existing option has been slightly changed: Option J, Duplicate Disk, now formats the target disk before copying.

Three new utility files are included with DOS 2.5. The first, SETUP.COM, lets you customize DOS in various ways without the POKEs that used to be necessary. For instance, you can significantly speed up disk accesses by turning off the write-with-verify mode. You can also set up one of three AUTORUN.SYS files: the usual RS-232 handler for the 850 Interface Module; a file which automatically boots a BASIC program; or a file which boots both the RS-232 handler *and* a BASIC program.

The second utility, DISKFIX.COM, can help clean up garbled disks by closing open files and verifying that allocated sectors correspond to information in the disk directory. It can even recover deleted files, as long as new data hasn't been saved over the deleted data. The third utility, COPY32.COM, converts DOS 3 files to 2.0/2.5 format. All three utilities guide you with screen prompts and are nearly foolproof.

New Disk Commands

DOS 2.5 also makes a few additional disk commands available in BASIC. There are now two methods of reading a disk directory:

```
OPEN #1,6,0,"D:*.*":FOR X=1 TO
  1E9:GET #1,A:? CHR$(A);:NEXT X
OPEN #1,7,0,"D:*.*":FOR X=1 TO
  1E9:GET #1,A:? CHR$(A);:NEXT X
```

The first method is the same as before. But the second method identifies files in the directory which cannot be accessed from DOS 2.0 because they occupy extra sectors on an enhanced-density disk. These files are flagged by a pair of less-than/greater-than symbols, such as <FILENAME.BAS>.

Also, there are now three ways to format a disk from BASIC:

```
XIO 253,#1,0,0,"D1:"
XIO 253,#1,34,0,"D1:"
XIO 254,#1,0,0,"D1:"
```

The first XIO statement formats a disk in single density. The second formats in enhanced density (generating an error 139 if attempted on an 810 drive). The third XIO statement attempts to format in enhanced density, then switches to single density if the drive isn't 1050-compatible.

Incidentally, if you select option J (Duplicate Disk) with DOS 2.5 when using a 1050 drive, the disk is automatically formatted in *enhanced* density before copying starts. Keep this in mind if you're duplicating a disk for someone who doesn't have an enhanced-density drive. Instead, you'll have to format the destination disk for single density (option P) and then copy the source disk one file at a time.

Memory Location 54017 (130XE Only)

Bit Position	Function
0	If 1, enable OS ROM, disable RAM from $C000–$FFFF (default) If 0, disable OS ROM, enable RAM from $C000–$FFFF
1	If 0, enable BASIC ROM at $A000–$BFFF (default)* If 1, disable BASIC ROM, enable RAM at $A000–$BFFF
2–3	If 00 (decimal 0), switch first 16K bank of extra 64K into $4000–$7FFF If 01 (decimal 4), switch second 16K bank of extra 64K into $4000–$7FFF If 10 (decimal 8), switch third 16K bank of extra 64K into $4000–$7FFF If 11 (decimal 12), switch fourth 16K bank of extra 64K into $4000–$7FFF
4	If 1, deny 6502 access to extra bank (default) If 0, allow 6502 access to extra bank
5	If 1, deny ANTIC access to extra bank (default) If 0, allow ANTIC access to extra bank
6	Not presently used. Default = 1
7	If 1, disable self-test ROM, enable RAM at $5000–$57FF (default after powerup) If 0, enable self-test ROM, disable RAM at $5000–$57FF

*Note: *A similar chart on page 122 of the 130XE* Owner's Manual *indicates that bit 1 should always be set. However, bit 1* should not *be set unless you want to disable BASIC.*

Instant DOS

The 130XE's extra 64K RAM can be used as either a superfast RAM disk with DOS 2.5 or as additional memory for programming. Of these two options, the RAM disk is by far the easiest to use, especially for those who aren't too familiar with bank-switching or bit manipulations.

The only accessory you need to set up a RAM disk with the 130XE is a free DOS 2.5 file called RAMDISK.COM. When you boot DOS 2.5 on a 130XE, RAMDISK.COM automatically initializes the RAM disk and loads two DOS files: DUP.SYS and MEM.SAV DUP.SYS is the DOS utility package—the part that normally must be loaded from disk when you type the DOS command in BASIC. Usually this takes 10 to 20 seconds or more. But with DUP.SYS stored in the RAM disk, the DOS 2.5 menu comes up almost instantly when you type DOS.

The second DOS file stored in the RAM disk, MEM.SAV, temporarily saves the portion of BASIC memory that would be overwritten when you enter DOS. That means you can enter DOS and return to BASIC without losing your BASIC program.

DUP.SYS and MEM.SAV take up 87 sectors total, leaving the RAM disk with 412 free "sectors"—51.5K of high-speed (though temporary) storage. If you don't mind waiting for the DOS menu to load from disk as usual, you can delete DUP.SYS and MEM.SAV from the RAM disk to create 499 free sectors (62.3K).

You access the RAM disk by addressing it as drive 8 (D8:). For example, LOAD"D8:FILENAME.EXT" or SAVE"D8:FILENAME.EXT" Almost all DOS commands work, too: Disk Directory, Delete File, Rename File, Copy File, Lock File, Unlock File, Binary Load, Binary Save, and Run At Address.

Duplicate File doesn't work because there's no way to swap disks

with a RAM disk (use the two-drive Copy File command instead). Also, the Format Disk and Duplicate Disk commands sometimes cause strange results and should be avoided. For instance, if you erase DUP.SYS by deleting it or formatting the RAM disk, then replace it by duplicating a floppy disk that contains DUP.SYS, you might not be able to enter DOS from BASIC afterward.

Aside from these exceptions, the 130XE RAM disk seems to be very transparent; it's worked with everything we've tried. Although a RAM disk is no substitute for a floppy—it's at the mercy of power interruptions and system crashes—it can make a world of difference when running disk-intensive applications, such as assemblers, compilers, database managers, mailing list programs, and word processors with linked files.

Like Memory In The Bank

Using the 130XE's extra memory for programming is a lot more difficult than using it as a RAM disk. For one thing, the 6502 microprocessor which is the central brain of 8-bit Atari computers was not designed to access more than 64K memory at a time. So even though the 130XE has 128K RAM, the 6502 is "blind" to the extra 64K.

Making the extra memory visible requires a technique known as *bank-switching*. A block, or bank, of memory in the regular 64K is temporarily switched off and replaced with a bank from the "hidden" memory. Under program control, banks can be switched in and out at will. It's sort of like reading a book and flipping between the page you're on and a footnote section in the back.

The 130XE organizes its extra 64K RAM into four 16K banks. Only one of these banks can be switched in at a time. When you're using the RAM disk, the RAMDISK.COM file and DOS 2.5 handle these details for you automatically. But using this memory for other purposes means writing your own bank-switching routine in BASIC or machine language.

Bank-switching on the 130XE is controlled by memory location 54017 ($D301 hexadecimal). This byte was previously reserved for port B of the Peripheral Interface Adapter (PIA), an input/output control chip. On the Atari 400 and 800, it's used for controller jacks 3 and 4, which have been eliminated on the XL and XE series. On the 1200XL, part of this byte controls the keyboard LEDs, which were dropped from the 600XL, 800XL, and XE series. On all XLs and XEs, location 54017 also lets you switch off the operating system and BASIC ROM to reveal the full 64K RAM underneath. On the 130XE, you can now flip other bits at this location to switch on any 16K bank of the extra 64K RAM into the address space from 16384 to 32767 ($4000 to $7FFF). See the accompanying table for a guide to this important address.

Notice that bits 4 and 5 control whether the 6502 and ANTIC chips can access the extra banks of memory. Some special applications may blind either chip from seeing the banks. Also note that the 130XE *Owner's Manual* contains errors on page 122 when explaining how location 54017 works. The location normally contains 241 when the RAM disk is booted and 253 otherwise, not 193; and all bits *except* bit 1 should be set for normal operations.

If you're an experienced machine language programmer, you shouldn't have any trouble manipulating the bits at location 54017. BASIC programmers won't have it so easy, because bit-flipping is rarely required in BASIC and Atari BASIC lacks bitwise operators. So try this formula:

POKE 54017,193+4*_bank_+16*_mode_

where *bank* is the 16K bank you want to select (0 = bank 1, 1 = bank 2, 2 = bank 3, 3 = bank 4) and *mode* chooses which chip has access to the extra banks (0 = 6502/ANTIC, 1 = ANTIC, 2 = 6502, 3 = neither).

A word of caution: One wrong POKE into this critical memory location could instantly disable the operating system or BASIC or both, triggering a hopeless system crash. The only recovery might be to switch the machine off and then on again, wiping out your program. So be careful when experimenting. ©

Atari Animation With P/M Graphics Part 2

Robert J. Powell

Part 1 of this series introduced the basic concepts of Atari player/missile graphics and showed how to display all four player strips on the screen. This month, Part 2 demonstrates how to redefine players into any shapes you want and how to move them horizontally.

If you ran last month's example program, you saw the Atari's players as they really appear: four colored strips which are eight bits wide and taller than the screen. To really make use of player/missile graphics, your program must transform these featureless strips into shapes of your own design. It isn't a difficult task, though it helps if you have a grasp of binary numbering. But even if you know nothing about binary, we'll provide plenty of step-by-step examples so you can learn by experimentation.

First, run last month's program again. (For those who missed it, it's listed below as Program 1.) When the program finishes, you should see four colored strips at the right side of the screen and the READY

prompt at the left. Don't press SYSTEM RESET or any other keys for now; we'll illustrate how shapes are defined by changing one of these players in direct mode so you can see the effects immediately.

If you refer to the P/M memory map in Part 1, you'll notice that the memory area for the four players extends from PMBASE+1024 to PMBASE+2048. That's a total of 1,024 bytes, or 1K. (Remember, this program is using *single-line resolution* P/M graphics, so each of the four players is 256 bytes tall. If it were using *double-line resolution*, each player would be only 128 bytes tall, and player memory would extend from PMBASE+512 to PMBASE+1024.)

The numbers stored in this memory area determine the shape of each player. Right now, the memory area for all four players is filled with the number 255, POKEd there by line 90 of Program 1. The players appear as solid strips because 255 is the largest number which can be stored in a single byte. *The key to defining a shape is to selectively display only parts of the player strip by POKEing numbers between 0 and 255 into the player's memory area.*

Building A Box

Let's start by redefining the shape of player 0 (by custom, the four players are numbered 0 to 3). Referring again to the P/M memory map in Part 1, notice that player 0's memory extends from PMBASE+1024 to PMBASE+1280 (256 bytes). This is the target for our POKEs. In direct mode—that is, without a line number—type this line and press RETURN:

```
FOR X=PMBASE+1024 TO PM
BASE+1280:POKE X,0:NEXT
 X
```

You should see the player 0 strip disappear. Why? Because this line POKEs 256 zeros into the memory area for player 0, erasing the 255s previously stored there. Notice that players 1, 2, and 3 remain unaffected.

Now let's restore part of the player 0 strip to make a simple shape. One by one, enter the following lines, pressing RETURN each time:

```
POKE PMBASE+1152,255
POKE PMBASE+1153,129
POKE PMBASE+1154,129
POKE PMBASE+1155,129
POKE PMBASE+1156,255
```

Each time you press RETURN, you should see a hollow box taking shape where the player 0 strip used to be. If you examine the POKE statements, you'll notice that the first number in each statement is a memory address in the middle of the player 0 memory area. These addresses determine the shape's vertical position within the strip—and therefore its vertical position on the screen.

The second number in each statement actually defines part of the box. Experiment by POKEing other numbers between 0 and 255 into these addresses (as well as other addresses in the player 0 memory area). Once you learn how these numbers are arrived at, you can create almost any shape you want.

Patterns Of Bits

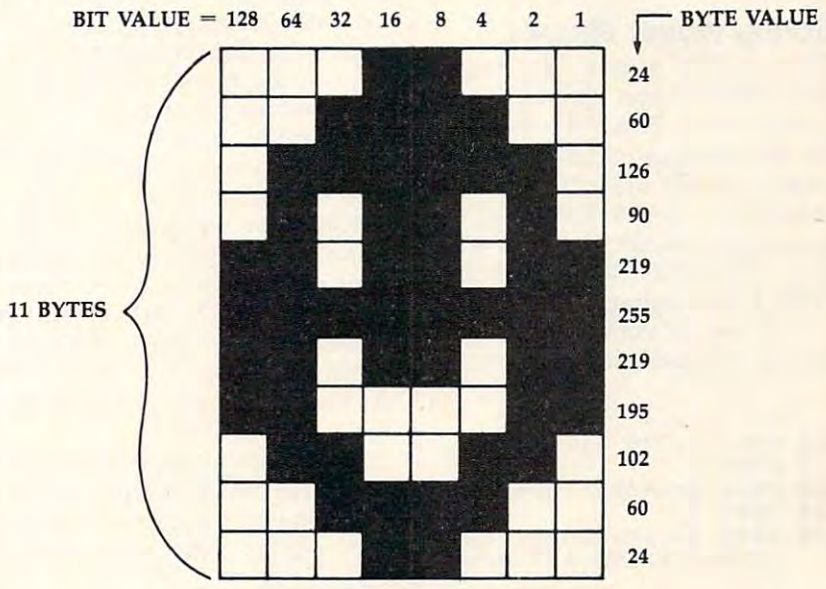
The numbers between 0 and 255, when POKEd into a byte, represent *bit values* in the binary number system. These bit values translate directly into player shapes.

A byte contains eight bits, or positions. Each position has a different value ranging from 1 to 128. When a certain bit position in a player/missile strip is turned "on," it appears onscreen as a tiny dot. Bits which are turned "off" do not appear onscreen. To define a shape, then, you have to figure out which bits to turn on, add up the bit values of their positions, and POKE the resulting number into the appropriate memory address.

The accompanying figure makes this explanation more clear. It shows the bit pattern for a player defined as a happy face. The bit values are the numbers running across the top of the figure; notice now the values double for each bit position running from right to left.

The numbers running down the side of the figure are the *byte values*, or the sums of the bit values for each byte. To arrive at the byte values, you add up all the bit values for "on" bits in each row. For instance, the top row, or byte, has two bit positions turned "on": bits 8 and 16. Therefore, the byte value for that row is 8 + 16, or 24. The next byte has four bit positions turned "on": bits 4, 8, 16, and 32. Therefore, the byte value is 4 + 8 + 16 + 32, or 60. All the other byte values are determined in a similar fashion. These are the numbers you POKE into the player memory area

Calculating byte values for a player shape.



to make the shape appear.

To see this in action, press SYSTEM RESET and run Program 1 again. When it stops, fill the player 0 memory area with zeros using the FOR-NEXT loop as we did before. Then enter these lines, pressing RETURN after each one:

```
POKE PMBASE+1152,24
POKE PMBASE+1153,60
POKE PMBASE+1154,126
POKE PMBASE+1155,90
POKE PMBASE+1156,219
POKE PMBASE+1157,255
POKE PMBASE+1158,219
POKE PMBASE+1159,195
POKE PMBASE+1160,102
POKE PMBASE+1161,60
POKE PMBASE+1162,24
```

Each time you press RETURN, another byte of the player shape should appear.

Try designing your own shape using a blank version of the grid in the figure. After coloring in each square to make the shape, add up the bit values to arrive at the numbers for your POKE statements. Remember that your shape can be only eight bits wide, but can be as tall as the screen.

Storing Player Shapes

When you're writing a program that defines player shapes, it's inconvenient to POKE the byte values into memory in direct mode, of course. Usually the byte values are stored in a DATA statement, retrieved by a READ statement within a FOR-NEXT loop, and then POKEd into memory.

To see an example, add these lines to Program 1:

```
   XT X
100 FOR X=1 TO 11
110 READ A
120 POKE PMBASE+1152+X,A
130 NEXT X
140 DATA 24,60,126,90,219
    ,255,219,195,102,60,2
    4
```

Line 90 clears out the player memory area with zeros. Lines 100–130 are the loop which READs the DATA in line 140. Notice that line 120 POKEs the byte values into the middle of the player 0 memory area. To define this shape as player 1, you could simply add 256 to this address; to define it as player 2, add 512; and to define it as player 3, add 768.

Missiles are defined in a similar way, with one important difference: Because each missile is only two bits wide, all four missiles share the same amount of memory as a single player. That means the bit patterns are two-bit slices of the grid in the figure. By referring to this figure and the P/M memory map in Part 1, you can see that missile 0 is defined by adding the bit values 1 and 2; missile 1 is defined by the bit values 4 and 8; missile 2 is defined by the bit values 16 and 32; and missile 3 is defined by the bit values 64 and 128.

Of course, with only two bits to work with, missile shapes are pretty limited. That's why they're used mostly in games as "bullets" fired by player shapes.

Horizontal Animation

By now you're probably wondering how to animate the shapes you've created. We'll tackle horizontal movement first because it's the easiest; we'll save vertical animation for Part 3 next month.

In Part 1 we mentioned that each player has a *horizontal position register*, a memory location which determines the horizontal placement of the player on the screen. These memory locations are 52348 for player 0, 53249 for player 1, 53250 for player 2, and 53251 for player 3. Line 80 of Program 1 POKEs these registers to group all four players together near the right edge of the screen. Any number from 0–255 can be POKEd into the registers, but the range of numbers which position the player on the visible part of the screen is only about 45 to 205.

Moving a player horizontally is as simple as POKEing different numbers into the appropriate position register. Add these lines to Program 1:

```
100 FOR X=45 TO 205
110 POKE 53248,X
120 NEXT X
```

When you type RUN, this loop moves player 0 across the screen from left to right. By changing the register address in line 110, you can move any of the four players.

Missiles are moved horizontally like players; the four horizontal position registers for the missiles are at memory locations 53252 to 53255. To see the missiles onscreen, add these lines to Program 1:

```
85 POKE 53252,140:POKE 53
   253,144:POKE 53254,148
   :POKE 53255,152
90 FOR X=PMBASE+768 TO PM
   BASE+2048:POKE X,255:N
   EXT X
```

One-Way Registers

There's only one tricky detail to keep in mind when manipulating the horizontal registers—they are *write-only* memory locations, which means they can be POKEd but do not return useful values when PEEKed. This makes your programming more complicated, because you can't keep track of a player or missile's horizontal screen position merely by PEEKing its horizontal register. Instead, you have to set aside a variable for each object to store its horizontal position. Every time the object moves, your program must update the corresponding variable.

This technique is demonstrated in Program 2. It's a modified version of Program 1 that lets you move player 1 left or right with a joystick plugged into port 1. Notice how the variable P1 keeps track of the player's horizontal position. Also notice how player 1 moves over players 2 and 3, but beneath player 0. These different *display priorities* let your programs simulate 3-D graphics effects.

Try modifying Program 2 yourself to move the other three players. Be careful about moving the player too far off the edges of the screen, though—if the program tries to POKE a value smaller than 0 or greater than 255 into the horizontal register, it will crash with an error.

In Part 3, we'll cover a method of vertical animation and a few other details about player/missile graphics as well.

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

Program 1: P/M Demo

```
10 POKE 106,PEEK(106)-8
20 POKE 54279,PEEK(106)
```

```
HD 30 GRAPHICS 0:SETCOLOR 2,
     0,0
CN 40 PMBASE=PEEK(106)*256
ML 50 POKE 559,62
PM 60 POKE 53277,3
DP 70 POKE 704,68:POKE 705,1
     98:POKE 706,168:POKE 7
     07,148
PA 80 POKE 53248,160:POKE 53
     249,170:POKE 53250,180
     :POKE 53251,190
DN 90 FOR X=PMBASE+1024 TO P
     MBASE+2048:POKE X,255:
     NEXT X
```

Program 2: Horizontal Animation

```
10 POKE 106,PEEK(106)-8
20 POKE 54279,PEEK(106)
30 GRAPHICS 0:SETCOLOR 2,
   0,0
40 PMBASE=PEEK(106)*256
50 POKE 559,62
60 POKE 53277,3
70 POKE 704,68:POKE 705,1
   98:POKE 706,168:POKE 7
   07,148
80 POKE 53248,160:POKE 53
   249,170:POKE 53250,180
   :POKE 53251,190
90 FOR X=PMBASE+1024 TO P
   MBASE+2048:POKE X,255:
   NEXT X
100 P1=170
110 S=STICK(0)
120 IF S=7 THEN P1=P1+1:I
   F P1>255 THEN P1=255
130 IF S=11 THEN P1=P1-1:
   IF P1<1 THEN P1=1
131 POKE 53249,P1
140 GOTO 110
```


Lightning Renumber For Atari

Raymond Citak

This fast, convenient utility renumbers any BASIC program. It runs on any Atari 400, 800, XL, or XE with at least 48K RAM.

If you write BASIC programs, you know how frustrating it can be to run out of space to insert program lines, especially when the program is nearly finished. Since Atari BASIC has no RENUMBER command, you may be forced to renumber dozens of lines manually, creating the risk that you'll inadvertently delete or misnumber a line. "Lightning Renumber" removes that worry and saves a lot of time, too. It can handle any Atari BASIC program, and it renumbers internal line references as well as the lines themselves. Because it uses a machine language (ML) routine, it does the job in only a few seconds. But it's easy enough for anyone to use, even if you don't know anything about machine language.

Type in and save Lightning Renumber as listed below, then run it. The program offers two options. You can either write the ML routine as a binary (machine language) file to disk, or POKE it directly into memory. The binary file option is straightforward: After you designate the drive number, the program creates and locks a binary file named RENUMBER.OBJ on your disk. The binary file can then be loaded into memory and called with a USR statement (see below) whenever you like. If you don't have a disk drive, select the second option to POKE the ML into memory.

Call It With USR

Once the ML routine is in memory, enter NEW and load the BASIC program you want to renumber. Now you can call the ML routine by typing in a USR statement and pressing RETURN. The USR statement must include three numbers: the address of the routine (always 38900), the starting line number, and the line increment value. For example, the statement U=USR(38900,10,10) renumbers a program so the first line is 10 and the rest are numbered in increments of 10 (20, 30, and so on). To start with line 1000 and renumber in increments of 100, use the statement U=USR(38900,1000,100), and so on. When the message **RENUMBERED** appears, the job is complete. At this point, you should resave the renumbered program.

The routine checks for several errors. First, it makes sure the renumbered program will not have line numbers above 32767. If the values you specify in the USR statement would create a line number greater than 32767, you'll get the

message ERROR — CHANGE YOUR USR ARGUMENTS. Enter a new USR statement with appropriate values.

Incorrect line references are detected as well. For instance, your program may contain the statement GOTO 300 when no line 300 exists. When such an error occurs, you'll see the message ERROR — LINE # MISMATCH. Mismatched line references (300 in this example) are replaced by 55555, and the rest of the program is renumbered as usual. When this error message appears, you must LIST the program and change any 55555 line references to the correct line numbers before resaving the program.

TRAP statements (except for TRAP 40000) are also renumbered by this routine. However, it cannot change *computed* line references (GOTOs or GOSUBs that use a variable to refer to a line number). If your program uses computed line references, LIST the program and change them yourself after the rest of the program is renumbered.

Possible Memory Conflicts

Although Lightning Renumber is designed to be reliable, it's possible to disrupt it by running BASIC programs. The ML normally resides in high memory just beneath the display list in GRAPHICS 0. Running a BASIC program that's very long or that uses the same memory area for other graphics modes, player-missile data, etc., may overwrite and destroy the ML. When that occurs, trying to call the routine may crash the computer (and destroy your program). When in doubt, save your BASIC program and reload the binary file (RENUMBER.OBJ) from disk; then reload the BASIC program and call the routine with USR.

If you use this routine frequently, you may want to include the USR call within the BASIC program itself. Since line 32767 will never be renumbered, place the USR statement in that line. Then you can renumber the program at any time by entering GOTO 32767.

You could also create an AUTORUN.SYS file that loads Lightning Renumber into memory automatically when the disk is booted. If you already have an AUTORUN.SYS file on the disk, you can append the renumber file to it from the DOS menu. Choose the Binary Save option, then type in AUTORUN.SYS/A,97F4,9BFF. Lightning Renumber will be appended to the existing AUTORUN.SYS file and will load automatically when you boot that disk.

If you want to save typing, send a blank disk or tape, a self-addressed postage-paid mailer, and $3 to:

Raymond Citak
1514 Park Avenue
Laramie, WY 82070

Special thanks to W. A. Bell for his useful line dump routine which appears in *COMPUTE!'s First Book of Atari.*

Lightning Renumber

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

```
JP 10 DIM DRIVE$(2),A$(15):P
      OKE 709,0:POKE 710,168
      :POKE 712,146
OD 20 ? CHR$(125):? :? "
      {9 SPACES}RENUMBER BA
      SIC "
HG 30 ? "TO LOAD THIS OBJECT
       FILE DIRECTLY
      {5 SPACES}INTO MEMORY
      AND NOT TO DISK, PRESS
      "
EE 40 ? "KEY ";CHR$(34);"L";
      CHR$(34);".  REQUIRES
      48K MEMORY.":? "PRESS
      ANY KEY FOR DISK WRITE
      ."
CB 50 OPEN #4,4,0,"K":GET #4
      ,Z:IF Z=76 THEN 1440
DD 60 CLOSE #4
IM 70 ? CHR$(125):? :? :? "
      {6 SPACES}RENUMBER.OB
      J - LORDER "
MJ 80 ? :? "**REQUIRES 48K M
      EMORY AND DOS v.2.**"
MJ 90 ? :? "To which disk dr
      ive would you like the
      file written to (D1,D2
      ,D3,or D4)";
LP 100 INPUT DRIVE$
NO 110 GOSUB 1380
LC 120 ? :? "One moment whil
      e I write the file to
      ":? DRIVE$;"..."
IN 130 A$(1,2)=DRIVE$:A$(3,1
      5)="RENUMBER.OBJ"
HB 140 TRAP 300:OPEN #2,8,0,
      A$
GG 150 TRAP 180
OL 160 READ B:PUT #2,B
GI 170 GOTO 160
GE 180 CLOSE #2
PH 190 OPEN #1,12,0,A$:XIO 3
      5,#1,0,0,A$
FM 200 CLOSE #1
DF 210 ? CHR$(125):?
DN 220 ? "File is now writte
      n to ";DRIVE$;"."
PK 230 ? "You may now use th
      e DOS menu selection'
      L' to place the renum
      ber program "
EK 240 ? "into memory.  Retu
      rn to BASIC, load
      {3 SPACES}file to be
      renumbered, and use"
ON 250 ? "U=USR(38900, start
      ing line number,
      {4 SPACES}increment)
      to renumber your prog
      ram."
GE 260 ? "Or place the USR s
      tatement into your  p
      rogram at line 32767.
        Watch for"
PN 270 ? "possible overwrite
       of the renumber
      {4 SPACES}program if
      RUNning a BASIC progr
      am"
GG 280 ? "that changes GRAPH
      ICS modes, or uses  o
      ther high memory."
GE 290 POKE 709,202:POKE 710
      ,148:POKE 712,0:END
HH 300 ? CHR$(125):? :? "ERR
      OR #";:? PEEK(195);:?
       " trying to write th
      e file...":FOR I=1 TO
       500:NEXT I:RUN
KJ 310 REM THIS DATA FOR DIS
      K WRITE ONLY
CL 320 DATA 255,255,244,151,
      255,155
BL 330 REM THIS DATA FOR MEM
      ORY 38900($97F4) TO 3
      9935($9BFF)
ML 340 DATA 76,80,153,165,13
      6,133,203,165,137,133
KA 350 DATA 204,169,0,133,20
      5,133,206,133,207,96
GF 360 DATA 201,14,240,1,96,
      152,141,243,151,136
GN 370 DATA 177,203,32,61,15
      2,165,207,208,10,32
DL 380 DATA 101,152,165,207,
      208,3,76,40,152,32
MG 390 DATA 148.152,172,243,
      151,169,0,133,205,133
BA 400 DATA 206,133,207,141,
      243,151,200,200,200,2
      00
DC 410 DATA 200,200,96,201,1
      8,240,1,96,136,152
JH 420 DATA 201,3,240,249,17
      7,203,201,14,208,244
IK 430 DATA 136,177,203,201,
      23,240,11,201,24,240
EH 440 DATA 7,201,4,240,3,76
      ,66,152,169,1
AJ 450 DATA 133,207,96,172,2
      43,151,136,177,203,20
      1
CA 460 DATA 10,240,32,201,12
      ,240,28,201,23,240
BP 470 DATA 24,201,24,240,20
      ,201,13,240,16,201
MK 480 DATA 4,240,12,201,27,
      240,8,201,35,240
OG 490 DATA 1,96,32,220,154,
      169,1,133.207,96
DD 500 DATA 172,243,151,138,
      141,242,151,165,136,1
      33
CL 510 DATA 205,165,137,133,
      206,200,177,203,133,2
      12
CE 520 DATA 200,177,203,133,
      213,200,177,203,133,2
      14
CJ 530 DATA 200,177,203,133,
```

```
      215,200,177,203,133,2
      16
MP 540 DATA 200,177,203,133,
      217,32,198,154,32,210
MI 550 DATA 217,169,0,141,24
      0,151,141,241,151,160
HF 560 DATA 0,177,205,200,19
      7,212,208,6,177,205
EC 570 DATA 197,213,240,30,3
      2,90,154,160,2,177
IP 580 DATA 205,24,101,205,1
      33,205,144,2,230,206
NH 590 DATA 238,240,151,173,
      240,151,208,3,238,241
PP 600 DATA 151,76,207,152,1
      73,240,151,141,234,15
      1
CK 610 DATA 173,241,151,141,
      235,151,173,230,151,1
      41
ML 620 DATA 236,151,173,231,
      151,141,237,151,32,41
AI 630 DATA 155,24,173,238,1
      51,109,228,151,133,21
      2
AI 640 DATA 173,239,151,109,
      229,151,133,213,32,17
      0
DD 650 DATA 217,172,243,151,
      174,242,151,200,165,2
      12
CJ 660 DATA 145,203,200,165,
      213,145,203,200,165,2
      14
CO 670 DATA 145,203,200,165,
      215,145,203,200,165,2
      16
AD 680 DATA 145,203,200,165,
      217,145,203,96,104,10
      4
CO 690 DATA 141,229,151,104,
      141,228,151,104,141,2
      31
MH 700 DATA 151,104,141,230,
      151,173,6,228,170,232
DC 710 DATA 138,141,154,153,
      141,114,154,141,171,1
      54
NG 720 DATA 141,252,154,173,
      7,228,141,155,153,141
DF 730 DATA 115,154,141,172,
      154,141,253,154,173,2
      30
EG 740 DATA 151,208,8,173,23
      1,151,208,3,76,244
LG 750 DATA 154,32,138,155,1
      62,13,138,72,189,244
JN 760 DATA 153,32,176,242,1
      04,170,202,16,243,32
JN 770 DATA 247,151,160,0,17
      7,203,201,255,240,14
JC 780 DATA 201,0,208,20,200
      ,177,203,201,128,208
HA 790 DATA 13,76,2,154,200,
      177,203,201,127,208
NB 800 DATA 3,76,2,154,160,2
      ,177,203,170,200
LK 810 DATA 200,177,203,201,
      22,240,22,201,155,240
AO 820 DATA 6,32,8,152,76,20
      2,153,152,133,208
KF 830 DATA 230,208,228,208,
      240,3,76,202,153,138
FO 840 DATA 24,101,203,133,2
      03,144,2,230,204,76
KH 850 DATA 164,153,155,155,
      46,46,46,103,110,105
ML 860 DATA 107,114,111,87,1
      55,125,32,247,151,173
DL 870 DATA 228,151,133,205,
      173,229,151,133,206,1
      60
DB 880 DATA 0,177,203,201,25
      5,240,14,201,0,208
KC 890 DATA 20,200,177,203,2
      01,128,208,13,76,163
KA 900 DATA 154,200,177,203,
      201,127,208,3,76,163
NJ 910 DATA 154,160,0,165,20
      5,145,203,200,165,206
PL 920 DATA 145,203,200,177,
      203,170,173,230,151,2
      4
CC 930 DATA 101,205,133,205,
      173,231,151,101,206,1
      33
JA 940 DATA 206,138,24,101,2
      03,133,203,144,2,230
AH 950 DATA 204,76,15,154,16
      0,0,177,205,201,0
EL 960 DATA 208,7,200,169,12
      8,209,205,240,1,96
LE 970 DATA 162,22,138,72,18
      9,140,154,32,176,242
OA 980 DATA 104,170,202,16,2
      43,169,66,133,212,169
KJ 990 DATA 5,133,213,169,85
      ,133,214,133,215,104
BP 1000 DATA 104,76,43,153,1
      55,72,67,84,65,77
JC 1010 DATA 83,73,77,32,35,
      69,78,73,76,32
MI 1020 DATA 45,32,210,207,2
      10,210,197,162,18,13
      8
AM 1030 DATA 72,189,179,154,
      32,176,242,104,170,2
      02
BO 1040 DATA 16,243,96,155,1
      55,42,42,32,68,69
JP 1050 DATA 82,69,66,77,85,
      78,69,82,32,42
NA 1060 DATA 42,155,165,212,
      201,66,208,15,165,21
      3
DE 1070 DATA 201,4,208,9,165
      ,214,208,5,104,104
DN 1080 DATA 76,43,153,96,13
      6,152,201,3,240,13
CI 1090 DATA 177,203,201,54,
      208,244,104,104,104,
      104
JG 1100 DATA 76,40,152,96,10
      4,104,104,104,162,36
KH 1110 DATA 138,72,189,4,15
      5,32,176,242,104,170
FD 1120 DATA 202,16,243,96,1
      55,155,46,83,84,78
JJ 1130 DATA 69,77,85,71,82,
      65,32,82,83,85
JP 1140 DATA 32,82,85,79,89,
      32,69,71,78,65
GJ 1150 DATA 72,67,32,45,32,
      210,207,210,210,197
PI 1160 DATA 155,169,0,141,2
      32,151,141,233,151,1
      41
NN 1170 DATA 238,151,141,239
      ,151,162,16,24,78,23
      5
PL 1180 DATA 151,110,234,151
      ,144,40,24,173,238,1
      51
HB 1190 DATA 109,236,151,141
      ,238,151,173,239,151
      ,109
GN 1200 DATA 237,151,141,239
      ,151,176,153,173,238
      ,151
DC 1210 DATA 24,109,232,151,
      141,238,151,173,239,
      151
PM 1220 DATA 109,233,151,141
      ,239,151,24,14,236,1
      51
GJ 1230 DATA 46,237,151,144,
      13,24,14,232,151,46
AD 1240 DATA 233,151,238,232
      ,151,76,134,155,14,2
      32
BF 1250 DATA 151,46,233,151,
      202,208,176,96,169,2
      55
CG 1260 DATA 141,240,151,141
      ,241,151,32,247,151,
      160
JJ 1270 DATA 0,177,203,208,7
      ,200,177,203,201,128
JD 1280 DATA 240,29,160,2,17
      7,203,24,101,203,133
PG 1290 DATA 203,165,204,105
      ,0,133,204,238,240,1
      51
NF 1300 DATA 173,240,151,208
      ,3,238,241,151,76,14
      9
FN 1310 DATA 155,173,240,151
      ,141,234,151,173,241
      ,151
FN 1320 DATA 141,235,151,173
      ,230,151,141,236,151
      ,173
MJ 1330 DATA 231,151,141,237
      ,151,32,41,155,24,17
      3
HC 1340 DATA 238,151,109,228
      ,151,141,238,151,173
      ,239
AN 1350 DATA 151,109,229,151
      ,141,239,151,176,14,
      56
IG 1360 DATA 169,254,237,238
      ,151,169,127,237,239
      ,151
GM 1370 DATA 48,1,96,76,242,
      154
MJ 1380 REM CK FOR CORRECT E
      NTRY
KN 1390 IF DRIVE$(1,1)<>"D"
      OR LEN(DRIVE$)=1 THE
      N 1410
PI 1400 IF DRIVE$(2,2)="1" O
      R DRIVE$(2,2)="2" OR
       DRIVE$(2,2)="3" OR
      DRIVE$(2,2)="4" THEN
       1430
PF 1410 POP :? :? "Error in
      entry.  Try again...
      "
CD 1420 FOR Q=1 TO 300:NEXT
      Q:? CHR$(125):? :GOT
      O 70
KI 1430 RETURN
PK 1440 REM LOAD DATA INTO M
      EMORY
IC 1450 CLOSE #4:? :? "Loadi
      ng DATA into memory.
      ."
EE 1460 RESTORE 340:FOR I=38
      900 TO 38900+1035:RE
      AD A:POKE I,A:NEXT I
FD 1470 ? :? "Load complete.
        NEW this program,
      and LOAD or ENTER yo
      ur BASIC program to"
IE 1480 ? "be renumbered.  T
      hen use U=USR(38900,
       first line number,
      increment) to"
OI 1490 ? "renumber the prog
      ram.  All error
      {6 SPACES}checking i
      s done by the renumb
      er pro- gram."
IP 1500 POKE 709,202:POKE 71
      0,148:POKE 712,0:END
```

Fred D'Ignazio, Associate Editor

More Adventures Of Junior, The Robot

Last month I described the trials of traveling across the country with a personal robot ("A Robot Toddler," September 1985). Among other things, my Heath HEROjr—nicknamed Junior—had panicked in the coat closet of a jetliner and started screaming for help, alarming some of the passengers.

We finally got Junior quieted down again, but more incidents were to follow. When we reached Chicago's giant O'Hare Airport, I suddenly realized that our connecting flight was at the opposite end of the terminal. Would I have to walk Junior clear across the airport? Luckily, two porters came to my rescue and pointed out a luggage cart I could rent for only a dollar. A moment later Junior and I were sailing along the corridors of O'Hare. Junior was perched high on the front of the cart singing "Summertime! Summertime! Sum-sum-summertime!" Meanwhile, I was pushing the cart like a good rickshaw boy and warning people, "Watch out for the robot! Please clear the way! The robot's trying to catch a plane!"

Drinks For Junior

I always tried to keep Junior quiet when loading him on a jet. I felt the best strategy was to keep a low profile so nobody would have second thoughts about flying with a robot. But it was no use. It's like accompanying Michael Jackson and expecting no one to notice. Everyone on board always seems to be aware of Junior. And everyone seems to delight in teasing me about him.

For instance, after stowing Junior in the closet and collapsing in my seat, a man came up and said, "Your robot just woke up and left the plane!" I leaped to my feet, alarmed, and he pushed me gently back down. "Just kidding," he said.

Another time, a flight attendant brought me a soda and a glass of champagne. I had ordered the soda, but not the champagne. "The champagne's for Junior," she explained, "compliments of the captain."

After one long flight, I headed for the men's room as soon as we landed. Naturally, I carried Junior along. Behind me, a number of men who were on the same flight saw us enter the men's room. They began laughing and followed us. "This I've gotta see," said one. I turned around and gave him a look of disapproval, then disappeared into one of the stalls. After all, even a robot deserves his privacy.

Is He Alive Or Isn't He?

Often, while waiting around to board a plane, I would set Junior on the floor, wake him up, then step back and quietly observe people's reactions.

It was fascinating. I loved to see the childlike curiosity and playfulness Junior would evoke in adults. And it was amazing to see the paradox Junior created in the adults' minds. I could almost see them wondering, "Is he alive, or isn't he?" And, "If he isn't alive, why does he seem to be alive?" This ambiguity seemed to create a tension in many people's minds that found its outlet in jokes about Junior being my son.

I observed another paradox as well. They seemed to ask themselves, "Is this machine a friend or an enemy? Is he here to help us do our jobs, or will he take our jobs away?"

The person who asked these questions the most simply and eloquently was the elderly cabbie in Roanoke, Virginia, who drove Junior and me back to my house at the end of our journey. The cabbie was fascinated by Junior and drawn to him, but his fascination was mixed with a pinch of fear. He began speculating about robots like Junior becoming humanlike and driving taxicabs. "If robots can do everything a man can," he said as he spat out the window, "we ought to hang it up." However, after some more thought, he decided: "There are just too many complications for a robot to be a good cab driver." And, referring to the possibility of robots getting out of control and taking over, he remarked, "There's more than one way to shut them off!"

The cabbie's fascination and affection for the robot ultimately won out over his fear. He pulled up in front of my house and turned around to face me and Junior. "You know something?" he said. "I sort of like that old box."

Time For A Recharge

When the cabbie dropped us off at the end of our trip, we were happy to be home and totally exhausted. We had traveled almost 7,000 miles together, and we had remained the best of friends in spite of crowded airports, grilling from customs officials, and Junior's tendency to wander off when I wasn't looking.

But now our trip was over, and boy, were we tired! The suitcases, computers, and Junior were sprawled across the front yard, and I was so groggy that I reclined on the grass for a little catnap.

I had just closed my eyes when, in a weak little voice, Junior pleaded, "Please charge my battery." Then he began mumbling a song: "All good robots sing this song: Doo Dah! Doooooo...."

"Okay, Junior," I said, getting up. "You win." I hefted the little robot on my shoulder and carried him into the house.

Five minutes later the two of us were fast asleep. ©

Computers and Society

David D. Thornburg, Associate Editor

Of Babbages And Things

Computer jargon and concepts have permeated our language in strange ways. This came home to me one night when I heard a caller on a talk show say that she had trouble "interfacing" with her partner. I guess this is just a reflection of the pervasiveness of computer technology. Every new technology spawns its own vocabulary, and computers are no exception.

In fact, the computer industry has provided us with both a rich assortment of words and a rich collection of concepts that alter how we think about our world. While the words of technology wax and wane in popularity, the concepts are longer-lived. This gives us the chance to misjudge the newness of a concept we have just learned. When this happens, a brief look at history often shows that what we thought was new was known a long time ago. I got caught in one of these historical time warps last spring. I was teaching a graduate-level computer course at Stanford University and had introduced a model of program design that I called a *microworld.*

To my way of thinking, microworlds are made of two kinds of things—objects and operators. The objects have certain attributes, and the operators work on these objects to create new instances of them. These new instances may inherit some or all of the attributes of the old objects. Sound like gobbledygook? Read on.

For example, the microworld of arithmetic contains objects we call numbers. These numbers have attributes (they may be integers, decimals, imaginary, etc.). The operators for arithmetic include addition, subtraction, multiplication, and so on. These operators combine the number objects to produce new numbers. Notice that this way of thinking about arithmetic has nothing to do with computers.

Computer Microworlds

Because we have devised ways to represent both numbers and their operations inside computers, the microworld of arithmetic is a suitable domain for implementation in a computer. Of course, the arithmetic microworld is not the only one we have. For example, word processing is a microworld which contains letters as objects and insert and delete as operators.

What I like about this concept is that it provides a framework for creating flexible computer programs in nearly any domain. To build a microworld, one has to identify the objects and operators, and then build representations of these in the computer using a suitable programming language.

I thought this way of looking at programming was fairly new, but I soon received the shock of my life while reading a collection of papers about Charles Babbage and the Analytical Engine—a nineteenth-century predecessor to the digital computer. At the end of one article translated into English by Ada Augusta, Countess of Lovelace, were some notes added by the Countess:

> In studying the action of the Analytical Engine, we find that the peculiar and independent nature of the considerations which in all mathematical analysis belong to *operations*, as distinguished from *the objects operated upon* and from the results of the operations performed upon those objects, is very strikingly defined and separated. It is well to draw attention to this point, not only because its full appreciation is essential to the attainment of any very just and adequate general comprehension of the powers and mode of action of the Analytical Engine, but also because it is one which is perhaps too little kept in view in the study of mathematical science in general.

Here was my microworld model, described by Ada Augusta in 1842!

So Much For Arithmetic

Lest you think she had only mathematics on her mind, she went on to say:

> By the word *operation*, we mean *any process which alters the mutual relation of two or more things*, be this relation of what kind it may. This is the most general definition, and would include all subjects in the universe.

In fact, she went on to point out that the Analytical Engine was capable of symbolic computation and was not restricted to numerical analysis. This capability came from the fact that the programs in the Analytical Engine (coded on punch cards) not only contained the values of variables, but also the sequence of commands and operations to be performed. The Analytical Engine had what we call today an instruction set. These primitive instructions allowed values to be read and saved to memory (which Babbage called the *store*), and a series of basic operations, such as addition, which were carried out in the central processing unit (which Babbage called the *mill*). The punch cards contained what we would call machine language programs.

The Analytical Engine embodied the basic concepts of today's computers, but nineteenth-century craftsmen lacked the technology to build it. Though it was not constructed in Babbage's lifetime, his dreams and Ada's ideas finally came to light a century later.

So the next time you toss computer jargon into your conversation to be trendy, remember that you might be reflecting on the trends of some British inventors in the 1800s!

Telecomputing Today

Arlan R. Levitan

The Latest Developments

AT&T Technologies and Bell Atlantic have been testing a new modem that works at 2400 bits per second (bps) since July of this year. The CTS-1620 will debut some time in 1986 and be pegged between $1,600 and $2,600. Why the relatively steep price tag? The CTS-1620 will be the communications giant's first *cellular* modem.

The testing is being conducted in the Baltimore-Washington, D.C. area and includes users in several government agencies, banks, insurance companies, and real estate agencies. The cellular modem requires a cellular telephone and transmitter, as well as an input/-display device. While the majority of initial buyers are expected to be lap computer owners, reliable sources within Ford Motor Company report that prototypes of a built-in dash terminal are being readied for trials late next year.

Although the CTS-1620 will be AT&T's first cellular modem, two lower-speed cellular units are already available from other companies. Motorola offers a 300 bps modem for $195, and Spectrum Cellular has a 1200 bps modem that goes for $695. Few details are available on the free-wheeling AT&T modem, but you can bet your seatbelt that by definition it will have "auto-answer" and "auto-dial."

Better Than Gorillas

The Source information service added 2400 bps access in August, with surcharges far lower than had been anticipated by industry watchers. Subscribers with 2400 bps modems pay $1.80 and $1.20 premiums for prime and nonprime time, respectively. With 1200 bps service priced at $25.80 and $10.80 for the same time periods, users are said to be moving to the higher-speed modems in droves.

Prices for 1200 bps modems continue to plummet. Cermetek of Sunnyvale, California has announced the Infomate 1200-TPC, an internal "bare minimum" Hayes-compatible modem for the IBM PC priced at $198. Cermetek isn't alone in the under-$200 market. A recent issue of a popular electronic hobbyist publication contained several advertisements for stand-alone Hayes compatibles, with prices as low as a $129 kit version for those bold enough to wield a soldering iron.

And 300 bps modems for under $50—including software—are springing up like mushrooms after three days of rain. I fully expect them to be given out as party favors at upscale kids' birthday parties. Tacky? It's a definite improvement over singing gorillas with balloons.

The 2400 bps market is heating up as well. With industry leader Hayes at $895 and the bulk of its competitors at $795, U.S. Robotics (the manufacturer of Apple's 300 and 1200 bps modems) raised more than a few eyebrows when it dropped the list price of its Courier 2400 to $695. Hats off to U.S. Robotics not only for lowering prices, but also for a number of "now why hasn't somebody else done that before" features of the Courier.

The Speed Of Choice

Here are some examples. Ever lose the "handy" reference card of commands that comes with most modems? The bottom of the Courier is imprinted with a complete command and register summary as well as an RS-232 pin assignment cheat sheet. If you're too lazy to turn the modem over, there are three separate full-screen help displays that can be called up while online. Also directly accessible on the bottom of the unit are DIP switches for changing the default settings, and a sliding volume control that (unlike those on some modems) can actually be manipulated by human beings to control the internal speaker.

U.S. Robotics is working closely with system operators of computer-based bulletin boards to encourage 2400 bps. A special acquisition deal available to operators of heavily trafficked systems is rapidly making 2400 bps the speed of choice for serious telecomputerists. (If you're a system operator who'd like more information on the U.S. Robotics program, contact the company at 8100 North McCormick Boulevard, Skokie, IL 60076.)

The rapid move to 2400 bps seems to have caught some people unawares, however. During a recent visit to Atari Corp. in Sunnyvale, I was pleasantly surprised to find that the new ST series of computers includes a terminal emulator as a standard desktop accessory. But I was even more surprised when I opened its configuration menu and was presented with choices of 300, 1200, 4800, or 9600 bps. Something was missing—apparently an oversight.

"What happened to 2400?" I asked. The person showing me the ST managed to minimize his look of distress to a few nanoseconds. "Hmmmm...I'll have to write that one down," he said. "Hey, look at this graphics demo...."

Atari's 4800 and 9600 bps options indicate that some companies are looking far beyond 2400 bps, though. If 2400 bps isn't fast enough for you, how about 10,000 bps—over *regular phone lines?* Digital Communications Associates of Alpharetta, Georgia has unleashed both internal ($1,995) and external ($2,395) modems, dubbed DCA Fastlinks. Even more of a mouthful than the Fastlink's speed is the proprietary DCA protocol it uses, called *Dynamically Adaptive Multicarrier Quadrature Amplitude Modulation,* or DAMQAM for short. And I thought that was an engine problem. ©

Donald B. Trivette

Games People Play

In February I wrote about a new adventure game called *King's Quest*—and about a million of you wrote back asking me for the dwarf's name. Now the sequel is out. Sierra On-Line has just published *King's Quest II: Romancing the Throne*, and it is every bit (sorry) as challenging as the original game.

Playing the role of Sir Graham—now King Graham in the sequel—you can move through 93 three-dimensional animated screens looking for your true love, the fair maiden Valanice. But before you can find and rescue her, you must swim with a mermaid, bargain with an antique dealer, pray with a monk, and defy the curse of Dracula. Yes, there's even a mushy kissing scene at the end. To accumulate points, you have to solve such problems as crossing the poison lake surrounding Dracula's castle—although the points are secondary to rescuing Valanice. Like the original *King's Quest*, the game is full of hidden goodies: If you visit the entrance to the Hag's cave often enough, occasionally a Batmobile comes roaring out. (If you keep falling through the bridge, write and I'll tell you why.)

Ken and Roberta Williams, the husband-and-wife founders of Sierra On-Line, live in the foothills of the Sierra mountains in a real stone castle—complete with spiral stairs, three hot tubs, and a racquetball court. (Incidentally, the most technically difficult part of *Kings Quest II* was to program King Graham realistically winding his way up the castle's spiral stairs.) Roberta writes and draws the storyline on a giant sheet of paper, and Ken works with a group of programmers to turn her ideas into computer language and a finished game. Then Ken's brother John helps promote the product—he's the director of public relations (and he lives in a conventional house).

If you've never played an adventure game, and are reluctant to part with $49.95 to try *King's Quest II*, check around for a free demonstration disk. Instead of spending a lot of money running advertisements, Sierra On-Line has produced 15,000 incomplete versions of *KQII* and shipped them to dealers and computer clubs across the country. If you like the demo, you'll love the game.

King's Quest II runs on all IBM PCs, PCjrs, and most compatibles with 128K RAM, one disk drive, and a color monitor. (An Apple II version is under construction.) This is one game that no PCjr owner will want to be without; the color and sound are excellent.

Climbing The Money Tree

If galloping around 93 screens in search of a maiden isn't your idea of fun, then how about slogging through 77 weeks' worth of financial data in an attempt to make a million dollars?

Blue Chip Software creates games for the Walter Mitty in us. *Millionaire* is for wheelers and dealers on the New York Stock Exchange; *Tycoon*, for the commodity speculators; and *Baron*, for those who believe that the only sure way to millions is real estate. These games are available for the IBM PC family of computers, most compatibles, the Apple II series, Macintosh, and Commodore 64/128. The IBM version costs $49.95; the others a little less.

Which of these games you'll want to play depends on your perspective and experience. I bought my first stock when I was 12 years old. The company promptly went bankrupt and my three-share certificate now graces my wall. How to invest in real estate has become the biggest TV-ad fad since how to grow hair on a bald head—and about as successful, I imagine. The only thing I know about commodity speculation is that I shouldn't. Therefore, *Tycoon* was the game I chose to test my financial acumen.

Before you can begin *Tycoon*, the computer takes about four minutes to generate a unique trading environment from 300,000 possibilities. Once the environment is set, you are given $10,000 and a list of 15 commodities to buy and sell.

Although I've never seen a soybean, and can't stand soy sauce, I selected them as a likely vehicle for my fortune. Somewhere I read that the way to play commodities is to pick one and stick with it—not to jump from wheat to pork bellies (yuck!) to heating oil. Apparently that is sound advice. By ignoring all other commodities and concentrating on soybeans, I parlayed my $10,000 into $1,082,598 in just 60 weeks. (If only I were so lucky in real life!)

But *Tycoon* is more than a game for those of us too chicken to buy real soybeans. Like *Millionaire* and *Baron*, it is an educational game which closely simulates actual economic situations and the workings of real markets. Blue Chip Software says these programs are used at all levels of instruction—from fifth-grade economics classes in the Chicago Public Schools to college courses at Penn State and Southern Illinois University.

It's true, you will learn about interest, commissions, taxes, margins, short-selling, and options, but these games may not make you a more successful investor. They may have just the opposite effect. Once you see how easy it is to make money, once you think you've mastered the technique, you may be tempted to mortgage the house and play in the real world. But before you do, give me a call. I've got a tonic guaranteed to grow hair.... ©

INSIGHT: Atari

Bill Wilkinson

Atari Disk Drive Compatibility

Way back in 1978, when Atari announced the double-density 815 disk drive, Percom Data Corporation saw the prototypes displayed at several shows and decided it could easily build a better drive which would sell for less.

Because Percom produced both single- and double-sided disk drives using both single and double density, and because it wanted to maintain compatibility with both the single-density 810 and double-density 815 drives, Percom invented the *configuration block* (more on this below). With some cooperation from a small, brand-new software company (wonder who that could be) which had inherited the source code rights to Atari's File Management System (FMS), Percom succeeded in establishing standards which have been adhered to by all other Atari-compatible drive manufacturers. All Atari-compatible drive manufacturers except one, that is: Atari. Before the 815 even hit the market, Atari dropped it from the product line. Years later, in 1984, Atari introduced the "enhanced density" 1050, which is actually somewhere between single- and double-density. Sigh.

As of this writing, the following drives and/or modification kits are known to be capable of understanding the Percom-standard double-density mode and configuration table: Percom, Indus, Amdek, Astra, Trak, Rana, SWP (ATR-8000), Happy Doubler, and ICD's US Doubler.

The Percom Config Block

As defined by the Percom standard, a config block is a set of 12 bytes within the memory of the disk control microprocessor—which is inside your disk drive(s). You read a drive's config block by passing "N" to it as an SIO command. You can write a new config block to a drive via an "O" command. The "N" and "O" commands closely parallel the "R" and "W" sector input/output commands, except the data length is always 12 bytes and no sector number is needed. The 12 bytes in the block are shown in the table.

Byte #	# of Bytes	Description
0	1	Number of Tracks
1	1	Step Rate
2-3	2	Sectors per Track
4	1	Number of Sides or Heads
5	1	Density (0=Single, 4=Double)
6-7	2	Bytes per Sector
8	1	Drive Selected?
9	1	Serial Rate Control
10-11	2	Miscellaneous (reserved)

This table requires some explanation. First, all the double-byte values are in high-byte/low-byte order, the opposite of normal 6502 practice (because that's how the microprocessor Percom used in their drives worked). Also, not all these values have meaning to all manufacturers. In fact, some don't allow you to change more than two or three of the values listed here.

The Step Rate controls the speed of a drive's head stepping motor, and the values used here have no universal meaning. A step rate of 2 may mean 6 milliseconds per track to one drive, 20 milliseconds per track to another, or be illegal to yet another.

Number of Sides is actually one less than the actual number. So most drives use a zero here, meaning one head.

Changing the value of Drive Selected may turn the drive off as far as the computer is concerned. Percom must have had its reasons for this, but I don't know what they were.

Changing The Config Block

For the Density byte of the config block, I don't know of any drives which use values other than 0 (FM mode, single density) or 4 (MFM mode, double density). If you find a drive that actually *uses* some other value (not just ignores it), let me know.

The Serial Rate Control value and Miscellaneous bytes have no universal meanings. Some drives will remember these values if you change them; other drives ignore your values.

So that leaves Number of Tracks, Sectors per Track, and Bytes per Sector, all of which should be self-explanatory. Again, though, many drives ignore values outside certain legal ranges. Indus drives, for example, reject any changes to the number of tracks or sectors. In fact, Indus pays attention only to the Bytes per Sector and the Density bytes. Experiment with your own drive(s). See what they will and will not allow. And even if they seem to allow a change, do they execute it or ignore it? (Fun, if you're a masochist, right?)

And just how do you read and/or change the config block? Have a look at the BASIC program following this column. It should be pretty much self-explanatory. You can use the subroutines at 8010, 8210, and 9010 in your own programs. Remember what we said at the beginning, however: Atari drives do not follow the Percom config block standard. As a result, *this program works only on Atari-compatible disk drives, not on the Atari 810 or 1050.*

Configuration Block Modifier

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

```
KG 1010 REM
NP 1020 REM CONFIGURE FROM B
        ASIC
KI 1030 REM
DJ 1050 DIM TEMP$(20),TBL$(1
        2),CMD$(1)
GK 1060 GRAPHICS 0:PRINT "
        *** DISK CONFIGURATI
        ON PROGRAM ***"
MO 1070 PRINT :PRINT :PRINT
```

```
        "What disk drive wil
        l we work with";
ND 1080 INPUT DRIVE
EA 1090 IF DRIVE<1 OR DRIVE>
        8 OR DRIVE<>INT(DRIV
        E) THEN RUN
NL 1100 GRAPHICS 0:PRINT "DR
        IVE #";DRIVE;
AL 1110 GOSUB 8000
PB 1120 IF SIOSTATUS<128 THE
        N 1170
DI 1130 PRINT " won't let me
         read"
IJ 1140 PRINT "{3 SPACES}the
         configuration block
        ."
OI 1150 PRINT :PRINT "It gav
        e me error #";SIOSTA
        TUS
AO 1160 STOP
CA 1170 PRINT " looks like t
        his:":PRINT
CI 1180 PRINT TRACKS;" TRACK
        S of ";SECTORSPERTRA
        CK;" SECTORS each"
JB 1190 PRINT :PRINT "each s
        ector has ";BYTESPER
        SECTOR;" BYTES, & de
        nsity"
NB 1200 PRINT "  is ";DENSIT
        Y;", considered ";
MO 1210 IF DENSITY=0 THEN PR
        INT "SINGLE density,
        "
MM 1220 IF DENSITY=4 THEN PR
        INT "DOUBLE density,
        "
DM 1230 IF DENSITY<>0 AND DE
        NSITY<>4 THEN PRINT
        "UNKNOWN DENSITY,"
JN 1240 PRINT "  with ";SIDE
        S;" SIDE(s)."
IG 1250 PRINT :PRINT "the ST
        EP RATE setting is "
        ;STEPRATE
AI 1260 PRINT "other setting
        s are SELECT=";SELEC
        T;","
MN 1270 PRINT "  ACIA=";ACIA
        ;", and MISC=";MISC
EJ 1280 PRINT :PRINT "SELECT
         A CHOICE:"
BH 1290 PRINT "{3 SPACES}0 -
         quit and save confi
        guration"
DF 1300 PRINT "{3 SPACES}1 -
         change drive settin
        g(s)"
HP 1310 PRINT "{3 SPACES}2 -
         work with another d
        rive"
EI 1320 PRINT :PRINT "your c
        hoice ";:INPUT CHOIC
        E
GK 1330 IF CHOICE=0 THEN JUN
        K=USR(58484)
JF 1340 IF CHOICE=2 THEN RUN

ED 1350 GRAPHICS 0:PRINT "En
        ter new values.  Hit
         RETURN to"
AB 1360 PRINT "  leave a val
        ue unchanged."
FI 1370 PRINT
BF 1380 PRINT "TRACKS";:TEMP
        =TRACKS
IJ 1390 GOSUB 7000:TRACKS=TE
        MP
HM 1400 PRINT "SECTORS PER T
        RACK";:TEMP=SECTORSP
        ERTRACK
DJ 1410 GOSUB 7000:SECTORSPE
        RTRACK=TEMP
PM 1420 PRINT "BYTES PER SEC
        TOR";:TEMP=BYTESPERS
        ECTOR
PK 1430 GOSUB 7000:BYTESPERS
        ECTOR=TEMP
NA 1440 PRINT "NUMBER OF SID
        ES";:TEMP=SIDES
DG 1450 GOSUB 7000:SIDES=TEM
        P
ME 1460 PRINT "DENSITY";:TEM
        P=DENSITY
OA 1470 GOSUB 7000:DENSITY=T
        EMP
FK 1480 PRINT
FH 1490 PRINT "STEP RATE";:T
        EMP=STEPRATE
CC 1500 GOSUB 7000:STEPRATE=
        TEMP
AA 1510 PRINT "SELECT";:TEMP
        =SELECT
HM 1520 GOSUB 7000:SELECT=TE
        MP
JO 1530 PRINT "ACIA";:TEMP=A
        CIA
MM 1540 GOSUB 7000:ACIA=TEMP
MA 1550 PRINT "MISCELLANEOUS
         WORD";:TEMP=MISC
OM 1560 GOSUB 7000:MISC=TEMP
BH 1570 GOSUB 8200
PE 1580 IF SIOSTATUS<128 THE
        N 1100
CD 1590 PRINT :PRINT
GI 1600 PRINT "Unable to set
         that configuration!
        "
JH 1610 PRINT "  drive issue
        d error #";SIOSTATUS
BP 1620 PRINT :PRINT "(hit R
        ETURN to continue)"
MF 1630 GOTO 1100
CH 7000 REM ENTER DATA OR NO
         CHANGE
LN 7030 PRINT " [";TEMP;"] ?
        ";
LF 7040 INPUT TEMP$
BF 7050 IF LEN(TEMP$) THEN T
        EMP=VAL(TEMP$)
KN 7060 RETURN
IP 8000 REM EXTRACT INFO FRO
        M TABLE
IM 8030 TBL=ADR(TBL$):ADDR=T
        BL
MJ 8040 CMD$="N":GOSUB 9000:
        REM ---READ BLOCK---
IF 8050 TRACKS=PEEK(TBL+0)
CH 8060 STEPRATE=PEEK(TBL+1)
OI 8070 SECTORSPERTRACK=PEEK
        (TBL+2)*256+PEEK(TBL
        +3)
JI 8080 SIDES=PEEK(TBL+4)+1
OG 8090 DENSITY=PEEK(TBL+5)
KJ 8100 BYTESPERSECTOR=PEEK(
        TBL+6)*256+PEEK(TBL+
        7)
IC 8110 SELECT=PEEK(TBL+8)
NC 8120 ACIA=PEEK(TBL+9)
PA 8130 MISC=PEEK(TBL+10)*25
        6+PEEK(TBL+11)
KN 8140 RETURN
FP 8200 REM PUT NEW INFO INT
        O TABLE
IO 8230 TBL=ADR(TBL$):ADDR=T
        BL
CO 8240 POKE TBL+0,TRACKS
NA 8250 POKE TBL+1,STEPRATE
PB 8260 POKE TBL+2,INT(SECTO
        RSPERTRACK/256)
JE 8270 POKE TBL+3,SECTORSPE
        RTRACK-PEEK(TBL+2)*2
        56
EE 8280 POKE TBL+4,SIDES-1
JA 8290 POKE TBL+5,DENSITY
KP 8300 POKE TBL+6,INT(BYTES
        PERSECTOR/256)
FG 8310 POKE TBL+7,BYTESPERS
        ECTOR-PEEK(TBL+6)*25
        6
CN 8320 POKE TBL+8,SELECT
HN 8330 POKE TBL+9,ACIA
MM 8340 POKE TBL+10,INT(MISC
        /256)
JO 8350 POKE TBL+11,MISC-PEE
        K(TBL+10)*256
DO 8360 CMD$="O":GOSUB 9000:
        REM ---WRITE BLOCK--
        -
LC 8370 RETURN
ME 9000 REM DISK DENSITY CHA
        NGE ROUTINE
LA 9030 REM
LN 9040 REM ENTER:  DRIVE NU
        MBER IN DRIVE
DC 9050 REM .{5 SPACES}buffe
        r address in ADDR
IP 9060 REM .{12 SPACES}comma
        nd in CMD$
LE 9070 REM
GH 9080 REM (ONLY "N" AND "O
        " ARE VALID FOR CMD$
        )
LG 9090 REM
GM 9100 REM EXIT: status in
        SIOSTATUS
KP 9110 REM
OL 9130 TRAP 9190:REM activa
        ted if SIOCALL$ alre
        ady DIM'd
IL 9140 DIM SIOCALL$(16)
MF 9150 RESTORE 9180
JM 9160 FOR CNT=1 TO 14:READ
         BYTE
FD 9170 SIOCALL$(CNT)=CHR$(B
        YTE):NEXT CNT
MI 9180 DATA 104,32,89,228,1
        73,3,3,133,212,169,0
        ,133,213,96
FH 9190 TRAP 40000:REM turn
        off TRAP
ML 9200 POKE 768,ASC("1"):RE
        M don't ask me why
FP 9210 POKE 769,DRIVE:REM m
        ust be 1 through 8
OG 9220 POKE 770,ASC(CMD$)
MA 9230 POKE 771,128:REM ass
        ume output
LI 9240 IF CMD$="N" THEN POK
        E 771,64
GN 9250 POKE 773,INT(ADDR/25
        6):REM buffer addres
        s
PC 9260 POKE 772,ADDR-256*PE
        EK(773)
FH 9270 POKE 774,3:REM short
         timeout
KA 9280 POKE 775,0:REM (high
         byte of timeout)
BI 9290 POKE 776,12:POKE 777
        ,0:REM assume std co
        nfig block
HG 9300 SIOSTATUS=USR(ADR(SI
        OCALL$))
KN 9310 RETURN
```

The Beginners Page

Tom R. Halfhill, Editor

Clearing Up Variable Cloudiness

If you're just learning to program, variables can be confusing at first—especially because there are so many varieties of variables. Last month's column introduced the concept of numeric variables. But, depending on your computer's BASIC, there are also integer variables, double-precision variables, string variables, numeric array variables, and string array variables. This month we'll cover integer variables and tackle the rest later.

Numeric variables, you'll recall, represent ordinary numbers. For instance, you can store the number 10 in the variable X with the BASIC statement X = 10. Numeric variables can represent fractions just as easily, as in X = 98.6. An *integer variable* is similar, but with one important difference. As the term implies, integer variables can only represent *integers*—whole numbers. Fractions like 98.6 aren't allowed. There's one other limitation, too. In most BASICs which allow integer variables, the value cannot range beyond a maximum of 32,767 or a minimum of −32,768.

At first, these restrictions may seem odd. What's the advantage of limiting a variable to a whole number, and especially a whole number within a relatively narrow range?

The answer has to do with the way computers manipulate numbers. Internally, they use the binary numbering system instead of our everyday decimal system. Translating decimal numbers into binary gets tricky when the decimal number is a fraction, or *floating point* number (so-called because the decimal point can "float" to the left or right, as in 98.6 or 9.86). The conversion process requires a few valuable microseconds, and it takes several bytes of memory just to store a single floating point number.

Are Integers Faster?

Integer variables can greatly simplify matters for a computer. Because fractions aren't allowed, the operating system doesn't have to spin its wheels performing lengthy floating point conversions. And when the integers are limited to a range of −32,768 to 32,767, each number can be stored in only two bytes of memory.

Saving a few bytes of memory isn't a terribly important consideration anymore, now that nearly all personal computers come with at least 64K of RAM. But on certain computers, integer variables *can* help your programs run faster—often significantly faster.

In Commodore BASIC, Applesoft, and IBM BASIC, you declare an integer variable by appending a percent symbol (%) to the variable name, as in X% = 10. (Integer variables are not available in TI BASIC or Atari BASIC, but are supported in Atari Microsoft BASIC.) A common mistake is to accidentally omit the % symbol in a statement somewhere, often leading to a mysterious error or unexpected result. Keep in mind that two variable names such as X and X% are treated by the computer as completely separate variables—they can store independent values and are as different as A and Z.

To test the performance of integer variables versus regular variables on your computer, enter this simple program:

```
10 FOR X=1 TO 32000
20 Y=Y+1
30 NEXT X
40 PRINT Y
```

Use a watch to measure how long this program takes to execute. Jot down the result, then change all three occurrences of Y to integer variables by adding the % symbol. Now run the program and time it again.

Surprising Results

What happened? If you have an IBM PC or PCjr, the program should run measurably faster. But if you have a Commodore or Apple, the program actually runs *slower*. What's going on?

Integer variables are indeed faster and more memory-efficient on IBM computers. But on Commodore and Apple computers, integer variables actually execute slower and consume just as much memory as regular variables. This is true even though all three computers have versions of Microsoft BASIC. The reason is that the math routines in the Commodore and Apple are designed to handle floating-point numbers only. Therefore, the computer must convert integer variables into floating-point values, perform the math requested by the program, and then convert the results back into integers. All this conversion takes so long (in computer terms) that integer variables really aren't any faster than regular variables on Commodore or Apple computers.

It would seem, then, that integer variables are useless if you have a Commodore or Apple. But in fact, they can speed up your programs and save memory when used to construct *arrays*—a future column topic.

In the meantime, let's clear up another mystery raised by the above program. If you examine it closely, you might wonder why converting Y to Y% makes it run faster even on the IBM. Since the FOR-NEXT loop is incrementing Y by steps of one, Y is never a fraction, anyway—it's always a whole number. But computers handle all numeric variables as floating point numbers, *even when the value is a whole number and not a fraction.* Defining a variable as an integer variable forces the IBM to treat it as an integer. ©

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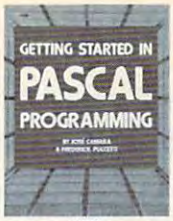

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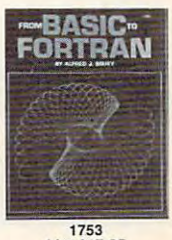

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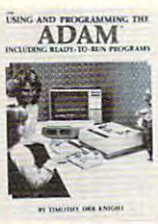

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HOTWARE: Software Best Sellers

This Month	Last Month	Title	Publisher	Remarks	Systems: Apple	Atari	Commodore	IBM	Macintosh
Entertainment									
1.	4.	*The Hitchhiker's Guide To The Galaxy*	Infocom	Comic adventure strategy game	•	•	•	•	•
2.	3.	*F-15 Strike Eagle*	MicroProse	Air combat simulation	•	•	•	•	
3.	1.	*Flight Simulator II*	SubLogic	Aircraft simulation	•	•	•		
4.	5.	*Flight Simulator*	Microsoft	Aircraft simulation				•	
5.	2.	*Karateka*	Brøderbund	Action karate game	•		•		
Education									
1.	3.	*New Improved MasterType*	Scarborough	Typing instruction program	•	•	•	•	•
2.	2.	*Typing Tutor III*	Simon & Schuster	Typing instruction program	•		•	•	•
3.	1.	*Math Blaster!*	Davidson	Introductory math program, ages 6-12	•	•	•	•	
4.	4.	*Early Games*	Springboard	Educational games, ages 2-6	•	•	•	•	
5.		*Music Construction Set*	Electronic Arts	Music composition program	•	•	•		
Home Management									
1.	1.	*Print Shop*	Brøderbund	Do-it-yourself print shop	•	•	•		
2.	2.	*Print Shop Graphics Library*	Brøderbund	100 additional graphics	•	•	•		
3.		*Print Shop Graphics Library II*	Brøderbund	More graphics	•	•	•		
4.	5.	*The Newsroom*	Springboard	Do-it-yourself newspaper	•		•	•	
5.	3.	*HomePak*	Batteries Included	Word processing, telecommunications, & data management	•	•	•	•	

CAPUTE!

Modifications or Corrections To Previous Articles

Commodore Disk 64 Commander

A character was smudged in the listing for this disk utility program from the September issue. Line 3315 (p. 82) should read as follows:

```
3315 :168,160,000,177,098,153,231
```

Also, the DOPEN command example for relative files (p. 81) is incorrect. The record length must be specified *outside* the quotes surrounding the filename, not within the quotes as shown. Thus, the example for opening a relative file named TEST with a record length of 20 characters should read:

```
DOPEN#1,"TEST",L20
```

Commodore 64 Headliner

The large characters displayed by this program from the August issue (p. 72) do not have the desired color on newer 64s, and are invisible on older 64s which do not fill color memory. This is because the variable G, which is defined in line 100 as the address of the start of color memory and intended for use in line 530 to color the large characters, is redefined when it is used for another purpose in lines 200 and 220. There are several possible solutions to this problem, the simplest of which is to change the G in lines 200 and 220 to some other variable:

```
200 PRINTCHR$(147)TAB(125)"DOW
    NLOADING THE CHARACTER SET
    ":C=53248:GN=12288:rem 114
220 POKE 56333,127:POKE1,51:FO
    R Q=0TO1023:POKEGN+Q,PEEK(
    C+Q):NEXT          :rem 85
```

When adding the "Headliner" routine to your own programs, you should make sure that your program does not use any of the variables in the main subroutine (lines 500–550) for any other purpose. The variables are P, L, X$, G, CC, and SL.

©

MLX Machine Language Entry Program For Commodore 64

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. At least 8K expansion memory is required.

MLX is a new way to enter long machine language (ML) programs with a minimum of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter illegal characters when you should be typing numbers. It won't let you enter numbers greater than 255 (forbidden in ML). It won't let you enter the wrong numbers on the wrong line. In addition, MLX creates a ready-to-use tape or disk file.

Using MLX

Type in and save the appropriate version of MLX (you'll want to use it in the future). When you're ready to type in an ML program, run MLX. MLX for the 64 asks you for two numbers: the starting address and the ending address. These numbers are given in the article accompanying the ML program.

When you run MLX, you'll see a prompt corresponding to the starting address. The prompt is the current line you are entering from the listing. It increases by six each time you enter a line. That's because each line has seven numbers—six actual data numbers plus a *checksum number*. The checksum verifies that you typed the previous six numbers correctly. If you enter any of the six numbers wrong, or enter the checksum wrong, the computer rings a buzzer and prompts you to reenter the line. If you enter it correctly, a bell tone sounds and you continue to the next line.

MLX accepts only numbers as input. If you make a typing error, press the INST/DEL 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 redefines part of the keyboard as a numeric keypad (lines 581–584):

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

64 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.

64 MLX: Machine Language Entry

```
10 REM LINES CHANGED FROM MLX
   {SPACE}VERSION 2.00 ARE 750
   ,765,770 AND 860      :rem 50
20 REM LINE CHANGED FROM MLX V
   ERSION 2.01 IS 300 :rem 147
100 PRINT"{CLR}{63}";CHR$(142);
    CHR$(8);:POKE53281,1:POKE5
    3280,1                :rem 67
101 POKE 788,52:REM DISABLE RU
    N/STOP                :rem 119
110 PRINT"{RVS}{39 SPACES}";
                          :rem 176
120 PRINT"{RVS}{14 SPACES}
    {RIGHT}{OFF}{*}£{RVS}
    {RIGHT} {RIGHT}{2 SPACES}
    {*}{OFF}{*}£{RVS}£{RVS}
    {14 SPACES}";         :rem 250
130 PRINT"{RVS}{14 SPACES}
    {RIGHT} {G}{RIGHT}
    {2 RIGHT} {OFF}£{RVS}£
    {*}{OFF}{*}{RVS}
    {14 SPACES}";         :rem 35
140 PRINT"{RVS}{41 SPACES}"
                          :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK} M
    ACHINE LANGUAGE EDITOR VER
    SION 2.02{5 DOWN}":rem 238
210 PRINT"{5}{2 UP}STARTING AD
    DRESS?{8 SPACES}{9 LEFT}";
                          :rem 143
215 INPUTS:F=1-F:C$=CHR$(31+11
    9*F)                  :rem 166
220 IFS<256OR(S>40960ANDS<4915
    2)ORS>53247THENGOSUB3000:G
    OTO210                :rem 235
225 PRINT:PRINT:PRINT :rem 180
230 PRINT"{5}{2 UP}ENDING ADDR
    ESS?{8 SPACES}{9 LEFT}";:I
    NPUTE:F=1-F:C$=CHR$(31+119
    *F)                   :rem 20
240 IFE<256OR(E>40960ANDE<4915
    2)ORE>53247THENGOSUB3000:G
    OTO230                :rem 183
250 IFE<STHENPRINTC$;"{RVS}END
    ING < START{2 SPACES}":GOS
    UB1000:GOTO 230       :rem 176
260 PRINT:PRINT:PRINT :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S
                          :rem 56
310 A=1:PRINTRIGHT$("0000"+MID
    $(STR$(AD),2),5);":";
                          :rem 33
315 FORJ=ATO6             :rem 33
320 GOSUB570:IFN=-1THENJ=J+N:G
    OTO320                :rem 228
390 IFN=-211THEN 710      :rem 62
400 IFN=-204THEN 790      :rem 64
410 IFN=-206THENPRINT:INPUT"
    {DOWN}ENTER NEW ADDRESS";Z
    Z                     :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETH
    ENPRINT"{RVS}OUT OF RANGE"
    :GOSUB1000:GOTO410:rem 225
417 IFN=-206THENAD=ZZ:PRINT:GO
    TO310                 :rem 238
420 IF N<>-196 THEN 480
                          :rem 133
430 PRINT:INPUT"DISPLAY FROM";
    F:PRINT,"TO";:INPUTT
                          :rem 234
440 IFF<SORF>EORT<SORT>ETHENPR
    INT"AT LEAST";S;"{LEFT}, N
    OT MORE THAN";E:GOTO430
                          :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINT
    RIGHT$("0000"+MID$(STR$(I)
    ,2),5);":";           :rem 30
451 FORK=0TO5:N=PEEK(I+K):PRIN
    TRIGHT$("00"+MID$(STR$(N),
    2),3);",";            :rem 66
```

```
460 GETA$:IFA$>""THENPRINT:PRI
    NT:GOTO310              :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI
    :PRINT:PRINT:GOTO310
                            :rem 50
480 IFN<0 THEN PRINT:GOTO310
                            :rem 168
490 A(J)=N:NEXTJ            :rem 199
500 CKSUM=AD-INT(AD/256)*256:F
    ORI=1TO6:CKSUM=(CKSUM+A(I)
    )AND255:NEXT            :rem 200
510 PRINTCHR$(18);:GOSUB570:PR
    INTCHR$(146);           :rem 94
511 IFN=-1THENA=6:GOTO315
                            :rem 254
515 PRINTCHR$(20):IFN=CKSUMTHE
    N530                    :rem 122
520 PRINT:PRINT"LINE ENTERED W
    RONG : RE-ENTER":PRINT:GOS
    UB1000:GOTO310          :rem 176
530 GOSUB2000               :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):
    NEXT:POKE54272,0:POKE54273
    ,0                      :rem 227
550 AD=AD+6:IF AD<E THEN 310
                            :rem 212
560 GOTO 710                :rem 108
570 N=0:Z=0                 :rem 88
580 PRINT"££3";             :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
    $="0"                   :rem 134
584 IFAV>0THENA$=CHR$(48+AV)
                            :rem 134
585 PRINTCHR$(20);:A=ASC(A$):I
    FA=13ORA=44ORA=32THEN670
                            :rem 229
590 IFA>128THENN=-A:RETURN
                            :rem 137
600 IFA<>20 THEN 630        :rem 10
610 GOSUB690:IFI=1ANDT=44THENN
    =-1:PRINT"{OFF}{LEFT}
    {LEFT}";:GOTO690        :rem 62
620 GOTO570                 :rem 109
630 IFA<48ORA>57THEN580
                            :rem 105
640 PRINTA$;:N=N*10+A-48
                            :rem 106
650 IFN>255 THEN A=20:GOSUB100
    0:GOTO600               :rem 229
660 Z=Z+1:IFZ<3THEN580      :rem 71
670 IFZ=0THENGOSUB1000:GOTO570
                            :rem 114
680 PRINT",";:RETURN        :rem 240
690 S%=PEEK(209)+256*PEEK(210)
    +PEEK(211)              :rem 149
691 FORI=1TO3:T=PEEK(S%-I)
                            :rem 67
695 IFT<>44ANDT<>58THENPOKES%-
    I,32:NEXT               :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1)
    ;:RETURN                :rem 7
710 PRINT"{CLR}{RVS}*** SAVE *
    **{3 DOWN}"             :rem 236
715 PRINT"{2 DOWN}(PRESS {RVS}
    RETURN{OFF} ALONE TO CANCE
    L SAVE){DOWN}"          :rem 106
720 F$="":INPUT"{DOWN} FILENAM
    E";F$:IFF$=""THENPRINT:PRI
    NT:GOTO310              :rem 71
730 PRINT:PRINT"{2 DOWN}{RVS}T
    {OFF}APE OR {RVS}D{OFF}ISK
    : (T/D)"                :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"T
    HEN740                  :rem 36
750 DV=1-7*(A$="D"):IFDV=8THEN
    F$="0:"+F$:OPEN15,8,15,"S"
    +F$:CLOSE15             :rem 212
760 T$=F$:ZK=PEEK(53)+256*PEEK
    (54)-LEN(T$):POKE782,ZK/25
    6                       :rem 3
762 POKE781,ZK-PEEK(782)*256:P
    OKE780,LEN(T$):SYS65469
                            :rem 109
763 POKE780,1:POKE781,DV:POKE7
    82,1:SYS65466           :rem 69
765 K=S:POKE254,K/256:POKE253,
    K-PEEK(254)*256:POKE780,25
    3                       :rem 17
766 K=E+1:POKE782,K/256:POKE78
    1,K-PEEK(782)*256:SYS65496
                            :rem 235
770 IF(PEEK(783)AND1)OR(191AND
    ST)THEN780              :rem 111
775 PRINT"{DOWN}DONE.{DOWN}":G
    OTO310                  :rem 113
780 PRINT"{DOWN}ERROR ON SAVE.
    {2 SPACES}TRY AGAIN.":IFDV
    =1THEN720               :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E
    2$:PRINTE1$;E2$:CLOSE15:GO
    TO720                   :rem 103
790 PRINT"{CLR}{RVS}*** LOAD *
    **{2 DOWN}"             :rem 212
795 PRINT"{2 DOWN}(PRESS {RVS}
    RETURN{OFF} ALONE TO CANCE
    L LOAD)"                :rem 82
800 F$="":INPUT"{2 DOWN} FILEN
    AME";F$:IFF$=""THENPRINT:G
    OTO310                  :rem 144
810 PRINT:PRINT"{2 DOWN}{RVS}T
    {OFF}APE OR {RVS}D{OFF}ISK
    : (T/D)"                :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"T
    HEN820                  :rem 34
830 DV=1-7*(A$="D"):IFDV=8THEN
    F$="0:"+F$              :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK
    (54)-LEN(T$):POKE782,ZK/25
    6                       :rem 2
841 POKE781,ZK-PEEK(782)*256:P
    OKE780,LEN(T$):SYS65469
                            :rem 107
845 POKE780,1:POKE781,DV:POKE7
    82,1:SYS65466           :rem 70
850 POKE780,0:SYS65493      :rem 11
860 IF(PEEK(783)AND1)OR(191AND
    ST)THEN870              :rem 111
865 PRINT"{DOWN}DONE.":GOTO310
                            :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.
    {2 SPACES}TRY AGAIN.{DOWN}
    ":IFDV=1THEN800         :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E
    2$:PRINTE1$;E2$:CLOSE15:GO
    TO800                   :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:POKE5427
    6,32:POKE54273,0:POKE5427
    2,0:RETURN              :rem 202
2000 REM BELL SOUND         :rem 78
2001 POKE54296,15:POKE54277,0:
    POKE54278,247           :rem 152
2002 POKE 54276,17:POKE54273,4
    0:POKE54272,0           :rem 86
2003 FORT=1TO100:NEXT:POKE5427
    6,16:RETURN             :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PA
    GE OR ROM":GOTO1000
                            :rem 89
```

©

Programming the TI

C. Regena

Sprites In TI Extended BASIC

Since this month's COMPUTE! is a game issue, let me remind you that *COMPUTE!'s First Book of TI Games* is still available. It offers a variety of games that do not require TI Extended BASIC.

Eventually, however, game programmers usually want the Extended BASIC command module because it adds several programming features, including up to 28 *sprites* (smoothly moving screen objects). With one statement you can define a sprite and set it in continuous motion. For example, try this short program:

```
100 REM TI EXTENDED BASIC
110 REM SPRITE DEMO
120 DEF R(X)=INT(X*RND)
130 CALL CLEAR
140 FOR S=1 TO 28 :: RAND
    OMIZE
150 CALL SPRITE(#S,64+S,R
    (15)+2,90,128,R(255)-
    127,R(255)-127)
160 NEXT S
170 GOTO 170
180 END
```

This month's main program, "Sprite Tester," offers a way to test your sprites before putting them into a program of your own. After it displays a sprite on the screen, it lets you change various characteristics of the sprite by entering different numbers. You may experiment as much as you wish. When you have the sprite moving as you want, simply jot down the CALL SPRITE statement shown at the bottom of the screen.

Designing The Sprite

To get started, type in and run Sprite Tester. Choose a magnification factor from 1 to 4. (A regular-size character is magnification 1 and a four-times size is magnification 2. Magnification 3 is made up of four regular-size characters, and magnification 4 is four large characters.)

Next choose a character number from 33 to 95—one of the characters from the regular ASCII character set. If you prefer to use your own graphic character, insert a CALL CHAR statement to redefine a character.

You may then choose a sprite color. Since 1 is transparent (the screen color), you must choose a color number from 2 to 16. If you choose color 8, the screen changes so you'll be able to see the sprite. All other colors use the cyan background screen.

Next choose a dot row and dot column position from which the sprite should start moving. Then, to move the sprite, select a row velocity and column velocity. Since these may be positive or negative numbers, first choose + or −, press ENTER, then pick the number and press ENTER again. If you want to experiment with the position of the sprite, keep the row velocity and column velocity at +0. Otherwise, the sprite will be in motion, and you may not be able to see the dot row and dot column changes.

As you enter parameters, the CALL MAGNIFY and CALL SPRITE statements at the lower part of the screen show the sprite's present conditions. The program continues until you press FCTN-CLEAR.

Extended BASIC Features

Extended BASIC contains a number of statements which make programs such as Sprite Tester easier to write. The DISPLAY AT statements, for instance, allow you to print at a specified row and column. USING helps to format output, right-justifying numbers in this case.

The ACCEPT statement is quite versatile for accepting input. BEEP sounds a tone when the computer is waiting for the input. AT() lets you receive the input starting at a certain row and column on the screen, and SIZE limits the input to a specified number of characters. VALIDATE allows you to specify what characters are acceptable as input. To erase or change before you press ENTER, you can press FCTN-ERASE. Unfortunately, if you enter something wrong, an error message appears and the printing on the screen starts to scroll. Afterward, the cursor may not be lined up with the original question.

Unlike Console BASIC, Extended BASIC lets you follow THEN and ELSE in IF statements with either a line number or a command.

The CALL SPRITE statement specifies the sprite number, the character number for the sprite, the foreground color, the beginning dot row and dot column positions, and the row velocity and column velocity.

CALL MAGNIFY sets the magnification factor. You can change characteristics of the sprite either by using another CALL SPRITE statement or CALL PATTERN for the character number, CALL COLOR for color, and CALL MOTION for the velocities.

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

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

Please be sure to specify that you want Sprite Tester.

```
100 REM TI EXTENDED BASIC
110 REM SPRITE TESTER
120 CALL CLEAR
130 CALL SCREEN(8)
140 CALL CHAR(96,"080402F
    F020408")
150 CALL COLOR(9,10,1)
160 CALL CHAR(95,"10107C1
    01000 7C")
170 CH=42
180 COLOR=2
```

```
190 DROW=96
200 DCOL=128
210 VROW=0
220 VCOL=0
230 M=1
240 CALL MAGNIFY(M)
250 DISPLAY AT(20,1):"CAL
    L MAGNIFY(1)"
260 DISPLAY AT(22,1):"CAL
    L SPRITE(#1,42, 2, 96
    ,{3 SPACES}128,
    {3 SPACES}0,
    {3 SPACES}0)"
270 CALL SPRITE(#1,CH,COL
    OR,DROW,DCOL,VROW,VCO
    L)
280 CALL HCHAR(1,3,96)
290 DISPLAY AT(1,2):"MAGN
    IFY 1-4:"
300 ACCEPT AT(1,16)VALIDA
    TE("1234")BEEP SIZE(1
    ):M
310 CALL MAGNIFY(M)
320 CALL HCHAR(20,16,M+48
    )
330 CALL HCHAR(1,3,32)
340 CALL HCHAR(3,3,96)
350 DISPLAY AT(3,2):"CHAR
    ACTER 33-95:"
360 ACCEPT AT(3,20)VALIDA
    TE(DIGIT)BEEP SIZE(2)
    :CH
370 IF (CH<33)+(CH>95)THE
    N 360
380 CALL PATTERN(#1,CH)
390 DISPLAY AT(22,16):USI
    NG "##":CH;
400 CALL HCHAR(3,3,32)
410 CALL HCHAR(5,3,96)
420 DISPLAY AT(5,2):"COLO
    R 2-16:"
430 ACCEPT AT(5,15)VALIDA
    TE(DIGIT)BEEP SIZE(2)
    :COLOR
440 IF (COLOR<2)+(COLOR>1
    6)THEN 430
450 IF COLOR<>8 THEN 480
460 CALL SCREEN(16)
470 GOTO 490
480 CALL SCREEN(8)
490 CALL COLOR(#1,COLOR)
500 DISPLAY AT(22,19):USI
    NG "##":COLOR;
510 CALL HCHAR(5,3,32)
520 CALL HCHAR(7,3,96)
530 DISPLAY AT(7,2):"DOT
    ROW 1-196:"
540 ACCEPT AT(7,18)VALIDA
    TE(DIGIT)BEEP SIZE(3)
    :DROW
550 IF (DROW<1)+(DROW>196
    )THEN 540
560 CALL SPRITE(#1,CH,COL
    OR,DROW,DCOL,VROW,VCO
    L)
570 DISPLAY AT(22,22):USI
    NG "###":DROW;
580 CALL HCHAR(7,3,32)
590 CALL HCHAR(9,3,96)
600 DISPLAY AT(9,2):"DOT
    COLUMN 1-256:"
610 ACCEPT AT(9,21)VALIDA
    TE(DIGIT)BEEP SIZE(3)
    :DCOL
620 IF (DCOL<1)+(DCOL>256
    )THEN 610
630 CALL SPRITE(#1,CH,COL
    OR,DROW,DCOL,VROW,VCO
    L)
640 DISPLAY AT(23,1):USIN
    G "###":DCOL;
650 CALL HCHAR(9,3,32)
660 CALL HCHAR(9,3,32)
670 CALL HCHAR(11,3,96)
680 DISPLAY AT(11,2):"ROW
     VELOCITY _127:  +"
690 ACCEPT AT(11,22)VALID
    ATE("+-")BEEP SIZE(1)
    :S$
700 ACCEPT AT(11,23)VALID
    ATE(DIGIT)SIZE(3):VRO
    W
710 IF VROW>127 THEN 680
720 IF S$="-" THEN VROW=-
    VROW
730 CALL MOTION(#1,VROW,V
    COL)
740 DISPLAY AT(23,5):USIN
    G "####":VROW;
750 CALL HCHAR(11,3,32)
760 CALL HCHAR(13,3,96)
770 DISPLAY AT(13,2):"COL
    UMN VELOCITY _127:  +
    "
780 ACCEPT AT(13,25)VALID
    ATE("+-")BEEP SIZE(1)
    :S$
790 ACCEPT AT(13,26)VALID
    ATE(DIGIT)SIZE(3):VCO
    L
800 IF VCOL>127 THEN 770
810 IF S$="-" THEN VCOL=-
    VCOL
820 CALL MOTION(#1,VROW,V
    COL)
830 DISPLAY AT(23,10):USI
    NG "####":VCOL;
840 CALL HCHAR(13,3,32)
850 GOTO 280
860 END                    ©
```

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Raid/Moscow-D 24.95
Mach V-Cart 21.95

BATTERIES INCLUDED

Consultant-D 52.95
Paperclip w/Spellpak-D 79.95
Super Busscard II 129.95
Home Organizer Items-D 16.95
B.I. 80 Card 109.95
Cal-Kit 34.95
Home Pak-D 34.95

COMMODORE

Easy Calc-Cart 34.95
Easy Mail-D 19.95
Easy Script-D 44.95
Easy Spell-D 19.95
Logo-D 49.95
The Manager-D 34.95
Suspended-D 29.95
Starcross-D 29.95
Deadline-D 29.95
Cutthroats-D 29.95
The Suspect-D 29.95
Zork I,II or III-D 29.95

ELECTRONIC ARTS

Sky Fox-D 24.95
Mail Order Monster-D 24.95
Adv. Construction-D 29.95
Racing Destruction-D 24.95

INSTA

Insta-Calc/Graph Combo-D 24.95
Insta-Ledger-D 39.95
Insta-Writer-D 14.95
Management Combo-D 39.95
Insta-Speed-D 39.95

SSI

Questron-D 24.95
Phantasie-D 24.95
Germany 1985-D 37.95
Wings of War-D 24.95
Fighter Command-D 37.95
Mech Brigade-D 37.95
Norway 1985-D 21.95

See Atari Section for Rest of Items and Prices

T-Cassette
D-Disk Cart-Cartridge

INFOCOM

Enchanter-D 24.95
Planetfall-D 24.95
Sorcerer-D 29.95
Hitchiker-D 24.95
Wishbringer-D 29.95

MISC. COMMODORE

Ultima III-D 37.95
Flight Simulator II-D 34.95
Castle Wolfenstein-D 20.95
Superbase 64-D 47.95
Strip Poker-D 23.95
Slap Shot Hockey-D 14.95
Mastertype-D 27.95
Star League Baseball-D 20.95
S.A.M.-D 41.95
Alien Voice Box 99.95
Sargon III-D 34.95
Ultima IV-D 41.95
Typing Tutor III-D 34.95
On Field Football-D 20.95
Ultima II-D 37.95
Blue Max-D 23.95
Blue Max 2001-D 20.95
Relax-D 79.95
Microleague Baseball-D 29.95
Stunt Flyer-D 27.95
Expedition Amazon-D 23.95
Xyphus-D 27.95
Transylvannia-D 23.95
Halley Project-D 29.95
Bounty Bob-Cart 29.95
Fleet System II-D 44.95
Space Shuttle-D 20.95
Ghostbusters-D 24.95
Batter-Up-D 29.95
Amer. Cross Country Race-D 20.95
Syncalc-D 34.95
Superbowl Sunday-D 24.95
Railroad Works-D 24.95
VIP Terminal-D 29.95
Compuserve Starter Kit 21.95
Reach for the Stars-D 29.95
Carriers at War-D 34.95
Compubridge-D 19.95
Grand Master Chess-D 19.95
Voice Messenger-D 44.95
Main Event Boxing-D 20.95
On Court Tennis-D 20.95

No surcharge for MasterCard VISA

What the world really needs is a 99 cent Double Sided, Double Density Diskette with a LIFETIME WARRANTY!

And DISK WORLD! has it.

Introducing Super Star Diskettes: the high quality diskette with the lowest price and the best LIFETIME WARRANTY!

In the course of selling more than a million diskettes every month, we've learned something: higher prices don't necessarily mean higher quality.

In fact, we've found that a good diskette manufacturer simply manufactures a good diskette...no matter what they charge for it. (By way of example, consider that none of the brands that we carry has a return rate of greater than 1/1,000th of 1 percent!)

In other words, when people buy a more expensive diskette, they aren't necessarily buying higher quality.

The extra money might be going toward flashier advertising, snazzier packaging or simply higher profits.

But the extra money in a higher price isn't buying better quality.

All of the good manufacturers put out a good diskette. Period.

How to cut diskette prices ...without cutting quality.

Now this discovery posed a dilemma: how to cut the price of diskettes without lowering the quality.

There are about 85 companies claiming to be "diskette" manufacturers.

Trouble is, most of them aren't manufacturers.

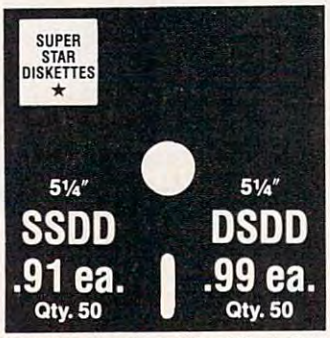
Rather they are fabricators or marketers, taking other company's components, possibly doing one or more steps of the processing themselves and pasting their labels on the finished product.

The new Eastman Kodak diskettes, for example, are one of these. So are IBM 5¼" diskettes. Same for DYSAN, Polaroid and many, many other familiar diskette brand names. Each of these diskettes is manufactured in whole or in part by another company!

So, we decided to act just like the big guys. That's how we would cut diskette prices...without lowering the quality.

We would go out and find smaller companies to manufacture a diskette to our specifications...specifications which are higher than most...and simply create our own "name brand" diskette.

Name brand diskettes that offered high quality at low prices.



Super Star diskettes are sold in multiples of 50 only. Diskettes are shipped with white Tyvec sleeves, reinforced hubs, user ID labels and write-protect tabs.

Boy, did we get lucky. Our Super Star Diskettes are the same ones you've been using for years...without knowing it.

In our search for the low priced, high quality diskette of our dreams, we found something even more interesting.

We found that there are several manufacturers who don't give a hoot about the consumer market for their diskettes. They don't spend millions of dollars in advertising trying to get you, the computer user, to use their diskettes.

Instead, they concentrate their efforts on turning out the highest quality diskettes they can...because they sell them to the software publishers, computer manufacturers and other folks who (in turn) put their name on them...and sell them for much higher prices to you!

After all, when a software publisher or computer manufacturer or diskette marketer puts their name on a diskette, they want it to work time after time, everytime. (Especially software publishers who have the nasty habit of copy-protecting their originals!)

Super Star Diskettes. You already know how good they are. Now you can buy them...cheap.

Well, that's the story.

Super Star diskettes don't roll off the boat from Pago-Pago or emerge from a basement plant just east of Nowhere.

Super Star diskettes have been around for years...and you've used them for years as copy-protected software originals, unprotected originals. Sometimes, depending on which computer you own, the system master may have been on a Super Star diskette. And maybe more than once, you've bought a box or two or more of Super Star diskettes without knowing it. They just had some "big" company's name on them.

Super Star Diskettes are good. So good that a lot of major software publishers, computer manufacturers and other diskette marketers buy them in the tens or hundreds of thousands.

We buy them in the millions.

And than we sell them to you.

Cheap.

When every little bit counts, it's Super Star Diskettes.

You've used them a hundred times...under different names.

Now, you can buy the real McCoy, the same diskette that major software publishers, computer manufacturers and diskette marketers buy...and call their own.

We simply charge less.

Super Special!

Order 50 Super Star Diskettes and we'll be happy to sell you an Amaray Media-Mate 50 for only $8.75, shipping included...a lot less than the suggested retail price of $15.95.

Regular DISK WORLD! price: $9.69 ea. + $2.00 Shpng.

DISKETTE STORAGE CASES

DISK CADDIES

The original flip-up holder for 10 5¼" diskettes. Beige or Grey only.

$1.65 ea. + .20 Shpng.

DISKETTE 70 STORAGE

Dust-free storage for 70 5¼" diskettes. Six dividers included. An excellent value.

$11.95 ea. +$3.00 Shpng.

HOURS:
Human: 8AM-6PM Central Time, Monday through Friday
Answering Machine: 6PM-8AM, All Times
MCI MAIL: 24 hours a day.

HOW TO ORDER:

ORDERS ONLY:
1-800-621-6827
(In Illinois: 1-312-256-7140)

INQUIRIES:
1-312-256-7140

FOR FASTEST SERVICE, USE NO-COST MCI MAIL: Our address is DISKWORLD. It's a FREE MCI MAIL letter. No charge to you. (Situation permitting, we'll ship these orders in 24 hours or less.)

SHIPPING: 5¼" & 3½" DISKETTES—Add $3.00 per each 100 or fewer diskettes. **OTHER ITEMS:** Add shipping charges as shown in addition to other shipping charges. **PAYMENT:** VISA, MASTERCARD and Prepaid orders accepted. **COD ORDERS:** Add additional $3.00 special handling charge. **APO, FPO, AK, HI & PR ORDERS:** Include shipping charges as shown and additional 5% of total order amount to cover PAL and insurance. We ship only to United States addresses, except for those listed above. **TAXES:** Illinois residents, add 8% sales tax.

MINIMUM ORDER: $35.00 or 20 diskettes.

The Super Star LIFETIME WARRANTY!

Super Star Diskettes are unconditionally warranted against defects in original material and workmanship so long as owned by the original purchaser. Returns are simple: just send the defective diskettes with proof of purchase, postage-paid by you with a short explanation of the problem, and we'll send you the replacements. (Incidentally, coffee stained diskettes and diskettes with staples driven through them don't qualify as "defective".)

WE WILL MEET OR BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES SUBJECT TO THE SAME TERMS AND CONDITIONS.

DISK WORLD!, Inc.

629 Green Bay Road
Wilmette, Illinois 60091

MUST LIQUIDATE At Far Below Dealer Cost!
TOTAL Personal Computer System

Factory Reconditioned with Factory Warranty!

Carries easily as a suitcase! Plugs into 115V outlet!

GREAT GIFT IDEA FOR STUDENTS!

Sorry, we're not permitted to PRINT the famous brand-name. BUT, we CAN "tell all" if you call us TOLL FREE: 1-800-328-0609!

THE COMPUTER

Snap-on computer keyboard! 64K RAM, 20K ROM. Full-size typewriter keyboard. Upper and lower case letters, numerals, symbols, reverse characters. 2 cursor control keys, 4 function keys, programmable to 8. Music synthesizer with 3 independent voices, each with 9 octave range. Input/output ports accommodate . . . user, serial, ROM cartridge, joysticks, external monitor, phone modem.

Built-in disk drive! Intelligent high speed unit with 5¼" floppy disk recorder. 170K formatted data storage; 35 tracks. 16K ROM. Uses single sided, single density disk. Serial interface. Second serial port to chain second drive or printer.

Built-in color monitor! Displays 40 columns x 25 lines of text on 5" screen. High resolution. 320 x 200 pixels. 16 background, character colors.

Built-in ROM cartridge port! Insert ROM program cartridge. Multitude of subjects available in stores across the nation!

Mfr. List Price $995.00

Liquidation Priced At Only **$388**

Item H-621-63631-00 Ship. handling: $20.00

THE PRINTER

Print method: Bi-directional impact dot matrix.
Character matrix: 6 x 7 dot matrix.
Characters: Upper and lower case letters, numerals and symbols. All PET graphic characters.
Graphics: 7 vertical dots — maximum 480 columns. Dot addressable.
Character codes: CBM ASCII code.
Print speed: 60 characters per second.
Maximum columns: 80 columns.
Character spacing: 10 characters per inch.
Line feed spacing: 6 lines per inch in character mode or 8 lines per inch selectable. 9 lines per inch in graphics mode.
Line feed speed: 5 lines per second in character mode. 7.5 lines per second in graphics mode.
Paper feed: Friction feed.
Paper width: 4.5" to 8.5" width.
Multiple copies: Original plus maximum of two copies.
Dimensions: 13"W x 8"D x 3¼"H. Wt.: 6½ lbs. **Power:** 120V AC, 60 Hz.

Mfr. List: $200.00

Liquidation Priced At **$118**

Item H-621-63831-00 Ship. handling: $7.00

THE SOFTWARE

"Easy Script" One of the most powerful word processors at any price! Cut re-typing, create documents from standard paragraphs, do personalized letters, see and change a document before it is printed. Instruction manual has extensive training section that simplifies use . . . even for someone who has never used a computer or word processor before!

"The Manager" A sophisticated database manager for business or home use. Business uses: accounts payable/receivable, inventory, appointments, task manager. Home uses: mailing lists, home inventory, recipes, collection organizer, investment tracking, checkbook balancing. School uses: research article index, gradebook.

Mfr. List: $73.98

Liquidation Price **$24**

Item H-621-64011-03 Ship. handling: $3.00

BUY INDIVIDUAL UNITS OR GET THIS ULTRA-FAMOUS SYSTEM AT ONE LOW PACKAGE PRICE!

TOTAL Personal Computer System available at FAR BELOW dealer cost!

Mfr. Sug. Retail . . $1,268.98

TOTAL PACKAGE PRICE $488

Item H-621-64011-02 Ship. handling: $24.00

Compatible with above Computer System (Not included in package price.)

JOYSTICKS (Set of 2)
Mfr. List: $59.90 pr.
Liquidation Price . . . . . **$18 pr.**
Item H-621-63622-01 S/H: $6.00 pr.

64 MODEM
Mfr. List: $124.95
Liquidation Price **$44**
Item H-621-63646-00 S/H: $4.00

VISA · MasterCard · AMERICAN EXPRESS · DINERS CLUB

Credit card members can order by phone, 24 hours a day, 7 days a week.

Toll-Free: 1-800-328-0609

TeleCheck — Your check is welcome! No delays when you pay by check!

C.O.M.B. CO.®
Authorized Liquidator
14605 28TH AVENUE NORTH
MINNEAPOLIS, MINNESOTA 55441-3397

SEND ME THE ITEMS I HAVE LISTED BELOW

Price subject to change after 60 days. Sales outside continental U.S. are subject to special conditions. Please call or write to inquire.

Item No.	How Many	Item	Price	Ship/ Handl.

C.O.M.B. CO.® Item H-621
14605 28th Ave. N./Minneapolis, MN 55441-3397

Send the items indicated at left. (Minnesota residents add 6% sales tax. Please allow 3-4 weeks delivery. Sorry, no C.O.D.)

☐ My check or money orders is enclosed. (No delays in processing orders paid by check, thanks to TeleCheck.)

Charge: ☐ MasterCard® ☐ VISA ☐ Am. Ex. ☐ Diners Club

Acct. No. _____ Exp. _____

PLEASE PRINT CLEARLY

Name _____

Address _____

City _____

State _____ ZIP _____

Phone _____

Sign here _____

DISK WORLD! is proud to introduce the lowest-priced, LIFETIME-WARRANTY diskettes ever! And they're BRAND NAME PRODUCT to boot!

5.25″ SSDD➡.79 ea. 5.25″ DSDD➡.89 ea.
5.25″ DSDD-HD➡$2.35 ea.
3.50″ SSDD➡$2.25 ea. 3.50″ DSDD➡$2.65 ea.

Based on multiples of 100 each.
Boxed in 10's with heavy-duty cardboard sleeves, user ID labels, reinforced hubs (where appropriate) and write-protect tabs.

Introducing Wabash Pinnacle Series Diskettes.

Two years ago, if you'd told me I'd be writing this ad, I would have laughed.

At that time, Wabash diskettes were synonymous with "s—t".

Just saying that quality control was poor would be charitable.

So much was wrong that DISK WORLD wouldn't sell them.

That was yesterday.

Kearney-National Inc., a $202-million division of a much larger company, came into Wabash.

Out went the old management, the old methods, the old production techniques...and in went a lot of new people, ideas, production lines and some really imaginative thinking.

The end result.

Today, I'm proud to offer you the Wabash Pinnacle Series of diskettes at the prices shown.

This isn't evolution in diskette manufacturing: it's revolution.

Here's what you get.

Wabash Pinnacle diskettes are
...certified 100% Error Free
...are coverd by a LIFETIME WARRANTY
...meet or exceed all industry specifications (by quite some distance)
...and are simply the best value in diskettes available today.

The torture test.

Considering Wabash's earlier dubious reputation, I wasn't exactly a true believer when their Director of Marketing came into my office with samples.

So I took a box at random, selected a disk, bent the thing every which way and slipped it into my IBM-PC.

It formatted. It booted. It stored and retrieved data.

That wasn't enough.

I gave samples of the diskettes to Curt Rostenbach and, in turn, to Tom Streit, both hackers of long experience and members of the Waukegan (Illinois) Apple Users Group.

Tom really went at it.

He took a quartz-halogen lamp, aimed it at the diskette until it started to smoke (and melt)...and then formatted, booted the diskette and stored and retrieved data!

The same terribly (and intentionally) mutilated diskette ran on an ITT, Corona and IBM.

Curt was nicer.

He simply bent the diskette every which way...and it still formatted, booted and ran on his Apple.

The best buy I've ever seen.

DISK WORLD!, Inc. sells more flexible magnetic media by mail-order than anyone else in the world.

I, as President of the corporation, won't tolerate a product with a failure rate of more than 1/1000th of 1 percent.

I also don't like companies who try to milk a "quality" or "premium" image for a higher price like Dysan and Verbatim did...until they failed.

As President of DISK WORLD!, Inc., my motto is simple: "the best diskette for the least amount of money."

Wabash is it.

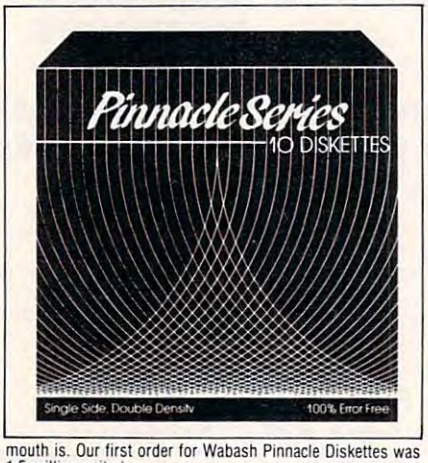
Right now, there is no better value than the Wabash Pinnacle Series of diskettes.

Granted, you have to buy a hundred at a time, but so what? Split the order with friends, relatives, co-workers or even your worst enemies.

The key thing is to get the most diskette for the money.

And this is it.

(Incidentally, as a corporation, we put our money where our mouth is. Our first order for Wabash Pinnacle Diskettes was 1.5-million units.)



That's an awful lot of faith and confidence.

But, then again, I have the diskette that Tom Streit literally melted...and kept on running.

The truth about $1.00 or less diskettes.

More and more ads are popping up offering diskettes for $1.00 or less.

By the same token, more and more people who were selling used cars a few months ago are now selling diskettes by mail.

We did a little survey of current ads for diskettes advertised for a dollar or less and did some analysis of the market and here's what we found as it applies to 5.25″ DSDD diskettes "supposedly" selling for a dollar or less.

VENDOR:	ADVERTISED LOW PRICE:	ACTUAL PRICE PER 100:	ACTUAL MFGR.:
Unitech	.89 ea.	.92 ea.	Unspecified.
Datatech	.99 ea.	.99 ea.	Unspecified.
Computer Club	.95 ea.	.98 ea.	Unspecified.
	.99 ea.	1.02 ea.	Unspecified.
Communications & Electronics	.49 ea.	.80 ea.	Unspecified.
Precision Data	.89 ea.	.93 ea.	Unspecified.
Diskette Connec.	.93 ea.	.93 ea.	Unspecified.
Comp Soft Serv.	.77 ea.	.77 ea. + shpg.	Unspecified.
Computer/Computer	.99 ea.	.99 ea.	Unspecified.
DISK WORLD	.89 ea.	.92 ea.	Wabash Datatech

The real truth about $1.00 or less diskettes.

It costs all diskette manufacturers about the same to produce a diskette. Some may charge more because they want to project a "premium quality" image, ala the late, lamented Dysan who bought their basic media from 3M.

Some charge less because they sell a sub-standard product...and we're not foolish enough to name names here.

But here's the truth about the $1.00 or less diskette market.

It falls into four categories:

1. The DISK WORLD's of the universe who simply are so big that they can buy first quality product in massive quantities and choose to pass on the savings to you. (Precision Data and Diskette Connection on **BRAND NAME** products also fall into this category.)

2. The people who buy "cosmos"...stuff from major manufacturers that usually hits quality control standards, but is cosmetically blemished and thus can't be packaged and sold under the manufacturer's own name.

3. "Duplicator Quality". Uncertified media, usually below manufacturer's own standards and frequently below ANSI and IBM standards. Sold on an "as-is" basis with the understanding that the manufacturer's name will never be divulged. Usually about a 20% reject rate...as compared to DISK WORLD's standard of less than 1/1000th of 1% reject/return rate. Next to garbage, this is the source of most diskettes advertised at a dollar or less.

They may work...and then again they may not. (Frankly, the odds at the Blackjack table in Las Vegas are more in your favor.)

4. Garbage. Stuff that shouldn't be sold at all. But some manufacturers are hurting for cash, so they sell it anyway. (After all, they want to meet their payroll. Look what happens when you don't: you become a Dysan or Verbatim. Lots of history, but no money.) More and more garbage is being dumped into the market as manufacturers become pressed for cash and are motivated into selling anything and everything they can manufacture. (Read the article in FORBES about Verbatim and its "Bonus" brand.)

Finally, the Taiwanese counterfeiters are moving into the act. Perfect duplicates of the packaging of major manufacturers with one exception: the quality isn't there.

The Critical Factor.

Only DISK WORLD!, Inc. offers fully brand-identified, LIFETIME-WARRANTY product for less than a dollar.

Every one else offering 5.25″ product for less than a buck doesn't tell you who makes it.

We do.

And that ought to tell you a lot right there.

Ordering & Shipping Instructions

SHIPPING: Wabash Pinnacle Diskettes are sold in multiples of 100 only. Shipping charges are $3.00 per 100, regardless of type or size.

PAYMENT: VISA, MASTERCARD and PREPAID orders accepted. Corporations rated 3A2 or better and government and quasi-government open accounts are accepted on a NET 15 basis.

C.O.D. orders are subject to a $5.00 special handling charge. (Sorry for the increase, but too many people have been refusing C.O.D. orders or using bad checks. It's a classic example of a few "bad eggs" making life more expensive for everyone else.)

APO, FPO, AK, HI & PR ORDERS: Include shipping as shown **and** an additional 5% of the total amount of the order to cover PAL and insurance.

No other non-continental U.S. orders are accepted.

TAXES: Illinois residents only, add 7%.

All orders subject to acceptance.
Not responsible for typographical errors.

ORDERS ONLY:
1-800-621-6827
(In Illinois: 1-312-256-7140)

INQUIRIES & INFORMATION
1-312-256-7140

FOR FASTEST SERVICE, USE MCI MAIL:
Just address **"DISKWORLD"**
(24-hour shipping on any item in stock if you order via MCI MAIL.)

DISK WORLD!, Inc.

629 Green Bay Road
Wilmette, Illinois 60091

Incredible value!

Nashua™ Diskettes

LIFETIME WARRANTY!

97¢ ea. Qty. 50 — 5¼" SSDD

$1.07 ea. Qty. 50 — 5¼" DSDD

These are poly-bagged diskettes packaged with Tyvek sleeves, reinforced hubs, user identification labels and write-protect tabs. NASHUA Corporation is a half-billion dollar corporation and a recognized leader in magnetic media.

SOFT SECTOR ONLY! Sold in multiples of 50 only!

FOR ORDERS ONLY:
1-800-621-6827
(In Illinois: 1-312-256-7140)

INFORMATION & INQUIRIES:
1-312-256-7140

HOURS: 8AM-5PM Central Time, Monday-Friday

WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES!

DISK WORLD!, Inc.
629 Green Bay Road • Wilmette, Illinois 60091

DISK WORLD! Authorized Distributor — NASHUA MAGNETIC MEDIA

FANTASTIC LOW PRICES ON

BASF QUALIMETRIC DISKETTES!

LIFETIME WARRANTY!

$1.14 ea. Qty. 20 — 5¼" SSDD

$1.31 ea. Qty. 20 — 5¼" DSDD

5¼" SSDD-96TPI — **$1.46** ea. 5¼" DSDD-96TPI — **$1.75** ea.

PACKED IN CARDBOARD CASES!

BASF QUALIMETRIC DISKETTES have a LIFETIME WARRANTY with Tyvek sleeves, reinforced hubs, user identification labels and write-protect tabs.

SOFT SECTOR ONLY! MINIMUM ORDER: 20 DISKETTES

BASF 3.5" MICRO-FLOPPIES
5SSDD-135 TPI — **$2.34** ea.

BASF 5¼" HIGH DENSITY FOR IBM PC-AT
DSDD-HD — **$3.14** ea.

FOR ORDERS ONLY:
1-800-621-6827
(In Illinois: 1-312-256-7140)

INFORMATION & INQUIRIES:
1-312-256-7140

HOURS: 8AM-5PM Central Time, Monday-Friday

WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES!

DISK WORLD! Authorized Reseller Information Processing Media — BASF

Now, the lowest prices ever on

3M Scotch® DISKETTES

LIFETIME WARRANTY!

The best deal on 3M diskettes you've ever seen!

FREE!

FLIP N' FILE 15 with every order for 5.25" SSDD and DSDD.

$1.42 ea. — 5.25" SSDD with FREE Flip n' File 15
5.25" DSDD with FREE Flip n' File 15 — **$1.74** ea.

100% LIFETIME WARRANTY

This is a Super Special promotion. It was supposed to end around the end of May.

But we decided to buy more than 1,000,000 3M diskettes packed in the FREE Flip n' File 15's...and give you the benefits of this terrific value.

One word of warning: **this offer is limited only to supplies on hand. Once these supplies are used up, the prices stay the same...but there's no free Flip n' File.**

The last time we ran an offer like this, everything was sold out in about six weeks.

So don't wait. Order now.

Other 3M diskettes:

(Flip n' File offer does not apply.)

5.25" SSDD-96TPI	$2.06 ea.
5.25" DSDD-96TPI	$2.57 ea.
5.25" DSDD-HD for IBM PC/AT	$3.93 ea.
3.50" SSDD-135TPI for Apple Mac	$2.86 ea.

DATA CARTRIDGES

100% certified 3M data cartridges.

DC-1000	$13.90 ea.
DC-300XLP	$19.83 ea.
DC-600A	$22.13 ea.

Sold in cases of 10 only.
Add $5.00 shipping per 10.

DISK WORLD! Authorized Distributor Information Processing Products — 3M

ATHANA DISKETTES
The great unknown!

97¢ ea. Qty. 50 — ← 5¼" SSDD

$1.01 ea. Qty. 50 — 5¼" DSDD →

You've used these diskettes hundreds of times...as copy-protected originals on some of the most popular software packages. They're packed in poly-bags of 25 with Tyvek sleeves, reinforced hubs, user identification labels and write-protect tabs.

LIFETIME WARRANTY!

SOFT SECTOR ONLY! Sold in multiples of 50 only.

FOR ORDERS ONLY:
1-800-621-6827
(In Illinois: 1-312-256-7140)

INFORMATION & INQUIRIES:
1-312-256-7140

HOURS: 8AM-5PM Central Time, Monday-Friday

WE WILL BEAT ANY NATIONALLY ADVERTISED PRICE ON THE SAME PRODUCTS AND QUANTITIES!

DISK WORLD!, Inc.
629 Green Bay Road • Wilmette, Illinois 60091

DISK WORLD! Authorized Distributor — ATHANA MAGNETIC MEDIA

DISK WORLD!
Ordering & Shipping Instructions

Shipping: 5¼" & 3.5" DISKETTES—Add $3.00 per each 100 or fewer diskettes. **Other Items:** Add shipping charges as shown in addition to other shipping charges. **Payment:** VISA and MASTERCARD accepted. **COD Orders:** Add additional $3.00 Special Handling charge. **APO, FPO, AK, HI & PR Orders:** Include shipping charges as shown **and** additional 5% of total order amount to cover PAL and insurance. **Taxes:** Illinois residents only, add 7% sales tax.

Prices subject to change without notice.
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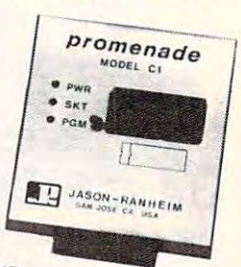

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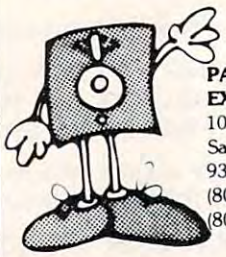

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