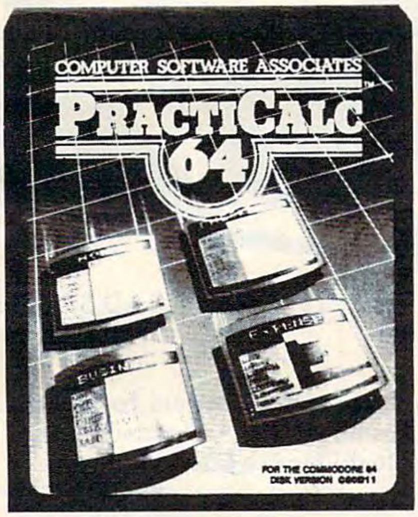

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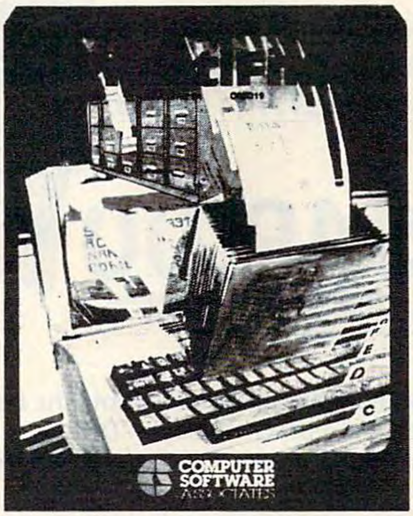

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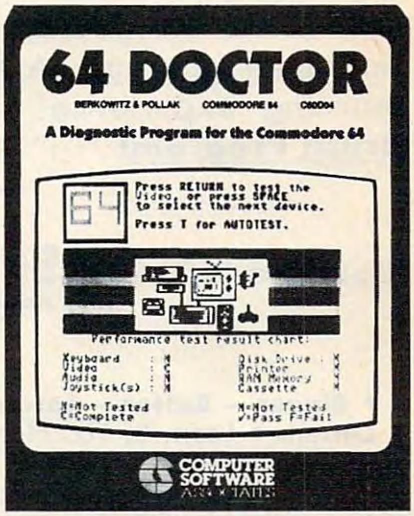

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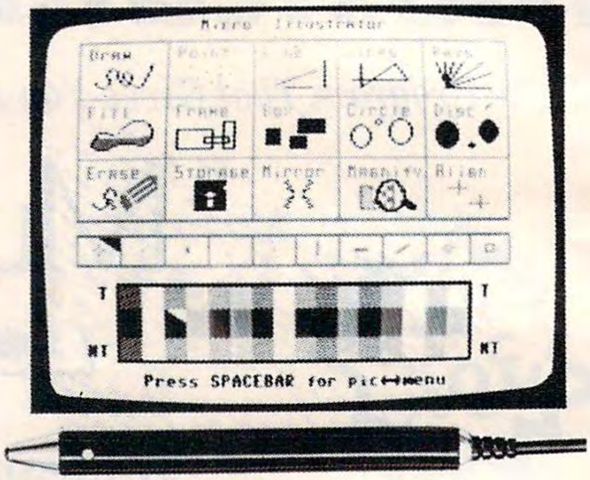

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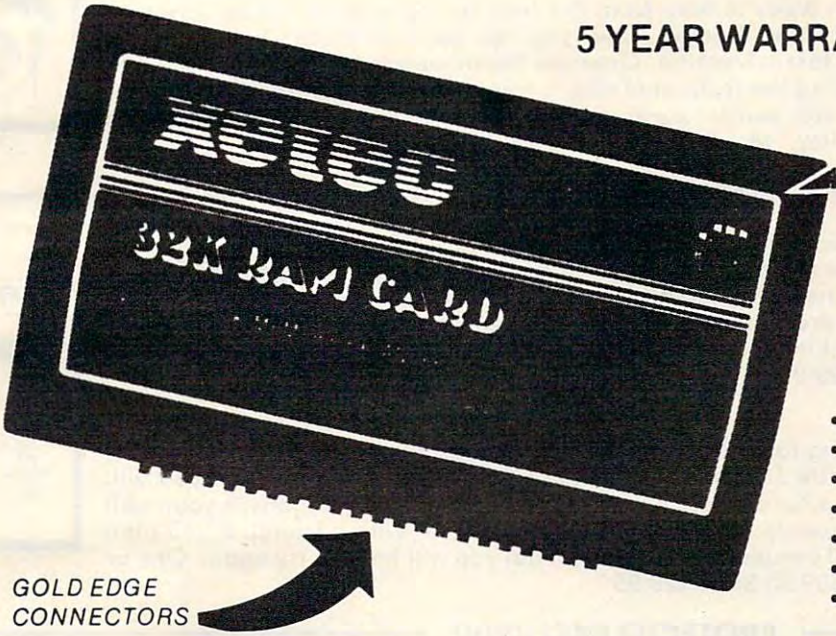

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Robots of Dawn — Elijah Baley is here from the best-selling science fiction series by world renowned author Isaac Asimov. Now you can become Earth's most famous detective in this exciting test-adventure. Question the inhabitants of far flung cultures — who's lying, who's telling the truth, and who is trying to murder you? Jump into the action in this fascinating epic murder mystery. Can you piece together the elusive clues to solve the eternal question "who done it?" (Disk) List $39.95 **SALE $29.95**

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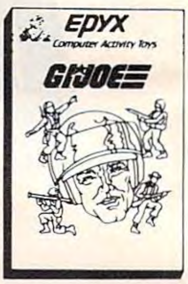
Barbie — The biggest name in dolls. Browse through Barbie's closet full of beautiful clothing and dress her for the party. You can cut her hair or make it longer and color it or change the style. Buy new clothing at the boutique or any of the six other specialty shops, or even go to the dress shop and create Barbie's designer clothes with the help of the computer. The combinations are endless and so is the fun. One or two players. (Disk) List $39.95 **SALE $29.95**



G.I. Joe — The best selling toy soldier is now available as an activity toy on the home computer. Select the battle situation then choose the equipment you think you will need to get the job done. Choose from a number of uniforms and weapons in your well stocked arsenal and get ready for the action. Play alone or with a friend, if you plan the right strategy you will complete the mission if not you will have to try again. One or two players. (Disk) List $39.95 **SALE $29.95**

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Hot Wheels — Now all the action and fun from playing with Hot Wheels cars is taken one step further on the home computer. Hot Wheels lets you choose your play activity from repairing cars to the destruction derby. You can actually play the activities along with a partner on the computer screen, even build and customize your own cars. A whole new way to play Hot Wheels. One or two players. (Disk) List $39.95 **SALE $29.95**

Break Dance — Break Dance is an action game in which your dancer tries to break through a gang of break dancers descending on him. "A simon-like game" where your dancer has to keep the steps of the computer controlled dancer, and even a free dance segment where you develop your own dance routines and the computer plays them back for you to watch. Now anyone can break dance!! (Disk) List $34.95 **SALE $24.95**

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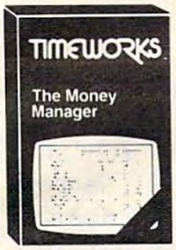

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16 categories can be input on a monthly basis for a 12 month period. Full analysis including budget and actual comparisons plus detail by individual items. Colorful bar charts show where you're spending to much or too little. Record all information to tape or disk. List $24.95. **Sale $19.95**.

The Electronic Checkbook

Check recording, sorting and balancing system. Organize and record checkbook transactions for easy recall and sorting by category. A must for tax time. Also produce the sum and average for transaction amounts by indexed categories. Interface with the MONEY MANAGER for graphic detail and actual-budget comparison. List $24.95. **Sale** $19.95.

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Learn Basic Programming from the ground up. This first step takes you through the actual design of Lunar Lander, using moving graphics.

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Intermediate game design and Sprite Builder. Design Slot Machine and study intermediate programming including arrays, subroutines, sound, special function keys, and random function. Plus Sprites are covered in detail and a Sprite Editor is included. List $24.95. **Sale $19.95.**

Programming Kits

Manuals are written in plain, easy to follow English. The 8 step approach to program design is fully explained and can easily be applied to your future programming adventures.

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Intermediate Data Base design. Instead of games you may want to go the business route. Use this program to develop a Data Base Manager to allow quick storage and retrieval of any information. Learn disk/tape storage, sorting, menus, plus multi dimensioned arrays, plus a whole lot more. List $24.95. **Sale $19.95.**

Dungeons Of The Algebra Dragons

At last a good educational game. You must wander through 3-D mazes until you encounter dragons, then you must answer the algebra problems they give you. A right answer gets you a free ride, a wrong answer gets you eaten. Fantastic educational value. (Tape or Disk.) List $29.95. **Sale $24.95.**

Spellbound

The screen is sprinkled with the letters from one of 20 words of your choice along with a few extra random ones. Use your Joystick to sting the letters in the right order but don't sting the wrong ones or cross your path or you explode. Fantastic educational value. Fun for all ages. List $24.95. **Sale $17.95.**

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Better than Qbert. Guide Pogo Joe across 32 screens of cylinders. As many as 8 nasties at a time are out to kill you. Fantastic graphics and sound. List $29.95. **Sale $19.95**. Coupon $16.95.

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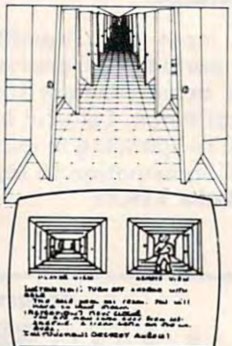
• GAME OF THE YEAR!

Asylum



One of the best graphic adventures we've seen. Get yourself out of the Asylum past guards and secret doors. Stunning, 3D graphics will make you feel like an inmate. List $34.95. **Sale $24.95**. Coupon $22.00.

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Dunzhin

A good sword, little magic, and lots of cunning takes you against Evil Wyverns, Saber Toothed Tigers, and the Undead. If you reach the bottom of the dungeon your halfway home. Great and 3D graphics. List $34.95. **Sale $24.95.** Coupon $22.00.

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Wylde

Be a Hobbit! Make your way through the magic mountains to the treasure of the mountain king. Fight Trolls, Orks and other nasties along the way. Fantastic realism. List $34.95. **Sale $24.95**. Coupon $22.00.

(Disk)

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Make your way to the treasure by correctly answering math problems. If you guess wrong and the professor shows you how step by step. Addition, subtraction, multiplication, and division basics are all covered. Fantastic educational value. List $34.95. **Sale $24.95**. Coupon $22.00.

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The ultimate Blackjack tutor made famous by Ken Uston, $5,000,000 winner. All different casino Blackjacks are discussed as well as a free $29.95 value Blackjack Book are yours. Fantastic tutor. List $79.95. **Sale $49.95.**

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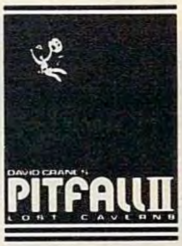
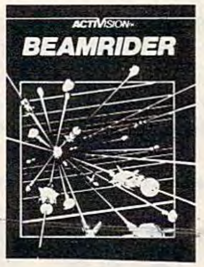
Pitfall II - Lost Caverns — The feats of Pitfall Harry continue with the full advantages of the Commodore-64. The caverns are 27 levels deep and you must make Harry swim through rivers, float through the air on balloons, even freefall with perfect timing. Fantastic sound, graphics, and action. (Very Highly Recommended) List $39.95. **Sale $27.95**. (Disk)



Beamrider — (Better than Tempest) Move and fire along the grid as aliens attempt to destroy you. Super fast joystick action is the only thing that will keep you alive to make it to the next grid (99 grids) where more challenges await you. Super Action and Graphics. List $39.95. **Sale $27.95**. (Disk)



Decathalon — Finally an Olympic Event for two players at the same time (or play against the computer) Run, Hurl, Vault, Jump and more (10 events in all). Fantastic graphics and sound will keep you playing this one for days on end. Great Competition. List $39.95. **Sale $27.95**. (Disk)

Toy Bizarre — The toy factory has gone crazy. Toys spring to life and try to destroy you and the factory. Jump from level to level and close the valves, and capture the toys before the toys do you and the factory in. Fantastic Graphics and Sound. List $39.95. **Sale $27.95**. (Disk)

H.E.R.O. — Descend through the caverns with your dynamite and laser helmet; clear the tunnels to rescue the trapped miners; watchout for molten lava, animals, insects, etc. If you hit the lights they go out and you're in the dark. Fantastic Graphics and Sound combine with a superb theme to make this a best game for the year. List $39.95. **Sale $27.95**. (Disk)

Zenji — Find your way through the paths. Easy? The paths constantly change as the squares slide around. Use your senses to decide which way is out. If your senses fail, you are trapped and dead! Fantastic action. List $39.95. **Sale $27.95**. (Disk)

Zone Ranger — Better than Asteroids and Omega Race. You must pilot your starship first through asteroid alien territory and dock at your base, then you must make your way through the mazes past hostile aliens. Constantly 4-way scrolling screens make this a must for all game players. Fantastic Graphics and Action. List $39.95. **Sale $27.95**. (Disk)

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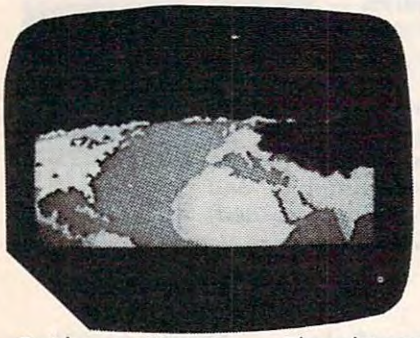
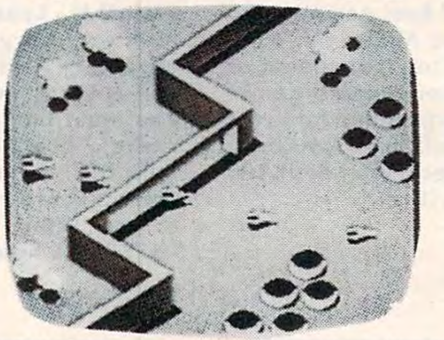
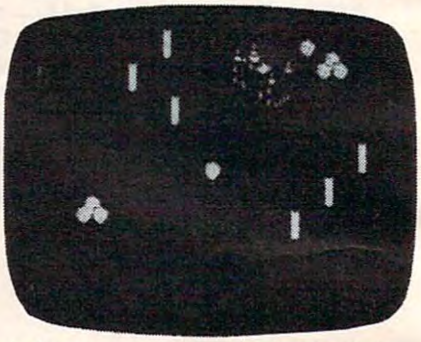
RAID OVER MOSCOW







Raid over Moscow — The ultimate in multi screen computer graphics has arrived. (over six screens) The Soviets have launched an attack. First you must locate and destroy the ICBM missiles from your Stealth Bomber, then you must lead your squadron through the Soviet terrain to the Kremlin itself. Destroy the defenses, then destroy the defense center and finally the attack operations themselves. Fly planes, launch grenades, shoot bazookas. Super Fantastic Graphics, Sound, Animation. (**The best multi-level game we've seen!!!**) List $39.95. **Sale $29.95.** (Disk.) *Coupon $26.95.*

BEACH HEAD

Beach Head — Multi Screen computer graphics at its finest. First you must maneuver your fleet through the mine laden channel while torpedoes are fired at you from all sides. Next you must engage the enemy planes with your anti-aircraft guns (best scenario graphics anywhere). Then you must sink the enemy fleet before they sink you. Next you maneuver to the beach head where your tanks must get through an obstacle course and finally fight the ultimate battle at Headquarters. All scenes in stunning 3-D graphics. (Will be the best graphics of 1984, definitely).

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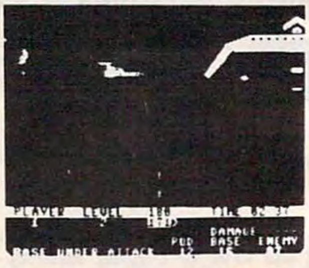
Actual Screens

Actual Screens

NEUTRAL ZONE



Neutral Zone — Reach the outer edges of the galaxy. You must protect your spaceship from attacking enemy space ships while defending yourself from enemy missiles. Fantastic 360 degree 3-D High Resolution Graphics. Rated No. 1 for graphics in 1983. List $34.95. **Sale $24.95.** (Tape or disk).

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Plantin Pal — Finally a full analysis and advisor for all your gardening needs. Plantin Pal asks you what you want to plant (gives suggestions, too!). Then tells you where to plant them! (garden layout) How to take care of them! Plus what to do when something goes wrong! (Insects, pests, and plant diseases) Fantastic for all your gardening needs. List $29.99. **Sale $19.99** (Disk).

Speed Reading Coach — Teaches vocabulary, comprehension, and speed to help you read better. Eye training and vocabulary come first, then the screen flashes word by word or sentence by sentence through paragraphs and asks you questions when you're done. Fantastic Reading Aid. List $29.99. **Sale $19.99** (Disk).

Robin Hood — You as Robin must fight your way through Sherwood Forest, Nottingham Castle, past the Duke, rescue Maid Marion, and finally steal the gold. Fantastic graphics with 5 different screens of challenges. List $19.99. **Sale $14.99**. (Disk)

Ice Palace — You as the Penguin must make your way through the automated Ice Block Factory on your way to your true love. 3 screens worth of melting ice blocks, deadly snowballs, and Freddies Fire Demons try to stop you. Plus you must eat the fruit to keep your strength up and build an ice ladder before your love can be yours again. Fantastic graphics and action. List $24.95. **Sale $19.95**. (Disk)

Sir Lancelot — Fight your way through the castle, kill the dragons, and save the maiden. But this is just the beginning! 8 more quests with 8 more challenging screens await your rise to be knighted king of the realm. Fantastic graphics and sound. List $19.95. **Sale $14.95**.(Disk)

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Now you can control the Starship Enterprise as you fight Klingons before they destroy your bases. Full 3-D view as well as overhead radar lets you know what's going on around you. Use your joystick to control warp drive, impulse power, photon torpedoes and phasers. But watch your shields, photon supply and warp power. Fantastic graphics and sound make this a must for everyone. List $39.95. **Sale $29.95** (cartridge).

Congo Bongo

• Official arcade version • 3-D graphics
• Two screen displays • One or two players.

The famous arcade game featuring the coconut throwing gorilla, monkeys, hippos, sharks and rhinos now comes to the Commodore 64. Superb reproduction of the arcade machine challenges you to destroy the gorillas lair. List $39.95. **Sale $29.95** (cartridge).

ZAXXON

• Official arcade version • Stunning 3-D scrolling graphics • Multiple screen displays.

Now the famous invasion of robot Zaxxon's lair can be done in your own home. Invade the fortress, get past the fighters then through Zaxxon's home and finally destroy Zaxxon himself. Just like the arcade game. This one's fantastic. List $39.95. **Sale $29.95** (cartridge).

BUCK ROGERS
PLANET OF ZOOM

• Official arcade version • 3-D color graphics
• Four Galactic screen displays.

Just like the arcade version. Steer your ship through deadly electron posts as you fight off enemy space saucers and hoppers. Finally you meet the enemy source ship. If you get through all this you start again only this time the enemies have more powers and surprises. Fantastic graphics and sound. List $39.95. **Sale $29.95** (cartridge).

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(World's Greatest Adventure Game)

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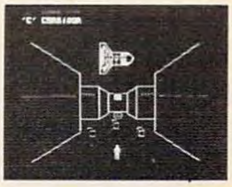

This five-screen arcade adventure packs the computer with intense graphics and sound! You are a special Cyberleague agent in a universe full of hostile aliens and vicious robots. Joystick and keyboard transport you through 3-D rooms, space barriers, fleets of invaders, and warship-ridden quadrants of space. Over 100 sprites, 8 new character sets, and dozens of mind-boggling sound effects make up this multi-layered adventure. Animation, action, and strategy all combined into a game so extensive that two disk sides are jammed with game programs and data! Reach the ultimate rank of admiral and you may carve a niche in the permanent high-score list. A full-size book quality manual with full-color covers is included to guide you through your most exciting game experience.

NEW

NEW

Perplexian Challenger

List $34.95 **Sale $24.95**

The incredibly responsive three-axis joystick control of a space fighter is in your hands. Split screen graphics provide a continuous display of your ship's instrumentation, as well as a three-dimensional, animated view of space.

You, as a pilot, must utilize lightning fast reflexes to destroy invading ships, and avoid their return fire. Simultaneously, you must maneuver your ship to capture space debris that remains from the explosions.

Outstanding graphics features include smooth 3-D rotations, split screens, and the most incredible high-resolution hyperspace sequence ever produced.

Programmed entirely in machine language, this action-strategy game is guaranteed to blow you away.

All the professional features you expect are included: automatic self-demo, high score retention, pause, and provisions for 1 to 4 players. Add to this, features you don't expect like easy-loading, and music during the load. Perplexian Challenger is a game that brings the arcade experience to your home.

Wizard

List $49.95 **Sale $34.95**

Jump from ropes to ladders, dodge plummeting boulders and duck under deadly arrows in your quest for sparkling diamonds, gleaming bars of gold, and glistening pearls. With joystick in hand you must explore forty dazzling screens, each a new and exciting adventure. Take the key to unlock the doorway to your next spine-tingling level. Each key restores your magical powers, allowing you to cast over ten different spells. With these magic spells you have the power to overcome vicious creatures, terrifying traps, and perilous plunges.

Your Wizard is realistically animated in every possible direction. Dozens of movements are possible — jump over burning fires, shimmy up or down ropes and ladders, even slip down treacherous sliding staircases! Magic portals move your Wizard through midair and protect you from a myrjad of fully-animated fiendish monsters. Catch an elevator to the top of the screen and dart through sliding gates in your quest for magic and treasure.

Wizard's fascinating variety of screens are sure to please and entertain, and of course you can build an unlimited number of your own levels using the construction set provided with your game.

Gothmog's Lair

List $44.95 **Sale $34.95**

Real-time adventure excitement at its best. Solve countless puzzles and slay over a dozen monsters by using the huge vocabulary of over 200 words. Two challenging difficulty levels await you with over 80 areas, each fully described in Old English script.

Menacing monsters, kniving villains, tattered code books and treacherous terrain are just a few of the situations you must overcome in your quest for the thirteen priceless treasures. More than seventy objects are invaluable to you in your search for glory and wealth!

A full-size, thoroughly illustrated manual is included. Featuring color front and back, book quality, and a fold-out map, this "extra" further extends the professionalism of this game. The following are quotes from unsolicited testimonials sent to us by adventurers in Gothmog's Lair...

"I have extremely enjoyed Gothmog's Lair, and plan to buy more adventure games..."

Scott Tulman, Memphis, TN

"Gothmog's Lair is the best adventure I've ever played..."

Dennis Manochio, Jr., Saratoga, CA

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All About The Status Register

Part 1

Louis F. Sander

The status registers have always been a mystery to the beginning machine language programmer. This article will help clear up the mystery.

All but the simplest machine language programs make use of the 6502's seven processor status flags, and any ML programmer worth his salt masters their functions and uses. Like almost everything in ML programming, the flags operate in a straightforward and unambiguous way, but they are full of mystery for the beginner.

If you've started ML programming, but are confused by that NV-BDIZC business, this article will help you understand it. It includes a fully explained ML demo program, identically executable on a Commodore 64/PET/CBM, Apple, or Atari computer.

These explanations will assume that you have some ML knowledge and at least a beginning grasp of hexadecimal arithmetic.

Let's start by defining a *register*, which is a circuit inside a processor. Registers have the characteristics of memory locations, in that data can be written to them or read from them. But they often don't have addresses as such, since they are used internally by the microprocessor itself. The accumulator is the most familiar register, but there are many others in your computer.

The 6502 has an internal 8-bit register, variously called the flags register, processor status register, or P register, the bits of which are set or cleared by the results of various operations. In this context, *set* means equal to 1, and *cleared* means equal to 0. At times the bits are set and cleared, or *conditioned*, automatically by the 6502 chip itself; other times they are conditioned by specific program instructions. Any book on 6502 programming will show you each instruction's effect on the status bits.

Bit Branches

Programs can check these bits and use the results of the check for whatever purpose the programmer has in mind, often to decide on a branch. The bits are sometimes called flags, and indeed, they work like the little red flags on rural mailboxes—the postal patron can raise the flag to let the mailman know there's outgoing mail, and the mailman can lower it to signal he's emptied the box. Here are the names and purposes of the eight bits in the status register, moving from left (high-order bit) to right (low-order bit):

N (bit 7)—Negative flag. (Some books call it S, for sign.) The N flag matches the high bit of the result of whatever operation the processor has just completed. If you load $FF (1111 1111) into the Y-register, for example, since the high bit of the Y-register is set, the N flag will be set, too. ML programmers make good use of the N flag. (By the way, even though this is the eighth bit, we call it bit 7, because computers start numbering things at 0.) In a computer technique called twos complement arithmetic, the high-order bit of a number is set to 1 if the number is negative, and cleared to 0 if it's positive, and that's where the N flag gets its name.

V (bit 6)—Overflow flag. This flag is important in twos complement arithmetic, but elsewhere it is rarely used. In the interest of simplicity, we'll say no more about it.

Bit 5 has no name, and is always set to 1. Since nothing can change it, it is of no use to the programmer.

B (bit 4)—Break flag, set whenever a BRK instruction is executed, clear at all other times. Rarely used by beginners.

D (bit 3)—Decimal flag. When D is set by the programmer, the 6502 does its arithmetic in BCD, binary coded decimal, which is yet another exotic type of computer math. Fortunately for nonexperts, it's seldom used, and the beginner's only concern with the D flag is to be sure it is not set unintentionally, because when it *is*, program behavior can be bizarre.

I (bit 2)—Interrupt mask. When this bit is set, the computer will not honor interrupts, such as those used for keyboard scanning in many computers. It is widely used, but so different from the other flags that we'll say no more about it.

Z (bit 1)—Zero flag. This one's used a great deal, and basically the computer sets it when the result of any operation is zero. Load the X-register with $00, and you set the zero flag. Subtract $32 from $32, and you do the same. Many 6502 instructions affect the Z flag, and there's always a "zero or not-zero" aspect to it, but it's not always obvious to the novice when a zero condition exists. This is probably the most important of the flags, and if you master it, mastery of the others will be easy.

C (bit 0)—Carry flag. Carry is set whenever the accumulator rolls over from $FF to $00 (just like the odometer on a car, rolling over from all nines to all zeros). It's also set by various rotation and comparison instructions. The carry flag is about as important as the Z flag, and a little more mysterious, at least to me, but its operation is really rather simple.

Next month we'll go through some practical examples to demonstrate exactly how everything works. ©

Unicopy

Single Disk Copying For The Commodore 64

Jim Butterfield, Associate Editor

Copying programs and sequential files can sometimes be difficult. There are backup programs, of course; but they require that you copy the whole disk, and sometimes you just want to copy one or two programs. LOAD and SAVE work for simple BASIC programs, but not for anything complex. Well-equipped users have two disk drives and can use utilities that will transfer from one to the other.

Dual disk units (notably the Commodore 4040) don't quite do the job for Commodore 64 owners. There's a slight format difference between 4040 and 1541 that makes it undesirable to write on a disk formatted on the other unit. Thus, a 4040-copied disk is not well-suited for the 1541 if you wish to write further material to the disk.

"Unicopy" will help to solve these problems. It will take your choice of programs or sequential files from the disk and hold them in memory. When you're finished, or when memory is full, you can then write the files to a new disk or to cassette tape.

Buffering Files

As you scan the input disk, you'll be offered programs and sequential files for copying. You may tap the Y or N key to signal: yes, you want to copy this file; or no, you don't want this one. More on this in a moment.

Before presenting you with the filename, Unicopy looks at the size of the file and the amount of memory space that is left. If the file is too big to fit, the program won't offer it to you; instead, it will signal MORE and quit scanning the directory. That way, you know that there is more on the disk, but it can't be fitted in this time. Unicopy could catch the missing files on a subsequent run. The program will not skip by the big ones to look at smaller files later in the directory, since it might be important to you to keep a group of files in the same order as they were shown on the previous disk.

There's one exception to the big files rule. If the file won't fit into the whole memory buffer area, there's no way to copy it with this program. Unicopy will skip such jumbo files.

How big is the buffer area? It depends on how your Commodore 64 is configured. If it's a "clean" system with no other resident programs, Unicopy will throw out BASIC (temporarily) and use all the memory it can get—about 48K, or the equivalent of 192 disk blocks. On the other hand, a program in residence—monitor, DOS wedge, interface package, or whatever—must not be disturbed; in this case, UNICOPY will become conservative and restrict itself to less than 36K or 144 disk blocks. The exact amount of space will depend on the other program's location and size.

You'll be asked "Any resident programs?" at the start of Unicopy; buffer size will be set accordingly.

One more thing: If you plan to direct the output to cassette tape, Unicopy must insure that no more than 28K or 112 blocks are used. Tape routines forbid writing a program from above address 32766; so Unicopy will trim accordingly. By the way, this solves a subtle problem with cassette tape: Normally, you can never save memory above hex $7FFE; but Unicopy will move the program down and save it successfully from where it is held in lower memory.

Initial Tasks And First Questions

If you're copying to another disk, be sure that the destination disk is formatted before running Unicopy. The disk may already be formatted if you're just adding some new files; but if not, remember to NEW it, since Unicopy won't do the job for you. You may copy files to more than one disk; format them all as necessary.

We've already mentioned ANY RESIDENT PROGRAMS?; answer Y or N.

OUTPUT TO TAPE OR DISK? calls for touching the T or D key.

If you select tape, you'll be asked WRITE END-OF-TAPE MARK? If you respond with N, you'll copy the programs to tape and that's all. If you answer Y, you'll copy the programs to tape and then write a special block called a "tape mark." Here's what the tape mark does: At some later time, if you're searching through this tape for a particular file, the tape mark will stop the search.

Thus, if you don't find the file you want on tape, you won't go running through the whole tape, most of which is blank. An unsuccessful search will terminate early, thanks to the tape mark.

DISK INPUT PATTERN? allows you to use pattern matching. You're prompted with the asterisk; if you want to see everything, just press RETURN. But there are many other combinations. AR* will present only programs that begin with AR, such as: AR, ARCHER, ARM, or ARRRRGH. R?D? will present you with such names as REDS, RIDE, or R2D2, but not RIDDLE. *=P will offer programs only. And PLUTO will offer you only a file called PLUTO.

When you are presented with names from the directory, you may tap Y or N to accept or reject the files for copying. If you know that you want to take or reject a sequence of files, you may hold down the appropriate key. The RETURN key acts to "lock in" the previous key, so that pressing Y, RETURN will accept everything and N, RETURN will reject everything.

The Output

Eventually the questionnaire will stop, and the computer will advise READING FILES. The programs or sequential files will be brought into the buffer area. The programs won't be in their usual place in memory, but that doesn't matter; we just want to copy them, not to run them.

After the files are loaded, the computer will say READY TO WRITE FILES; PRESS ANY KEY. Don't press a key—yet.

If you're writing to cassette tape, place the tape in the drive. If you have time and think it's necessary, fast forward and rewind the tape to even up the tension. Finally, press PLAY and RECORD and touch any key on the keyboard. The tape will start to write: The screen will go blank, of course.

If you're writing to another disk, take the source disk out of the drive and insert the destination disk. (You did make sure that the destination disk was preformatted, didn't you?) Now touch any key on the keyboard. As the files write to the disk, you'll see their names displayed.

If any errors are encountered during input or output, you'll be told about them.

When the copying job is done, you'll be asked ANOTHER OUTPUT? If you want to write to another tape or disk, put it into the drive and press Y for "yes." Otherwise, press N and the job is done.

The Generator

The listing given here is a generator program that will write Unicopy for you. The DATA statements will be checked carefully for accuracy before Unicopy is created for you; you'll be told of any errors.

Type in the program. Take special care with lines 200 to 320; and don't miss the semicolon at the end of line 300. When the program is complete, place a disk into your disk drive (Unicopy will be written onto it) and type RUN.

It will take the generator over a minute to check the accuracy of your DATA statements. If there are any errors, you'll be told about them (the line number will be given) and Unicopy will not be written.

If there are no errors in the DATA statements, Unicopy will be written to disk ready to be loaded and used.

Other Types Of Files

Unicopy does not attempt to copy USR or REL type files, nor does it try to copy "direct" data. This type of job should be done by the programs which use these types of files.

Unicopy

```
1 DATA 1,8,11,8,100,0,158,50,48,54,51,0,-
  45                                :rem 35
2 DATA 0,0,53,0,160,255,140,34,15,169,89,
  141,-5                           :rem 242
3 DATA 33,15,169,0,141,37,15,141,39,15,16
  9,13,-39                         :rem 100
4 DATA 32,210,255,200,185,186,13,208,247,
  165,55,141,-50                   :rem 138
5 DATA 43,15,165,56,141,44,15,32,207,255,
  201,78,-44                       :rem 200
6 DATA 208,13,169,0,141,43,15,169,208,141
  ,44,15,-35                       :rem 196
7 DATA 141,39,15,32,115,13,201,68,240,15,
  162,0,-13                        :rem 128
8 DATA 142,39,15,169,127,205,44,15,176,3,
  141,44,-55                       :rem 208
```

```
9 DATA 15,169,122,133,141,169,15,133,142,
  24,173,44,-44                     :rem 93
10 DATA 15,229,142,141,35,15,169,15,162,8
  ,160,111,-23                      :rem 28
11 DATA 32,186,255,169,0,162,49,160,15,32
  ,189,255,-34                      :rem 54
12 DATA 32,192,255,160,255,169,13,32,210,
  255,200,185,-13                   :rem 182
13 DATA 51,14,208,247,160,0,185,75,14,153
  ,49,15,-35                        :rem 199
14 DATA 200,192,3,208,245,32,207,255,201,
  13,240,6,-49                      :rem 28
15 DATA 153,49,15,200,208,243,140,30,15,1
  60,255,169,-41                    :rem 132
16 DATA 13,32,210,255,200,185,232,14,208,
  247,169,1,-11                     :rem 76
17 DATA 162,8,160,96,32,186,255,173,30,15
  ,162,49,-50                       :rem 5
18 DATA 160,15,32,189,255,32,192,255,169,
  13,32,210,-29                     :rem 100
19 DATA 255,162,1,32,198,255,32,228,255,3
  2,228,255,-47                     :rem 111
20 DATA 32,228,255,141,31,15,32,228,255,1
  3,31,15,-9                        :rem 186
21 DATA 240,122,169,0,141,32,15,141,41,15
  ,32,228,-36                       :rem 225
22 DATA 255,141,38,15,32,228,255,240,3,23
  8,41,15,-34                       :rem 243
23 DATA 173,38,15,240,17,56,173,35,15,237
  ,38,15,-4                         :rem 155
24 DATA 176,3,238,41,15,32,210,9,240,198,
  32,228,-29                        :rem 203
25 DATA 255,170,208,250,173,32,15,201,83,
  240,16,201,-4                     :rem 75
26 DATA 80,208,181,173,41,15,240,7,173,37
  ,15,240,-17                       :rem 247
27 DATA 171,208,36,140,36,15,160,2,185,50
  ,15,32,-26                        :rem 191
28 DATA 210,255,200,204,36,15,144,244,169
  ,13,32,210,-27                    :rem 127
29 DATA 255,32,204,255,32,63,10,162,1,32,
  198,255,-25                       :rem 248
30 DATA 76,227,8,160,255,169,32,32,210,25
  5,200,185,-44                     :rem 94
31 DATA 15,15,208,247,32,204,255,169,1,32
  ,195,255,-54                      :rem 47
32 DATA 160,255,169,13,174,37,15,208,11,3
  2,210,255,-4                      :rem 35
33 DATA 200,185,78,14,208,247,240,69,32,2
  10,255,200,-56                    :rem 142
34 DATA 185,95,14,208,247,32,234,10,32,86
  ,13,173,-64                       :rem 1
35 DATA 39,15,240,4,169,54,133,1,32,176,1
  1,32,-64                          :rem 96
36 DATA 204,255,173,39,15,240,4,169,55,13
  3,1,160,-45                       :rem 251
37 DATA 255,169,13,32,210,255,200,185,213
  ,14,208,247,-53                   :rem 191
38 DATA 32,228,255,170,208,250,32,228,255
  ,201,89,240,-1                    :rem 144
39 DATA 203,201,78,208,245,169,15,32,195,
  255,96,160,-9                     :rem 116
40 DATA 20,169,160,153,51,15,136,208,250,
  32,228,255,-54                    :rem 138
41 DATA 170,240,55,201,34,208,246,160,2,3
  2,228,255,-43                     :rem 81
42 DATA 201,34,240,9,153,50,15,200,170,20
  8,242,240,-19                     :rem 70
43 DATA 33,32,228,255,170,240,27,201,32,2
  08,246,32,-2                      :rem 29
44 DATA 228,255,170,240,17,201,32,240,246
  ,141,32,15,-62                    :rem 128
45 DATA 153,51,15,169,44,153,50,15,200,20
  0,96,56,-42                       :rem 245
46 DATA 173,35,15,237,38,15,141,35,15,238
  ,37,15,-3                         :rem 155
47 DATA 160,17,185,52,15,145,141,136,16,2
  48,24,165,-12                     :rem 96
48 DATA 141,105,22,133,141,165,142,105,0,
  133,142,96,-40                    :rem 122
49 DATA 160,0,162,0,202,208,253,136,208,2
  48,165,203,-35                    :rem 135
50 DATA 45,34,15,141,31,15,32,228,255,201
  ,89,240,-27                       :rem 242
51 DATA 17,201,78,240,13,201,13,240,15,17
  3,31,15,-19                       :rem 227
52 DATA 201,64,240,226,208,11,141,33,15,1
  69,255,44,-26                     :rem 85
53 DATA 169,0,141,34,15,173,33,15,201,78,
  240,5,-42                         :rem 140
54 DATA 32,26,10,144,3,32,192,10,96,162,1
  5,32,-9                           :rem 40
55 DATA 198,255,160,0,32,228,255,153,72,1
  5,200,201,-47                     :rem 91
56 DATA 13,240,8,192,49,176,4,165,144,240
  ,237,32,-55                       :rem 5
57 DATA 204,255,169,13,153,72,15,173,72,1
  5,201,49,-37                      :rem 53
58 DATA 144,18,238,42,15,160,0,185,72,15,
  201,13,-32                        :rem 191
59 DATA 240,6,32,210,255,200,208,243,96,1
  69,145,32,-38                     :rem 99
60 DATA 210,255,169,32,162,25,32,210,255,
  202,208,250,-3                    :rem 125
61 DATA 169,145,32,210,255,169,13,76,210,
  255,230,141,-1                    :rem 136
62 DATA 208,2,230,142,165,141,205,43,15,1
  65,142,237,-54                    :rem 133
63 DATA 44,15,96,169,122,133,139,169,15,1
  33,140,165,-26                    :rem 156
64 DATA 141,141,45,15,165,142,141,46,15,1
  60,18,140,-50                     :rem 79
65 DATA 36,15,136,177,139,153,52,15,201,1
  60,208,3,-9                       :rem 253
66 DATA 140,36,15,136,16,241,238,36,15,23
  8,36,15,-29                       :rem 2
67 DATA 160,18,165,141,145,139,200,165,14
  2,145,139,160,-1                  :rem 241
68 DATA 0,140,42,15,185,50,15,32,210,255,
  200,204,-49                       :rem 232
69 DATA 36,15,144,244,169,32,32,210,255,1
  69,2,162,-62                      :rem 52
70 DATA 8,160,98,32,186,255,173,36,15,162
  ,50,160,-36                       :rem 6
71 DATA 15,32,189,255,32,192,255,32,132,1
  0,176,37,-63                      :rem 50
72 DATA 162,2,32,198,255,32,228,255,160,0
  ,145,141,-51                      :rem 40
73 DATA 32,217,10,176,20,166,144,240,240,
  32,132,10,-33                     :rem 69
74 DATA 176,11,160,20,165,141,145,139,200
  ,165,142,208,-31                  :rem 231
75 DATA 4,160,21,169,0,145,139,24,165,139
  ,105,22,-21                       :rem 244
76 DATA 133,139,165,140,105,0,133,140,32,
  204,255,169,-52                   :rem 185
77 DATA 2,32,195,255,169,13,32,210,255,17
  3,42,15,-53                       :rem 254
```

```
78 DATA 208,3,32,192,10,165,139,205,45,15
,165,140,-58                        :rem 50
79 DATA 237,46,15,176,3,76,252,10,96,169,
122,133,-25                         :rem 13
80 DATA 139,169,15,133,140,173,40,15,201,
68,208,23,-15                       :rem 89
81 DATA 162,15,32,201,255,169,73,32,210,2
55,169,48,-17                       :rem 101
82 DATA 32,210,255,169,13,32,210,255,32,2
04,255,160,-38                      :rem 134
83 DATA 18,140,36,15,136,177,139,153,52,1
5,201,160,-28                       :rem 95
84 DATA 208,3,140,36,15,136,16,241,172,36
,15,136,-7                          :rem 198
85 DATA 185,52,15,141,32,15,172,36,15,169
,44,153,-9                          :rem 211
86 DATA 52,15,200,169,87,153,52,15,200,20
0,200,140,-22                       :rem 72
87 DATA 36,15,160,18,177,139,133,141,200,
177,139,133,-40                     :rem 199
88 DATA 142,200,177,139,141,43,15,200,177
,139,240,65,-27                     :rem 199
89 DATA 141,44,15,160,0,173,40,15,201,68,
240,21,-12                          :rem 181
90 DATA 185,52,15,153,50,15,200,204,36,15
,144,244,-14                        :rem 30
91 DATA 56,173,36,15,233,6,141,36,15,160,
0,140,-41                           :rem 138
92 DATA 42,15,185,50,15,32,210,255,200,20
4,36,15,-38                         :rem 237
93 DATA 144,244,169,32,32,210,255,173,40,
15,201,68,-3                        :rem 40
94 DATA 240,6,32,208,12,76,154,12,169,2,1
62,8,-20                            :rem 97
95 DATA 160,98,32,186,255,173,36,15,162,5
0,160,15,-54                        :rem 59
96 DATA 32,189,255,32,192,255,32,132,10,1
76,23,162,-23                       :rem 99
97 DATA 2,32,201,255,160,0,177,141,32,210
,255,32,-33                         :rem 232
98 DATA 217,10,144,246,32,204,255,32,132,
10,169,2,-4                         :rem 241
99 DATA 32,195,255,169,13,32,210,255,173,
42,15,208,-27                       :rem 107
100 DATA 3,32,192,10,24,165,139,105,22,13
3,139,165,-58                       :rem 83
101 DATA 140,105,0,133,140,165,139,205,45
,15,165,140,-62                     :rem 168
102 DATA 237,46,15,176,3,76,214,11,173,40
,15,201,-22                         :rem 233
103 DATA 84,208,5,169,5,32,106,247,96,169
,2,162,-17                          :rem 214
104 DATA 1,160,1,32,186,255,173,36,15,162
,50,160,-10                         :rem 229
105 DATA 15,32,189,255,173,32,15,201,83,2
08,29,32,-52                        :rem 43
106 DATA 192,255,162,2,32,201,255,160,0,1
77,141,32,-38                       :rem 81
107 DATA 210,255,32,217,10,144,246,32,204
,255,169,2,-60                      :rem 130
108 DATA 32,195,255,96,32,56,248,160,1,17
7,141,153,-41                       :rem 104
109 DATA 193,0,136,16,248,32,217,10,32,21
7,10,56,-13                         :rem 236
110 DATA 173,43,15,229,141,141,47,15,173,
44,15,229,-14                       :rem 86
111 DATA 142,141,48,15,24,165,193,109,47,
15,133,174,-18                      :rem 143
112 DATA 165,194,109,48,15,133,175,169,1,
170,32,106,-38                      :rem 149
113 DATA 247,165,141,133,193,165,142,133,
194,173,43,15,-28                   :rem 41
114 DATA 133,174,173,44,15,133,175,32,103
,248,96,160,-27                     :rem 195
115 DATA 255,169,13,32,210,255,200,185,11
2,14,208,247,-10                    :rem 227
116 DATA 32,228,255,168,208,250,32,228,25
5,168,240,250,-55                   :rem 47
117 DATA 32,192,10,96,160,255,169,13,32,2
10,255,200,-12                      :rem 129
118 DATA 185,159,14,208,247,32,228,255,16
8,208,250,32,-9                     :rem 213
119 DATA 228,255,201,84,240,4,201,68,208,
245,32,210,-50                      :rem 134
120 DATA 255,141,40,15,201,68,240,30,160,
255,169,13,-8                       :rem 79
121 DATA 32,210,255,200,185,186,14,208,24
7,32,228,255,-30                    :rem 234
122 DATA 201,89,240,7,201,78,208,245,238,
40,15,32,-63                        :rem 41
123 DATA 210,255,96,147,13,13,85,78,73,67
,79,80,-6                           :rem 176
124 DATA 89,32,32,86,49,46,49,32,32,74,73
,77,-26                             :rem 80
125 DATA 32,66,85,84,84,69,82,70,73,69,76
,68,-14                             :rem 94
126 DATA 13,13,70,79,82,77,65,84,32,79,85
,84,-62                             :rem 84
127 DATA 80,85,84,32,68,73,83,75,83,32,73
,78,-58                             :rem 92
128 DATA 32,65,68,86,65,78,67,69,13,13,65
,78,-54                             :rem 95
129 DATA 89,32,82,69,83,73,68,69,78,84,32
,80,-33                             :rem 98
130 DATA 82,79,71,82,65,77,83,32,46,46,46
,46,-30                             :rem 75
131 DATA 13,40,87,69,68,71,69,44,32,77,79
,78,-15                             :rem 87
132 DATA 73,84,79,82,44,32,76,73,78,75,41
,63,-7                              :rem 33
133 DATA 32,78,157,0,13,68,73,83,75,32,73
,78,-56                             :rem 75
134 DATA 80,85,84,32,80,65,84,84,69,82,78
,63,-47                             :rem 92
135 DATA 32,42,157,0,36,48,58,13,42,42,32
,78,-48                             :rem 58
136 DATA 79,32,70,73,76,69,83,32,42,42,13
,0,-52                              :rem 10
137 DATA 32,82,69,65,68,73,78,71,32,70,73
,76,-3                              :rem 32
138 DATA 69,83,58,13,0,42,42,32,82,69,65,
68,-60                              :rem 23
139 DATA 89,32,84,79,32,87,82,73,84,69,32
,70,-51                             :rem 91
140 DATA 73,76,69,83,32,42,42,13,32,32,32
,32,-39                             :rem 50
141 DATA 32,80,82,69,83,83,32,65,78,89,32
,75,-2                              :rem 28
142 DATA 69,89,13,0,79,85,84,80,85,84,32,
84,-47                              :rem 40
143 DATA 79,32,84,65,80,69,32,79,82,32,68
,73,-41                             :rem 83
144 DATA 83,75,63,32,42,157,0,87,82,73,84
,69,-58                             :rem 83
145 DATA 32,69,78,68,45,79,70,45,84,65,80
,69,-34                             :rem 96
```

```
146 DATA 32,77,65,82,75,63,32,42,157,Ø,32
    ,65,-3                          :rem 1Ø
147 DATA 78,79,84,72,69,82,32,79,85,84,8Ø
    ,85,-49                         :rem 112
148 DATA 84,63,32,13,Ø,72,79,76,68,32,68,
    79,-37                          :rem 35
149 DATA 87,78,32,39,89,39,32,79,82,32,39
    ,78,-4                          :rem 52
15Ø DATA 39,32,84,79,32,83,69,76,69,67,84
    ,32,-7                          :rem 42
151 DATA 7Ø,73,76,69,83,13,13,Ø,32,32,32,
    32,-17                          :rem 25Ø
152 DATA 32,46,46,46,32,77,79,82,69,13,Ø,
    -31                             :rem 122
2ØØ DATA{2 SPACES}153               :rem 69
21Ø M=63:T=63                       :rem 186
22Ø READ X:L=PEEK(M):H=L=2ØØ:IF H THEN L=
    X                               :rem 137
23Ø V=R<>L:S=(T<>63 AND V)          :rem 187
24Ø IF V THEN T=L:IF NOT S THEN R=R+1:S=R
    <>L                             :rem 226
25Ø T=(T*3+X)AND 63                 :rem 233
26Ø IF S THEN PRINT "ERROR LINE";R:E=-1
                                    :rem 211
27Ø R=L:IF NOT H GOTO 22Ø           :rem 67
28Ø IF E THEN STOP                  :rem 227
29Ø X=-1:RESTORE:OPEN 1,8,3,"Ø:UNICOPY64,
    P,W"                            :rem 182
3ØØ IF X>=Ø THEN PRINT#1,CHR$(X); :rem 7Ø
31Ø READ X:L=PEEK(M):IF L<2ØØ GOTO 3ØØ
                                    :rem 61
32Ø CLOSE 1                        :rem 6Ø
```

INSIGHT: Atari

Bill Wilkinson

Let me start my fourth year by discussing the biggest event in Atari history since the introduction of the 800 Home Computer. But first a moment's reflection on my years with COMPUTE!.

Sometime about three years ago, I was reading COMPUTE!'s "The Readers' Feedback" column when I noticed a couple of questions about Atari computers which the editorial staff hadn't answered. And I also noticed a question which a reader had answered incorrectly.

I reacted. I phoned COMPUTE! and, for reasons best known to himself alone, a nice gentleman by the name of Richard Mansfield listened to my ranting and raving. I started to write for COMPUTE!.

Since then, I have written many columns and have covered a wide range of topics. But now I feel that it's time to change the style of this column. When I started, I intended to answer two or three questions a month and perhaps add a tidbit of my own. Lately, though, I've paid less attention to what you, my readers, want and have shown you some exotic but (perhaps for many of you) uninteresting programs, etc.

I am going to try to revive the chitchat style of this column. It will be more fun for me to write like that again and, I hope, more fun for you to read.

Whither Atari?

As I write this, only a few days have passed since the bombshell exploded: Jack Tramiel bought Atari! I don't see how I could avoid commenting on this—even if I wanted to.

By the time you read this, some of the things I will speculate on here will have been reduced to the role of mere facts or—equally likely—humorous fiction. Nevertheless, I would like to try to play the crystal ball game. Bear with me, please, as I make some predictions:

Nobody pays a quarter of a *billion* dollars (even 1991 dollars) for a name alone. If Mr. Tramiel doesn't produce and sell some (many?) of Atari's current and/or soon-to-be-current products, he will have bought nothing at all (since the massive layoffs make it obvious that he has little use for the expertise of the people who *were* Atari).

What products will survive? Probably the 800XL. It's a good machine and can probably be cost-reduced to be truly competitive with the Commodore 64. It could well have an effective price/performance ratio for well into the next two years.

I'm not so sure about the peripherals. The disk drive, or a version of it, certainly. Printers, of course. The cassette recorder? It's a piece of junk, and everyone knows it. The much ballyhooed add-on box, with MSDOS, 80-column screen, 128K bytes, and an ice cream freezer? Maybe. But don't be surprised to see it licensed to a third-party, low-volume manufacturer. It's too difficult for a lean and mean company to support such a complex product.

A Fabulous Game Machine

What about the game machine side of Atari? Some have suggested that Mr. Tramiel will drop it like a hot potato. Baloney, I say. Why did he buy it then? Was he fooled by Warner and the ex-Atari management? I have heard Jack Tramiel called many things, but "stupid" is not one of them.

I have seen *and* played with the 7800 "Pro-System." It is a truly fabulous game machine (and it's even a fair computer, with 95 percent plus compatible Atari BASIC). Making it 100 percent compatible with the 2600 was a stroke of genius. When I buy one (and I will), I can keep my collection of 20-odd 2600 cartridges. Though I suspect—having seen *Xevious* and *BallBlazer* and *Rescue on Fractulus* and *Robotron* and . . .—that they will be little used. Tens of millions, like the 2600? Maybe not. A few million? Definitely yes.

Now what about the supposedly all-important, superadvanced, already developed computer that Tramiel and associates are bringing to the game? Well, first of all, I don't know how far along that machine is. Designed? Almost certainly. Prototypes available? A good probability. Debugged and with software ready? Possible, but I seriously doubt it.

Personally, I expect to see an early prototype shown in January 1985, with "selling" models shown in June, both probably at the Consumer Electronics Shows.

An Atari Mac?

And what will this miracle machine, the savior of Atari as a "name" in the industry, look like? Ah, now there you've got me. I am skeptical about reports that it will be a "business" machine: Why buy a game company's name for such a scheme? But an integrated "noncomputer" such as the Macintosh? Sure! Maybe even "a computer for the rest of us" (Apple's Macintosh slogan) that is *affordable* by the rest of us.

Well, how did I score? Or is it still too soon to tell? I am more than a little interested in knowing the outcome.

Answered Letters

Several people, led by Lloyd Keller of Palmetto, Florida, wrote me about something I tossed in, offhand, in my June column. While discussing the Atari *Translator Disk*, I had said, "Of course, you don't turn the power off to boot anymore."

And why not? Because, on an 800XL or 1200XL, the *Translator Disk* software loads into the RAM which is shared with OS (the hidden, bank-selected RAM). It then switches out the ROM completely, leaving you with an Operating System in RAM which is much, much more compatible with the old Atari 800's OS. Many programs which will not work in XL machines suddenly work just fine.

However, since your OS is now in RAM, you certainly can't turn off the power in order to boot another disk (for example, a protected game). Similarly, some cartridges insist on the old OS before they will run. You can't turn off the power to plug them in and still retain the OS in RAM.

Thus, before running, the *Translator Disk* software allows you to change cartridges or diskettes and then tell it you are ready to do a pseudoboot. That's all there is to it.

Mr. Keller, however, pointed out that his manuals tell him not once but many times to never change a cartridge with the power on. Well, sometimes manuals tend toward the cautious side.

Point 1: Nobody sticks a cartridge out in plain sight and then designs the electronics so that a three-year-old's sticky fingers can zap the whole machine by removing it. Point 2: The OS in the XL machines has a complex cartridge-presence checker built in. It checks to see if a cartridge has been inserted or removed every time the OS is called or every 1/60 second.

The action of this checker varies between the 600XL/800XL and the 1200XL. On the former, it causes the machine to "hang" until you hit reset, at which point it does a power-on sequence. The 1200XL simply keeps trying to do a power-on sequence, over and over again, and could lock up as a result.

So my point remains: Someone could and should produce an inexpensive cartridge which would act like the *Translator Disk*, thus giving cassette-only owners access to a wider range of software.

The Loop That Shouldn't Work

Shame on all you loyal Atari readers. It took a couple of Commodore 64 owners to bring one of my mistakes to light. A. J. Bryant of Winnipeg, Canada, and David MacKenzie of Bethesda, Maryland, tried the FOR-NEXT nesting test that I presented in my March 1984 column on their 64 machines.

Lo and behold, the program works (it is supposed to fail). And Mr. MacKenzie even asked me if Microsoft knew something we didn't. Well. I couldn't take a challenge like that lying down, so I powered up our 64 (yes, we really do have one) and tried it myself. Hmm.

Then I tried it on my trusty 800XL. It worked there also! My face is red. Between the time I developed the test and the time I submitted it for publication by COMPUTE!, I tried to pretty it up. There is a variation on Murphy's law which is appropriate here: "If it ain't broke, don't fix it."

So Program 1 is the original FOR-NEXT test. It fails on all Atari computers. It fails on Commodore 64s *and* Applesoft. The normal mode of failure is to issue a NEXT WITHOUT FOR error at line 280.

At first, I was surprised when Apple Integer BASIC passed this test. But I soon discovered why: Integer BASIC doesn't treat nested FOR loops properly at all. Program 2 is another, simpler test I devised to smoke out BASICs which have this kind of problem, so let's take a quick look at it.

Line 10 and 20 simply set up a pair of nested loops. But then line 30 starts an outer loop over again (or at least an intelligent BASIC interpreter will think so, since we are reusing I as a loop variable). Thus, line 50 should cause an error, because starting the outer loop over should erase the information about the inner (FOR J) loop. Indeed, on all the BASICs I mentioned except Apple Integer BASIC, it does. With Integer BASIC, though, the error does not occur until line 60. Tch-tch.

If there are any BASICs which pass both these tests, I would like to hear of them. Thanks.

More Letters Next Month

I've already started wading through a pile of letters; and, although I obviously can't promise a response to every one, maybe I'll try to answer *your* question or comment next month. See you then.

Program 1: Original FOR-NEXT Test

```
100 REM IT IS NORMAL FOR THIS PRO
    GRAM TO STOP
101 REM WITH AN ERROR ON LINE 280
110 PRINT "I","J","I*J"
120 FOR I=1 TO 9
130    FOR J=1 TO 9
140       PROD=I*J
150       IF PROD > 14 THEN 200
160       IF PROD > 10 THEN 190
170       PRINT I,J,PROD
180       NEXT J
190    NEXT I
200 PRINT "J","I","J*I"
210    FOR J=1 TO 9
220       FOR I=1 TO 9
230       PROD = J*I
240       IF PROD > 14 THEN 300
250       IF PROD > 10 THEN 280
260       PRINT J,I,PROD
270       NEXT I
280    NEXT J
290 STOP
300 STOP
```

Program 2: FOR-NEXT Test 2

```
10 FOR I=1 TO 3
20    FOR J=1 TO 3
30 FOR I=10 TO 12
40    PRINT I,J
50    NEXT J
60 NEXT I
```

©

MACHINE LANGUAGE

Jim Butterfield, Associate Editor

Same Game, Different Players

It's sometimes hard to recognize a simple, obvious fact: Machine language runs in the same machine as the other languages, such as BASIC. Thus, if you want to figure out how to do something in machine language, you need only figure out how it's done in BASIC.

Programmers often have a blind spot. They feel that once they abandon BASIC they must relearn all about their machine from the beginning. But it's the same machine, and most things work essentially the same way.

I sometimes have questions from programmers that almost baffle me, since I have trouble recognizing this blind spot. For example: "How do I set the background color to white on the 64?" Just POKE 53281,1. "No, I mean in machine language." Yes; just put value 1 into address 53281, whatever that works out to be in hexadecimal. "But that's BASIC—I want machine language." That's neither BASIC nor machine language—that's how the 64 sets color. I get the feeling that some programmers somehow see a barrier that isn't there.

Special characters seem to be a major obstacle. Users often view Commodore's "programmed cursor" as something special to BASIC. It's not; it's part of the operating system. Providing that the normal output path at subroutine $FFD2 is used, all the control characters work as they would in BASIC. Want to clear the screen? Do a LDA #$93:JSR $FFD2. Want to print the next characters in black? Code LDA #$90:JSR $FFD2 and then go ahead and print. Want to home the cursor, print in reverse font, switch to text mode, or whatever? Use the same special characters as for BASIC.

Tables of these special characters have been printed on numerous occasions, and I could include one here, but I'd rather give you a special procedure to let the computer tell you the character to use. For most keyboard-generated characters, this will work splendidly.

In BASIC, choose the programmable key you want and type the following partial line:

```
PRINT ASC("
```

Don't press RETURN yet. Now, touch the key you're interested in; use SHIFT or CTRL if appropriate. The key's graphic representation will appear in reverse video directly behind the quotation mark. Complete the line by pressing the quotes again and closing the parentheses, giving:

```
PRINT ASC(" ... ")
```

Now press RETURN. You'll be given the value of that key. Use the hexadecimal equivalent in your machine language program: It will do the same thing.

Using this technique, you'll discover that the code to turn all printed output to blue is decimal 31, hex $1F; to home the cursor, decimal 19, hex $13, and so on. A couple of codes that you can't discover this way include Return (you should know this one) as decimal 13, hex $0D; Delete (rarely needed) as decimal 20, hex $14; Set text mode as decimal 14, hex $0E; and Set graphics mode as decimal 142, hex $8E.

The above character-finding technique also works on the function keys of the VIC-20 and Commodore 64. You won't usually want to print these, of course, but it's often useful to detect these keys after reading the keyboard with subroutine GETIN at $FFE4. The function keys can give you very user-friendly programs.

Output Control

The same sort of question crops up for outputting to devices. Users ask, "How do I make my printer do certain lines in text mode?" When questioned as to how they do it in BASIC, the reply is something like, "Easy: I just prefix each new line with a cursor-down character." Fine. The same character exists in machine language (decimal 17, hex $11). Send it at the right time and the printer will do the appropriate thing.

It seems odd having to explain that peripheral devices don't even know what languages are sending data to it; when the right characters are delivered, the appropriate thing happens. But many users have a mental block. Somehow, machine language is suspected of making all the mechanical parts work in a different manner. 'Tain't so. It's the same machine and the same system.

Disk systems are especially tricky in some users' minds. Although it seems natural to them to open a data channel for writing using a name such as 0:DFILE,S,W in BASIC, they come unglued when it's time to do the same job in machine language. They have the name DFILE but somehow can't cope with the idea of tacking on a ,S,W behind it before opening the file.

The same mental gap occurs when it's time to scratch a file. In BASIC, users know that all they have to do is to open the command channel (secondary address 15), and then send "S0:FILENAME" to this command channel in order to scratch the file. It works the same way in machine language, of course.

Yet it sometimes seems that all we need to do is pick up a book on machine language and all the knowledge we have learned about the machine fades away into the distance.

Character Confusion

Sometimes, the confusion is understandable because of the way BASIC sends values. If BASIC outputs a value K (with a statement such as PRINT# ... K) it breaks the value into separate digits. In other words, if K is 13, BASIC will send a space, a numeric 1 character, and a numeric 3 character. A machine language programmer with a value of 13 to send might just load it into the A register and send it. But that's not a value—that's just a carriage return character. We must convert the value to decimal, and then the characters to ASCII, before sending.

On the other hand, if BASIC sends a character with CHR$(..), such as is done with the M-R and M-W commands, machine language can send the value directly.

So how would we initiate a block read in machine language? First, examine how it would be done in BASIC. To do a direct block read, we must open the command channel and open a data channel. Let's assume that we have done this using OPEN 15,8,15 and OPEN 1,8,2,"#". When this has been done, we finally give the command for the block read with:

```
PRINT#15,"U1:2,0,";25,14
```

This would read drive 0, track 25, sector 14. The value of 2, by the way, is the secondary address of the data file. Command U1, by the way, is preferable to its equivalent B-R for doing a block read.

In machine language, we would open the print path with LDX #15 and JSR $FFC9. We would then send the U, followed by 1, then the colon, the two, the comma, the zero, and the second comma.

Now comes the part where we need to be careful—not tricky, just careful. The track number, in this case 25, must be broken into two digits, the two and the five. That's not hard: Such a simple division could be accomplished by repeatedly comparing the value to 10, subtracting if necessary, and counting how many times we subtract. Two subtractions leave five: We send space, ASCII two, ASCII five. Now we do the same thing with the sector value and we're done. To keep precisely to the BASIC syntax, we'd also send a Return before disconnecting from the print path.

Yes, it does work like BASIC. Yes, I'd work out a logic flow in BASIC before diving directly into machine language. But ultimately, I'd feel quite secure: If it works in BASIC, it must also work in machine language.

Once you get a wholesome feeling for your machine, the language you use becomes less significant. After all, a language—any language—is just a tool to help you get the job done. ©

C. Regena

Algebra Tutorial

Part 1

We have examined educational software in previous columns and discussed how to construct drill programs. Now let's create a tutorial program. There have been a lot of requests for an educational program for algebra so here is the first part of a tutorial program on multiplying binomials.

"Algebra Tutorial," assumes the student has some knowledge of algebra and understands terms usually introduced before binomial multiplication. This program only covers multiplication of one binomial (numeric expression of two terms) by another binomial—such as (x + 5) times (x + 4). Additional related units could include multiplying polynomials, dividing polynomials by binomials, and factoring trinomials.

The program uses PRINT statements to avoid DATA statements with lots of numbers. If you prefer to prevent scrolling, you can use the graphics method of CALL HCHAR and CALL VCHAR to print problems on the screen.

Redefining Characters

Lines 160 and 170 redefine two characters for use in printing the problems. Character 94 is ordinarily the caret or exponentiation symbol, but is redefined here as a 2, which will be used as the superscript for a number squared. To type the program in, use SHIFT 6 to get the ^ symbol in lines such as line 400.

The underline is also redefined. Character 95 is ordinarily the underline, but several underlines together yield a dotted line, and we want a solid line. Lines 230 and 270 are examples of the underline in the listing. To type the underline, press the FCTN key and the U. As you type the listing, you will see the regular symbols, but when you run the program, you will see the redefined characters.

When learning algebra, it is important to understand that you can work with letters using the same rules and methods that are used with regular numbers. Lines 190–300 print a screen showing a comparison of binomial multiplication in algebra with a numeric multiplication problem. Lines 310–460 show the general form of the multiplication problem and its answer.

Generating A Random Problem

Lines 470–950 present a problem for the student to try. A and B are two random numbers chosen for the second terms of the binomials. This problem is the simple case using X plus a number from 1 to 3. The computer goes through the problem step by step, and the student presses a number where prompted. Correct numbers must be entered to continue.

CALL KEY is used rather than INPUT, so the student just needs to press a key for the answer. If you use INPUT, there is a greater chance for user error or for the program to crash. Avoid INPUT in tutorials so the student can use the program as easily as possible.

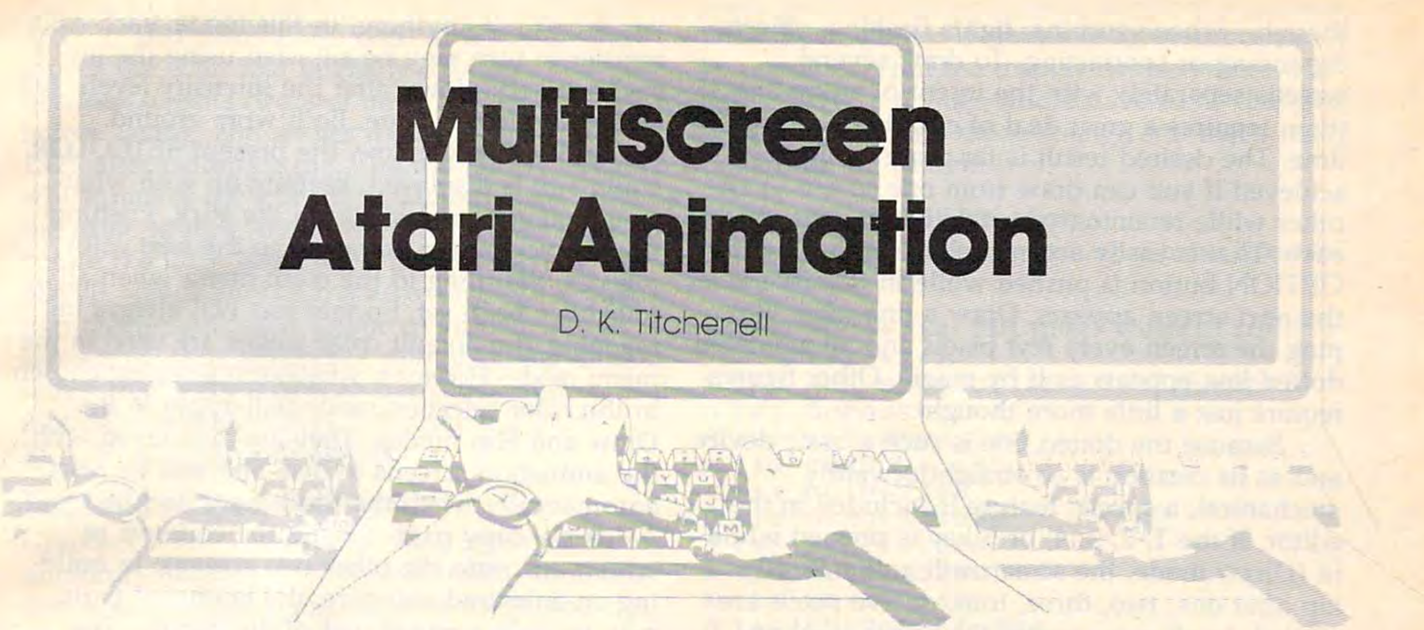
The tutorial adds new information a little at a time. Lines 960–1110 present a screen showing numeric coefficients for the first term. Lines 1120–1180 (and the subroutine starting at line 1960) give the student a problem of this type. Lines 1190–1300 present a screen of information about using positive and negative numbers.

```
110 CALL CLEAR
120 PRINT "  BINOMIAL MULTIPLICATIO
    N"
130 PRINT ::"THIS PROGRAM DISCUSSES
    "
140 PRINT :"MULTIPLICATION OF BINOM
    IALS"
150 PRINT :"SUCH AS (X+5) TIMES (X+
    3).":::::
160 CALL CHAR(94,"0000304808102078")
170 CALL CHAR(95,"00000000000000FF")
180 GOSUB 1530
190 CALL SCREEN(8)
200 PRINT "COMPARE":"  ALGEBRA TO":
    "  REGULAR MULTIPLICATION:"
210 PRINT ::"{3 SPACES}12";TAB(21);
    "X + 2"
220 PRINT :"{3 SPACES}23";TAB(21);"
    X + 3"
230 PRINT "   ___";TAB(20);"______"
240 PRINT :"{3 SPACES}36";TAB(20);"
    3X + 6"
250 PRINT TAB(16);"^"
260 PRINT "   24";TAB(15);"X  + 2X"
270 PRINT "   ___";TAB(15);"________
    ___"
280 PRINT TAB(16);"^"
290 PRINT "  276";TAB(15);"X  + 5X
    + 6"::::
300 GOSUB 1530
310 CALL SCREEN(4)
320 PRINT "IN GENERAL,"
330 PRINT :TAB(15);"X  +  A"
340 PRINT :TAB(15);"X  +  B"
350 PRINT TAB(12);"__________"
360 PRINT :TAB(14);"BX  + AB"
370 PRINT TAB(7);"^"
380 PRINT TAB(6);"X  +{4 SPACES}AX"
390 PRINT TAB(6);"________________"
400 PRINT TAB(7);"^"
410 PRINT TAB(6);"X  + (A+B)X + AB"
420 PRINT :::"THE FIRST TERM IS X*X
    "
430 PRINT "THE LAST TERM IS A*B"
440 PRINT "THE MIDDLE TERM COMBINES
    "
450 PRINT "A AND B MULTIPLIED BY X"
460 GOSUB 1530
470 CALL CLEAR
480 CALL SCREEN(8)
490 PRINT "NOW YOU MULTIPLY:"
500 RANDOMIZE
510 A=INT(3*RND)+1
520 B=INT(3*RND)+1
530 F=0
540 PRINT :TAB(22);"X +";A
550 PRINT :TAB(22);"X +";B
560 PRINT TAB(21);"______"
570 PRINT :B;"TIMES TOP";TAB(21);"?
    X +"
580 C=23
590 GOSUB 1620
600 IF K=48+B THEN 630
610 GOSUB 1580
620 GOTO 590
630 C=28
640 GOSUB 1620
650 IF K=48+A*B THEN 680
660 GOSUB 1580
670 GOTO 640
680 PRINT TAB(17);"^"
690 PRINT " X TIMES TOP";TAB(16);"X
     +  X"
700 C=23
710 GOSUB 1620
720 IF K=48+A THEN 750
730 GOSUB 1580
740 GOTO 710
750 PRINT TAB(16);"__________"
760 PRINT TAB(17);"^"
770 PRINT " ADD";TAB(16);"X  +  X +"
780 GOSUB 1620
790 IF K=A+B+48 THEN 820
800 GOSUB 1580
810 GOTO 780
820 C=28
830 GOSUB 1620
840 IF K=A*B+48 THEN 870
850 GOSUB 1580
860 GOTO 830
870 GOSUB 1690
880 IF F=0 THEN 910
890 GOSUB 1530
900 GOTO 470
910 PRINT :::"CHOOSE:  1 ANOTHER PR
    OBLEM"
920 PRINT TAB(10);"2 CONTINUE PROGR
    AM"
930 CALL KEY(0,K,S)
940 IF K=49 THEN 470
950 IF K<>50 THEN 930
960 CALL CLEAR
970 CALL SCREEN(12)
980 PRINT "THERE MAY BE COEFFICIENT
    S"
990 PRINT "OF THE FIRST TERM,"
1000 PRINT "BUT THE RULES DON'T CHA
     NGE."
1010 PRINT ::"FOR EXAMPLE,"
1020 PRINT :TAB(15);"2Y + 5"
1030 PRINT :TAB(15);"3Y + 1"
1040 PRINT TAB(15);"______"
1050 PRINT :TAB(15);"2Y + 5"
1060 PRINT TAB(10);"^"
1070 PRINT TAB(8);"6Y  + 15Y"
1080 PRINT TAB(8);"_____________"
1090 PRINT TAB(10);"^"
1100 PRINT TAB(8);"6Y  + 17Y + 5":::
1110 GOSUB 1530
1120 CALL SCREEN(8)
1130 T=1
1140 SD=1
1150 SD$="+"
1160 SE=1
1170 SE$="+"
1180 GOSUB 1960
1190 CALL CLEAR
1200 CALL SCREEN(4)
1210 PRINT "BINOMIALS MAY CONTAIN"
1220 PRINT :"+ OR - NUMBERS."
1230 PRINT ::"MULTIPLY THE NUMBERS."
1240 PRINT :"AND REMEMBER THE RULES"
1250 PRINT :"FOR THE SIGNS."
1260 PRINT ::"{3 SPACES}+ * + = +"
1270 PRINT :"{3 SPACES}+ * - = -"
1280 PRINT :"{3 SPACES}- * + = -"
1290 PRINT :"{3 SPACES}- * - = +"
1300 GOSUB 1530
```

Next month, we'll present the remainder of the program. ©

Multiscreen Atari Animation

D. K. Titchenell



Often when creating computer graphics, it is useful to be able to draw more than one picture at a time using alternate screens. It also helps to be able to flip through the pictures to compare them. This flexible graphics editor lets you use a joystick to draw, and allows you to flip, copy, erase, easily animate portions of a screen, and more—using up to three screens simultaneously.

Of the many remarkable graphics facilities provided by Atari's video chip, ANTIC, the load memory scan feature, is one of the most powerful. Among many other things, it permits screen flipping by allowing the programmer to select the area or areas of memory to be used for screen display.

Screen flipping, the process in which multiple screens are displayed in rapid succession, has been covered fairly thoroughly. But in order to implement this feature easily and to greatest advantage, an editor designed specifically for the purpose is needed. Such an editor should ideally contain a sketchpad utility, and provide special features for coordinating and offsetting images on multiple screens. In addition, the ability to save and reload the completed animation screens, display facilities, and color control is desirable.

The Sketchpad

Select option D (Draw) in the main menu to enter the sketchpad mode where all the plotting is done. It is impractical to implement a cursor in this mode because the cursor would need to be too small. With a cursor of about the size of one pixel, it would be difficult to distinguish between colors. The best solution is to make the cursor a player-missile that changes colors under user control.

As much as possible, input is restricted to the joystick. With just the stick and one button you won't have great input flexibility, but it can be improved considerably. When drawing, each push of the joystick button advances the color register to the next color, cycling through all four, including the background color, then repeating. Keep the button depressed, however, and the cursor may be moved freely and rapidly about the screen without plotting. This permits detailed work, but doesn't make it easy to color large areas. The special XIO 18 fill function is designed for this purpose, but does not lend itself particularly well to this application.

Rather than use it as it was intended, it serves here as a one-dimensional fill function—it simply draws a line from the cursor to the right until it encounters a previously plotted point or wraps around. The second dimension is added by moving the cursor while the fill function is turned on. Large and complex areas can be thus filled by drawing the right border first and turning on FILL before drawing the left side. Having stretched the joystick to its limits, the fill function is activated by pressing the console START switch. It turns off as soon as the joystick button is pressed.

Animation

Some interesting and practical effects can be created using full-screen cyclic animation. One of the easiest and most obvious is the dotted line. The dots seem to flow along in an endless stream and can be used to illustrate the flow of fluid in a piping diagram or the movement of current through an electrical circuit.

Many other figures are also possible

```
   6+32:GOSUB PMSET:GOSUB COLOUR
   SET:GOSUB PAGDRAW:GOTO 400
EG 290 IF ANS$="E" THEN GRAPHICS 7+1
   6:GOTO 400
JM 300 IF ANS$="S" THEN GOSUB SAV:GO
   TO 400
CG 310 IF ANS$="R" THEN GRAPHICS 7+1
   6:GOSUB REED:GOTO 400
DI 320 IF ANS$="C" THEN GOSUB COLOUR
   SELECT:GOTO 400
GF 350 IF ANS$="K" THEN GOSUB DUPAGE
   :GOTO 400
NG 360 IF ANS$="F" THEN GOSUB FLIP:G
   OTO 400
LB 370 ? "SORRY, I DON'T UNDERSTAND
   ";ANS$:FOR W=1 TO 200:NEXT W
FP 400 GOTO 200
EG 410 REM ************ PMSET ******
   ********
KL 430 A=PEEK(106)-52:POKE 54279,A:P
   MBASE=256*A:REM SET PLAYER AD
   DRESS
ID 440 POKE 559,46:POKE 53277,3:REM
   ENABLE PM GRAPHICS
GE 450 POKE PMBASE+512,0:D=USR(ADR(M
   OV$),PMBASE+512,PMBASE+513,12
   8):REM CLEAR PLAYER AREA
EO 455 XP=X-47:YP=Y-5
FM 470 POKE 623,1:REM CURSOR PRIORIT
   Y OVER BACKGROUND
AB 475 D=USR(ADR(UPDOWN$),ADR(IMG$),
   PMBASE+512+Y,13,0)
HM 480 RETURN
AB 500 REM ********* COLOUR SELECT *
   ********
BC 510 ? "SELECT COLOR WITH STICK"
CN 512 ? "LEFT-RIGHT -- HUE"
EI 514 ? "UP-DOWN -- INTENSITY"
BC 516 ? "PUSH TRIGGER TO CHOOSE";
JM 518 IF STICK(0)=15 THEN 518
FE 519 ? "{CLEAR}":GOSUB COLOURSET:P
   OKE 752,1:REM CURSOR OFF
KP 520 ? :FOR C1=0 TO 4
GD 530 IF C1=3 THEN 650:REM COLOR 3
   IS NOT USED
MP 540 SETCOLOR C1,COL(C1),IN(C1)
HM 545 ? CHR$(28);"SETCOLOR ";C1;","
   ;COL(C1);",";IN(C1);"
   {3 SPACES}"
BO 550 FOR W=1 TO 50:NEXT W
MA 560 COL(C1)=COL(C1)+DIRH(STICK(0)
   )
JN 570 IN(C1)=IN(C1)+DIRV(STICK(0))*
   2
LC 580 IF COL(C1)>15 THEN COL(C1)=0
LB 590 IF COL(C1)<0 THEN COL(C1)=15
BM 600 IF IN(C1)>14 THEN IN(C1)=0
BL 610 IF IN(C1)<0 THEN IN(C1)=14
PJ 620 IF STRIG(0) THEN 540
MC 630 SOUND 0,64,10,12:FOR W=1 TO 5
   0:NEXT W
GH 640 SOUND 0,0,0,0
EO 650 NEXT C1
HM 660 RETURN
NH 700 REM ********** COLOURSET ****
   ********
AC 710 SETCOLOR 0,COL(0),IN(0)
AG 720 SETCOLOR 1,COL(1),IN(1)
AK 730 SETCOLOR 2,COL(2),IN(2)
BB 740 SETCOLOR 4,COL(4),IN(4)
HM 750 RETURN
BI 800 REM ********** DRAW *********
   ********
EJ 810 XP=X-47:YP=Y-5
BL 815 A=STICK(0)
OB 820 IF STRIG(0)=0 THEN ANIM=0:FIL
   L=0:IF A<>15 THEN 900
BL 830 IF STRIG(0)=0 THEN FILL=0:C=C
   +1:IF C>4 THEN C=1
HO 840 IF STRIG(0)=0 AND STICK(0)=15
    THEN 840:REM RELOOP UNTIL BU
   TTON RELEASED
NA 850 POKE 704,COL(C-1)*16+6:REM CU
   RSOR COLOR
BO 860 COLOR C:IF STRIG(0) THEN PLOT
    XP,YP
IO 865 IF PEEK(764)<>255 THEN GOSUB
   KEYIN
KC 867 IF A<>15 THEN IF ANIM>1 THEN
   AD=AD+1:IF AD>=ANIM THEN AD=0
   :RETURN
OF 870 IF PEEK(53279)=6 THEN FILL=1
II 880 IF FILL AND X<206 AND C<>4 TH
   EN POSITION XP+1,YP:POKE 765,
   C:XIO 18,#6,0,0,"S:":REM FILL
    FUNCTION
AH 890 IF PEEK(53279)<6 THEN RETURN
   :REM EXIT ROUTINE, SELECT OR
   OPTION BUTTON PRESSED
HJ 900 REM MOTION ROUTINE
DL 905 OX=X:X=X+DIRH(A):IF X>206-FIL
   L OR X<47 THEN X=OX
MC 907 OY=Y:Y=Y+DIRV(A):IF Y>100 OR
   Y<5 THEN Y=OY
CK 908 D=USR(ADR(UPDOWN$),ADR(IMG$),
   PMBASE+512+Y,13,X)
JO 909 IF A<>15 THEN IF ANIM=1 THEN
   AD=AD+1:IF AD>=ANIM THEN AD=0
   :RETURN
GM 910 GOTO 810
PM 990 REM ********* SET UP DIRECTIO
   N ARRAYS ************
HJ 1000 DIM DIRV(15):DIM DIRH(15)
KM 1005 RESTORE 1100
HL 1010 FOR W=5 TO 15
DA 1020 READ Q
CB 1030 DIRH(W)=Q
DC 1040 READ Q
DB 1050 DIRV(W)=Q
FN 1060 NEXT W
KI 1070 RETURN
LC 1100 DATA 1,1,1,-1,1,0,0,0,-1,1,-
   1,-1,-1,0,0,0,0,1,0,-1,0,0
AD 1110 REM ********* SAV **********
   **
GB 1115 D=USR(ADR(MOV$),ADR(ANS$)+1,
   SCREEN3+SCREENSIZE,62)
FB 1120 GRAPHICS 7+32:? "{CLEAR}";
CA 1130 ? "ENTER FILE NAME":INPUT SP
   EC$
DI 1135 IF SPEC$="" THEN RETURN
KD 1140 TEMP$(1,2)="D:":TEMP$(3)=SPE
   C$
MH 1145 TRAP 1220
GE 1150 OPEN #2,8,128,TEMP$:TRAP 400
   00
KN 1190 SIO=11:RW=8
LF 1200 GOSUB REDIN
KJ 1210 CLOSE #2:RETURN
IH 1220 CLOSE #2:? SPEC$;" DOESN'T S
```

```
     EEM TO WORK. TRY AGAIN":? "O
     R PRESS RETURN FOR MENU":GOT
     O 1130
DK 1250 REM *********** REED *******
     *********
FK 1255 GRAPHICS 7+32:? "{CLEAR}";
CE 1260 ? "ENTER FILE NAME":INPUT SP
     EC$
DM 1265 IF SPEC$="" THEN RETURN
KH 1270 TEMP$(1,2)="D:":TEMP$(3)=SPE
     C$
MO 1275 TRAP 1340
FN 1300 OPEN #2,4,128,TEMP$:TRAP 400
     00
HI 1310 SIO=7:RW=4
LI 1320 GOSUB REDIN
GE 1325 D=USR(ADR(MOV$),SCREEN3+SCRE
     ENSIZE,ADR(ANS$)+1,62)
KM 1330 CLOSE #2:RETURN
LM 1340 CLOSE #2:? SPEC$;" DOESN'T S
     EEM TO WORK. TRY AGAIN":? "O
     R PRESS RETURN FOR MENU.":GO
     TO 1260
GN 1400 REM ********** KEYIN *******
     *********
DH 1410 K=PEEK(764):POKE 764,255
BP 1430 IF K=30 THEN ANIM=2:RETURN
CG 1440 IF K=26 THEN ANIM=3:RETURN
CG 1450 IF K=24 THEN ANIM=4:RETURN
CN 1460 IF K=29 THEN ANIM=5:RETURN
CH 1465 IF K=31 THEN ANIM=1:RETURN
HI 1470 ANIM=0:RETURN
FO 2110 REM ********* REDIN ********
     *********
EN 2120 POKE 832+IOCB+2,SIO
EH 2130 POKE 832+IOCB+4,SCL
DA 2140 POKE 832+IOCB+5,SC3
DM 2150 POKE 832+IOCB+8,LENGTH-(INT(
     LENGTH/256)*256)
DH 2160 POKE 832+IOCB+9,INT(LENGTH/2
     56)
DP 2170 POKE 832+IOCB+10,RW
DD 2180 POKE 832+IOCB+11,128
ID 2190 DUM=USR(ADR(CALLIO$),IOCB)
KE 2200 RETURN
HJ 2210 REM ********* DUPAGE *******
     *********
NE 2220 DUM=USR(ADR(MOV$),SCREEN1,SC
     REEN2,SCREENSIZE)
NG 2230 DUM=USR(ADR(MOV$),SCREEN1,SC
     REEN3,SCREENSIZE)
KI 2240 RETURN
JP 2300 REM ********** PAGDRAW *****
     *********
HE 2310 GOSUB DRAW
LM 2320 IF PEEK(53279)=5 THEN 2440:R
     EM OPTION SWITCH EXITS MODE
KN 2330 IF PEEK(53279)<>7 THEN 2330:
     REM RELOOP UNTIL SWITCH IS R
     ELEASED
MH 2340 POKE LMSH,SC2:POKE 89,SC2:RE
     M POINT ANTIC AND OS TO NEW
     SCREEN
HI 2350 GOSUB DRAW
EF 2360 IF PEEK(53279)=5 THEN 2440
IH 2370 IF PEEK(53279)<>7 THEN 2370
PE 2380 POKE LMSH,SC3:POKE 89,SC3
HM 2390 GOSUB DRAW
EA 2400 IF PEEK(53279)=5 THEN 2440
HN 2410 IF PEEK(53279)<>7 THEN 2410
OL 2420 POKE LMSH,SC1:POKE 89,SC1
MI 2430 GOTO 2310
KK 2440 RETURN
EE 2500 REM *********** FLIP *******
     *********
PA 2505 GRAPHICS 7+16+32:GOSUB COLOU
     RSET
KE 2510 POKE LMSH,SC1:GOSUB 2550
DJ 2515 IF PEEK(53279)<>7 THEN RETUR
     N :REM ANY CONSOLE SWITCH EX
     ITS MODE
HB 2520 POKE LMSH,SC2:GOSUB 2550:REM
      ROTATE HIGH BYTE OF LMS OPE
     RAND
KI 2530 POKE LMSH,SC3:GOSUB 2550
MM 2540 GOTO 2510
DN 2550 FOR W=1 TO 5:NEXT W:REM SHOR
     T DELAY
KN 2560 RETURN
GM 2600 REM ********** DLSET *******
     *********
HD 2610 GRAPHICS 7+32+16
JM 2620 DLIST=PEEK(560)+256*PEEK(561
     )
KK 2630 LMSL=DLIST+4:LMSH=DLIST+5
IB 2640 SCL=PEEK(LMSL):SC1=PEEK(LMSH
     )
MJ 2650 SC2=SC1-16:SC3=SC2-16
KD 2660 SCREEN1=256*SC1+SCL:SCREEN2=
     256*SC2+SCL:SCREEN3=256*SC3+
     SCL
NH 2670 SCREENSIZE=3841
LA 2680 RETURN
IK 2999 REM ********** MLSET *******
     *********
KP 3000 RESTORE 3005
DH 3002 DIM MOV$(39):FOR W=1 TO 39:R
     EAD P:MOV$(W,W)=CHR$(P):NEXT
      W
MH 3005 DATA 104,104,133,215,104,133
     ,214,104
NE 3006 DATA 133,217,104,133,216,104
     ,133,218
HF 3007 DATA 104,170,160,0,177,214,1
     45,216
GJ 3008 DATA 200,208,4,230,215,230,2
     17,202
NA 3009 DATA 208,242,198,218,16,238,
     96
OJ 3019 REM UPDOWN$ IS MOSTLY MOV$ W
     ITH A LITTLE ADDED
FJ 3020 DIM UPDOWN$(44)
LG 3025 RESTORE 3050
BK 3030 UPDOWN$=MOV$
HE 3040 FOR W=39 TO 44:READ P:UPDOWN
     $(W,W)=CHR$(P):NEXT W
LH 3050 DATA 104,104,141,0,208,96
LJ 3060 RESTORE 3090
FG 3070 DIM CALLIO$(7):FOR W=1 TO 7:
     READ P:CALLIO$(W,W)=CHR$(P):
     NEXT W
KL 3080 RETURN
LM 3090 DATA 104,104,104,170,76,86,2
     28
HH 3105 REM ******* SET UP CURSOR IM
     AGE *****
LA 3110 RESTORE 3130
DE 3120 FOR W=1 TO 13:READ P:IMG$(W,
     W)=CHR$(P):NEXT W
KA 3130 DATA 0,7,7,14,14,28,28,56,56
     ,112,96,64,0
KI 3140 RETURN
```

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David D. Thornburg, Associate Editor

That's not a game, that's a microworld...

Although computer manufacturers extol the utility of home computers, the overwhelmingly popular use of these machines has been games. Many owners of computer stores tell me that customers come into their stores to purchase a computer as, for example, an educational tool for the family, but then purchase five entertainment programs and only one educational program.

From my perspective there is nothing wrong with this. Games and playing are an important part of life. A game gives the player a safe environment to test the responses of a culture in a controlled way. Baby tigers play at fighting with each other, and thus acquire skills they will need later for hunting and self-protection. Someone once said that play is the child's work.

Misplaced Calvinism

It is all too easy to get caught up in the idea that because games are entertaining they are "bad" for us. This misplaced Calvinism has had some positive consequences, however. In particular, it may have caused us to look closely at some of our games in an effort to provide a rationale for continuing to play them. For example, in the early days of personal computing a standard comment was "That's not a game, that's a simulation."

This comment, only partially in jest, was applied to many of the programs that embodied understandable (if somewhat deficient) representations of the real world. A teacher who wanted to use the game *Lemonade* could justify its use to concerned parents by showing that children were learning about the marketplace by running a simulated lemonade stand. By playing in this environment, they were developing an intuition on their own for the types of decisions (and consequences) that might face them if they were to engage in business in the real world.

This is not to suggest that all games are simulations, or that games which aren't simulations are not worthwhile. Just the same, it became accepted that simulations had a special quality that made them different and thus acceptable for use in environments where play was somehow to be discouraged.

Icon-Based Languages

While simulation was a popular topic in the late 1970s, the early 1980s gave us a new set of games about which I have said, "That's not a game, that's a language." As regular readers of this column will recall, I have treated such activities as *Lode Runner* and *Pinball Construction Set* as though they were icon-based, two-dimensional computer languages. The most recent entry to this field, *Robot Odyssey I* from The Learning Company, was the subject of last month's column. The important point regarding this class of games is that, by playing them, the user is also learning that the computer is a rich and flexible environment which can be tailored to each user's whims. If you want to play a simple pinball game, you can build one; if you want to play a pinball game that no one can win, you can build that too. The responsibility for the level and nature of the game activity has now shifted from the game designer to the player. The authors of these new games provide the player with a set of tools and an environment with which the player can explore, experiment, and create.

Moldable Microworlds

What happens when a game is both a simulation and a language at the same time? In that case we can say "That's not a game, that's a microworld."

The microworld concept is discussed by Seymour Papert in his classic book, *Mindstorms: Children, Computers and Powerful Ideas.* While a universally accepted definition of microworlds has yet to be formulated, I believe that it should contain at least these basic elements:

First, the microworld must be moldable by the user. This means that the user should be able

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to make his or her own constructions within the context of the microworld, and perhaps to change some of the underlying characteristics of the environment. This is a characteristic of *Pinball Construction Set* where, for example, the user can build his or her own pinball games and can even adjust the "gravity" field in which the game is played.

Second, the microworld must support a fantasy that has some relevance or connection to the real world. The skills that one obtains in the microworld are clearly more beneficial if they have some connection to the rest of the user's life.

A question that arises is just how much of a real-world connection is needed to qualify a program as a microworld. *Lemonade* is a fine representation of a real-world environment, but it is not a microworld simply because the program does not allow the user to modify the rules by which the lemonade stand is run. Logo's turtle geometry is a microworld since drawing and movement are real-world activities, and the user has the flexibility to explore and modify the environment at will. I feel that *Rocky's Boots* and *Robot Odyssey* are microworlds as well, since these programs develop an understanding of formal logic by allowing the user to construct and operate machines of the user's own design.

Papert Speaks Out

My view of microworlds is perhaps a bit broader than that of Seymour Papert who, at the Logo 84 conference in Boston, had this to say about the topic:

> If we look at environments such as Budge's program for building pinball machines, I feel that these programs have many of the elements of a well-designed microworld: They are child-centered; they're driven in a constructive way; no one is giving you exercises, you can sit there, working with the system without anybody saying "Do this, solve this problem." But they do lack something that the turtle world has: a set of recognizable mathematical programming ideas.
>
> Our task has to be to continue to invent worlds that have both open-endedness and a connection to other ideas in our culture.
>
> *Rocky's Boots* is an example of something significant: It does incorporate some very fundamental ideas. The idea that you can build, from several logic elements, any computational device, is surely one of the most powerful ideas of all time. It's one of the ideas that one might say gave rise to the whole microcomputer revolution. So you can't say of *Rocky's Boots* that it doesn't tap into powerful ideas. But you can say that hardly any of the people who use it—be they teachers or children—acquire through using it any appreciation of this particular powerful idea or any uses of this particular powerful idea outside of the use of this program.
>
> The major task of our microworlds is to link what we learn to the outside world. With the turtle, there is a cultural resonance with the outside world. I don't think that the idea of a universal logical element has such a resonance. Not in the lives of children anyway. How could it acquire one? It could only do it through quite profound change on a cultural level in the learning world. There are certain ideas of the turtle world, like drawing, that are already part of our culture. So, through the turtle, we pick up a mathematical form of that idea that fits in with our world.

Adult Environments

Except for his perception of *Rocky's Boots*, Papert's view of microworlds is not so different from mine. I would argue more for the creation of microworlds for adults and children alike. To the extent that they are useful (and entertaining) environments for children, appropriately designed microworlds can be captivating environments for adults as well.

Regarding the future of microworld development, Papert went on to say:

> If we look ahead ten years to the future of Logo, we might find, to a large part, that it presented us with the first of many microworlds that have become, if not the substitute for what we call curriculum, the vitally important part of what constitutes the learning environment for children. I envision the existence of 10 to 30 microworlds of which the turtle world is but one example. Some of these might be controlled by a computer language like Logo, and some of them won't, but they will all be computer-based worlds in which powerful central ideas either exist already in our scientific and intellectual heritage, or will come about in the interim. This network of microworlds will have a different

kind of life. If something like *Rocky's Boots* is one of them, it will have its cultural resonances, and will have a form that will let you meet these ideas in appropriate manners when you are six, and again as you grow older. The shape of the learning environment will be influenced by the kinds of movements that Logo is part of, and I see that as the immediate task of the next ten years.

The Computing Horizon

What I find so absolutely fascinating about all of this is that the personal computer software industry is far from falling into a rut. Just as we start to identify and classify certain types of software, entirely new categories appear on the horizon. Games become simulations, simulations become languages, and in the process the combinations become microworlds. As all of these advances are taking place, the computer itself appears to be drifting ever further into the background. We are increasingly interested in computing and decreasingly interested in the computer per se.

Even as I find myself getting tempted to design new microworlds of my own, I have the nagging suspicion that by next year I'll be saying, "That's not a game, that's a ...." ©

Commodore Disk Pattern Matching
Part 2

Jim Butterfield, Associate Editor

Last month we looked at some of the features of pattern matching. Now let's see how to deal with those annoying comma files.

Most disk users who do a little programming end up with one or more files on disk with an odd name: a comma. The files seem to be good, but the name makes them impossible to handle: It seems that you can't open or scratch such a file since attempting to use such a name always gives a syntax error response.

Such files seem so inaccessible that many users start to wonder how they managed to create them in the first place. Any attempt to create them deliberately usually ends up in the same syntax error message.

Just in case you've never seen one, or wonder how they happen, the following program has a bug which will cause a comma file to be created. You may want to try it.

```
100 INPUT "NAME OF FILE";N$
110 OPEN 1,8,3,"0:"+F$+",S,W"
120 FOR J=1 TO 50
130 PRINT#1,SQR(J)
140 NEXT J
150 CLOSE 1
```

The above program puts 50 square root values on a file. The user is asked to give a filename, which becomes the string variable N$. The program then opens a sequential file for writing, but there's an oops: We mistakenly use variable F$ for the filename instead of N$. F$ contains nothing; so we create a "no name" file—our open name file string ends up as "0:,S,W". The disk opens the file, but can't find a name; so it uses the first character it sees where the name should be: the comma.

The same thing could happen on a Commodore 64 or VIC even if the program were correct, with N$ instead of F$ in line 110. If the user pressed the RETURN key instead of typing in a filename, N$ would contain nothing—it would be a "null string," and the same comma file would be written. By contrast, a "nothing" input on a PET/CBM would cause the program to stop and the file wouldn't be written.

Oddly, you can have more than one comma file on a disk. You won't get a FILE EXISTS message.

Scratching Comma Files

If your disk has one or more comma files and you just want to get rid of them, the job is fairly easy. Use pattern matching to find out how many files you have with one-character names. Type:

LOAD "$0:?",8
LIST

or, with the DOS wedge:

@$0:?

and you'll see all the one-character names, including all the comma files.

If you have any files other than the comma ones with one-character names, change their names using the RENAME command. For example, if you have a file named X, you could temporarily change it to X99. After the comma files are gone, you can change the name back again. To change name X to X99, type:

OPEN 15,8,15
PRINT#15,"R0:X99=0:X"
CLOSE 15

or, with the DOS wedge:

@R0:X99=0:X

Now, take the same directory command as before to get a new list of the files with single-character names. If you've correctly renamed the legitimate files, you'll get only the comma files. If you have missed any, go back and rename them.

When you are sure that the only one-character names belong to comma files, get rid of them with the Scratch command. Type:

```
OPEN 15,8,15
PRINT#15,"S0:?"
CLOSE 15
```

or, with the DOS wedge:

```
@S0:?
```

One command scratches all the files. The job is done.

Reclaiming Data

It would be nice if we could rename files using the same pattern-matching system. Sometimes the data on a file is of value, and we'd like to reclaim it. Providing we need only the first comma file, we can usually get the information back.

We follow the previous procedure of insuring that the comma program is the only single-character name on the disk. If it's a program (and this is rare), we can usually get it with LOAD "?",8 followed by a save with an appropriate name. If it's a sequential file (by far the most common situation), we must write a small program to read the data.

If we just want to read the data, and not copy it to a new file, the following simple program will work with most files:

```
100 OPEN 1,8,2,"0:?,S,R"
120 INPUT#1,A$
140 PRINT A$
160 IF ST=0 GOTO 120
180 CLOSE 1
```

If we want to copy the data to a new file, the above program needs to be expanded a little:

```
100 OPEN 1,8,3,"0:?,S,R"
110 OPEN 2,8,4,"0:RECLAIM,S,W"
120 INPUT#1,A$
130 SW=ST
140 PRINT A$
150 PRINT#2,A$
160 IF SW=0 GOTO 120
170 CLOSE 2
180 CLOSE 1
```

As you can see, we're still using pattern matching to get the data. If your file is more complex, you may still use the same techniques to go after the information. Line 110 has named the new file RECLAIM; you may of course give it any name you like.

Pattern matching is useful for a variety of disk tasks. It's almost indispensable for dealing with the comma file.

Comma files are caused by programming or user mistakes. Get after them quickly, since you might be able to reclaim information written there. And, of course, look to the cause of these files—something needs fixing. ©

TI Disassembler

James Dunn

Since information on the operating system and BASIC interpreter used by the TI-99 is scarce, "TI Disassembler" will come in handy if you want to try your hand at programming in TI-9900 machine language.

A disassembler converts the jumble of numbers that actually constitute a machine language program into a more readily understandable form. For each machine language instruction (called an opcode), TI has established a one- to four-letter representation called a *mnemonic*. This disassembler decodes the contents of memory into standard TI mnemonics, making ML programs less difficult to understand. However, this program will not teach you machine language programming. To use this program, you must have at least an elementary understanding of TI machine language and a familiarity with TI's standard format for ML assemblers. Refer to any of the several books on this subject for further information.

This Disassembler is written in Extended BASIC. However, it can be easily translated for the *Mini Memory* or *Editor/Assembler* cartridges. All that is necessary is to unstack the lines so that there is only one statement on a line. All the commands can be found in console BASIC except the PEEK command which is in Extended BASIC, and also available when the *Mini Memory* or *Editor/Assembler* cartridge is installed.

Printer Output

Depending upon your printer setup, you may have to modify line 110 or the subroutine starting on line 860, which prints to the screen. It might be wiser to leave that routine as is and just add the extra lines necessary to output to your printer.

Notice that all computations and input are in decimal. If you want hexadecimal numbers, you can modify the program to add conversions. Be warned, however, that this will slow down the program. When you are disassembling 16K blocks, that can be something to think about.

The Disassembler does an excellent job on machine language programs; however, it has one weakness. It cannot tell if the area of memory you ask it to disassemble contains data, text, or jump tables. It will attempt to disassemble these as if they were legitimate opcodes. To tell if this is happening, watch for the BYT output, which indicates that the area you are disassembling contains something other than machine language.

Where You Can't PEEK

The Disassembler can only look into the CPU address space. This is a fault of the architecture of the computer itself. Since the 16K RAM area used by console BASIC is not connected to the CPU, but rather to the VDP (Video Display Processor), the Disassembler cannot access it. Also unreadable are the GROMs which contain the GPL. If you have expansion memory, it is accessible, as are the command modules. Both the *Mini Memory* and the *Editor/Assembler* cartridges provide PEEK and POKE commands which can access these areas.

In order to be consistent with TI machine language conventions, the Disassembler uses the same field symbols and addressing mode symbols used in the TI *Editor/Assembler* package. In case you don't have that package, Tables 1 and 2 show the symbols.

Explanation Of Program

30–110	Initialization and input.
120	Start of main loop.
140	PEEK locations.
150–260	Determines the format of the opcode and sends program to appropriate line number for decoding.
270–370	Decodes Format VIII opcodes.
380–420	Decodes Format VI opcodes.
430–450	Decodes Format V opcodes.
460–530	Decodes Format II opcodes.
540–590	Decodes Format IV opcodes.
600–680	Decodes Format III and IX opcodes.
690–780	Decodes Format I opcodes.
790–810	Decodes Format VII opcodes.

820	If not one of the above, byte is not a valid opcode.
840	Optional sound signal and hold when no opcode found.
860	Print to screen routine.
900	Subroutine to READ DATA and pick out mnemonic.
930	Subroutine to decode the Ts address mode.
1000-	DATA statements which contain mnemonics listed according to their Format.

Variables Used

A	Start address
A1	Temporary variable to cover quirk of PEEK statement
A$	Opcode
B	End address
B$	Source field
C$	Destination field
H	High byte of PEEK address
I	Temporary loop variable
J	Base to which value K is added
J$	Want printout
K	Displacement variable for loop
L	Low byte of PEEK address
N	Computed total of H and L
O1, O2, O3, O4	next bytes in order after L
PR	Printout variable (0 = no, 1 = y)
Q$	Temporary storage for txfr to A$
R	Register number
TR	Loop indicator
Z	Number of opcodes in format type

Table 1: TI Opcode Field Symbols

CO	Count
D	Destination operand
NU	Number
S	Source operand
Td	Specific address mode of destination operand
Ts	Specific address mode of source operand
WR	Workspace register

Table 2: TI Addressing Mode Symbols

*	means Indirect address mode
(R)	means Indexed address mode
+	after * means Auto Increment address mode
#	means Workspace Register address mode
@	means Direct address mode

TI Disassembler

```
30 REM INITIALIZE
40 TR=0 :: CALL CLEAR :: PR=0
50 PRINT "START ADDRESS (MUST BE AN
   EVEN DECIMAL NUMBER )?" :: INPU
   T A
60 IF A=0 THEN 80
70 IF A/2<>INT(A/2)THEN 50
80 PRINT "END ADDRESS ?" :: INPUT B
90 PRINT "DECODE FROM : ";A;" TO :
   ";B
100 PRINT "WANT PRINTOUT?" :: INPUT
    J$
110 IF J$="Y" THEN PR=1 :: CLOSE #1
    :: OPEN #1:"RS232",OUTPUT
120 IF A>=B THEN 50
130 A1=A :: IF A>32767 THEN A1=A-65
    536
140 CALL PEEK(A1,H,L,O1,O2,O3,O4)
150 REM TEST FOR OP CODES & ADDRESS
     MODES
160 N=H*256+L :: IF N>16383 THEN 69
    0
170 IF N>14335 THEN 600
180 IF N>12287 THEN 540
190 IF N>11263 THEN 600
200 IF N>8191 THEN 600
210 IF N>4095 THEN 460
220 IF N>2047 THEN 430
230 IF N>1023 THEN 380
240 IF N>831 THEN 790
250 IF N>511 THEN 270
260 GOTO 820
270 REM FORMAT VIII OP-CODES
280 IF (L AND 16)=16 THEN 820
290 RESTORE 1020 :: J=480 :: Z=5 ::
     K=32 :: R=(L AND 15):: N=((H A
    ND 3)*256)+(L AND 224):: GOSUB
    900
300 IF TR<>1 THEN 330
310 C$=STR$(O1*256+O2):: A=A+4
320 B$="R"&STR$(R)&"," :: GOTO 370
330 Z=2 :: GOSUB 900 :: IF TR<>1 TH
    EN 350
340 C$="" :: A=A+2 :: B$="R"&STR$(R
    ):: GOTO 370
350 Z=2 :: GOSUB 900 :: IF TR<>1 TH
    EN 820
360 B$=STR$(O1*256+O2):: A=A+4 :: C
    $=""
370 GOSUB 860 :: TR=0 :: GOTO 120
380 REM FORMAT VI OP-CODES
390 N=(H*256)+(L AND 192):: J=960 :
    : Z=14 :: K=64 :: RESTORE 1000
    :: GOSUB 900
400 GOSUB 930
410 C$="" :: IF A$="B" AND B$="*R11
    " THEN C$="(SAME AS RTS)"
420 GOSUB 860 :: TR=0 :: GOTO 120
430 REM FORMAT V OP-CODES
440 N=(H AND 11)*256 :: J=1792 :: C
    O=(L AND 240):: WR=(L AND 15)::
     RESTORE 1040 :: Z=4 :: K=256 :
    : GOSUB 900
450 B$="R"&STR$(WR)&"," :: C$=STR$(
    CO):: A=A+2 :: GOSUB 860 :: TR=
    0 :: GOTO 120
460 REM FORMAT II OP-CODES
470 RESTORE 1050 :: J=3840 :: TR=0
    :: Z=13 :: K=256 :: N=H*256 ::
    GOSUB 900
480 IF TR=0 THEN 500
490 B$=STR$(2*L+2):: GOTO 520
500 Z=3 :: K=256 :: GOSUB 900
510 B$=STR$(L)
520 C$="" :: A=A+2 :: IF A$="JMP" A
    ND B$="2" THEN C$="(SAME AS NOP
    )"
530 GOSUB 860 :: TR=0 :: GOTO 120
540 REM FORMAT IV OP-CODES
550 IF (H AND 252)=48 THEN A$="LDCR
    " :: GOTO 580
```

```
560 IF (H AND 252)=52 THEN A$="STCR" :: GOTO 580
570 GOTO 820
580 GOSUB 930 :: NU=((H AND 3)*4)+((L AND 192)/64)
590 C$=","&STR$(NU):: GOSUB 860 :: TR=0 :: GOTO 120
600 REM FORMAT III & IX OP-CODES
610 RESTORE 1070 :: J=7168 :: N=((H AND 60)*256):: D=((H AND 3)*4)+((L AND 192)/64):: Z=3 :: K=1024 :: GOSUB 900
620 IF TR<>1 THEN 650
630 C$=","&"R"&STR$(D)
640 GOSUB 930 :: GOSUB 860 :: TR=0 :: GOTO 120
650 IF N<>11264 THEN 670
660 A$="XOP" :: C$="XOP OP #"&STR$(D):: GOTO 640
670 J=13312 :: Z=2 :: K=1024 :: GOSUB 900 :: IF TR<>1 THEN 820
680 GOTO 640
690 REM FORMAT I OP-CODES
700 RESTORE 1080 :: J=12288 :: N=(H AND 224)*256 :: Z=12 :: K=4096 :: GOSUB 900
710 TD=(H AND 12):: D=((H AND 3)*4)+((L AND 192)/64):: GOSUB 930
720 IF TD=0 THEN C$=","&"R"&STR$(D) :: GOTO 770
730 IF TD=4 THEN C$=","&"*R"&STR$(D):: GOTO 770
740 IF TD=12 THEN C$=","&"R"&STR$(S)&"+" :: GOTO 770
750 IF (TD=8)AND(D=0)THEN C$=","&"@"&STR$(01*256+02):: A=A+2 :: IF TS=32 THEN C$=","&"@"&STR$(03*256+04)
760 IF (TD=8)AND(D<>0)THEN C$=",@"&STR$(01*256+02)&"(R"&STR$(S)&")" :: A=A+2 :: IF TS=32 THEN C$=",@"&STR$(03*256+04)&"(R"&STR$(S)&")"
770 GOSUB 860 :: TR=0 :: GOTO 120
780 IF (TD=8)AND(D=0)THEN C$=",@"&STR$(01*256+02):: A=A+2 :: IF TS=32 THEN C$=",@"&STR$(03*256+04)
790 REM FORMAT VII
800 N=(H*256+L):: A=A+2 :: B$="" :: C$="" :: Z=6 :: J=800 :: K=32 :: RESTORE 1100
810 GOSUB 900 :: GOSUB 860 :: TR=0 :: GOTO 120
820 REM NOT OP-CODE
830 A$="BYTE" :: B$=STR$((H*256)+L) :: C$=CHR$(H)&" "&CHR$(L):: A=A+2 :: GOSUB 860
840 REM CALL SOUND(800,400,0):: ACCEPT Q4$ :: GOTO 97
850 GOTO 120
860 REM PRINT ROUTINE
870 PT$=STR$(A1)&"    "&A$&"  "&B$&C$ :: PRINT PT$ :: A1=A
880 IF PR=1 THEN PRINT #1;TAB(10);PT$
890 RETURN
900 REM FIND OP-CODE FROM DATA
910 FOR I=1 TO Z :: J=J+K :: READ Q$ :: IF N=J THEN A$=Q$ :: TR=1
920 NEXT I :: RETURN
930 REM SUBROUTINE TS ADDRESS
940 S=(L AND 15):: TS=(L AND 48):: IF TS=0 THEN B$="R"&STR$(S):: A=A+2 :: RETURN
950 IF TS=16 THEN B$="*R"&STR$(S):: A=A+2 :: RETURN
960 IF TS=48 THEN B$="*R"&STR$(S)&"+" :: A=A+2 :: RETURN
970 IF (TS=32)AND(S=0)THEN B$="@"&STR$(01*256+02):: A=A+4 :: RETURN
980 IF (TS=32)AND(S<>0)THEN B$="@"&STR$(01*256+02)&"(R"&STR$(S)&")" :: A=A+4 :: RETURN
990 BREAK
1000 DATA BLWP,B,X,CLR,NEG,INV,INC,INCT,DEC
1010 DATA DECT,BL,SWPB,SETO,ABS
1020 DATA LI,AI,ANDI,ORI,CI
1030 DATA STWP,STST,LWPI,LIMI
1040 DATA SRA,SRL,SLA,SRC
1050 DATA JMP,JLT,JLE,JEQ,JHE,JGT,JNE
1060 DATA JNC,JOC,JNO,JL,JH,JOP,SBO,SBZ,TB
1070 DATA COC,CZC,XOR,MPY,DIV
1080 DATA SZC,SZCB,S,SB,C,CB,A,AB
1090 DATA MOV,MOVB,SOC,SOCB
1100 DATA IDLE,RSET,RTWP,CKON,CKOF,LREX
```
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Atari Speed-Reading

Clark Morrow

Everybody knows that the Atari plays great arcade games, but can it improve your reading skills? This program will turn your Atari into a private speed-reading tutor.

"Speed-Reading" is an enjoyable and effective way to increase your reading speed. This program flashes phrases on the screen at your choice of four speeds.

While the phrases flash on the center of the screen, keep your eyes focused in the middle to avoid reading from left to right.

At first, a menu is displayed. You can then select the speed by pressing OPTION and the line length by pressing SELECT. Pushing START runs the program. You can return to the menu by holding down the OPTION button.

Start with short lines and medium speed. As your speed increases, try the longer lines, but remember to keep your eyes on the center of the screen.

POKEs And PEEKs

There are several interesting POKE and PEEK statements in the program. One that is particularly useful is POKE 752,1. This POKE will turn the cursor off. To test if either the START, SELECT, or OPTION key is pressed, a PEEK(53279) is executed. A result of 7 means that no key is being pressed, 6 that START is pressed, 5 that SELECT is pressed, and 3 that OPTION is being pressed. POKEs to locations 84 and 85 position the cursor horizontally and vertically in the graphics window.

Creating More Data

By removing the first REM in line 670, the program will randomly select a line number that is greater than or equal to 2100 and is a multiple of 100. It will then read data until it reaches a /END. When a /END is encountered, this process is repeated.

To add more data, change the 5 in line 670 to reflect the total number of lines (beginning with a multiple of 100). If the first REM in line 670 is removed, the beginning line number of each group of words must be divisible by 100 and be 100 greater than the previous group. However, any lines between the beginning line number and the /END may have any statement number. When typing more data, place a comma after every two words. At the end of each group of words, type two commas as a delay then type /END.

Atari Speed-Reading

Refer to the "Automatic Proofreader" article before typing this program in.

```
LP 50 DIM A$(100),B$(100),SPEED$(30)
      ,L$(30)
IN 60 B=10:MENU=730
EL 70 REM
FH 80 REM *** PRINT TITLE ***
EN 90 REM
EL 100 GRAPHICS 18
HG 110 REM
DM 120 REM *** INITIALIZE STRING ***
HI 130 REM
NI 140 A$(1)=" ":A$(19)=" ":A$(2)=A$
       (1):A$(20)="S":B$="PEED READI
       NG":B$(13)=" ":B$(32)=" ":B$(
       14)=B$(13)
EO 150 B$(LEN(B$)+1)="by clark morro
       w"
NA 160 B$(49)=" ":B$(74)=" ":B$(50)=
       B$(49)
```

```
HM 17Ø REM
DC 18Ø REM *** MOVE TITLE ***
HO 19Ø REM
EF 2ØØ A$=A$(2):A$(LEN(A$)+1)=B$(1,1
       ):B$=B$(2)
MJ 21Ø POSITION Ø,5:? #6;A$:FOR X=1
       TO 3Ø:NEXT X
KJ 215 IF A$(5,5)="S" OR A$(4,4)="b"
        THEN FOR X=1 TO 2ØØ:IF PEEK(
       53279)=7 THEN NEXT X
OP 22Ø IF LEN(B$)=4 THEN 24Ø
NJ 23Ø IF PEEK(53279)=7 THEN 2ØØ
EL 24Ø GOSUB MENU
HM 25Ø GRAPHICS Ø:POKE 752,1
PB 26Ø PRINT :PRINT " PRESS OPTION T
       O RETURN TO MENU"
EP 27Ø FOR X=1 TO 5ØØ:NEXT X
HA 28Ø TRAP 69Ø
HP 29Ø REM
OK 3ØØ REM *** MAIN PROGRAM LOOP ***
HI 31Ø REM
JH 32Ø READ A$:IF A$="/END" THEN 67Ø
AD 33Ø IF L=1 THEN B$="":GOTO 38Ø
MO 34Ø READ B$:IF B$="/END" THEN R=1
       :GOTO 67Ø
HM 35Ø REM
ED 36Ø REM *** CENTER THE LINE ***
HO 37Ø REM
ML 38Ø T=19-(LEN(A$)+LEN(B$))/2
PC 39Ø POSITION T,1Ø
LA 4ØØ IF L=1 THEN ? A$
FD 41Ø IF L=2 THEN ? A$;B$
HK 42Ø REM
IF 43Ø REM *** DETERMINE SPEED ***
HM 44Ø REM
MJ 45Ø IF OPT=Ø THEN SP=2
MN 46Ø IF OPT=1 THEN SP=4
NB 47Ø IF OPT=2 THEN SP=6
NF 48Ø IF OPT=3 THEN SP=8
PM 49Ø FOR X=1 TO SP*B
NN 5ØØ IF PEEK(53279)=3 THEN 55Ø
CN 51Ø NEXT X
HL 52Ø REM
JP 53Ø REM *** CLEAR SCREEN ***
HN 54Ø REM
BB 55Ø PRINT CHR$(125)
HP 56Ø REM
HN 57Ø REM *** IF OPTION IS PRESSED
       THEN RETURN TO MENU ***
IB 58Ø REM
AL 59Ø IF PEEK(53279)=3 THEN GOSUB M
       ENU:GOTO 25Ø
GD 6ØØ GOTO 31Ø
HL 61Ø REM
ED 62Ø REM *** END OF MAIN LOOP ***
HN 63Ø REM
HO 64Ø REM
EI 65Ø REM *** RANDOMLY CHOOSE SELEC
       TION ***
IA 66Ø REM
IJ 67Ø REM SEL=INT(5*RND(1)+1):RESTO
       RE SEL*1ØØ+2ØØØ:IF R=1 THEN R
       =Ø:GOTO 34Ø:REM _*RND= NUMBER
        OF SELECTIONS
GL 68Ø GOTO 31Ø
NA 69Ø RESTORE :GOTO 28Ø
HL 7ØØ REM
MB 71Ø REM *** GRAPHIC MENU DISPLAY
       ***
HN 72Ø REM
CH 73Ø SPEED$="FAST":L$="SHORT":L=1:
       OPT=Ø
BB 74Ø GRAPHICS 2:SETCOLOR 2,Ø,Ø:POK
       E 752,1
JA 75Ø PRINT #6;"{4 SPACES}speed rea
       ding":? #6:? #6
HN 76Ø PRINT #6;" SPEED: ";SPEED$
DF 77Ø PRINT #6:? #6;" LINES: ";L$
ED 78Ø PRINT "PUSH OPTION TO CHANGE
       SPEED"
HM 79Ø PRINT "PUSH SELECT TO CHANGE
       LENGTH"
FP 8ØØ PRINT "PUSH START TO BEGIN"
CB 81Ø IF PEEK(53279)<>7 THEN 81Ø
HO 82Ø REM
AN 83Ø REM *** START OF MENU LOOP **
       *
IA 84Ø REM
EN 85Ø POKE 84,3:POKE 85,8:PRINT #6;
       SPEED$;:? #6;"{4 SPACES}"
CL 86Ø POKE 84,5:POKE 85,8:PRINT #6;
       L$;:? #6;"{7 SPACES}"
ID 87Ø REM
CA 88Ø REM *** CHECK CONSOLE BUTTONS
        ***
IF 89Ø REM
OE 9ØØ IF PEEK(53279)=7 THEN 9ØØ
CL 91Ø IF PEEK(53279)=6 THEN RETURN
CI 92Ø IF PEEK(53279)<>5 THEN 97Ø
DL 93Ø L=L+1:IF L=3 THEN L=1
GC 94Ø IF PEEK(53279)<>7 THEN GOTO 9
       4Ø
JH 95Ø IF L=1 THEN L$="SHORT"
DJ 96Ø IF L=2 THEN L$="LONG"
FA 97Ø IF PEEK(53279)<>3 THEN 1Ø4Ø
NM 98Ø OPT=OPT+1:IF OPT=4 THEN OPT=Ø
GM 99Ø IF PEEK(53279)<>7 THEN GOTO 9
       9Ø
CD 1ØØØ IF OPT=Ø THEN SPEED$="FAST"
CJ 1Ø1Ø IF OPT=1 THEN SPEED$="MED. F
        AST"
LK 1Ø2Ø IF OPT=2 THEN SPEED$="MEDIUM
        "
EA 1Ø3Ø IF OPT=3 THEN SPEED$="SLOW"
JL 1Ø4Ø GOTO 85Ø
KK 1Ø5Ø REM
IC 1Ø6Ø REM *** END OF MENU LOOP ***
KM 1Ø7Ø REM
KN 1Ø8Ø REM
MN 21ØØ DATA It was, now the, eighte
        enth of, September and, my y
        acht, was ready, to sail.  ,
        ,/END
LH 22ØØ DATA We were, 4Ø miles, out
        when, I first, saw the, stor
        m. , It grew, larger, every
        second.  ,,/END
KB 23ØØ DATA The waves, were nearly,
         ten feet, high.
LO 231Ø DATA I was, almost swept, in
        to the, sea; but, I managed,
         to grab, onto the, rail and
        , climb aboard.  ,,/END
JI 24ØØ DATA The storm, passed over,
         and my, yacht had, only rec
        eived, minimal damage, but I
        , had to, return to, port
DP 241Ø DATA ,,/END
FO 25ØØ DATA Now I'll, leave it, to
        you, to add, to this, story
        or, write your, own.  ,,/END
```
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How Computers Made Me Smarter After Only Thirteen Years Of Daily Use

On this occasion of my third anniversary as a COMPUTE! columnist, I am going to look back, back into the mists of time, and count (on my fingers and toes) all the blessings computers have brought me.

Blessing 1: Cuisinart-Brain Thinking

Sometime ago I was up in Toronto, Canada, making a speech to educators on using computers in the classroom, and after my speech, an educator came up to me and complimented me by telling me I was an "integrated brain thinker." She explained to me that, from my speech, it was obvious that I could think with my left brain (the analytical side), and I could think with my right brain (the creative side). Ergo, I must be an integrated brain thinker.

I was flattered, but modestly I said she was far too generous. I told her that I wasn't a left-brain thinker, a right-brain thinker, or an integrated-brain thinker. Instead, I said, I was a *Cuisinart-brain thinker*. As a Cuisinart-brain thinker I had the rare ability to process facts and ideas by slicing them, dicing them, mixing them together, then spinning them around. I told her I owed my talent to a long and deep association with computers.

Blessing 2: An Algorithmic Lifestyle

The next morning after I had talked to the educator in Toronto, I was in the shower in my hotel room. I had soaped up and rinsed off, so I was ready to turn the shower off.

With my computerlike memory I recalled that most showers have screw handles. You usually turn them to the left to get more water; and you turn them to the right to get less. Since I wanted less water, I turned my shower handle to the right. The algorithm was simple and clear, and I was determined to follow it.

However, when I turned the shower handle to the right, the water didn't turn off. Instead, it became cold—*freezing cold*.

Gasping from the ice-cold water and dancing around in the shower, I swiftly concluded that: (1) My algorithm had some bugs in it; (2) To the right was not the way to shut the water off in *this* shower; and (3) I had better find a way to shut off the water soon or I would succumb to acute hypothermia.

I clenched my teeth and coldly reasoned that if the shower didn't shut off by turning it to the right, it must have a reverse screw in the handle. This made sense. I was in Canada, wasn't I? Canada is a foreign country. In Canada they probably used reverse screws for everything.

If the handle had a reverse screw, that meant that if I wanted to turn off the shower I had to turn to the left. Boldly I turned the handle all the way to the left to shut off the water.

This time I got a blast of steaming, scalding hot water. "Aagh," I yelled. I backed away from the shower head and conked my head on the towel rack at the rear of the tub.

In another moment I would be boiled like a

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hot dog in my own shower. I had to think quickly. In a last-ditch effort, I called on my brain's full computer-trained reflexes and realized that my shower handle must not be a left-right, on-off shower handle at all. Instead, it must be a push-pull shower handle. Pull turned it on. (Something I had unfortunately forgotten.) And push must turn it off.

In a final, desperate gesture I charged toward the front of the shower and jammed the handle into the wall.

Instantly, miraculously, and logically, the shower stopped.

Blessing 3: Computers Give Me Lightning-Fast Logic

In the last year I have traveled to 13 conventions, made 49 speeches, given 11 interviews, and appeared on 18 radio programs and 14 TV programs. And I am not alone. There are dozens of others in the computer industry with a schedule similar to mine. We are roaming the country, playing with the latest gadgets, trading gossip about computer companies and their media superstars, and searching for juicy stories for our magazines.

Back in the spring I was attending so many events each week that sometimes I forgot which city I was in. But I never lost the lightning-fast logic that years of close association with computers had given me. That tided me over even during my most grievous overdoses of travel, speaking, and interviewing.

I remember well one conference I went to (which conference? which city?) when I was handed a name badge with a unique and wonderful feature. I noticed this feature the moment I put the badge on the lapel of my sport coat. The badge had been designed to allow me to look down at my chest and read my name as if it were rightside up.

During the day, as I made speeches at the convention and interviewed a number of illustrious conventioneers, I continually glanced down at the badge and marveled at its design.

That night I went out to dinner, so I took the badge off and stuffed it in my sport coat pocket.

The next morning, when I put the badge on again, I was startled. All of a sudden the badge no longer worked. When I glanced down at it, all the information on it was upside down and backwards.

I puzzled over this problem all during breakfast that morning. At last, as I was munching on a sprig of parsley that had come with my fried eggs, it hit me. The badge was not a special badge after all. I could read my name the first day because *I was wearing the badge upside down.*

Blessing 4: I've Become A Whiz Around Machines

When I first got into computers I was no wizard with machines or a do-it-yourselfer. In fact I had almost no mechanical savvy at all. As proof I need only cite a test I took in high school in which I achieved a score of 0.06 percent for mechanical aptitude.

Yet I've always loved computers.

However, since computers are machines (a fact that I frequently try to overlook), I often run into problems. It's not their software or their logic that waylays me, mind you, since I have become quite a thinker in these areas (see my blessings above). Instead it's their physical nature—their "machineness"—that confounds me.

For example, last spring I was ecstatic when my newest computer toy arrived, special delivery, in the mail. It was a portable Compaq computer, and I intended to take it with me to London, England, to teach a course on robotics.

Except I couldn't get it open.

So, after I unboxed this lovely machine, I spent half an hour just looking at it on the kitchen table. But I couldn't, for the life of me, figure out how it opened up. It looked like a big ivory-colored sewing machine or suitcase, except there were no handles, no latches—no *nothing.*

I was getting more and more nervous and depressed as the minutes ticked away. My plane to London would be taking off soon, and I had to get packed, yet I hadn't even turned the computer on. Maybe it didn't work. But how was I to know. I couldn't get inside to find out.

I sat there and stewed, and I cursed my miserable 0.06 percent mechanical aptitude.

Then Catie came home from school.

Catie is my daughter, and even though she was only seven years old at the time, she was very perceptive. She immediately noticed something was wrong when she saw me slumped over the kitchen table, crying on what looked like a sewing machine.

I told her my problem, and she began snooping around the computer case looking for a way to open it. About fifteen seconds later, she popped up from the other side with a big grin on her face. "No wonder you couldn't open it," she said. "You were looking at the top. The latch is on this side—on the bottom."

Five minutes later, Catie had the computer out on the table, plugged in, and running a word processing program. "You shouldn't cry over a computer, Daddy, " she advised me. "Wait until I come home from school next time, and I'll help you."

©

Apple Disk Checker

Bruce Wiseman

Here's a description of the technique and a program which is fast, simple, and doesn't require any modifications to DOS.

On sector 0 of track 17 of every diskette initialized by Apple DOS 3.3 is something called the Volume Table of Contents, or VTOC.

One of the things in the VTOC is the bitmap which tells which sectors are used and which are free. Each track on the diskette is represented by four bytes on the bitmap. There are 16 sectors per track in DOS 3.3. The first two bytes of the four assigned to each track keep count of the used and free sectors; the other two bytes are reserved for expansion and contain zeros. The problem, then, is how do you keep count of 16 sectors with just two bytes?

The bitmap is exactly what the name says: a map expressed in bits (binary 0's and 1's). It shows which sectors are used and which are free. When we look at memory in the Apple with the monitor, we see each byte as two hex characters. FF, for example, is one byte in memory. These hex characters represent the binary bits that make up that byte. In other words, the hex FF that we see represents 1111 1111 in the byte. The first F represents the first half-byte, and the second F the last half-byte. If the byte was, say, C1, then in binary it would be 1100 0001.

Recall that DOS is keeping track of 16 sectors for us. Recall also that DOS is using two bytes of eight bits each to do it. Each bit in the two bytes keeps track of one of the 16 sectors. The map is laid out like this:

Byte 1	Sectors	F	E	D	C	B	A	9	8
Byte 2	Sectors	7	6	5	4	3	2	1	0

DOS uses a binary 1 to show a sector free and a binary 0 to show it used. Thus if sector F on a particular track is free, DOS sets the first bit of the first byte to 1.

Now for a few examples. Suppose track 8 on a diskette has only sectors 15 and 8 free. The bitmap for that track would be:

Byte 1 1000 0001
Byte 2 0000 0000

The first bit in the first byte is set to 1; this is the map location for sector $F (15). The locations for sectors E, D, C, B, A, and 9 are all set to 0 since these sectors are used. The bit location for sector 8, however, is set to 1 since that sector is free. In a similar fashion, the second byte containing the map to sectors 7, 6, 5, 4, 3, 2, 1, and 0 contains all zeros since the sectors are all used.

If we were to look at this bitmap, we would see it in hex as:

Byte 1 81
Byte 2 00

Let's take one more example. Suppose track 12 has sectors 15, 14, 11, 9, 7, 3, 2, and 1 all free. The bitmap would be:

Byte 1 1100 1010
Byte 2 1000 1110

If you check this against the layout for the map, you will see that the 1's bits correspond to the free tracks. If we look at the map, we'll see the hex representation of the binary as:

Byte 1 CA
Byte 8 8E

Understanding Disk Checker

The problem, then, is twofold. First we must get the VTOC into memory so we can look at the bitmap, and then we must count the binary 1's to see how many free sectors there are on the diskette.

Apple DOS has a machine language subroutine called the Read/Write Track Sector routine, or RWTS for short, that will read or write a sector on a diskette. We can enter the routine through a jump to subroutine (JSR) instruction to address $3D9. The RWTS routine requires some information from us about what it is we want to read and where in memory to place it, etc. We provide the routine with this information in the form of a couple of tables that we build in memory. The first table is called the Input Output Control Block, or IOCB for short. It will provide the RWTS subroutine with the slot, drive number, track, sector, and the address in memory to store what it reads. The other table we need to provide is called the Device Characteristics Table.

As you might guess from the name, it provides the RWTS subroutine with information about the disk drive itself.

The RWTS routine normally reads a whole sector at a time, and since a sector is 256 bytes long, we must reserve memory space of that size to place the information that the Read/Write Track Sector subroutine reads in. Technically, this space is referred to as a buffer.

Table 1 shows the IOCB that we will be using, while Table 2 shows the Device Characteristics we will need.

Table 1: The IOCB

Byte (in hex)	Value (in hex)	Description
$00	$01	Table type (always 1)
$01	$60	Slot number * 10 (slot 6)
$02	$01	Drive number
$03	$00	Volume ID (00 means any)
$04	$11	Track number ($11 is the track for the VTOC)
$05	$00	Sector number ($00 for the VTOC)
$06-07	$20, $03	Address of the Device Characteristics table, low/high format
$08-09	$00, $60	Address of the buffer, low/high format
$0A	$00	Not used
$0B	$00	Read whole sector
$0C	$01	Control code for a read
$0D	$00	Space for return code from DOS
$0E	$00	Volume ID of last access
$0F	$60	Slot number of last access
$10	$10	Drive number of last access

Table 2: Device Characteristics

Byte (in hex)	Value (in hex)	Description
$00	$00	Device type (always a 00 for Disk II)
$01	$01	Phases per track (always 01 for disk)
$02-03	$EF, $D8	Motor on time (always these values for disk II)

After we build these two tables in memory, we load the Y and A registers with the address of the IOCB table, and JSR to $3D9. The RWTS subroutine will then read the track and sector that we provided it in the IOCB table and place that sector in the buffer address we provided it in the IOCB. Half of our problem is now taken care of; we have the VTOC in memory. Now all we have to do is count the binary 1's in the bitmap to see how many free sectors we have.

The complication is that the bitmap will be in hex and we need to see it in binary. There are several ways in which we could do this. One is to use the machine language instruction ROL. ROL stands for rotate left. What this instruction does is roll the bits of a byte one bit to the left. It rolls the leftmost bit into the Carry flag, so if the bit was a 1, then the Carry flag gets set on.

As an example, say the accumulator held $C1. In binary this would be 1100 0001. The first ROL would set the Carry flag on, since the leftmost bit is a 1 and is rotated into the Carry flag. After that the contents of the accumulator look like this: 1000 0010. Now if we reset the Carry flag and ROL again, the flag gets set and the accumulator looks like this: 0000 0100.

What we will do is load the accumulator with the contents of the first byte of the bitmap. Then we will roll it left eight times as we count the number of times the Carry flag gets turned on. Each time the flag is set on we will increment (add one to) a special memory location that will hold our total. We then go get the next byte of the bitmap and repeat the entire operation again. The process continues until the whole bitmap is counted.

Recall that earlier we found out that each track has four bytes in the bitmap, but only the first two are really used. Our machine language program counts them all, but since the last two contain all zeros it doesn't matter. This is less complicated than trying to skip the unused bytes since it is easier to spend a few microseconds to count some zeros than to build the logic to go around them.

Program 1 is a BASIC program which POKEs in the machine language for "Disk Checker," then executes it. After you have typed in and run Program 1, you can save a copy of the machine language with:

```
BSAVE SPACE.OBJ,A768,L85
```

With this copy of the machine language, you can use Program 2 as your disk HELLO program, so that you'll be told the number of free sectors on the disk when you boot the system.

Program 1: Disk Checker Loader

```
10  HOME
20  FOR I = 768 TO 852
30  READ A:CK = CK + A: POKE I,A: NEXT

35  IF CK <  > 7986 THEN  PRINT "ERR
     OR IN DATA STATEMENTS": STOP
40  CALL 768
50 T =  PEEK (896) +  PEEK (897) * 2
     56
60  PRINT "THERE ARE ";T;" FREE SECT
     ORS"
61  REM
62  REM **************************
65  REM  DATA IS ASSEMBLY PROGRAM+IO
      B AND  DEVICE TABLES
67  REM
68  REM **************************
70  DATA  169,3,160,64,32,217,3,169,
      0,141
```

```
80  DATA  128,3,141,129,3,24,162,0,
    160,56
90  DATA  185,0,96,42,144,24,24,238,
    128,3
100 DATA  72,169,0,205,128,3,208,3,
    238,129
110 DATA  3,104,232,224,8,208,232,7
    6,55,3
120 DATA  232,224,8,208,224,162,0,2
    00,192,196
130 DATA  208,214,96,0,1,96,1,0,17,
    0
140 DATA  81,3,0,96,0,0,1,0,25,96
    ,1
150 DATA  0,1,239,216
```

Program 2: Free Sector HELLO

```
10 HOME :D$ = CHR$ (4)
20 PRINT D$"BLOAD SPACE.OBJ"
30 CALL 768
40 T = PEEK (896) + PEEK (897) * 2
    56
50 PRINT "THERE ARE ";T;" FREE SECT
    ORS"
```

©

Donald W. Watson

Ten minutes is all it takes to get a printer dump of your Apple II text screen. And there are dozens of uses for this simple subroutine.

Boot your system into Applesoft BASIC, type NEW to clear the program memory, type HOME to clear the screen, and type in the following seven short lines:

```
100 D$ = CHR$ (4):I$ = CHR$ (9)
105  PRINT D$"PR#1"
110  PRINT I$"80N";
115  FOR G = 0 TO 2: FOR L = 1 TO 8:
      PRINT  SPC( 20): FOR P = 0 TO
     39
120 C = PEEK (896 + G * 40 + L * 12
     8 + P)
150  PRINT  CHR$ (C);: NEXT : PRINT
     : NEXT : NEXT
160  PRINT D$"PR#0"
```

With a parallel printer interface card in slot 1, you can use the program exactly as shown; with a serial printer interface card, delete the second statement in line 100 and delete line 110 completely.

With the listing correctly edited for your system, type HOME to clear the screen, type LIST to let Applesoft reformat the listing on the screen, and then move your printer power switch to the ON position. If you wanted to print a copy of the listing, you would ordinarily have to set up the printer with (at least) an immediate mode PR#1 command followed by an immediate mode LIST command. Since the program you just entered is a screen dump program, why not use it to print itself? Just execute a RUN command and watch your system dump the full 960-character screen from the Apple II text screen memory to your printer.

The Okidata Microline 80 parallel printer will dump the text screen memory in about one and a half minutes. The Qume Sprint 5/55 serial printer will dump it in one minute.

Screen Organization

Lines 100 through 110 are explained in the printer control card manuals. Line 110 is required in the program if a parallel printer interface control card is used; in addition to setting the printer to accept 80-character lines, it directs output to the printer only—holding the screen display "frozen" while the screen memory is dumped.

Line 115 sets up three loop functions, indexing the dump routine to the requirements of the Apple II text screen memory address plan. See Figure 1 on page 16 of the *Apple II Reference Manual* for the map of the text screen. The screen is organized into three vertical sections or groups (G = 0 to 2) of eight lines each (L = 1 to 8), and each line contains 40 addresses for the characters to be printed (P = 0 to 39). The PRINT SPC(20) statement provides a 20-character left-hand margin to center the printed record in an 80-character horizontal print format.

At line 120, the three loop indices from line 115 are used with an offset starting value (896) in an expression to yield each successive text screen memory address. The expression yields the first screen position, decimal address (1024) for G = 0, L = 1, and P = 0; and it yields the correct value for each of the remaining 959 memory addresses as the loop variables are incremented. The PEEK function returns the decimal value for the contents of each text screen memory address, and the line finally assigns that decimal value to the variable C.

Line 150 directs the printer to print the ASCII character identified by the decimal value of the variable C, and terminates each of the index loops at the appropriate increments. The PRINT statement provides a linefeed and carriage return for each group of 40 characters printed.

The gap in the program line numbers is significant. The program as entered so far will dump the text screen memory correctly only if the memory does not contain INVERSE or FLASH mode character codes. Insert the following three lines to convert INVERSE and FLASH character codes to NORMAL mode character codes:

```
130  IF C < 32 THEN C = C + 192
135  IF C > 31 AND C < 96 THEN C = C
       + 128
140  IF C > 95 AND C < 128 THEN C =
     C + 64
```

Using It As A Subroutine

The program is easily converted to a subroutine for use in other Applesoft II programs. Just add a line 170 with a RETURN statement and call the subroutine from your program code with a line containing a GOSUB 100 statement.

For example, Figure 1 shows a Summary Screen used in a property management accounting program. In the instruction lines at the base of the screen, the operator is prompted for an E to make Final Entries, an X to Exit the program, or an M to return to the program Menu. The accounting program code supporting the prompts contains an INPUT X$ statement to halt program execution and wait for a keyboard response. No visual prompt is needed, but an S response from the keyboard will call the text screen dump subroutine if the following line is added to the accounting program code:

```
5000  IF X$ = "S" THEN  GOSUB 100
```

With line 5000 present in the accounting program, an S response at the Summary Screen

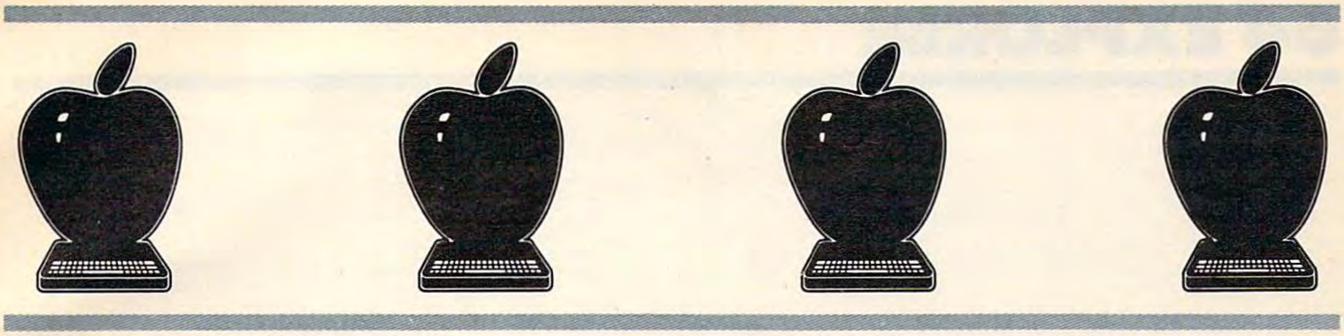
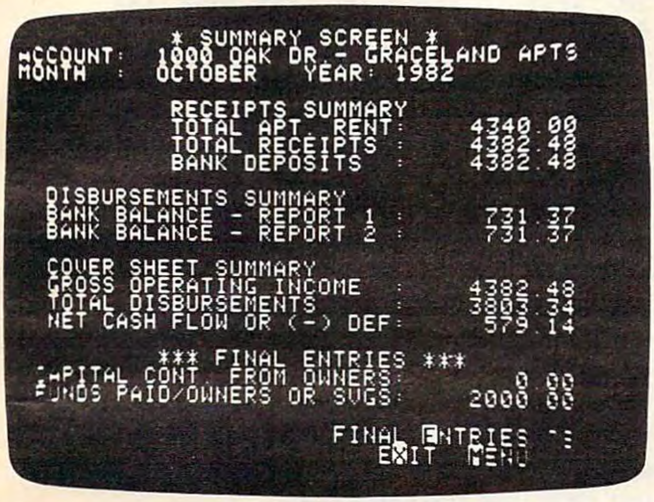


Figure 1:
Accounting Program Summary Screen



will dump the screen to the printer, producing a hard copy as shown in Figure 2.

Potential Uses

In the property management program, the manager and system operators can get a hard copy of the summary screen for any property in the data files in a moment or two. A paper record of the screen is very useful in monitoring the system and for reference in conferences (especially with property owners) away from the computer.

Screen dump copy is especially useful in inventory management systems. While filling orders, a stock clerk can interrogate the computer inventory files to get a screen display of quantity on hand and bin location for a needed part number. The screen dump copy can be carried to the bin location, the parts picked from the bin to fill the order, and the dump copy (marked with the quantity picked) becomes the transaction record for later use in correcting the computer inventory file information.

With a little screen format and label format planning, a text screen dump can be used to print labels or envelopes for addresses selected from a mailing or shipping file.

Figure 2:
Printer Copy Of The Summary Screen Dump

```
             * SUMMARY SCREEN *
ACCOUNT:  1000 OAK DR.- GRACELAND APTS.
MONTH  :  OCTOBER    YEAR: 1982

           RECEIPTS SUMMARY
           TOTAL APT. RENT:        4340.00
           TOTAL RECEIPTS :        4382.48
           BANK DEPOSITS  :        4382.48

  DISBURSEMENTS SUMMARY
  BANK BALANCE - REPORT 1 :         731.37
  BANK BALANCE -'REPORT 2 :         731.37

  COVER SHEET SUMMARY
  GROSS OPERATING INCOME  :        4382.48
  TOTAL DISBURSEMENTS     :        3803.34
  NET CASH FLOW OR (-) DEF:         579.14

          *** FINAL ENTRIES ***
 CAPITAL CONT. FROM OWNERS:           0.00
 FUNDS PAID/OWNERS OR SVGS:        2000.00

                        FINAL ENTRIES ?S
                           EXIT  MENU
```

There are many more very practical uses, of course. The benefits of the text screen dump routine presented here are that it is short, simple, and accessible—you can modify it to suit your own application requirements. Subroutines specifically written to format a report directly to the printer can often be avoided by use of the text screen dump.

An Even Shorter Method

If DOS is not present, if the screen contains no INVERSE or FLASH mode characters, and if you use a serial interface control card, the following one-line program (about 70 bytes) will dump the Apple II text screen to your printer:

```
100  PR# 1: FOR G = 0 TO 2: FOR L =
     1 TO 8: FOR P = 0 TO 39:C =  PEEK
     (896 + G * 40 + L * 128 + P): PRINT
      CHR$ (C);: NEXT : PRINT : NEXT
     : NEXT : PR# 0
```

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64 EXPLORER

Larry Isaacs

This month we've got some powerful programming techniques to offer, including a way to keep your disk files straight and a versatile method to modify or control BASIC directly from disk. But first, let's finish up our discussion of graphics and character drawing from the previous two columns.

One thing we haven't pointed out in our discussions of graphics and character-drawing machine language was that the code could be saved as an object code file to disk or tape. This would save a lot of time over the BASIC programs which POKE the machine language into memory. If you have access to a machine language monitor, such as Supermon, you can use its save command to write the machine language to disk. After the code has been POKEd into memory, use the appropriate command to save the regions of memory given in the following table for the line- and character-drawing routines:

Drawing Routine	Address Of First Byte	Address Of Last Byte
Line	49152 (C000)	50087 (C3A7)
Character	50176 (C400)	51090 (C792)

Adding A Byte

The addresses are given in decimal and hex, with hex being the value in parentheses. It is important to note that the address is given for the last byte. Some machine language monitors, such as Supermon, require the ending address to be one byte beyond the last byte of the machine language program. You must be sure to enter the address of the last byte plus 1. For example, the two commands to save the routines to disk with Supermon might be:

S "0:LDRAWC64",08,C000,C3A8

and

S "0:CHDRAWC64",08,C400,C793

If you don't have a machine language monitor at your disposal, you can use the following BASIC program to accomplish the same thing.

```
10 REM PROGRAM TO WRITE OBJECT FILE
20 INPUT "ADDRESS OF FIRST BYTE";SA
30 INPUT "ADDRESS OF LAST BYTE";EA
40 INPUT "FILE NAME";NM$
50 OPEN 1,8,2,NM$+",P,W"
60 PRINT#1,CHR$(SA-INT(SA/256)*256);
70 PRINT#1,CHR$(INT(SA/256));
80 FOR I=SA TO EA
90 PRINT#1,CHR$(PEEK(I));:NEXT
100 CLOSE 1
```

The program asks for the address of the last byte, though it would not hurt if you entered that address plus 1. This would simply save one extra byte in the object file. If you wanted to, you could save the code as one file instead of two. This would save some unused memory which lies between the two routines, but would simplify reloading the routines. To load the object code, use the command:

LOAD *"filename"*,8,1
NEW

where you supply the filename for the object code. The NEW command is necessary to restore some BASIC pointers which are corrupted by the load.

Though the object code file can simplify and speed up loading of the machine language routines, the BASIC program version (which POKEs the machine code) still has one advantage. The BASIC program version can be transferred from disk to disk very easily by using the BASIC LOAD and SAVE commands. The reason this doesn't work with machine language programs is that the starting and ending addresses of the code are not automatically communicated between the LOAD and SAVE commands.

If you have some machine language routines of your own, there may be occasions where it would be useful to convert the object file to a BASIC program version with the machine language in DATA statements. If you do the conversion by hand, the process will be very slow and error prone. To assist in the task, I used Program 1 to generate the DATA statements containing the line-drawing and character-drawing routines. This program generates DATA statements intended for use with the loader shown in Program 2.

Program Creator

The program works by writing the DATA statements to disk in the form of a BASIC program. If you would like to adapt this program to your own use, here is a brief explanation of what is involved.

The format of a saved BASIC program on disk is very simple. It starts with two bytes which specify the load address of the code, low byte followed by high byte. For BASIC programs, this address should be $801. Thus, the first two bytes should be 1 followed by 8. Following the load address comes a copy of the BASIC program the same as it would be found in memory. This would consist of a sequence of BASIC statements, each with the format shown in the table below:

Byte No.	Description
1	Link, low
2	Link, high
3	Line number, high
4	Line number, low
5 To N-1	BASIC statements
N	0

A *link* is a pointer to the beginning of the next line of the BASIC program. Actually, we do not need to be concerned with writing a valid link. The links are automatically recomputed each time a BASIC program is loaded. Following the link is the line number. Note that the two-byte line number is stored with the high byte first, followed by the low byte. Following the line number is the text of the BASIC line. This will be the same as the text you type for the line, except that the keywords (FOR, GOSUB, etc.) and arithmetic operators will be converted to single bytes called tokens. The end of the BASIC line is marked with a zero byte (that is, the ASCII value of the byte is 0). The end of a BASIC program is marked by two zero bytes following the last line. This means there will be three zero bytes at the end of a BASIC program.

Structured Output

The subroutine at line 300 is responsible for writing the link, line number, and the DATA token for each line. The subroutine at line 400 is responsible for outputting a number in the list which follows the DATA keyword. This list will consist of eight numbers which specify object code bytes, followed by the sum of the previous eight numbers. This sum is checked automatically by the loader (Program 2). An error and a line number will be printed if the sum doesn't match.

To prepare a finished program, run Program 1. Next, load Program 2 and list it to the screen. Then load the DATA statements program generated in the first step. Finally, cursor to each line of the listed program and press RETURN. This will combine the DATA statements with the loader program.

If you wish, you can adapt Program 1 to write DATA statements which contain data other than object code. The advantage of saving data in this manner is that the data can be easily examined from BASIC. To make use of the data, it will have to be combined with the appropriate program. This could be accomplished with another BASIC program as well, using the techniques described for adding the DATA statements to Program 2.

Now let's take a look at a couple of utility programs that you may find useful. The first computes a cyclic redundancy check, CRC for short, on the data in a file. This may sound strange, but can be quite useful in cleaning up disk files and keeping program versions straight. The second utility allows BASIC to enter a BASIC program from a sequential disk file. This utility can add some powerful features to your BASIC programming.

Redundancy Check

Whenever data is transferred from one device to another, it's always a good idea to do something to verify that the data was transferred correctly. A simple method is called the *checksum*. Since the data is usually transferred in bytes, this method usually involves adding the bytes of data together to form a sum. This is done by both the receiver and the sender. Once the data has been sent, the sum is sent. The receiver compares this sum with the sum it computed. If the sums don't match, the data wasn't received correctly.

Though simple, the checksum method is not foolproof. If the sum the receiver receives matches the sum it computed, it does not guarantee that the data was received without error. There are several ways in which errors in the transmission won't show in the checksum. For one thing, it's possible for errors in different bytes to balance each other.

CRC's Work Better

When a better method is needed, the cyclic redundancy check is the one to turn to. The cyclic redundancy check (CRC) uses each bit of each data byte to compute the CRC value. As a result, a change in a single bit in the stream of bytes will have a significant change in the final CRC value.

You may think that you haven't used a CRC, but if you have the 1541 disk drive, you have been using it quite a lot. In fact, I don't know of any disk drive that doesn't go to the expense of computing a CRC to insure that data has been read from the disk correctly.

Where I work, we have a utility program which uses the CRC for a slightly different purpose. Over a period of time we tend to accumulate various versions of a file or program, spread among many diskettes. Often, many of the versions have the same filename. This can present problems when we're not sure which version we are dealing with on a particular disk. To handle this situation, we have a utility program which computes a CRC on the bytes in a file. By comparing the CRC computed for two different files, we can be certain if the two files are identical. Armed with the CRC for the most recent version, we can weed out the older versions with no problem.

To accomplish the same thing on the 64, you can use Program 1. This will load a small machine language routine which reads the data and computes the CRC. It loads into the cassette buffer, so it can be used as is only for disk files. Since this routine must return the CRC value, it must be called via the USR function. To link the routine to the USR function, enter the following in direct mode (no line number):

POKE 785,60: POKE 786,3

To obtain the CRC for a file, execute the following two commands:

OPEN 1,8,2,"*file,type*,R"
PRINT USR(0)

where *file* is the name of the desired file, and *type* is the associated file type, Sequential, Program, or User. The routine won't work on random access or relative files. It is important to use logical file 1, since the machine language routine is designed to read from that channel.

Sequential Merge

Now for the second utility. There are several methods for merging routines from one BASIC program into another. One way is to write a program which can merge two BASIC programs to form a third program. Another way, which is a little more flexible, is to have BASIC read the text from a file instead of the keyboard. I have worked with a couple of BASICs which can do this via an ENTER command. This not only allows you to merge a BASIC text file with the program already in memory, but allows you to enter BASIC text files that are transferred from other computer systems.

There is a way of fooling BASIC to input from the cassette instead of the keyboard while in command mode. Unfortunately this doesn't work when inputting from the disk. After inputting the first line and adding it to the program, BASIC makes a subroutine call which closes all serial bus channels. This prevents any further input from the disk file. If this subroutine call could be eliminated, we would be half way to making BASIC enter commands and program lines from the disk.

Modifying BASIC

Fortunately, there is a solution: the submerged RAM. With RAM underneath the BASIC ROMs, we can copy BASIC to RAM and make any changes we want. Running Program 2 will load the required machine language routines into the cassette buffer.

Once the routines are loaded, you may enter a text file by executing the following two commands:

OPEN 1,8,2,"*file*,S,R"
SYS 828

where *file* is the name of the file to enter. It is assumed that the text file will be a Sequential file, though it could be a User file and work the same. It is important to use logical file 1, since the machine language routine inputs from that logical file.

If the text file you enter was generated by LISTing a program to a disk file, then the file will probably have a READY prompt at the end. This doesn't affect the entry of the program, though it will cause a SYNTAX ERROR message to be displayed when the READY prompt is encountered.

Listing BASIC To Disk

For those who haven't listed a BASIC program to disk, it's done approximately the same way as listing to a printer. For example, the following two commands will list lines 100–200 from the

BASIC program in memory to a disk file:

```
OPEN 1,8,2,"file,S,W":CMD 1
LIST 100-200:
PRINT#1:CLOSE 1
```

where *file* is the name of the file in which to write the listing.

The routine works by first opening a channel to logical file 1. If this is successful, it then copies the BASIC ROMs to the RAM underneath. This task is simplified by the fact that writing to the ROMs will write the RAM underneath even though the ROMs are enabled.

Adding The Patches

Once copied, a couple of patches are made to the RAM copy of BASIC. The first patch modifies the subroutine call which is responsible for inputting a character. The subroutine call is modified to call our routine instead. The main difference in our routine is that it will fix things back to normal when the end of the file is reached. The second patch disables a subroutine call which closes all open channels on the serial bus when a line is added or deleted from a BASIC program in memory. The patch makes this subroutine call to go to a location which does an immediate return.

Once the patches are made, the BASIC ROMs are switched off. In addition, an input flag in page 0 is set to nonzero so that a carriage return will not be sent to the display as each line is input. When all this is complete, the setup routine returns to the patched version of BASIC. BASIC will think it is in command mode and begin inputting commands or program lines. BASIC is unaware that the text will be coming from a disk file instead of the keyboard.

When the end of the file is reached, the input file is closed, the BASIC ROMs are switched in, and the input flag is cleared. At this point, everything is back to normal, except that the text has been entered into the BASIC program. The result is exactly the same as if you'd typed it in yourself. This also means that lines that do not begin with a line number will be executed immediately instead of being added to the BASIC program.

Refer to the "Automatic Proofreader" article before typing these programs in.

Program 1: DATA Statement Generator

```
10 REM PROGRAM TO SAVE CODE IN BASIC PROG
   RAM                                 :rem 91
20 GOTO 1000                           :rem 92
100 REM OPEN OUTPUT FILE              :rem 184
110 OPEN 2,8,2,NM$+",P,W"              :rem 17
120 RETURN                            :rem 115
200 REM OUTPUT STARTING ADDRESS       :rem 217
210 PRINT#2,CHR$(1);CHR$(8);           :rem 36
220 RETURN                            :rem 116
300 REM OUTPUT NEW LINE DATA          :rem 148
310 PRINT#2,CHR$(1);CHR$(8);:REM LINK
                                      :rem 113
320 T=INT(LN/256)                     :rem 200
330 PRINT#2,CHR$(LN-T*256);CHR$(T);
                                      :rem 244
340 PRINT#2,CHR$(131);" ";:REM DATA TOKEN
                                      :rem 255
350 LN=LN+10                          :rem 149
360 RETURN                            :rem 121
400 REM OUTPUT BYTE                   :rem 157
410 BY$=STR$(BY):SUM=SUM+BY           :rem 193
420 BY$=RIGHT$(BY$,LEN(BY$)-1)        :rem 189
430 PRINT#2,BY$;",";                   :rem 74
440 RETURN                            :rem 120
500 REM OUTPUT SUM                     :rem 95
510 SU$=STR$(SUM):SUM=0               :rem 158
520 SU$=RIGHT$(SU$,LEN(SU$)-1)        :rem 229
530 PRINT#2,SU$;CHR$(0);              :rem 106
540 RETURN                            :rem 121
600 REM CLOSE FILE                     :rem 16
610 PRINT#2,CHR$(0);CHR$(0);           :rem 31
620 CLOSE 2                            :rem 64
630 RETURN                            :rem 121
1000 REM GET PARAMETERS               :rem 121
1010 INPUT"STARTING ADDRESS=";SA       :rem 20
1020 INPUT"ENDING ADDRESS=";EA         :rem 80
1030 INPUT"STARTING LINE NUMBER";LN
                                      :rem 202
1040 INPUT"FILE NAME";NM$             :rem 212
2000 REM WRITE PROGRAM                 :rem 73
2010 GOSUB 100:REM OPEN FILE           :rem 68
2020 GOSUB 200:REM OUTPUT ADDRESS:rem 235
2030 SUM=LN:GOSUB 300:REM FIRST LINE
                                      :rem 172
2040 GOSUB 500                        :rem 219
2050 GOSUB 300:REM SECOND LINE        :rem 220
2060 SUM=SA:GOSUB 500                 :rem 221
2070 GOSUB 300:REM THIRD LINE         :rem 157
2080 SUM=EA:GOSUB 500                 :rem 209
2100 FOR I=0 TO EA-SA                  :rem 74
2110 IF INT(I/8)*8=I THEN GOSUB 300
                                      :rem 105
```

```
2120 BY=PEEK(SA+I):GOSUB 400        :rem 105
2130 IF INT((I+1)/8)*8=(I+1) THEN GOSUB50
     Ø                               :rem 199
2140 NEXT                            :rem 6
2150 IF INT(I/8)*8<>I THEN GOSUB 5ØØ
                                     :rem 172
2160 GOSUB 6ØØ:END                   :rem 240
```

Program 2:
Loader For DATA Statement Generator

```
1 READ LN,SA,EA:LN=LN+3Ø            :rem 146
1Ø FOR I=Ø TO EA-SA                 :rem 232
2Ø READ BY:POKE SA+I,BY:SUM=SUM+BY
                                    :rem 12Ø
3Ø IF INT((I+1)/8)*8<>(I+1) THEN 6Ø
                                    :rem 242
4Ø READ CS:IF CS<>SUM THEN 9Ø       :rem 124
5Ø SUM=Ø:LN=LN+1Ø                   :rem 254
6Ø NEXT                             :rem 165
7Ø IF INT(I/8)*8<>I THEN READ CS:IF CS<>S
   UM THEN 9Ø                       :rem 78
8Ø PRINT "SUCCESSFUL LOAD":END      :rem 1Ø6
9Ø PRINT "ERROR IN LINE";LN:END     :rem 1Ø5
```

Program 3: Cyclic Redundancy Check

```
1 READ LN,SA,EA:LN=LN+3Ø            :rem 146
1Ø FOR I=Ø TO EA-SA                 :rem 232
2Ø READ BY:POKE SA+I,BY:SUM=SUM+BY
                                    :rem 12Ø
3Ø IF INT((I+1)/8)*8<>(I+1) THEN 6Ø
                                    :rem 242
4Ø READ CS:IF CS<>SUM THEN 9Ø       :rem 124
5Ø SUM=Ø:LN=LN+1Ø                   :rem 254
6Ø NEXT                             :rem 165
7Ø IF INT(I/8)*8<>I THEN READ CS:IF CS<>S
   UM THEN 9Ø                       :rem 78
8Ø PRINT "SUCCESSFUL LOAD":END      :rem 1Ø6
9Ø PRINT "ERROR IN LINE";LN:END     :rem 1Ø5
5ØØ DATA 51Ø                        :rem 69
51Ø DATA 828                        :rem 82
52Ø DATA 897                        :rem 89
53Ø DATA 162,1,32,198,255,169,Ø,133,95Ø
                                    :rem 132
54Ø DATA 252,133,253,32,2Ø7,255,176,39,13
    47                              :rem 8Ø
55Ø DATA 133,251,162,8,6,252,38,253,11Ø3
                                    :rem 173
56Ø DATA 144,6,6,251,176,18,144,4,749
                                    :rem 42
57Ø DATA 6,251,144,12,165,252,73,5,9Ø8
                                    :rem 85
58Ø DATA 133,252,165,253,73,128,133,253,1
    39Ø                             :rem 128
59Ø DATA 2Ø2,2Ø8,225,165,144,24Ø,212,32,1
    428                             :rem 115
6ØØ DATA 2Ø4,255,169,1,32,195,255,164,127
    5                               :rem 29
61Ø DATA 252,165,253,1Ø8,5,Ø,783    :rem 4Ø
```

Program 4:
Entering BASIC From A Sequential File

```
1 READ LN,SA,EA:LN=LN+3Ø            :rem 146
1Ø FOR I=Ø TO EA-SA                 :rem 232
2Ø READ BY:POKE SA+I,BY:SUM=SUM+BY
                                    :rem 12Ø
3Ø IF INT((I+1)/8)*8<>(I+1) THEN 6Ø
                                    :rem 242
4Ø READ CS:IF CS<>SUM THEN 9Ø       :rem 124
5Ø SUM=Ø:LN=LN+1Ø                   :rem 254
6Ø NEXT                             :rem 165
7Ø IF INT(I/8)*8<>I THEN READ CS:IF CS<>S
   UM THEN 9Ø                       :rem 78
8Ø PRINT "SUCCESSFUL LOAD":END      :rem 1Ø6
9Ø PRINT "ERROR IN LINE";LN:END     :rem 1Ø5
5ØØ DATA 51Ø                        :rem 69
51Ø DATA 828                        :rem 82
52Ø DATA 937                        :rem 84
53Ø DATA 162,1,32,198,255,144,6,169,967
                                    :rem 148
54Ø DATA 1,32,195,255,96,169,Ø,133,881
                                    :rem 91
55Ø DATA 251,169,16Ø,133,252,16Ø,Ø,177,13
    Ø2                              :rem 63
56Ø DATA 251,145,251,2ØØ,2Ø8,249,23Ø,252,
    1786                            :rem 174
57Ø DATA 165,252,2Ø1,192,2Ø8,241,169,129,
    1557                            :rem 185
58Ø DATA 141,99,165,169,3,141,1ØØ,165,983
                                    :rem 245
59Ø DATA 169,128,141,97,166,169,3,141,1Ø1
    4                               :rem 37
6ØØ DATA 98,166,165,1,41,254,133,1,859
                                    :rem 89
61Ø DATA 169,255,133,19,96,134,251,32,1Ø8
    9                               :rem 36
62Ø DATA 2Ø7,255,36,144,48,5,112,3,81Ø
                                    :rem 74
63Ø DATA 166,251,96,72,132,252,32,2Ø4,12Ø
    5                               :rem 18
64Ø DATA 255,169,1,32,195,255,165,1,1Ø73
                                    :rem 185
65Ø DATA 9,1,133,1,169,Ø,133,19,465
                                    :rem 183
66Ø DATA 164,252,166,251,1Ø4,96,1Ø33
                                    :rem 242
```

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Commodore 64 Music:

Happy Birthday

Jim Butterfield, Associate Editor

"The trouble is," said my friend Andrew, "that you can't find the programs which are most wanted. For example, a program that plays 'Happy Birthday to You' is needed for several reasons. First, the 64 is often given as a birthday present; this should be its first program. Second, the computer is a member of the family, and should play a part in the celebrations...."

It didn't seem too hard a job to me. The music-playing program already existed in BASIC, and BASIC programs are easy to change and expand. The musically inclined SID chip gave BASIC lots of time to do extra things.

The music should be written rather slowly (people tend to sing along rather sluggishly), and the words should come up on the screen. A bouncing ball could be achieved by using sprites, but I chose a simpler approach.

Let's program along; I'll give brief notes on what's happening.

```
100 PRINT CHR$(147);CHR$(154)
```

Let's clear the screen, set the color to light blue (that's normal).

```
101 READ S:IFS=0GOTO109
102 READ S$:GOSUB1000
103 READ X1,Y1,X2,Y2,X3,Y3
104 GOTO101
```

The above code runs through the DATA statements, printing the words of the song. The subroutine at line 1000 does the actual printing; we'll look at it later.

```
109 RESTORE:PRINTCHR$(19);CHR$(5)
```

We back up to the start of the DATA statements with the RESTORE command. Now we HOME the cursor and change our printing color to white.

```
110 L1=54272:L2=54279:L3=54286
120 H1=L1+1:H2=L2+1:H3=L3+1
130 V1=L1+4:V2=L2+4:V3=L3+4
140 POKE 54296,15
```

This sets the locations of the various instruments in the SID chip. L and H will be the low and high parts of the frequency (pitch) for each note. V will be the "action" location where we strike the note. And we turn the volume up to its maximum value of 15.

```
150 POKE V1+1,9:POKE V1+2,0
160 POKE V2+1,36:POKE V2+2,36
170 POKE V3+1,18:POKE V3+2,170
```

This sets the "envelope" for each voice. Voice 1 is bell-like; voice 2 sounds something like a harmonica; and voice 3 has the sound of a bass guitar. As part of our POKE sequence we set the following characteristics:

Attack—how fast the sound appears. This will be fast for the bell and guitar, rather slow for the harmonica.

Decay—how quickly the initial sound settles. This will be fairly slow for the bell, fast for harmonica and guitar.

Sustain—at what level the sound will "hold" once it's settled in. Bell and guitar won't hold the sound at all; it must fade away. The harmonica can keep the sound going for some time.

Release—how long it will take for the sound to die away. The bell dies almost instantly; the harmonica holds for a brief period; and the bass guitar continues to sound longer after it has been plucked.

```
180 T=TI
```

We'll be using the timer TI to control the timing of each note. Synchronize your watches; here comes the music-playing part.

```
200 POKE V1,16:POKE V2,32:POKE V3,16
```

Release all the instruments. Let go of the string, stop blowing, take your finger off the keys. We must do this each time before we can start the next note. You might observe that the bell and guitar use a value of 16 for a mellow triangle sound; the harmonica uses a more raspy "sawtooth" created by value 32.

```
210 READ S:IFS=0GOTO290
212 READ S$:GOSUB1000
```

Read the timing of the next note. If it's zero, quit. Read the word or part of a word that goes with a note. Print it (this time in white).

```
220 READ X1,Y1,X2,Y2,X3,Y3
```

Get the pitch of each of the three notes. If an instrument is silent this time around, its pitch will be given as zero in the DATA statement.

```
230 IF X1 THEN POKEH1,X1:POKEL1,Y1:POKEV1
    ,17
240 IF X2 THEN POKEH2,X2:POKEL2,Y2:POKEV2
    ,33
250 IF X3 THEN POKEH3,X3:POKEL3,Y3:POKEV3
    ,17
```

For each instrument: If its pitch is not zero, set the pitch and hit the note. You will see that we make the note sound by adding 1 to the waveform value. Compare these values with the ones shown in line 200, above.

```
260 T=T+S
270 IF T>TI GOTO270
280 GOTO200
```

We calculate the note's timing, and wait until the proper amount of time has passed. Then we go back and get the next note.

```
290 FOR J=L1 TO 54296:POKE J,0:NEXT J
295 PRINT CHR$(154):END
```

Finally, we clear all the SID music registers, change the printing color back to light blue, and stop.

Here come the DATA statements to play the music and write the words. Note that whenever a word ends with a period or comma, it will be printed and then a new line will be started.

```
300 DATA 40,"{2 SPACES}HAP",34,75,0,0,0,0
310 DATA 20,"PY",34,75,0,0,0,0
320 DATA 60," BIRTH",38,126,28,214,5,185
330 DATA 60,"DAY",34,75,28,214,0,0
340 DATA 60," TO",45,198,38,126,5,185
350 DATA 60," YOU",43,52,30,141,4,73
360 DATA 60,",",0,0,0,0,0,0
370 DATA 40,"{2 SPACES}HAP",34,75,0,0,0,0
380 DATA 20,"PY",34,75,0,0,0,0
390 DATA 60," BIRTH",38,126,30,141,6,108
400 DATA 60,"DAY",34,75,30,141,0,0
410 DATA 60," TO",51,97,34,75,4,73
420 DATA 60," YOU",45,198,28,214,5,185
430 DATA 60,",",0,0,0,0,0,0
440 DATA 40,"{2 SPACES}HAP",34,75,0,0,0,0
450 DATA 20,"PY",34,75,0,0,0,0
460 DATA 60," BIRTH",68,149,22,227,5,185
470 DATA 60,"DAY",57,172,25,177,0,0
480 DATA 60," DEAR",45,198,28,214,7,53
500 DATA 60," AN",21,154,30,141,7,163
510 DATA 60,"DREW",19,63,30,141,0,0
520 DATA 60,",",0,0,0,0,0,0
530 DATA 40,"{2 SPACES}HAP",61,126,0,0,0,
    0
540 DATA 20,"PY",61,126,0,0,0,0
550 DATA 60," BIRTH",57,172,34,75,8,147
560 DATA 60,"DAY",45,198,28,214,0,0
600 DATA 60," TO",51,97,30,141,4,73
610 DATA 60," YOU.",45,198,28,214,2,220
620 DATA 0
1000 PRINTS$;:IF RIGHT$(S$,1)<"0"THENPRIN
     T
1010 RETURN
```

Finally, we see a subroutine at 1000 to print the word or part word, and to test if it ends in a nonalphabetic character. If so, a new line will be started. Be sure to include the semicolon after the PRINT statement in line 1000.

CAPUTE!

Modifications Or Corrections To Previous Articles

TI Jackpot

Our lister program garbled characters in several graphics definition lines of the TI-99/4A version of this program from the August issue (p. 83). Several readers have noted that lines 660, 680, and 690 should read as follows:

```
660 DISPLAY AT(12,2)SIZE(25):"w"&CH
    R$(133)&CHR$(134)&"wwwwwwwwwwst
    ststwwwwww" :: DISPLAY AT(13,2)
    SIZE(25):"wJJw~w~w>w2wwuvuvuvw>
    w14w"
680 DISPLAY AT(15,2)SIZE(25):"wJJJJ
    w~w>w5ww¦}¦}<=w>w18w" :: DISPLA
    Y AT(16,2)SIZE(25):"wdede:;wwww
    wwz{z{z{wwwwww"
690 DISPLAY AT(17,2)SIZE(25):"wfgfg
    <=w>10ww¦}¦}¦}w>w18w" :: DISPLA
    Y AT(18,2)SIZE(25):"wdededewwww
    ww:;:;:;wwwwww"
```

Also, the space near the end of the string in line 440 (between the characters 1F and 1F) should be omitted.

VIC Lightsaver

The machine language for this program from the September issue (p. 96) is correct, but there are bugs in the version of "Tiny MLX" (p. 151) to be used to enter it. Lines 100 and 210 of Tiny MLX do not contain the proper values for "Lightsaver." Also, a change is necessary to line 763 to allow you to use BASIC's standard LOAD and RUN commands to activate Lightsaver. The corrected lines are as follows:

```
100 POKE 55,30:POKE 56,25:CLR:POKE 788,19
    4                                  :rem 21
210 S=6430:E=7677                     :rem 135
763 POKE 780,1:POKE 781,DV:POKE 782,0:SYS
     65466                             :rem 68
```

64 Devastator

Readers using the "Automatic Proofreader" to check the BASIC portion of the 64 version of this game from the August issue (Program 7, p. 79) have noticed a problem with line 60. The error does not affect the operation of the program, but if you'd like the checksum for line 60 to match the one which appears in the magazine, add {7 RIGHT} after the {12 DOWN} in that line. ©

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. 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.

Since programs can contain some hard-to-read (and hard-to-type) special characters, we have developed a listing system that spells out in abbreviated form the function of these control characters. You will find these special characters within curly braces. For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. Commodore machines have a special control key labeled with the Commodore logo. Graphics characters entered with the Commodore logo key are enclosed in a new kind of special bracket. A graphics character can be listed as [<A>]. In this case, 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 S̲.

If a number precedes a symbol, such as {5 RIGHT}, {6 S̲}, 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 with the Atari logo key. Since spacing is sometimes important, any more than two spaces will be listed, for example, as: {6 SPACES}. A space is never left at the end of a line, but will be moved to the next printed line as {SPACE}. There are no special control characters found in our IBM PC/PCjr, TI-99/4A, and Apple program listings. For your convenience, we have prepared this quick-reference key for the Commodore and Atari special characters:

Atari 400/800/XL

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

When You Read:	Press:		See:	When You Read:	Press:		See:
{CLR}	SHIFT	CLR/HOME		{GRN}	CTRL	6	
{HOME}		CLR/HOME		{BLU}	CTRL	7	
{UP}	SHIFT	↑CRSR↓		{YEL}	CTRL	8	
{DOWN}		↑CRSR↓		{F1}	f1		
{LEFT}	SHIFT	←CRSR→		{F2}	f2		
{RIGHT}		←CRSR→		{F3}	f3		
{RVS}	CTRL	9		{F4}	f4		
{OFF}	CTRL	0		{F5}	f5		
{BLK}	CTRL	1		{F6}	f6		
{WHT}	CTRL	2		{F7}	f7		
{RED}	CTRL	3		{F8}	f8		
{CYN}	CTRL	4		←	←		
{PUR}	CTRL	5		↑	SHIFT	↑	

The Automatic Proofreader

Also, we have developed a simple, yet effective program that can help check your typing. Type in the appropriate Proofreader program for your machine, 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 will still be 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. The IBM Proofreader is a BASIC program that lets you enter, edit, list, save, and load programs that you type. It simulates the IBM's BASIC line editor.

Using The Automatic Proofreader

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a number (on the Commodore) or a pair of letters

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(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 and IBM listings, the checksum is given to the left of each line number. Just type in the program, a 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 and Atari Proofreader, spaces are not counted as part of the checksum, and no check is made to see that you've typed in the characters in the right order. If characters are transposed, the checksum will still match the listing. Because of the checksum method used, do not use abbreviations, such as ? for PRINT. However, the Proofreader does catch the majority of typing errors most people make. The IBM Proofreader is even pickier; it *will* detect errors in spacing and transposition. Also, be sure you leave Caps Lock on, except when you need to enter lowercase characters.

Special Proofreader Notes For Commodore Cassette Users

The Proofreader resides in the cassette buffer, which is used during tape LOADs and SAVEs. Be sure to press RUN/STOP–RESTORE before you save or load a program, to get the Proofreader out of the way. 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}"
   :FORX=1TO4:A$=A$+B$:NEXT

FORX=886TO1018:A$=A$+CHR$(PEEK(X))
   :NEXT:OPEN 1,1,1,A$:CLOSE1
```

Then press RECORD and PLAY on a blank tape, and a special version of the Proofreader will be saved to tape. Anytime you need to reload the Proofreader after it has been erased, just rewind the tape, type OPEN1:CLOSE1, then press PLAY. When READY comes back, enter SYS 886.

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 enter NEW, the Proofreader will prompt you to press Y to be especially 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 into the normal BASIC environment (this will replace the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it 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.

Program 1: VIC/64 Proofreader

```
100 PRINT"{CLR}PLEASE WAIT...":FORI=886TO10
    18:READA:CK=CK+A:POKEI,A:NEXT
110 IF CK<>17539 THEN PRINT"{DOWN}YOU MADE
    {SPACE}AN ERROR":PRINT"IN DATA STATEMEN
    TS.":END
120 SYS886:PRINT"{CLR}{2 DOWN}PROOFREADER A
    CTIVATED.":NEW
886 DATA 173,036,003,201,150,208
892 DATA 001,096,141,151,003,173
898 DATA 037,003,141,152,003,169
904 DATA 150,141,036,003,169,003
910 DATA 141,037,003,169,000,133
916 DATA 254,096,032,087,241,133
922 DATA 251,134,252,132,253,008
928 DATA 201,013,240,017,201,032
934 DATA 240,005,024,101,254,133
940 DATA 254,165,251,166,252,164
946 DATA 253,040,096,169,013,032
952 DATA 210,255,165,214,141,251
958 DATA 003,206,251,003,169,000
964 DATA 133,216,169,019,032,210
970 DATA 255,169,018,032,210,255
976 DATA 169,058,032,210,255,166
982 DATA 254,169,000,133,254,172
988 DATA 151,003,192,087,208,006
994 DATA 032,205,189,076,235,003
1000 DATA 032,205,221,169,032,032
1006 DATA 210,255,032,210,255,173
1012 DATA 251,003,133,214,076,173
1018 DATA 003
```

Program 2: Atari Proofreader

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:READ A:POK
    E I,A:CK=CK+A:NEXT I
120 IF CK<>19072 THEN ? "ERROR IN
     DATA STATEMENTS.  CHECK TYPI
    NG.":END
130 A=USR(1536)
140 ? :? "AUTOMATIC PROOFREADER N
    OW ACTIVATED."
150 END
```

```
1536 DATA 104,160,0,185,26,3
1542 DATA 201,69,240,7,200,200
1548 DATA 192,34,208,243,96,200
1554 DATA 169,74,153,26,3,200
1560 DATA 169,6,153,26,3,162
1566 DATA 0,189,0,228,157,74
1572 DATA 6,232,224,16,208,245
1578 DATA 169,93,141,78,6,169
1584 DATA 6,141,79,6,24,173
1590 DATA 4,228,105,1,141,95
1596 DATA 6,173,5,228,105,0
1602 DATA 141,96,6,169,0,133
1608 DATA 203,96,247,238,125,241
1614 DATA 93,6,244,241,115,241
1620 DATA 124,241,76,205,238,0
1626 DATA 0,0,0,0,32,62
1632 DATA 246,8,201,155,240,13
1638 DATA 201,32,240,7,72,24
1644 DATA 101,203,133,203,104,40
1650 DATA 96,72,152,72,138,72
1656 DATA 160,0,169,128,145,88
1662 DATA 200,192,40,208,249,165
1668 DATA 203,74,74,74,74,24
1674 DATA 105,161,160,3,145,88
1680 DATA 165,203,41,15,24,105
1686 DATA 161,200,145,88,169,0
1692 DATA 133,203,104,170,104,168
1698 DATA 104,40,96
```

Programs using the IBM Proofreader will appear beginning next month.

Program 3: IBM Proofreader

```
1ØØ DIM L$(5ØØ),LNUM(5ØØ):COLOR Ø,7,7:KEY OFF:CLS:MAX=Ø:LNUM(Ø)=65536!
11Ø ON ERROR GOTO 12Ø:KEY 15,CHR$(4)+CHR$(7Ø):ON KEY(15) GOSUB 64Ø:KEY (15) ON:GOTO 13Ø
12Ø RESUME 13Ø
13Ø DEF SEG=&H4Ø:W=PEEK(&H4A)
14Ø ON ERROR GOTO 65Ø:PRINT:PRINT"Proofreader Ready."
15Ø LINE INPUT L$:Y=CSRLIN-INT(LEN(L$)/W)-1:LOCATE Y,1
16Ø DEF SEG=Ø:POKE 1Ø5Ø,3Ø:POKE 1Ø52,34:POKE 1Ø54,Ø:POKE 1Ø55,79:POKE 1Ø56,13:POKE 1Ø57,28:LINE INPUT L$:DEF SEG:IF L$="" THEN 15Ø
17Ø IF LEFT$(L$,1)=" " THEN L$=MID$(L$,2):GOTO 17Ø
18Ø IF VAL(LEFT$(L$,2))=Ø AND MID$(L$,3,1)=" " THEN L$=MID$(L$,4)
19Ø LNUM=VAL(L$):TEXT$=MID$(L$,LEN(STR$(LNUM))+1)
2ØØ IF ASC(L$)>57 THEN 26Ø 'no line number, therefore command
21Ø IF TEXT$="" THEN GOSUB 54Ø:IF LNUM=LNUM(P) THEN GOSUB 56Ø:GOTO 15Ø ELSE 15Ø 'delete line
22Ø CKSUM=Ø:FOR I=1 TO LEN(L$):CKSUM=(CKSUM+ASC(MID$(L$,I))*I) AND 255:NEXT:LOCATE Y,1:PRINT CHR$(65+CKSUM/16)+CHR$(65+(CKSUM AND 15))+" "+L$
23Ø GOSUB 54Ø:IF LNUM(P)=LNUM THEN L$(P)=TEXT$:GOTO 15Ø 'replace line
24Ø GOSUB 58Ø:GOTO 15Ø 'insert the line
25Ø 'command processor.  step 1: convert to uppercase
26Ø TEXT$="":FOR I=1 TO LEN(L$):A=ASC(MID$(L$,I)):TEXT$=TEXT$+CHR$(A+32*(A>96 AND A<123)):NEXT
27Ø DELIMITER=INSTR(TEXT$," "):COMMAND$=TEXT$:ARG$="":IF DELIMITER THEN COMMAND$=LEFT$(TEXT$,DELIMITER-1):ARG$=MID$(TEXT$,DELIMITER+1) 'separate command from argument
28Ø IF COMMAND$<>"LIST" THEN 41Ø
29Ø OPEN "scrn:" FOR OUTPUT AS #1
3ØØ IF ARG$="" THEN FIRST=Ø:P=MAX-1:GOTO 34Ø
31Ø DELIMITER=INSTR(ARG$,"-"):IF DELIMITER=Ø THEN LNUM=VAL(ARG$):GOSUB 54Ø:FIRST=P:GOTO 34Ø
32Ø FIRST=VAL(LEFT$(ARG$,DELIMITER)):LAST=VAL(MID$(ARG$,DELIMITER+1))
33Ø LNUM=FIRST:GOSUB 54Ø:FIRST=P:LNUM=LAST:GOSUB 54Ø:IF P=Ø THEN P=MAX-1
34Ø FOR X=FIRST TO P:N$=MID$(STR$(LNUM(X)),2)+" "
35Ø IF CKFLAG=Ø THEN A$="":GOTO 37Ø
36Ø CKSUM=Ø:A$=N$+L$(X):FOR I=1 TO LEN(A$):CKSUM=(CKSUM+ASC(MID$(A$,I))*I) AND 255:NEXT:A$=CHR$(65+CKSUM/16)+CHR$(65+(CKSUM AND 15))+" "
37Ø PRINT #1,A$+N$+L$(X)
38Ø IF INKEY$<>"" THEN X=P
39Ø NEXT :CLOSE #1:CKFLAG=Ø
4ØØ GOTO 13Ø
41Ø IF COMMAND$="LLIST" THEN OPEN "lpt1:" FOR OUTPUT AS #1:GOTO 3ØØ
42Ø IF COMMAND$="CHECK" THEN CKFLAG=1:GOTO 29Ø
43Ø IF COMMAND$<>"SAVE" THEN 45Ø
44Ø GOSUB 6ØØ:OPEN ARG$ FOR OUTPUT AS #1:ARG$="":GOTO 3ØØ
45Ø IF COMMAND$<>"LOAD" THEN 49Ø
46Ø GOSUB 6ØØ:OPEN ARG$ FOR INPUT AS #1:MAX=Ø:P=Ø
47Ø WHILE NOT EOF(1):LINE INPUT #1,L$:LNUM(P)=VAL(L$):L$(P)=MID$(L$,LEN(STR$(VAL(L$)))+1):P=P+1:WEND
48Ø MAX=P:CLOSE #1:GOTO 13Ø
49Ø IF COMMAND$="NEW" THEN INPUT "Erase program - Are you sure";L$:IF LEFT$(L$,1)="y" OR LEFT$(L$,1)="Y" THEN MAX=Ø:GOTO 13Ø:ELSE 13Ø
5ØØ IF COMMAND$="BASIC" THEN COLOR 7,Ø,Ø:ON ERROR GOTO Ø:CLS:END
51Ø IF COMMAND$="FILES" THEN FILES:GOTO 13Ø
52Ø PRINT"Syntax error":GOTO 13Ø
53Ø 'find line
54Ø P=Ø:WHILE LNUM>LNUM(P) AND P<MAX:P=P+1:WEND:RETURN
55Ø 'delete line
56Ø MAX=MAX-1:FOR X=P TO MAX:LNUM(X)=LNUM(X+1):L$(X)=L$(X+1):NEXT:RETURN
57Ø 'insert line
58Ø MAX=MAX+1:FOR X=MAX TO P+1 STEP -1:LNUM(X)=LNUM(X-1):L$(X)=L$(X-1):NEXT:L$(P)=TEXT$:LNUM(P)=LNUM:RETURN
59Ø 'filename adjustments
6ØØ IF LEFT$(ARG$,1)<>CHR$(34) THEN 52Ø ELSE ARG$=MID$(ARG$,2)
61Ø IF RIGHT$(ARG$,1)=CHR$(34) THEN ARG$=LEFT$(ARG$,LEN(ARG$)-1)
62Ø IF INSTR(ARG$,".")=Ø THEN ARG$=ARG$+".BAS"
63Ø RETURN
64Ø PRINT"Stopped.":RETURN 15Ø
65Ø PRINT "Error #";ERR:RESUME 15Ø
```

MLX Machine Language Entry Program For 64 And 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. You can then use the LOAD command to read the program into the computer:

LOAD "filename",1,1 (for tape)
LOAD "filename",8,1 (for disk)

To start the program, you enter a SYS command that transfers control from BASIC to machine language. The starting SYS number appears in the article.

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 two numbers: the starting address and the ending address. These numbers are given in the article accompanying the ML program.

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 delete key; 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 less than three digits, you can press either the SPACE bar, or RETURN key to advance to the next number. The checksum automatically appears in inverse video for emphasis.

To simplify your typing, MLX for the 64 redefines part of the keyboard as a numeric keypad:

	U	I	O			7	8	9
H	J	K	L	become	0	4	5	6
	M	,	.			1	2	3

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:

SHIFT-S: Save
SHIFT-L: Load
SHIFT-N: New Address
SHIFT-D: Display

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 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 what address you stop at. The next time you run MLX, answer all the prompts as you did before, then insert the disk or tape. When you get to the entry prompt, press SHIFT-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 SHIFT-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 special listing, or else the checksum won't work. The Display command lets you display a section of your typing. After you press SHIFT-D, enter two addresses within the line number range of the listing. You can abort the listing by pressing any key.

What if you forgot where you stopped typing? Use the Display command to scan memory from the beginning to the end of the program. When you reach the end of your typing, the lines will contain a random pattern of numbers. When you see the end of your typing, press any key to stop the listing. Use the New Address command to continue typing from the proper location.

64 MLX: Machine Language Entry

```
10 REM LINES CHANGED FROM MLX VERSION 2.0
   0 ARE 750,765,770 AND 860          :rem 50
100 PRINT"{CLR}E6]";CHR$(142);CHR$(8);:
    POKE53281,1:POKE53280,1          :rem 67
101 POKE 788,52:REM DISABLE RUN/STOP
                                     :rem 119
110 PRINT"{RVS}{39 SPACES}";         :rem 176
120 PRINT"{RVS}{14 SPACES}{RIGHT}{OFF}
    E*]£{RVS}{RIGHT} {RIGHT}{2 SPACES}
```

```
{*}{OFF}{*}£{RVS}£{RVS}
{14 SPACES}";                    :rem 25Ø
13Ø PRINT"{RVS}{14 SPACES}{RIGHT} {G}
{RIGHT} {2 RIGHT} {OFF}£{RVS}£{*}
{OFF}{*}{RVS}{14 SPACES}";       :rem 35
14Ø PRINT"{RVS}{41 SPACES}"      :rem 12Ø
2ØØ PRINT"{2 DOWN}{PUR}{BLK} MACHINE LANG
UAGE EDITOR VERSION 2.Ø1{5 DOWN}"
                                 :rem 237
21Ø PRINT"{5}{2 UP}STARTING ADDRESS?
{8 SPACES}{9 LEFT}";             :rem 143
215 INPUTS:F=1-F:C$=CHR$(31+119*F)
                                 :rem 166
22Ø IFS<256OR(S>4Ø96ØANDS<49152)ORS>53247
THENGOSUB3ØØØ:GOTO21Ø            :rem 235
225 PRINT:PRINT:PRINT            :rem 18Ø
23Ø PRINT"{5}{2 UP}ENDING ADDRESS?
{8 SPACES}{9 LEFT}";:INPUTE:F=1-F:C$=
CHR$(31+119*F)                   :rem 2Ø
24Ø IFE<256OR(E>4Ø96ØANDE<49152)ORE>53247
THENGOSUB3ØØØ:GOTO23Ø            :rem 183
25Ø IFE<STHENPRINTC$;"{RVS}ENDING < START
{2 SPACES}":GOSUB1ØØØ:GOTO 23Ø
                                 :rem 176
26Ø PRINT:PRINT:PRINT            :rem 179
3ØØ PRINT"{CLR}";CHR$(14):AD=S:POKEV+21,Ø
                                 :rem 225
31Ø A=1:PRINTRIGHT$("ØØØØ"+MID$(STR$(AD),
2),5);":";                       :rem 33
315 FORJ=ATO6                    :rem 33
32Ø GOSUB57Ø:IFN=-1THENJ=J+N:GOTO32Ø
                                 :rem 228
39Ø IFN=-211THEN 71Ø             :rem 62
4ØØ IFN=-2Ø4THEN 79Ø             :rem 64
41Ø IFN=-2Ø6THENPRINT:INPUT"{DOWN}ENTER N
EW ADDRESS";ZZ                   :rem 44
415 IFN=-2Ø6THENIFZZ<SORZZ>ETHENPRINT"
{RVS}OUT OF RANGE":GOSUB1ØØØ:GOTO41Ø
                                 :rem 225
417 IFN=-2Ø6THENAD=ZZ:PRINT:GOTO31Ø
                                 :rem 238
42Ø IF N<>-196 THEN 48Ø          :rem 133
43Ø PRINT:INPUT"DISPLAY:FROM";F:PRINT,"TO
";:INPUTT                        :rem 234
44Ø IFF<SORF>EORT<SORT>ETHENPRINT"AT LEAS
T";S;"{LEFT}, NOT MORE THAN";E:GOTO43
Ø                                :rem 159
45Ø FORI=FTOTSTEP6:PRINT:PRINTRIGHT$("ØØØ
Ø"+MID$(STR$(I),2),5);":";       :rem 3Ø
451 FORK=ØTO5:N=PEEK(I+K):PRINTRIGHT$("ØØ
"+MID$(STR$(N),2),3);",";        :rem 66
46Ø GETA$:IFA$>""THENPRINT:PRINT:GOTO31Ø
                                 :rem 25
47Ø NEXTK:PRINTCHR$(2Ø);:NEXTI:PRINT:PRIN
T:GOTO31Ø                        :rem 5Ø
48Ø IFN<Ø THEN PRINT:GOTO31Ø     :rem 168
49Ø A(J)=N:NEXTJ                 :rem 199
5ØØ CKSUM=AD-INT(AD/256)*256:FORI=1TO6:CK
SUM=(CKSUM+A(I))AND255:NEXT      :rem 2ØØ
51Ø PRINTCHR$(18);:GOSUB57Ø:PRINTCHR$(146
);                               :rem 94
511 IFN=-1THENA=6:GOTO315        :rem 254
515 PRINTCHR$(2Ø):IFN=CKSUMTHEN53Ø
                                 :rem 122
52Ø PRINT:PRINT"LINE ENTERED WRONG : RE-E
NTER":PRINT:GOSUB1ØØØ:GOTO31Ø:rem 176
53Ø GOSUB2ØØØ                    :rem 218
54Ø FORI=1TO6:POKEAD+I-1,A(I):NEXT:POKE54
272,Ø:POKE54273,Ø                :rem 227
55Ø AD=AD+6:IF AD<E THEN 31Ø     :rem 212
56Ø GOTO 71Ø                     :rem 1Ø8
57Ø N=Ø:Z=Ø                      :rem 88
58Ø PRINT"{£}";                  :rem 81
581 GETA$:IFA$=""THEN581         :rem 95
582 AV=-(A$="M")-2*(A$=",")-3*(A$=".")-4*
(A$="J")-5*(A$="K")-6*(A$="L"):rem 41
583 AV=AV-7*(A$="U")-8*(A$="I")-9*(A$="O"
):IFA$="H"THENA$="Ø"             :rem 134
584 IFAV>ØTHENA$=CHR$(48+AV)     :rem 134
585 PRINTCHR$(2Ø);:A=ASC(A$):IFA=13ORA=44
ORA=32THEN67Ø                    :rem 229
59Ø IFA>128THENN=-A:RETURN       :rem 137
6ØØ IFA<>2Ø THEN 63Ø             :rem 1Ø
61Ø GOSUB69Ø:IFI=1ANDT=44THENN=-1:PRINT"
{OFF}{LEFT} {LEFT}";:GOTO69Ø     :rem 62
62Ø GOTO57Ø                      :rem 1Ø9
63Ø IFA<48ORA>57THEN58Ø          :rem 1Ø5
64Ø PRINTA$;:N=N*1Ø+A-48         :rem 1Ø6
65Ø IFN>255 THEN A=2Ø:GOSUB1ØØØ:GOTO6ØØ
                                 :rem 229
66Ø Z=Z+1:IFZ<3THEN58Ø           :rem 71
67Ø IFZ=ØTHENGOSUB1ØØØ:GOTO57Ø   :rem 114
68Ø PRINT",";:RETURN             :rem 24Ø
69Ø S%=PEEK(2Ø9)+256*PEEK(21Ø)+PEEK(211)
                                 :rem 149
691 FORI=1TO3:T=PEEK(S%-I)       :rem 67
695 IFT<>44ANDT<>58THENPOKES%-I,32:NEXT
                                 :rem 2Ø5
7ØØ PRINTLEFT$("{3 LEFT}",I-1);:RETURN
                                 :rem 7
71Ø PRINT"{CLR}{RVS}*** SAVE ***{3 DOWN}"
                                 :rem 236
715 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF}
ALONE TO CANCEL SAVE){DOWN}":rem 1Ø6
72Ø F$="":INPUT"{DOWN} FILENAME";F$:IFF$=
""THENPRINT:PRINT:GOTO31Ø        :rem 71
73Ø PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
{RVS}D{OFF}ISK: (T/D)"           :rem 228
74Ø GETA$:IFA$<>"T"ANDA$<>"D"THEN74Ø
                                 :rem 36
75Ø DV=1-7*(A$="D"):IFDV=8THENF$="Ø:"+F$:
OPEN15,8,15,"S"+F$:CLOSE15       :rem 212
76Ø T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
):POKE782,ZK/256                 :rem 3
762 POKE781,ZK-PEEK(782)*256:POKE78Ø,LEN(
T$):SYS65469                     :rem 1Ø9
763 POKE78Ø,1:POKE781,DV:POKE782,1:SYS654
66                               :rem 69
765 K=S:POKE254,K/256:POKE253,K-PEEK(254)
*256:POKE78Ø,253                 :rem 17
766 K=E+1:POKE782,K/256:POKE781,K-PEEK(78
2)*256:SYS65496                  :rem 235
77Ø IF(PEEK(783)AND1)OR(191ANDST)THEN78Ø
                                 :rem 111
775 PRINT"{DOWN}DONE.{DOWN}":GOTO31Ø
                                 :rem 113
78Ø PRINT"{DOWN}ERROR ON SAVE.{2 SPACES}T
RY AGAIN.":IFDV=1THEN72Ø         :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
;E2$:CLOSE15:GOTO72Ø             :rem 1Ø3
79Ø PRINT"{CLR}{RVS}*** LOAD ***{2 DOWN}"
                                 :rem 212
795 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF}
ALONE TO CANCEL LOAD)"           :rem 82
8ØØ F$="":INPUT"{2 DOWN} FILENAME";F$:IFF
$=""THENPRINT:GOTO31Ø            :rem 144
81Ø PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
{RVS}D{OFF}ISK: (T/D)"           :rem 227
82Ø GETA$:IFA$<>"T"ANDA$<>"D"THEN82Ø
                                 :rem 34
83Ø DV=1-7*(A$="D"):IFDV=8THENF$="Ø:"+F$
                                 :rem 157
84Ø T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
):POKE782,ZK/256                 :rem 2
```

```
841 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                  :rem 107
845 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                            :rem 70
850 POKE780,0:SYS65493            :rem 11
860 IF(PEEK(783)AND1)OR(191ANDST)THEN870
                                  :rem 111
865 PRINT"{DOWN}DONE.":GOTO310    :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.{2 SPACES}T
    RY AGAIN.{DOWN}":IFDV=1THEN800
                                  :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO800          :rem 102
1000 REM BUZZER                   :rem 135
1001 POKE54296,15:POKE54277,45:POKE54278,
     165                          :rem 207
1002 POKE54276,33:POKE 54273,6:POKE54272,
     5                            :rem 42
1003 FORT=1TO200:NEXT:POKE54276,32:POKE54
     273,0:POKE54272,0:RETURN     :rem 202
2000 REM BELL SOUND               :rem 78
2001 POKE54296,15:POKE54277,0:POKE54278,2
     47                           :rem 152
2002 POKE 54276,17:POKE54273,40:POKE54272
     ,0                           :rem 86
2003 FORT=1TO100:NEXT:POKE54276,16:RETURN
                                  :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PAGE OR ROM":
     GOTO1000                     :rem 89
```

Atari MLX: Machine Language Entry

```
DA 100 GRAPHICS 0:DL=PEEK(560)+256
       *PEEK(561)+4:POKE DL-1,71:P
       OKE DL+2,6
NJ 110 POSITION 8,0:? "MLX":POSITI
       ON 23,0:? "failsafe entry":
       POKE 710,0:?
JK 120 ? "Starting Address";:INPUT
        BEG:? "  Ending Address";:
       INPUT FIN:? "Run/Init Addre
       ss";:INPUT STARTADR
DD 130 DIM A(6),BUFFER$(FIN-BEG+12
       7),T$(20),F$(20),CIO$(7),SE
       CTOR$(128),DSKINV$(6)
JJ 140 OPEN #1,4,0,"K:":? :? ,"Tap
       e or Disk:";
BM 150 BUFFER$=CHR$(0):BUFFER$(FIN
       -BEG+30)=BUFFER$:BUFFER$(2)
       =BUFFER$:SECTOR$=BUFFER$
GC 160 ADDR=BEG:CIO$="hhh":CIO$(4)
       =CHR$(170):CIO$(5)="LV":CIO
       $(7)=CHR$(228)
EJ 170 GET #1,MEDIA:IF MEDIA<>84 A
       ND MEDIA<>68 THEN 170
PO 180 ? CHR$(MEDIA):? :IF MEDIA<>
       ASC("T") THEN BUFFER$="":GO
       TO 250
PL 190 BEG=BEG-24:BUFFER$=CHR$(0):
       BUFFER$(2)=CHR$(INT((FIN-BE
       G+127)/128))
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(PINIT/256
       ):L=PINIT-H*256:BUFFER$(5)=
       CHR$(L):BUFFER$(6)=CHR$(H)
PB 220 FOR I=7 TO 24:READ A:BUFFER
       $(I)=CHR$(A):NEXT I:DATA 24
       ,96,169,60,141,2,211,169,0,
       133,10,169,0,133,11,76,0,0
DP 230 H=INT(STARTADR/256):L=START
       ADR-H*256:BUFFER$(15)=CHR$(
       L):BUFFER$(19)=CHR$(H)
KL 240 BUFFER$(23)=CHR$(L):BUFFER$
       (24)=CHR$(H)
HI 250 IF MEDIA<>ASC("D") THEN 360
OO 260 ? :? "Boot Disk or Binary F
       ile:";
LI 270 GET #1,DTYPE:IF DTYPE<>68 A
       ND DTYPE<>70 THEN 270
GM 280 ? CHR$(DTYPE):IF DTYPE=70 T
       HEN 360
PJ 290 BEG=BEG-30:BUFFER$=CHR$(0):
       BUFFER$(2)=CHR$(INT((FIN-BE
       G+127)/128))
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 TO 30:R
       EAD A:BUFFER$(I)=CHR$(A):NE
       XT I
GA 330 DATA 169,0,141,231,2,133,14
       ,169,0,141,232,2,133,15,169
       ,0,133,10,169,0,133,11,24,9
       6
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=START
       ADR-H*256:BUFFER$(22)=CHR$(
       L):BUFFER$(26)=CHR$(H)
JP 360 GRAPHICS 0:POKE 712,10:POKE
        710,10:POKE 709,2
JK 370 ? ADDR;":";:FOR J=1 TO 6
NF 380 GOSUB 570:IF N=-1 THEN J=J-
       1:GOTO 380
BF 390 IF N=-19 THEN 720
OI 400 IF N=-12 THEN LET READ=1:GO
       TO 720
AI 410 TRAP 410:IF N=-14 THEN ? :?
        "New Address";:INPUT ADDR:
       ? :GOTO 370
JD 420 TRAP 32767:IF N<>-4 THEN 48
       0
AJ 430 TRAP 430:? :? "Display:From
       ";:INPUT F:? ,"To";:INPUT T
       :TRAP 32767
ML 440 IF F<BEG OR F>FIN OR T<BEG
       OR T>FIN OR T<F THEN ? CHR$
       (253);"At least ";BEG;", No
       t More Than ";FIN:GOTO 430
MH 450 FOR I=F TO T STEP 6:? :? I;
       ":";:FOR K=0 TO 5:N=PEEK(AD
       R(BUFFER$)+I+K-BEG):T$="000
       ":T$(4-LEN(STR$(N)))=STR$(N
       )
MA 460 IF PEEK(764)<255 THEN GET #
       1,A:POP :POP :? :GOTO 370
FN 470 ? T$;",";:NEXT K:? CHR$(126
       );:NEXT I:? :? :GOTO 370
```

```
GA 480 IF N<0 THEN ? :GOTO 370
MH 490 A(J)=N:NEXT J
JM 500 CKSUM=ADDR-INT(ADDR/256)*25
       6:FOR I=1 TO 6:CKSUM=CKSUM+
       A(I):CKSUM=CKSUM-256*(CKSUM
       >255):NEXT I
KK 510 RF=128:SOUND 0,200,12,8:GOS
       UB 570:SOUND 0,0,0,0:RF=0:?
        CHR$(126)
CN 520 IF N<>CKSUM THEN ? :? "Inco
       rrect";CHR$(253);:? :GOTO 3
       70
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(BUFFE
       R$)+ADDR-BEG+I-1,A(I):NEXT
       I
HB 550 ADDR=ADDR+6:IF ADDR<=FIN TH
       EN 370
GM 560 GOTO 710
FI 570 N=0:Z=0
PH 580 GET #1,A:IF A=155 OR A=44 O
       R A=32 THEN 670
FB 590 IF A<32 THEN N=-A:RETURN
EB 600 IF A<>126 THEN 630
ML 610 GOSUB 690:IF I=1 AND T=44 T
       HEN N=-1:? CHR$(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$(253);:GO
       TO 570
KC 680 ? ",";:RETURN
NO 690 POKE 752,1:FOR I=1 TO 3:? C
       HR$(30);:GET #6,I:IF T<>44
       AND T<>58 THEN ? CHR$(A);:N
       EXT I
PI 700 POKE 752,0:? " ";CHR$(126);
       :RETURN
KM 710 GRAPHICS 0:POKE 710,26:POKE
        712,26:POKE 709,2
FI 720 IF MEDIA=ASC("T") THEN 890
OJ 730 REM  DISK 
OK 740 IF READ THEN ? :? "Load Fil
       e":?
IG 750 IF DTYPE<>70 THEN 1040
AE 760 ? :? "Enter AUTORUN.SYS for
        automatic use":? :? "Enter
        filename":INPUT T$
GF 770 F$=T$:IF LEN(T$)>2 THEN IF
       T$(1,2)<>"D:" THEN F$="D:":
       F$(3)=T$
NJ 780 TRAP 870:CLOSE #2:OPEN #2,8
       -4*READ,0,F$:? :? "Working.
       .."
JM 790 IF READ THEN FOR I=1 TO 6:G
       ET #2,A:NEXT I:GOTO 820
PO 800 PUT #2,255:PUT #2,255
DJ 810 H=INT(BEG/256):L=BEG-H*256:
       PUT #2,L:PUT #2,H:H=INT(FIN
       /256):L=FIN-H*256:PUT #2,L:
       PUT #2,H
NF 820 GOSUB 970:IF PEEK(195)>1 TH
       EN 870
IF 830 IF STARTADR=0 OR READ THEN
       850
FD 840 PUT #2,224:PUT #2,2:PUT #2,
       225:PUT #2,2:H=INT(STARTADR
       /256):L=STARTADR-H*256:PUT
       #2,L:PUT #2,H
HH 850 TRAP 32767:CLOSE #2:? "Fini
       shed.":IF READ THEN ? :? :L
       ET READ=0:GOTO 360
HF 860 END
FO 870 ? "Error ";PEEK(195);" tryi
       ng to access":? F$:CLOSE #2
       :? :GOTO 760
MC 880 REM  BOOT TAPE 
HM 890 IF READ THEN ? :? "Read Tap
       e"
HI 900 ? :? :? "Insert, Rewind Tap
       e.":? "Press PLAY ";:IF NO
       T READ THEN ? "& RECORD"
LP 910 ? :? "Press RETURN when rea
       dy:";
JH 920 TRAP 960:CLOSE #2:OPEN #2,8
       -4*READ,128,"C:":? :? "Work
       ing..."
NH 930 GOSUB 970:IF PEEK(195)>1 TH
       EN 960
HH 940 CLOSE #2:TRAP 32767:? "Fini
       shed.":? :? :IF READ THEN L
       ET READ=0:GOTO 360
HF 950 END
CD 960 ? :? "Error ";PEEK(195);" w
       hen reading/writing boot ta
       pe":? :CLOSE #2:GOTO 890
MB 970 REM CIO Load/Save File#2 op
       ened READ=0 for write, REA
       D=1 for read
EA 980 X=32:REM File#2,$20
EF 990 ICCOM=834:ICBADR=836:ICBLEN
       =840:ICSTAT=835
MD 1000 H=INT(ADR(BUFFER$)/256):L=
        ADR(BUFFER$)-H*256:POKE IC
        BADR+X,L:POKE ICBADR+X+1,H
FH 1010 L=FIN-BEG+1:H=INT(L/256):L
        =L-H*256:POKE ICBLEN+X,L:P
        OKE ICBLEN+X+1,H
MD 1020 POKE ICCOM+X,11-4*READ:A=U
        SR(ADR(CIO$),X)
BG 1030 POKE 195,PEEK(ICSTAT):RETU
        RN
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 AND A<>8
        9 THEN 1070
EC 1080 ? CHR$(A):IF A=78 THEN 110
        0
CP 1090 ? :? "Formatting...":XIO 2
        54,#2,0,0,"D:":? "Format C
        omplete":?
AC 1100 NR=INT((FIN-BEG+127)/128):
        BUFFER$(FIN-BEG+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 1220:BU
        FFER$(I*128-127)=SECTOR$:G
        OTO 1160
PL 1140 SECTOR$=BUFFER$(I*128-127)
AM 1150 GOSUB 1220
DN 1160 IF PEEK(DSTATS)<>1 THEN 12
        00
FB 1170 NEXT I
GM 1180 IF  NOT READ THEN END
DH 1190 ? :? :LET READ=0:GOTO 360
JJ 1200 ? "Error on disk access.":
        ? "May need formatting.":G
        OTO 1040
KI 1210 REM
BL 1220 REM SECTOR ACCESS SUBROUT
        INE
IG 1230 REM Drive ONE
IH 1240 REM Pass buffer in SECTOR$
MP 1250 REM sector # in variable 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+1
        1
PN 1330 REM DIM DSKINV$(4)
CA 1340 DSKINV$="hLS":DSKINV$(4)=C
        HR$(228)
PF 1350 POKE DUNIT,1:A=ADR(SECTOR$
        ):H=INT(A/256):L=A-256*H
BP 1360 POKE DBUFHI,H
CO 1370 POKE DBUFLO,L
PD 1380 POKE DCOMND,87-5*READ
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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NEWS & PRODUCTS

Color Printer For Commodore And Atari

A $239, full-color thermal transfer printer that doesn't require special paper has been introduced for Commodore and Atari home computers by Okidata.

The Okimate 10 prints on almost any kind of paper. It also will print on acetate, to make transparencies for overhead projectors.

The printer uses a color or black ribbon cartridge. Okimate 10's print head has a life expectancy of 10 million characters, and prints at a speed of 60 characters per second (240 words per minute).

The Okimate 10 can produce more than 40 different shades of color. For printing without a ribbon, thermal paper may be used.

The printer comes with a software tutorial, color and black ribbons, and a Plug 'n Print module, which is required to operate the equipment.

The $239 Okimate 10 color thermal transfer printer doesn't require special paper. For Commodore and Atari computers.

Okidata
532 Fellowship Road
Mt. Laurel, NJ 08054
(609) 235-2600

Finance Manager For Apple II Family

Finance Manager, a software program designed to handle home management operations such as checking accounts, expenses, and tax records, has been announced by Human Engineered Software.

Available for the Apple II series of computers, *Finance Manager*'s capabilities include tracking income, expenses, and personal assets; building budgets and comparing results; balancing multiple checking accounts; paying bills; and printing checks.

Finance Manager includes built-in help files as well as message windows. The program also offers a wildcard search capability for access to specific transactions, as well as the ability to make financial calculations.

Suggested retail price is $99.95.

Human Engineered Software
150 North Hill Drive
Brisbane, CA 94005
(415) 468-4111

New Educational Software

DesignWare has released several educational programs that test and teach grammar, geography, math, and music skills.

In *The Notable Phantom,* ghosts, spiders, and a music-loving phantom teach children ages 5–10 the basics of piano playing.

Suggested retail price is $49.95. Versions for the Apple, Atari, Commodore, and IBM computers are available.

In *States and Traits,* families and children (ages 9 and above) can hone their knowledge of United States geography, history, and current trivia.

The map-maker/user has two options: charting states into their proper locations on a master map, or plotting topographic features into their correct geographic positions.

States and Traits has versions available for the Apple, Commodore 64, and IBM PC and PCjr. Suggested retail price is $49.95.

In *Mission: Algebra,* the right answer to a linear equation will locate the position of an errant sister ship, saving it from destruction.

Mission: Algebra is available for the Apple, Atari, Commodore, and IBM computers at a suggested retail price of $44.95.

Children ages 10–14 can improve their grammar skills with *The Grammar Examiner.* Players start the game as a cub reporter with the Grammar Examiner newspaper.

Editing copy and answering grammar questions pay off as the junior reporter earns promotions and moves his way up the masthead, to editor in chief.

Suggested retail price is $44.95. Available for the Apple, Atari, Commodore, and IBM computers.

DesignWare
185 Berry Street
San Francisco, CA 94107
(415) 546-1866

Story And Music Creation Software

Mindscape, Inc., has introduced two software programs in its *Bank Street Creativity* series. One allows children to create illustrated storybooks and the other to compose music.

Bank Street Storybook is designed for children ages 6–12. It allows them to draw pictures with a joystick in six colors on the screen. Then, using the keyboard, they can edit and color the pictures and write the story.

Storybook, available for Apple computers, retails for $39.95. A Commodore version will be released later.

In *Bank Street Musicwriter,* the user arranges notes on two musical staffs displayed on the screen. Notes are placed where the cursor is positioned, and as they are entered, are seen and heard.

Four voices—soprano, alto, bass and tenor—can be programmed and played at once. Eight editing modes allow the user to save and print the music.

Available for Atari and Commodore 64 computers, *Musicwriter* retails for $49.95. Apple and IBM PC versions will be available later.

Mindscape, Inc.
3444 Dundee Road
Northbrook, Il 60062
(312) 480-7667

Strategy, Action Games

Electronic Arts has introduced *Archon II: ADEPT,* a sequel to its strategy game, and *Skyfox,* a flying adventure game.

Skyfox is a single-player, disk-based game for the Apple II family. It pits Sky-Pilot against the enemy, whose mother ships are attacking Federation asteroid bases with aircraft and tanks.

After trying training missions, the player can attempt any one of 15 scenarios to advance in rank from Cadet to Ace.

In *Archon II: ADEPT,* chesslike strategy and action are combined. Players have the ability to conjure up spells, and the strategic goal is to gain magic power by capturing energy points.

Action play results when opposing pieces contest the ownership of a board square. The game may be played against the computer or another player.

Available for Atari computers with 48K of memory and the Commodore 64. Suggested retail price for each game is $40.

Electronic Arts
2755 Campus Drive
San Mateo, CA 94403
(415) 571-7171

Music Program, Economics Game

Spinnaker Software has introduced *Rock N' Rhythm,* a music writing program, and *President's Choice: Guns or Butter,* a simulation game that teaches economics and finance.

Rock N' Rhythm lets one to three players simulate a recording studio and record songs using a microcomputer. Players write their own music, or recreate favorite songs, and then perform them.

The melody, tempo, and rhythm can be changed by recalling songs from a storage area.

Available for the Atari and Commodore 64, *Rock N' Rhythm* retails for $39.95.

President's Choice: Guns or Butter uses data from the past five presidential administrations. The player in the role of president must review the state of the economy and prepare a national budget in order to keep the American economy running smoothly.

Success is reflected in positive opinion polls and reelection.

Available for the IBM PC and Apple II series, it retails for $39.95. Suggested age range is 13–adult.

Spinnaker Software
215 First Street
Cambridge, MA 02142
(617) 868-4700

New Arcade Games

Two Bally/Midway arcade games, *Spy Hunter* and *Tapper,* have been introduced in disk and cartridge formats for the Commodore 64, IBM PC and PCjr, Atari and Apple II families by Sega Enterprises, Inc.

In *Spy Hunter,* a shooting and driving game, the player is in command of an arsenal of weapons, including machine guns, oil slicks, smoke screens, and heat-seeking missiles.

Tapper features four different bar screens, which are crowded with unruly and thirsty customers. The bartender has to scramble to draw and serve drinks.

If he gets the tip on the bar, dancing girls appear. In the bonus round, players match wits with a riverboat gambler.

Suggested retail price for

Spy Hunter and *Tapper* is $39.95 each.

Sega Enterprises, Inc.
360 N. Sepulveda Blvd., Suite 3000
El Segundo, CA 90245
(213) 640-7087

Problem-Solving Program

Amazing Thinktanks, a mathematical/problem-solving program for ages 8–13, has been released by Sunburst Communications, Inc., for the Apple II series of microcomputers.

It is designed to put students in a situation where they must invent ideas, try them out, and if necessary, revise them. The program develops critical thinking and problem-solving skills while reinforcing the concepts of addition, subtraction, multiplication, and division.

Players are given two tanks and a storage tank, which they must fill and empty. There are four play levels, and the game can be played alone or competitively.

Retail price is $55.

Sunburst Communications, Inc.
Pleasantville, NY 10570
(914) 769-5030

New Product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication.

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PRODUCT MART

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LQ/3 11" carriage, 13 CPS

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"WRITE NOW" WORD PROCESSOR SOFTWARE
An excellent time saver, CARDCO OFFERS THE CØ2 "Write Now" program with built-in 80 column display. You see exactly what will print. All special codes can be transmitted to printers maintaining justification. Easy full-screen editing; works with any printer.

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LOOK WHAT'S ON TELEVISION TONIGHT.

6:00

JACK ATTACK

(Gold Medallion Game) Cartoon animation plus strategic challenge. 64 different screens. A Commodore original, rated "must buy" by Electronics Game Magazine. (Cartridge)

6:30

MATH FACTS

(Ages 5 to 10) (Micro School) Educational TV. Practice in basic math facts. Several levels. (Easy to hard) (Diskette)

7:00

FRENZY/ FLIP FLOP

(Ages 6 to 14) (Milliken Edufun) FRENZY (subtraction and division) The hungry gator arrives... save the fish... play the BONUS game... FLIP FLOP (transformed geometry) look at the two figures... do they need to flip, turn or slide? (Diskette)

7:30

SOLAR FOX

It's erase or be erased as you navigate spaceship over a grid of colorful pulsating entities, armed with laser. Unlimited levels. A BALLY MIDWAY original. (Cartridge)

8:00

EASY SCRIPT

Our best wordprocessor. Displays 764 lines by 40 characters. Prints over 130 columns. Global/local search/replace/hunt/find. Super/subscripts. Insert/delete characters, lines, sentences, paragraphs. (Diskette)

8:30

THE MANAGER

A powerful database management system. For business, educational or personal files. Not for Rockford's files. With four built-in applications. Or design your own. (Diskette)

9:00

MAGIC DESK I

The scene opens on an office desk, complete with digital clock, typewriter, wastebasket and file cabinet. Select functions (typing, filing, editing) by pointing animated finger. (Cartridge)

9:30

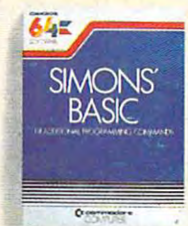
INTERNATIONAL SOCCER

(Gold Medallion Game) Sports highlight. With passing, kicking, diving goalies, even trophies! Great color, 3-D realism. No locker room interviews. (Cartridge)

10:00

SIMONS' BASIC

Rated PG. Expands Commodore BASIC by an additional 114 commands. Convenient programming commands such as RENUMBER and TRACE plus graphics plotting command. (Cartridge)



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COMMODORE 64

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