a part of the screen that is invisible to you. If you suspect this has occurred, type @SPLIT 0 or @SPLIT 25 in immediate mode (even if you have to type blind) to examine the entire text screen. In map 1, neither screen contains text, so use @SCREEN 0,4,4,0,0 to check the text screen.

Controlling Video Features

Once you've created a split screen with @SCREEN and @SPLIT, you essentially have two independent screens at your disposal. You may use any of the ordinary graphics techniques appropriate to the current configuration, keeping in mind the reduced size of each screen.

The usual way to control sprites and other video features is by POKEing values into the appropriate VIC-II control registers. A similar method is used with Screen Splitter, but the addresses are different. Instead of POKEing into the control registers themselves, you POKE mock registers and let Screen Splitter transfer the values to the actual control registers when the time is right.

There are 47 VIC-II control registers, which normally begin at location 53248. Screen Splitter provides two sets of mock control registers—one set for the upper screen and one for the lower. The 47 top screen registers begin at location 49235. The 47 mock registers for the bottom screen begin at location 49282. Whenever you POKE a new value into one of the mock registers, Screen Splitter waits until the correct time, then transfers that value into the corresponding control register.

Pointers to sprite dot patterns are normally stored in the last eight bytes of the video matrix (locations 2040–2047). But, since Screen Splitter permits as many as 16 sprites to share the screen in some configurations, it is necessary to use mock sprite pointer registers as well. The mock sprite pointers are always in the same place regardless of the screen's location. The top screen sprite pointers occupy the eight bytes beginning at location 49329. These bytes are preset to point to sprite shape locations 32–39 (locations 2048–2111 contain the data for sprite 0, the next 64 bytes contain the data for sprite 2, and so forth). The lower screen sprite pointers begin at location 49337 and point to sprite locations 40–47. Of course, you can POKE new values into these registers at any time.

At the start of each raster interrupt all the sprite pointers at the end of the current video matrix are reset to point to sprite shape location 11 (addresses 704–767, filled with zero bytes when you first activate Screen Splitter). If this occurs in the middle of a sprite, the video chip continues to send it to the screen, but since the dot pattern is blank, the rest of the sprite becomes invisible. Near the end of the interrupt, the sprite pointers for the new screen are copied into the last eight bytes of its video matrix. The video chip continues to project any remaining upper sprites, but uses the new horizontal position, color, and dot data. As a result, when an upper sprite sinks through the boundary, the bottom few lines of the corresponding lower sprite may appear just below the boundary, at the lower sprite's x position.

Changing the lower sprite's y position or even turning it off completely will not prevent this overlap problem—these controls are ignored once the chip begins projecting a sprite. So when an upper sprite is going to drop through the boundary, the same numbered sprite for the lower screen should contain a blank definition (at least for its bottom several lines), or it must be positioned off the side of the screen. Sprites rising from the lower screen are cut off at the top as they approach the boundary. But when the sprite's y position reaches the split point, the remaining portion of the sprite suddenly disappears.

Advanced Techniques

Most VIC-II registers control only one feature. However, locations 53265 and 53270 each control multiple functions. The @SCREEN statement initializes both of the mock registers corresponding to 53265 with a default value of 27 (three rasters of vertical fine scrolling, 25 rows, blanking off, bitmapping off, extended color off, raster bit 8 off). Both mock registers corresponding to 53270 are set to 8 (no horizontal fine scrolling, 40 columns, multicolor off). Changes are made as needed to turn on extended, multicolor, or bitmap graphics. The default settings may be changed with POKEs to address 49638 for register 53265 and 49646 for register 53270. For more information about these rarely used features, consult *Mapping the 64*, available from COMPUTE! Books, and the *Commodore 64 Programmer's Reference Guide*.

You can override @SPLIT's raster control with POKEs. The @SPLIT statement always sets the number of scan lines above the boundary to a multiple of eight, so that text will fit neatly on the screen. For an in-between position, adjust location 49253 to the value 48 plus the number of scan lines of upper screen you want to display. For example, this statement shows 43 scan lines of hi-res screen in the top screen:

```
POKE 49253, 43+48
```

You may also change the raster setting for the change from lower to upper screen. The normal value is 19 for an offscreen transition. But you can set location 49300 to a value greater than 48, creating a three-part screen with the bottom screen visible both below and above the top screen.

For a strange effect, POKE 49253 with a value of 19 to match the lower register. If the upper and lower screen colors are different, you will see them flicker in alternation. If the colors are the same, you will be able to see up to 16 flickering sprites at once against a steady background. Each sprite will be free to move anywhere on the screen. To display a flicker-free sprite, create a twin in the same position on the other screen.

Screen Splitter uses a delay during the interrupt to insure that any change in background color occurs between scans of the TV's electron beam. The length of the delay is controlled by location 50828, which, in turn, is set by @SCREEN. Maps 3 and 4 usually change colors early in the interrupt, when the screen type changes. @SCREEN sets location 50828 for eight passes

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of the delay loop. The other maps generally change colors later, when the color registers are copied, so six passes of the delay loop are sufficient. If something in your program disrupts the timing (for example, a sprite may be located at the boundary) the color may change in the middle of a row of pixels. You can correct such an imperfection by changing the value in location 50828.

Most VIC-II registers are intended to be POKEd rather than PEEKed. But four control registers are usually read: locations 53267–53268 for the light pen, and locations 53278–53279 for sprite collisions. Splitter ignores these locations, so you can PEEK them as usual. However, the VIC-II has no way to tell whether a collision involves upper or lower sprites. If there is any possibility of confusion on this point, your program must analyze the sprite positions to clear it up.

Program 1. Screen Splitter

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

```
C000:AD 15 03 C9 CF 90 0C AD 21
C008:14 03 8D C3 C0 AD 15 03 2C
C010:8D C4 C0 78 A0 06 B9 46 FF
C018:C0 99 03 03 88 D0 F7 58 C0
C020:A9 08 20 D2 FF A2 3F A9 5C
C028:00 9D C0 02 CA E0 FF D0 F3
C030:F8 60 40 53 43 52 45 45 B6
C038:CE D0 40 53 50 4C 49 D4 AD
C040:D1 00 00 32 C0 3A C0 3D 7B
C048:C1 E2 C0 18 C1 06 C4 B8 65
C050:C1 50 C3 00 00 00 00 00 3F
C058:00 00 00 00 00 00 00 00 D9
C060:00 00 00 00 1B 80 00 00 BC
C068:00 08 00 14 01 01 00 00 39
C070:00 00 00 06 06 00 00 00 82
C078:00 00 08 08 08 08 08 08 F3
C080:08 08 00 00 00 00 00 00 08
C088:00 00 00 00 00 00 00 00 0A
C090:00 00 00 1B 13 00 00 00 5C
C098:08 00 16 01 01 00 00 00 F8
C0A0:00 00 08 08 00 00 00 00 A3
C0A8:00 06 06 06 06 06 06 06 27
C0B0:06 20 21 22 23 24 25 26 9D
C0B8:27 28 29 2A 2B 2C 2D 2E 32
C0C0:2F 00 00 00 00 00 00 00 D9
C0C8:00 00 00 00 00 00 00 00 4A
C0D0:00 A9 2C A0 00 D1 7A F0 79
C0D8:05 A2 0B 6C 00 03 20 9B 95
C0E0:B7 60 08 2C 0F 00 30 0A FC
C0E8:C9 D0 90 06 C9 D2 B0 02 F2
C0F0:90 04 28 4C 1A A7 8C 49 57
C0F8:00 28 38 E9 D0 0A A8 B9 E3
C100:43 C0 85 FD B9 44 C0 85 CB
C108:FE A0 00 B1 FD 30 06 20 2B
C110:D2 FF C8 D0 F6 4C EF A6 92
C118:20 73 00 C9 D0 90 06 C9 C3
C120:D2 B0 02 90 06 20 79 00 26
C128:4C E7 A7 38 E9 D0 0A A8 93
C130:B9 4F C0 85 FD B9 50 C0 0D
C138:85 FE 6C FD 00 20 7C A5 CA
C140:A0 00 B9 00 02 F0 0C C9 01
C148:22 F0 16 C9 40 F0 1E C8 43
C150:4C 42 C1 99 02 02 E8 C8 0F
C158:C8 C8 C8 A9 FF 84 71 C8 E3
C160:60 C8 B9 00 02 F0 EC C9 F4
C168:22 F0 E4 D0 F4 84 FC A2 39
C170:00 BD 32 C0 29 7F D9 00 B0
C178:02 D0 0A BD 32 C0 30 1A 5D
C180:E8 C8 4C 71 C1 BD 32 C0 75
C188:30 03 E8 D0 F8 E8 E8 A4 F0
C190:FC BD 32 C0 D0 DB C8 4C 28
C198:42 C1 E8 BD 32 C0 C8 A6 73
C1A0:FC 9D 00 02 E8 B9 00 02 5A
C1A8:9D 00 02 F0 05 C8 E8 4C B3
C1B0:A5 C1 A4 FC C8 4C 42 C1 99
C1B8:20 DE C0 8E C6 C0 20 41 BF
C1C0:C3 20 D1 C0 8E C7 C0 20 A9
C1C8:30 C3 20 D1 C0 8E C8 C0 09
C1D0:20 30 C3 20 D1 C0 8E C9 63
C1D8:C0 20 4B C3 20 D1 C0 8E C2
C1E0:CA C0 20 4B C3 A9 1B 8D 3B
C1E8:CB C0 8D CE C0 A9 08 8D 6B
C1F0:CC C0 8D CF C0 A9 06 8D FF
C1F8:8C C6 A0 0F A2 07 AD C6 CC
C200:C0 D0 11 A9 10 8D CD C0 E9
C208:8D D0 C0 8E 2D C5 8E 6E 95
C210:C6 4C 80 C2 C9 01 D0 1B 57
C218:A9 20 0D CB C0 8D CB C0 6D
C220:A9 20 0D CE C0 8D CE C0 AB
C228:A9 18 8D CD C0 8D D0 C0 B5
C230:4C 0B C2 C9 02 D0 13 A9 B6
C238:10 8D CD C0 A9 30 8D D0 E8
C240:C0 8E 2D C5 8C 6E C6 4C C3
C248:80 C2 A9 08 8D 8C C6 C9 6A
C250:03 D0 15 A9 10 8D CD C0 DB
C258:A9 20 0D CE C0 8D CE C0 E3
C260:A9 38 8D D0 C0 4C 41 C2 04
C268:A9 10 8D D0 C0 A9 20 0D 7F
C270:CB C0 8D CB C0 A9 38 8D 25
C278:CD C0 8C 2D C5 8E 6E C6 85
C280:AE C7 C0 AD CB C0 29 20 16
C288:D0 07 8A 0D CD C0 8D CD B4
C290:C0 AE C8 C0 AD CE C0 29 9A
C298:20 D0 07 8A 0D D0 C0 8D A6
C2A0:D0 C0 AD C9 C0 F0 21 C9 E6
C2A8:02 D0 15 AD CB C0 29 20 B4
C2B0:F0 03 4C 46 C3 AD CB C0 8A
C2B8:09 40 8D CB C0 4C C8 C2 CC
C2C0:A9 10 0D CC C0 8D CC C0 24
C2C8:AD CA C0 F0 21 C9 02 D0 04
C2D0:15 AD CE C0 29 20 F0 03 E0
C2D8:4C 46 C3 AD CE C0 09 40 35
C2E0:8D CE C0 4C EE C2 A9 10 A3
C2E8:0D CF C0 8D CF C0 AD CB 82
C2F0:C0 8D 64 C0 AD CD C0 8D 86
C2F8:6B C0 AD CC C0 8D 69 C0 B6
C300:AD CE C0 8D 93 C0 AD D0 CE
C308:C0 8D 9A C0 AD CF C0 8D 6E
C310:98 C0 AD 2D C5 AE 6E C6 29
C318:A0 02 8D 0B C4 8E 4C C5 91
C320:C8 C8 C8 C0 1A D0 F3 8D EC
C328:BC C3 8E DB C3 4C AE A7 E2
C330:8A F0 13 6A 90 03 4C 46 B1
C338:C3 E0 0F 90 03 4C 46 C3 5E
C340:60 E0 05 B0 01 60 A2 0E B8
C348:6C 00 03 E0 03 4C 43 C3 08
C350:20 DE C0 8E C6 C0 E0 00 9B
C358:F0 09 E0 19 F0 0B 90 0F 2C
C360:4C 46 C3 20 C4 C3 4C AE 96
C368:A7 20 A5 C3 4C AE A7 8A B3
C370:0A 0A 0A 18 69 30 8D 65 CE
C378:C0 A9 7F 8D 0D DC 78 A9 0A
C380:C4 8D 15 03 A9 06 8D 14 35
C388:03 AD 94 C0 8D 12 D0 AD 9F
C390:11 D0 29 7F 8D 11 D0 A9 ED
C398:0F 8D 19 D0 A9 01 8D 1A C1
C3A0:D0 58 4C AE A7 20 E3 C3 64
C3A8:A2 2E BD 53 C0 9D 00 D0 47
C3B0:CA E0 FF D0 F5 A0 07 B9 DC
C3B8:B1 C0 99 F8 07 88 C0 FF E7
C3C0:D0 F5 58 60 20 E3 C3 A2 F9
C3C8:2E BD 82 C0 9D 00 D0 CA 8C
C3D0:E0 FF D0 F5 A0 07 B9 B1 88
C3D8:C0 99 F8 07 88 C0 FF D0 CE
C3E0:F5 58 60 2C 11 D0 10 FB 30
C3E8:78 AD C3 C0 8D 14 03 AD 0D
C3F0:C4 C0 8D 15 03 A9 00 8D 5A
C3F8:6D C0 8D 9C C0 8D 1A D0 24
C400:A9 81 8D 0D DC 60 78 A9 44
C408:0B 8D F8 07 8D F9 07 8D F9
C410:FA 07 8D FB 07 8D FC 07 B9
C418:8D FD 07 8D FE 07 8D FF D0
C420:07 20 8B C6 AD 77 C0 48 28
C428:AD 76 C0 48 AD 75 C0 48 CF
C430:AD 74 C0 48 AD 73 C0 48 4F
C438:AD 64 C0 AE 69 C0 AC 6B C7
C440:C0 8D 11 D0 8E 16 D0 8C B7
C448:18 D0 68 8D 20 D0 68 8D 9A
C450:21 D0 68 8D 22 D0 68 8D 37
C458:23 D0 68 8D 24 D0 AD 53 A0
C460:C0 8D 00 D0 AD 54 C0 8D 88
C468:01 D0 AD 55 C0 8D 02 D0 C2
C470:AD 56 C0 8D 03 D0 AD 57 65
C478:C0 8D 04 D0 AD 58 C0 8D 31
C480:05 D0 AD 59 C0 8D 06 D0 25
C488:AD 5A C0 8D 07 D0 AD 5B A2
C490:C0 8D 08 D0 AD 5C C0 8D D9
C498:09 D0 AD 5D C0 8D 0A D0 87
C4A0:AD 5E C0 8D 0B D0 AD 5F DF
C4A8:C0 8D 0C D0 AD 60 C0 8D 82
C4B0:0D D0 AD 61 C0 8D 0E D0 E9
C4B8:AD 62 C0 8D 0F D0 AD 63 1D
C4C0:C0 8D 10 D0 AD 6A C0 8D 43
C4C8:17 D0 AD 6E C0 8D 1B D0 F1
C4D0:AD 6F C0 8D 1C D0 AD 70 ED
C4D8:C0 8D 1D D0 AD 78 C0 8D 35
C4E0:25 D0 AD 79 C0 8D 26 D0 D7
C4E8:AD 7A C0 8D 27 D0 AD 7B 2C
C4F0:C0 8D 28 D0 AD 7C C0 8D BE
C4F8:29 D0 AD 7D C0 8D 2A D0 3A
C500:AD 7E C0 8D 2B D0 AD 7F 6A
C508:C0 8D 2C D0 AD 80 C0 8D 68
C510:2D D0 AD 81 C0 8D 2E D0 9D
C518:AD 65 C0 8D 12 D0 A9 01 EC
C520:8D 19 D0 8D 1A D0 A2 07 0C
C528:BD B1 C0 9D F8 07 CA E0 4B
C530:FF D0 F5 AD 68 C0 8D 15 FF
C538:D0 A9 C5 8D 15 03 A9 47 77
C540:8D 14 03 58 6C C3 C0 78 E9
C548:A9 0B 8D F8 07 8D F9 07 16
C550:8D FA 07 8D FB 07 8D FC 2F
C558:07 8D FD 07 8D FE 07 8D FE
C560:FF 07 20 8B C6 AD A6 C0 65
C568:48 AD A5 C0 48 AD A4 C0 47
C570:48 AD A3 C0 48 AD A2 C0 0B
C578:48 AD 93 C0 AE 98 C0 AC 18
C580:9A C0 8D 11 D0 8E 16 D0 0A
C588:8C 18 D0 68 8D 20 D0 68 F7
C590:8D 21 D0 68 8D 22 D0 68 CA
C598:8D 23 D0 68 8D 24 D0 AD A0
C5A0:82 C0 8D 00 D0 AD 83 C0 54
C5A8:8D 01 D0 AD 84 C0 8D 02 74
C5B0:D0 AD 85 C0 8D 03 D0 AD 94
C5B8:86 C0 8D 04 D0 AD 87 C0 B6
C5C0:8D 05 D0 AD 88 C0 8D 06 B1
C5C8:D0 AD 89 C0 8D 07 D0 AD 3D
C5D0:8A C0 8D 08 D0 AD 8B C0 19
C5D8:8D 09 D0 AD 8C C0 8D 0A EE
C5E0:D0 AD 8D C0 8D 0B D0 AD E5
C5E8:8E C0 8D 0C D0 AD 8F C0 7B
C5F0:8D 0D D0 AD 90 C0 8D 0E 2C
C5F8:D0 AD 91 C0 8D 0F D0 AD 8E
C600:92 C0 8D 10 D0 AD 99 C0 EA
C608:8D 17 D0 AD 9D C0 8D 1B 3D
C610:D0 AD 9E C0 8D 1C D0 AD 7D
C618:9F C0 8D 1D D0 AD A7 C0 76
C620:8D 25 D0 AD A8 C0 8D 26 3C
C628:D0 AD A9 C0 8D 27 D0 AD 23
C630:AA C0 8D 28 D0 AD AB C0 CC
C638:8D 29 D0 AD AC C0 8D 2A 79
C640:D0 AD AD C0 8D 2B D0 AD CB
C648:AE C0 8D 2C D0 AD AF C0 2F
```


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```
C650:8D 2D D0 AD B0 C0 8D 2E B6
C658:D0 AD 94 C0 8D 12 D0 A9 58
C660:01 8D 19 D0 8D 1A D0 A2 1B
C668:07 BD B9 C0 9D F8 07 CA D5
C670:E0 FF D0 F5 AD 97 C0 8D C2
C678:15 D0 A9 C4 8D 15 03 A9 B6
C680:06 8D 14 03 68 A8 68 AA 88
C688:68 58 40 A2 06 CA 10 FD 0C
C690:EA EA 60 00 00 00 00 00 5A
```

Program 2. Split Screen Demo

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

```
MJ 10 PRINT"{CLR}{2 DOWN}
      {13 RIGHT}PLEASE WAIT"
JD 20 FORA=8192TO14192:POKEA,0
      :NEXT
SG 30 FORX=100TO200:Y=30:GOSUB
      510:Y=90:GOSUB510:NEXT:F
      ORY=30TO90:X=100:GOSUB51
      0
BF 40 X=200:GOSUB510:NEXT
CF 50 FORK=2048TO2111:POKEK,25
      5:NEXT
DH 60 BR=49282:TR=49235:POKEBR
      +33,14:POKETR+33,6:POKE6
      46,1:POKETR+32,8:POKEBR+
      32,8
QB 70 POKE648,4:@SCREEN0,4,6,0
      ,0:@SPLIT12:PRINT"{CLR}"
FE 80 TY=95
GA 90 POKETR,200:POKETR+21,1
JG 100 FORK=1TO80
DJ 110 TY=TY+1
GK 120 POKETR+1,TY
HB 130 FORJ=1TO30:NEXT:NEXT
PP 140 POKETR+21,0
SB 150 PRINT"{8 DOWN}NOTICE TH
       E CHANGING CHARACTER SE
       TS"
PX 160 PRINT"{6 DOWN}ABOVE AND
        BELOW THE SPLIT."
CD 170 FORK=1TO3
HX 180 @SCREEN0,6,4,0,0
QJ 190 FORJ=1TO700:NEXT
AQ 200 @SCREEN0,4,6,0,0
HX 210 FORJ=1TO700:NEXT
DE 220 NEXT:PRINT"{CLR}"
SP 230 POKE648,12:PRINT"{CLR}"
       :@SCREEN2,4,4,0,0:@SPLI
       T19
DM 240 POKEBR+33,14:POKETR+33,
       14:POKE646,6
CJ 250 POKE648,4:PRINT"{CLR}
       {2 DOWN}THIS IS MAP NUM
       BER 2.{DOWN}"
PH 260 PRINT"THE TOP IS ON THE
        1K TEXT SCREEN.
KK 270 PRINT"THE BOTTOM IS ON
       {SPACE}THE 3K TEXT SCRE
       EN.
RD 280 POKE648,12
GS 290 PRINT"{17 DOWN}"
PR 300 PRINT"WATCH WHAT HAPPEN
       S WHEN I REACH THE
RB 310 PRINT"BOTTOM OF THE SCR
       EEN.
CG 320 FORK=1TO9:PRINTK"******
        SCROLLING *****":FORJ=
       1TO600:NEXTJ,K
RB 330 POKE648,4:PRINT"{CLR}
       {3 DOWN}WHERE DID THE O
       THER LINES GO???{DOWN}"
SK 340 PRINT"I'LL EXECUTE @SPL
       IT 0 SO YOU CAN SEE.":F
       ORK=1TO2000:NEXT:@SPLIT
       0
CF 350 FORK=1TO2000:NEXT:@SPLI
       T19
BG 360 PRINT"{CLR}{3 DOWN}PRES
       S ANY KEY AND I'LL CLEA
       R THE BOTTOM SCREEN ONL
       Y.":POKE198,0
EA 370 GETA$:IFA$=""THEN370
KX 380 POKE648,12:PRINT"{CLR}"
EA 390 FORK=1TO2000:NEXT:@SPLI
       T25:@SCREEN4,4,4,0,0:PO
       KE648,4
ER 400 PRINT"{CLR}{22 DOWN}NOW
        WE WILL ENTER MAP #4,
       {SPACE}A HIRES
MH 410 PRINT"UPPER SCREEN, WIT
       H A TEXT SCREEN
GJ 420 PRINT"BELOW.{2 SPACES}T
       HERE'S A HIRES PICTURE
SR 430 PRINT"ON THE SCREEN NOW
       . PRESS A KEY
FK 440 PRINT"AND I'LL SHOW IT
       {SPACE}TO YOU.
EC 450 PRINT"PRESS AGAIN, AND
       {SPACE}I'LL COME BACK."
       :POKE198,0
QR 460 GETA$:IFA$=""THEN460
AA 470 @SPLIT16
AM 480 GETA$:IFA$=""THEN480
FH 490 @SPLIT0:PRINT"{3 DOWN}T
       HIS ENDS THE DEMONSTRAT
       ION."
AJ 500 PRINT"{DOWN}FEEL FREE T
       O CONTINUE IN IMMEDIATE
        MODE.":END
FG 510 CH=INT(X/8):RO=INT(Y/8)
       :LN=YAND7:BY=8192+RO*32
       0+8*CH+LN:BI=7-(XAND7)
KM 520 POKEBY,PEEK(BY)OR(2↑BI)
       :RETURN
```
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Programming the TI

C. Regena

More Solitaire

This month's article and listing continue the game program, "Solitaire", started in last month's column. Although last month's listing included enough of the game to play, all the features had not been included. This month we'll add a way to keep track of each move so you can back up if you want or have the computer replay the whole game or print the moves with a printer.

Keep in mind as you are doing your own programming that there are many ways to accomplish the same thing (and most of the time it doesn't matter which method you choose). Some ways may be more sophisticated or more efficient. In this game I selected the techniques I thought would be easiest to understand. First, let's go back and see how to tell if you are making a legal move.

A Less Complicated Array

To move a peg, you must choose a peg, then jump over one (and only one) peg into a vacant place, or hole. I decided to use an array of numbers where the number 1 represents a peg's location and the number 0 represents a hole. For each location there is a row and a column. This array is the G array. The playing area is shaped like a cross, so there are locations that cannot be used. Rather than define a smaller, more complex array, I used all the elements of the array and used the number 2 for positions off the playing area—where pegs cannot be. I needed two spots around each peg to test the valid jumps, so there are two rows and two columns beyond each peg on the playing surface. The G array thus starts with the zero elements and goes to (12,12). The DATA statements in lines 340–460 define the elements for the starting game board. The border elements contain a 2; a peg is 1; and a hole is 0.

Each position is represented by a row R and a column C. The actual

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row and column on the screen are calculated by lines 820–830. Lines 850–1090 blink the peg or hole position while waiting in a CALL KEY loop for an arrow key or the ENTER key to be pressed. When an arrow key is pressed, the IF statements make sure the move is still within the playing area. If the G element is a 2, the peg cannot go in that direction.

The program branches to line 1100 if the ENTER key is pressed, and line 1110 makes sure a peg is there to move. Lines 1120–1540 detect the arrow key pressed for the direction of the jump, and the IF statements make sure there is an adjacent peg, then a hole. If a jump cannot be made, there is a low tone and the program branches back to line 850. If a jump can be made, the graphics change and the G elements are updated: The peg moves to a hole and leaves a hole in the first position, and the jumped peg is removed and a hole is shown there.

Keeping Track Of The Moves

The program then branches back to the CALL KEY loop for the next move. This process continues (indefinitely). By the way, you may want to add a routine to check for the end of a game—my program just stays in this loop.

Now let's add a way to keep track of the moves. Since the locations are designated by a row number and a column number, I decided to trace the move by making (R,C) the first position and (R2,C2) the new one. These moves are in the M$ array. To simplify further, by subtracting one from the row or column number used in the G array, all locations will be one-digit numbers. Therefore, the M$ string will be a four-digit number. For example, M$(5) might be 5351, which indicates the peg in (5,3) moves to (5,1). The top row of the cross shape is row 1, and the leftmost column is column 1. The center hole is (5,5).

Add line 795 to start with move 1. Line 1514 increments the number of the move. Lines 1115 and 1512 record the row and column numbers of the starting position and ending position of valid moves.

Lines 892–896 and 1152–1156 are added to detect a key press of REDO (FCTN-3), BEGIN (FCTN-5), or FCTN-P for print. Lines 1600–1760 are added to back up one move. Lines 1800–1980 are added to have the computer show how you played the whole game (or a game up to the present position). Lines 1990–2110 print the sequence of moves.

Variable Retracing

With a record of moves in M$, you can back up—or back up a number of moves. M$ is redefined as F$, then taken apart with the SEG function to get the row and column positions. To back up, a hole is printed in the second location and a peg in the first position. You also need to put a peg back in the position between these two listed positions. SGN is used to figure out the direction between the two locations. If the row is constant, SGN will return 0 and SGN(C2−C) will be 1 or −1 for the middle peg. If C and C2 are the same, then SGN (R2−R) will be 1 or −1. Line 1700 shows the peg on the screen. Lines 1730–1750 reset the G elements.

To have the computer show the game from the start, the screen clears and the original game board is shown. Lines 1820–1960 loop for the first move to the present move. After each move the player must press the space bar to continue. After all the moves are shown, the program is ready for the player to continue playing.

To print the sequence of moves, be sure to put your own printer configuration on line 2010. Line 2080 simply prints a move number, then the first position and second position (using coordinates).

If you wish to save typing effort, you may receive a copy of this (complete) program by sending a copying fee of $3 plus a stamped, self-addressed mailer and a blank cassette or disk to C. Regena, P. O. Box 1502, Cedar City, UT 84720. Please specify the title, "Solitaire" for the TI-99/4A.

Note: This listing is incomplete. Start by loading Solitaire from last month's column; then add these lines. You should then save a copy of the complete program.

```
105 REM  SOLITAIRE PART 2
795 M=1
892 IF K=6 THEN 1600
894 IF K=14 THEN 1800
896 IF K=34 THEN 2010
1115 N$=STR$(R-1)&STR$(C-1)
1152 IF K=6 THEN 1600
1154 IF K=14 THEN 1800
1156 IF K=34 THEN 2010
1512 M$(M)=N$&STR$(R-1)&STR
     $(C-1)
1514 M=M+1
1600 M=M-1
1610 IF M>0 THEN 1640
1620 CALL SOUND(200,130,2)
1630 GOTO 850
1640 F$=M$(M)
1650 R=VAL(SEG$(F$,1,1))+1
1660 C=VAL(SEG$(F$,2,1))+1
1670 R2=VAL(SEG$(F$,3,1))+1
1680 C2=VAL(SEG$(F$,4,1))+1
1690 CALL HCHAR(R2*2,C2*2+4
     ,105)
1700 CALL HCHAR((R+SGN(R2-R
     ))*2,(C+SGN(C2-C))*2+4
     ,97)
1710 CALL HCHAR(R*2,C*2+4,9
     7)
1730 G(R,C)=1
1740 G(R2,C2)=0
1750 G(R+SGN(R2-R),C+SGN(C2
     -C))=1
1760 GOTO 820
1800 GOSUB 620
1810 PRINT :"PRESS SPACE FO
     R NEXT MOVE"
1820 FOR T=1 TO M-1
1830 F$=M$(T)
1840 R=VAL(SEG$(F$,1,1))+1
1850 C=VAL(SEG$(F$,2,1))+1
1860 CALL HCHAR(R*2,C*2+4,9
     8)
1870 CALL SOUND(100,1048,2)
1880 R2=VAL(SEG$(F$,3,1))+1
1890 C2=VAL(SEG$(F$,4,1))+1
1900 CALL HCHAR(R2*2,C2*2+4
     ,98)
1910 CALL HCHAR((R+SGN(R2-R
     ))*2,(C+SGN(C2-C))*2+4
     ,105)
1920 CALL HCHAR(R*2,C*2+4,1
     05)
1930 CALL HCHAR(R2*2,C2*2+4
     ,97)
1940 CALL KEY(0,K,S)
1950 IF K<>32 THEN 1940
1960 NEXT T
1970 CALL HCHAR(23,3,32,25)
1980 GOTO 820
1990 REM  PUT YOUR PRINTER
2000 REM  CONFIGURATION HER
     E
2010 OPEN #1:"RS232.BA=600"
2020 FOR T=1 TO M-1
2030 F$=M$(T)
2040 R$=SEG$(F$,1,1)
2050 CC$=SEG$(F$,2,1)
2060 R2$=SEG$(F$,3,1)
2070 C2$=SEG$(F$,4,1)
2080 PRINT #1:T,R$;",";CC$;
     " TO ";R2$;",";C2$
2090 NEXT T
2100 CLOSE #1
2110 GOTO 820
2200 END                    ©
```


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The World Inside the Computer

Fred D'Ignazio, Associate Editor

Boy Shoppin' With Taunnie Howery

Taunnie Howery is about to release her first pop single. The name of the single, "Boy Shoppin'," will also be the name of Taunnie's first LP, to be released later this fall. Taunnie wrote and recorded "Boy Shoppin' " for her older sister Shanna, 15. "It's about girls going out on Friday nights looking for gorgeous guys," says Taunnie. "I wrote it for Shanna; she's kind of like that."

Taunnie is only 12 years old, but she has been making music for a long time. Her parents bought her a piano when she was only 2 years old. At age 3-1/2, Taunnie composed her first song, and she has been writing music ever since. She still plays the piano, but now she adds music from an electronic organ, drum machine, electric guitar, and several keyboard synthesizers.

Taunnie's dad, Clint, has built her a professional recording studio in the garage that connects to the back of their house. The family laundry room has become a studio control room. Taunnie has wanted to record her own album since she was 6 years old, but this seemed impossible until now. Not only was she just one person, amidst dozens of highly technical machines, but she was also blind. How could a blind child operate her own recording studio and record her own songs?

Taunnie and her parents didn't give up. Clint joined with Robert Artusy, a programmer who was working with blind people at the University of California at Berkeley, on a voice I/O system for computers. Together the two of them created the Pro Inovator MK I—a talking, musical computer that a blind person can control by giving verbal commands. Clint set up a Pro Inovator in Taunnie's garage studio, and Taunnie went to work composing and recording "Boy Shoppin'."

Who Needs A Keyboard?

Taunnie can control the entire studio from one location. She doesn't have to get up and try to find buttons or read a screen. She doesn't even need a keyboard. According to Taunnie, "It just gets in my way."

Taunnie talks to the computer and tells it settings for her musical instruments. The computer talks back and tells her the status of everything in the room. She uses an array of foot pedals to remotely operate multitrack recorders, mixers, and other devices in the control room. By singing through a delay box, Taunnie can harmonize with her own voice, create different voices, and give her voices special effects, reverberations, and echoes.

The heart of Taunnie's studio is the Pro Inovator. It's based on an IBM PC–compatible computer with a 48-channel, 16-track MIDI interface, a 20-megabyte hard disk drive and 640K of RAM. With this system, which costs less than $2000, Taunnie can mix together 32 musical instruments in any combination.

The voice recognition and speech synthesis software built into the Pro Inovator is the product of four years of effort by Robert Artusy and a dedicated group of blind people. Together they created something that is far more than a talking computer. According to Artusy, "My team of blind consultants worked very hard to help me design a product that would meet a blind person's needs. First, it had to be affordable, since the average blind person makes less than $3500 a year. Second, it had to run commercial software and use off-the-shelf hardware products. Third, it had to enable a blind or physically challenged person to review anything on the computer screen. Last, it had to be part of a lifelong learning and productivity system for blind people."

Not Only For Music

By using a DECTalk stand-alone speech synthesizer, Artusy was able to create an understandable computer voice with a 25,000-word vocabulary at a fraction of the cost of a digitized speech system. The entire product—including synthesizer, voice recognition and synthesis software, and cable—costs less than $1,000. "A blind person can take this equipment, hook it up to an IBM-compatible computer at home, school, or work," says Artusy. "He or she can do word processing, create databases and spreadsheets, and do anything else people normally do with computers. With this system a person can hold down a computer-related job or go to high school or college."

After her first album is released, Taunnie Howery is looking forward to additional challenges. "My biggest goal in life," says Taunnie, "is to reach people through music." To that end, she has appeared on the TV program "That's Incredible" and worked with Dudley Moore and Christina Crawford on charity benefits for abused and neglected children. She and her mother Diane are now putting together a band composed entirely of disadvantaged people. "We'll show physically challenged people you can do great things if you just make up your mind and go for it."

For more information about Robert Artusy's voice recognition/speech synthesis system, write Enable Talking Software, 1510 E-4 Walnut Avenue, Berkeley, CA 94709, or call 415/540-0389. For more information about the Pro Inovator computer, write Professional Innovations, 2828 Cochran Street, Suite 284, Simi Valley, CA 93063, or call 805/581-2078. ©

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A Nation Of Thieves?

Judging from articles appearing in some of the trade magazines these days, software piracy is becoming a big business. The most conservative estimate I've seen suggests that piracy cost the industry $168 million in 1984 alone. Estimates for 1985 losses are in the $800-million range.

According to industry observers, piracy is largely restricted to software that runs on personal computers, and the bulk of the loss comes from individuals who make copies as "gifts" for others rather than from organized counterfeiters who operate their thievery for profit.

Reasons For Copying

In the past few months I have corresponded with many people who make illicit copies of software. In many cases, these people feel that software is not "property" in the normal sense of the word, and that making a copy doesn't hurt anyone. "Sure I use copied software," one person wrote; "I wasn't going to buy it anyway, so who loses?" Another common argument is that the copy is merely for "testing," and, if the program is any good, a legitimate copy will be purchased from the manufacturer. Still another argument arises: "Most software is overpriced, and I paid enough for my computer, so why should I have to pay for software too?"

One of my favorites among the arguments is: "When I make copies, I am giving free advertising to the software vendor. They should thank me!"

Computer software is not the only victim of this mentality. The popularity of dual-bay tape recorders with "auto-dubbing" features is taken by many to be an indication that we have become a nation of copiers. The copying of audio recordings is thought to be so pervasive that the U.S. Senate has proposed a bill (S. 1739) that would impose a 5-percent royalty tax on all tape recorders, a 25-percent tax on dual-bay recorders, and a $1 (per cassette) tax on blank tapes. It is possible, if software vendors were to form a powerful lobbying organization, that similar legislation would be proposed for computers as well.

Imagine having to pay a special tax when you purchase a second disk drive, or whenever you buy blank disks!

I don't like this proposed legislation for two reasons. First, it penalizes those who do not copy, and second, it provides legitimacy to those who do. Once such a tax goes into effect, it will be easy for people to justify copying by saying, "I already paid my copying tax, so why shouldn't I do it?"

Industry's Response

If the software industry hasn't gotten special legislation enacted, it has tried many other ways to cut down on illicit copying. The most popular method involves *copy-protection* of the disk.

By making disks hard to copy, vendors hope to cut down on the number of "free" copies floating around the user community. In fact, virtually every copy-protection scheme can be broken within a half-hour by anyone who wants to take the time to do it. The real consequence of copy-protection is that legitimate users are burdened with problems when they make legitimate backup copies of a disk, or when they try to install their product on a hard disk. Many vendors allow their product to be copied to a backup disk or to a hard disk, but then require that a master disk be inserted each time the program is booted. This penalizes the honest user who wants to reconfigure the computer system, or who wants to place software on a hard disk drive. The person who makes illicit copies has no such penalty since, once the copy-protection is broken, new copies have no protection at all.

New schemes are being proposed weekly to solve this problem, but I think that copy-protection approaches the problem from the wrong angle.

A Different Approach

Call me naïve if you wish, but I'd like to think that people could be kept from copying software because it is wrong to do so, not because it is too difficult to do. Rather than invest time and energy in copy-protection schemes that are expensive to implement, that penalize honest users, and that can be broken in a short time anyway, I'd rather see the industry launch an educational effort to let the public know that software can be protected under Federal copyright law and that the unauthorized copying of this software is a Federal offense.

Quite simply, it is against the law to copy software.

A second prong in this educational effort would be to help the public understand that software theft is not a "victimless crime," that the loss of revenue can lead and has led to the bankruptcy of software developers. The real tragedy is that, since it is the good software that gets copied, it's the good, innovative developers being driven out of the business.

I feel certain that, once people come to realize the negative consequences of their copying, copy-protection can become a thing of the past. And if it is not enough to say that software copying is a violation of Federal law (which it is), it should be enough to say that we shouldn't copy software simply because it isn't fair to the people who created it in the first place.

David Thornburg enjoys hearing from readers and may be reached in care of this magazine. ©

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Telecomputing Today

Arlan R. Levitan

Fighting The Bloat Factor

Rapid change is one of the few constants in the world of personal computing. In a little over five years, the average personal computer's memory size has grown from about 48,000 bytes to more than one-half million bytes of storage, with one- and two-megabyte memories becoming common. Once the province of well-heeled small business computing, 40-megabyte hard disk drives are well within the reach of the average yuppie's pocketbook.

During this time, the average speed of computer hobbyist modems has barely kept pace. It has moved from 300 to 1200 bits per second (bps) over the past few years. While 2400 bps modems are now in vogue, far higher transmission speeds will be required by the average user in the future. Even now, the amount of computerized data we are likely to handle can be overwhelming.

This point was driven home rather forcibly to me the other day. I had decided to download four days of messages from the Atari ST special interest group on one of the commercial information services. I played it smart (or so I thought) by not pausing to read individual messages, instead capturing all the messages in a steady stream. I settled back in a lounge chair, put a new recording on the stereo, and closed my eyes for a moment....

No Smiles

I was rudely awakened by the bell signal from the computer which indicates that it has finished the download and logged off the information service. I sat down and gawked bleary-eyed at the screen. The sign-off message said that I had been on the system for almost an hour. Was that possible? I exited the terminal program to check the size of the downloaded message file. It consisted of a whopping 245K of text. With a healthy amount of trepidation, I loaded the document into a word processor that reputedly can take advantage of my ST's megabyte of memory. While the file did load, the word processor's performance was decidedly on the slothful side. Just for fun, I tried some global search and change operations. I stopped grinning when I found that each operation took several minutes.

Both my machine and I were victims of information overload, and more of the same is just around the corner for purchasers of so-called state-of-the-art microcomputers. Larger memory sizes encourage larger (and often less efficient) programs. Forget about 8K gems such as the original *Star Raiders* for the Atari 400 and 800. Say goodbye to the "huge" 128K address space of the Commodore 128. Bid a fond farewell to the ho-hum 640K of an IBM PC. There is already talk that serious software for the Amiga, Atari ST, Macintosh, and even PC will soon require at least a million bytes of memory (if not 2 or 4 megabytes) and third-generation versions of the microprocessor chips those machines use today.

Think I'm stretching things? Apple Computer recently posted a new version of the Mac's operating system on the commercial information services two weeks before it was to be distributed to dealers. I was tempted to download all of the files involved—a total of 978,000 bytes—until I took a closer look at what it would cost. Assuming the 75 character-per-second throughput rate I usually experience on that particular service, it would take 3½ hours to download the entire package—at a cost of about $42. Since the update would be available free of charge from my dealer in 14 days, I decided to pass on Apple's generosity.

Unless there is a corresponding increase in the base transmission speed of modems and the throughput of packet-switching networks, this trend bodes ill for the commercial information services and their subscribers. Under present circumstances, many hobbyists are willing to spend half an hour downloading a 48K program at 300 bps and pay $2.50 for the privilege. But how many of them will be willing to cough up $12 an hour to download bloated code for their new, increasingly more voracious computers? In my view, simple economics will force many hobbyists to abandon the commercial services and rely more and more on local, privately owned bulletin board systems and user groups for public domain software and personal networking.

What's Needed?

How fast is fast enough? 2400 bps is generally regarded as a stopgap measure. If modems and the commercial services are to keep pace with the increased demands of 16-bit machines, they will need to support 9600 bps and perhaps even 19,200 bps on regular voice grade lines. Pacific Telephone and several other firms will reportedly bring 19.2K bps technology to the consumer market by early 1988. How the commercial services will see fit to charge for such data rates is anybody's guess. The cost of upgrading existing packet networks to support higher speeds may prove prohibitively expensive.

But the telephone line isn't the only communications link into the American home. Millions of households are already wired for cable television—a medium that can bring you 9600 bps communications for a cost of about $20 per month. We'll look into that next month. ©

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The Beginners Page

C. Regena

The Many Faces Of PRINT

I am happy to be taking over "The Beginner's Page" from Tom Halfhill, who has assumed new responsibilities as editor of COMPUTE!'s Atari ST Disk & Magazine. Since buying my first computer in 1980, I have written hundreds of BASIC programs and have accumulated several newer machines (most recently, an Atari ST). So I have been a "beginner" several times. My goal for this column is to help you learn to program in BASIC on your own computer—and to enjoy doing it. Although each brand of computer has its own quirks, all versions of BASIC share many similarities; this column will focus on broad concepts that apply to all home computers.

This month let's look at one of the most important commands—the PRINT statement. PRINT used by itself prints a blank line on the screen. PRINT may be followed by items to be printed, either variables (using string variable or numeric variable names) or constants (actual numbers, or characters enclosed in quotation marks). You may also print the product of a BASIC function, such as the tangent of an angle or a segment of a string. Many computers allow you to abbreviate the keyword PRINT with a question mark (?).

Printing Multiple Items

If you include more than one item in a PRINT statement, the items may be separated by a special character—usually a comma or semicolon—known as a *delimiter*. Try these commands:

```
PRINT "HELLO","FRIENDS"
PRINT "ME";"AND";"YOU"
```

Notice the difference in the results. On most computers, the comma positions the next item in the next print column. The column width is predefined (different types of computers may use different column widths). The semicolon prints one item right after the other. If you need spaces between words, you can include a space inside the quotation marks as shown here:

```
PRINT "ME";" AND ";"YOU"
```

In some versions of BASIC, you can print multiple items without any delimiters at all, which is the same as using a semicolon. On Commodore computers, for instance, the statement PRINT A$"HI" works the same as PRINT A$;"HI".

When a delimiter falls at the end of a PRINT statement, it affects the next PRINT statement. This method is useful when you want to print something that doesn't fit conveniently into one program line.

```
100 FOR T=1 TO 5
110 READ N$
120 PRINT N$;" ";
130 NEXT T
140 DATA ED,BILL,JOHN,JIMMY,RI
    CHARD
```

Printing Functions

The TAB function mimics the operation of a tab key on a conventional typewriter, allowing you to move to a certain column before printing. The number in parentheses indicates the column where printing begins (some computers start with column 0; others start with column 1). Here are some examples:

```
PRINT TAB(8);"INDENT TO HERE"
PRINT TAB(5);L$;TAB(15);F$
PRINT TAB(T);A;TAB(T+8);B;TAB(
    T+16);C
```

Some computers let you skip screen lines by using a large value with TAB. For example, on a 40-column Commodore computer the statement TAB(85) skips two 40-column lines and indents five spaces. When you print numeric values, keep in mind that the computer adds space before the number to allow for a sign. If the number is negative, a minus sign (−) appears before the number. If the number is positive, an extra blank space appears. If you use TAB with a numeric value, don't forget to allow for these extra spaces.

You may prefer to move the cursor by printing actual spaces. The SPC function prints the number of spaces indicated by the value in parentheses. The difference between TAB and SPC is that TAB usually moves the cursor column without printing anything in the intervening area, but SPC prints spaces.

```
PRINT"SCORE";SPC(5);SC
PRINT "JEFF";SPC(8);"JILL"
PRINT TAB(T);X$;SPC(14);Y$
```

Closely related to the SPC function is the SPACE$ function—available in more advanced BASICs like those for the IBM, Amiga, and Atari ST—which creates a string consisting of the number of spaces specified in parentheses.

```
S$=SPACE$(15)
PRINT "ONE";S$;"TWO"
```

A string made by SPACE$ can also be concatenated (combined) with other strings.

```
S$="ONE"+SPACE$(20)+"TWO"
PRINT S$
```

STRING$ is another useful function of the more advanced versions of BASIC. It works like SPACE$, but allows you to create a string using any ASCII character. The first value enclosed in parentheses is the number of characters desired in the string, and the second item can be either an ASCII value or a character inside quotation marks. For example, you can print a string of 12 asterisks with either STRING$(12,42) or STRING $(12,"*"). ©

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ST Outlook

Philip I. Nelson, Assistant Editor

The New ST BASIC

We recently got an advance look at the new ST BASIC, which, at the time of this writing (July), is still under development by the British firm of MetaComCo. The BASIC itself isn't available, but we have a copy of the manual which describes the new language in detail. The new BASIC will be called MCC BASIC. It retains all the existing BASIC keywords (so it can run ST BASIC programs) and adds a number of new ones. Here's a brief rundown of the more interesting new keywords:

ASK MOUSE, ASK RGB. ASK MOUSE reads the mouse cursor's screen position and button status. ASK RGB tells you what RGB (Red, Green, and Blue) values are currently assigned to a given palette color. RGB (without ASK) redefines a palette color.

BOX. Draws an open or filled box shape.

DRAW, DRAWMODE. The DRAW statement draws a polyline (series of connected lines) defined by a group of *x,y*-coordinate pairs. DRAWMODE controls what happens when you draw over an existing shape.

LINEPAT. For line-drawing operations, selects a system line pattern (solid, dotted, and so on) or a user-defined pattern.

PATTERN. Selects a pattern for fill operations.

GSHAPE, SSHAPE. SSHAPE saves a specified screen area in an array and GSHAPE puts the stored shape on the screen in any location (similar to GET and PUT in IBM BASICA or SSHAPE and GSHAPE in Commodore BASIC 7.0).

MAT AREA, MAT DRAW, MAT LINEF, MAT SOUND. The first three commands perform polyline draw and fill operations (MAT LINEF duplicates MAT DRAW). MAT SOUND causes the ST's sound daemon (processor) to execute sound commands stored in a BASIC array. MAT stands for *matrix*, another name for an array.

GEMDOS, BIOS, XBIOS. Used to call GEMDOS, BIOS, or XBIOS operating system routines from BASIC, much as VDISYS and GEMSYS call VDI and AES routines.

GEM_ADDRIN, GEM_ADDROUT, GEM_CONTRL, GEM_GLOBAL, GEM_INTIN, GEM_INTOUT. Reserved variables that pass information between BASIC and the operating system when calling AES routines with GEMSYS.

STATUS. Reserved variable which returns information (often an error code marking success or failure) after you call a system routine.

Evolution, Not Revolution

On paper, MCC BASIC looks respectable. It offers mouse control, enhanced graphics and sound support, and more convenient access to system routines. But will it be good enough to make BASIC a predominant language for the ST?

Some might question the decision to go with a jazzed-up version of the existing BASIC rather than a completely new implementation. There's something to be said for compatibility. However, it's no secret that a goodly number of ST owners—particularly those who own other computers—are less than enthusiastic about ST BASIC. MCC BASIC fills some of the more glaring gaps in ST BASIC, but it appears to represent an evolutionary, not a revolutionary, change. There are still many jobs that can only be done by programming at the machine level—using system calls rather than BASIC commands.

A second, perhaps more important, question is whether MCC BASIC will stick with ST BASIC's clumsy editor and windowing scheme or replace it with something more convenient. The history of the Commodore 64 and eight-bit Ataris illustrates the value of a good editor. In both cases, many of the computer's best features are available from BASIC only if you program at the lowest level of the machine—by POKEing hardware registers. But both computers are very popular with BASIC programmers, due in no small part to their excellent full-screen BASIC editors. If you make the *process* of programming easy, even unsophisticated programmers enjoy using the computer enough to forgive the fact that BASIC contains some holes.

Interestingly, MetaComCo also wrote ABASIC, the BASIC shipped with the earliest Amigas. As soon as Microsoft's Amiga BASIC became available, Commodore-Amiga scrapped ABASIC and made Amiga BASIC the standard. For anyone who bought an early Amiga, moving from ABASIC to Amiga BASIC was like being given a sleek new sportscar in exchange for a clunky go-kart. ABASIC was better than no BASIC at all, but its primitive, line-oriented editor was a throwback to the earliest days of personal computing. Patterned closely after Microsoft BASIC for the Macintosh, Amiga BASIC has a powerful (some would say, luxurious) editor and ranks with Mac BASIC as one of the most complete implementations of BASIC for any microcomputer.

Are ST owners in for a similar treat? Only the release of MCC BASIC will answer that question. While we await that event, I'd like to know what you think of ST BASIC and what topics you'd like me to cover in this column. Address your comments to me, in care of COMPUTE!, 324 West Wendover Ave., Greensboro, NC 27408. ©

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Donald B. Trivette

Root Computing

In about 1742, a small band of Pennsylvania Indians murdered a settler and his wife and kidnapped their infant daughter. A short time later the Indians boldly rode into the village of Pennington, New Jersey, where the Reverend James Davenport recognized that something was amiss. He and his wife traded the Indians a jug of wine and a loaf of bread for the child and christened her Deliverance Paine—Deliverance for her rescue and Paine for Mrs. Davenport's maiden name. Deliverance grew to womanhood and married her school teacher, William Paisley, Jr., in November 1763. She and William moved south to settle in what is now Greensboro, North Carolina. They raised six sons and two daughters. Deliverance died in 1818 and her husband died four years later.

Deliverance and William Paisley are my great-great-great-great-grandparents. I came across that and lots of other family lore recently when I began researching and recording my ancestors.

Computer Genealogy

Paul Andereck, in his book *Computer Genealogy* (Ancestry Press, 1985), describes several pieces of software available for maintaining family records. He favors three programs for the IBM PC: *Roots II* by CommSoft ($195), *Family Roots* by Quinsept ($185), and *Personal Ancestral File*, written and distributed by the Church of Jesus Christ of Latter-day Saints ($35). After using all three programs for several days, I prefer *Personal Ancestral File*. However, my objections to the other two are more personal than substantive, so don't reject them automatically if you're in the market for genealogical software.

Though its price is quite low, *Personal Ancestral File* is a solid piece of software. And it's simple to use, which may be more important for a genealogy program than for other types of software. Even a computer novice should have no difficulty using this program.

Personal Ancestral File is driven by an old-fashioned numerical menu and each screen is clearly labeled so that you're never lost. Option 1 on the main menu selects data entry, which is the prime function of any genealogy program. For each person in the family tree, you may enter sex, surname, three given names, and both dates and locations for birth, death, christening, and burial. You may also enter notes of any length for any individual. For instance, the first paragraph in this column is the note I included in the record for Deliverance Paine.

After recording the information for Deliverance, I added William Paisley, Jr., and then selected the ADD FAMILY option. This allowed me to pair up Deliverance and William, enter their date and place of marriage, and record their eight children. While this is a convenient way to work—beginning with the older ancestors and working forward in time—*Personal Ancestral File* does not demand that you follow this order. You may add all individuals and pair them into families and children later.

Flexible Data Entry

One nice feature is that the program lets you enter dates in almost any order. The form day/month/year is evidently the conventional form, though all of my records were dated in the form month/day/year. *Personal Ancestral File* converted 1-31-1958 into 31 JAN 1958.

A feature that you may not enjoy as much is this program's obsession with accuracy. You can't simply enter *Deliverance* and then proceed. The program beeps and asks you to type Deliverance again. If you spell the name the same way both times, it is entered in the program's dictionary and thereafter you may enter the name without having to verify it. This feature slows down data entry, but it does reduce errors.

Once your family is entered, there are many ways to use the data. Option 6 on the main menu lets you print data in several forms, including a descendants list, indented by generation, and pedigree chart (often called a tree). Or, suppose you want to retrieve some information: You can search the database by any field. Perhaps you remember your grandmother talking about an aunt Chat but you can't remember who Chat was. *Personal Ancestral File* looks through all the records and displays the one for your great-great-aunt Chat (provided, of course, that you entered such a record in the first place). One of the program's more interesting features is the ability to compute the relationship of any two people in the database. It traces back through the chain until it finds an ancestor common to both individuals, then consults a built-in table to find the relationship.

The minimum configuration for running the IBM version of *Personal Ancestral File* is a 256K MS-DOS computer with 80-column monitor and two disk drives. Apple II and CP/M versions are also available. For those who are interested in customizing the program, the Church also plans to release the source code (Microsoft C) for a nominal fee. To obtain a copy of the program, you must request an order form by calling or writing:

Genealogical Library
35 N. West Temple
Salt Lake City, UT 84150
(801) 531-2331

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Getting Online

Any computer can become an information appliance with the addition of a modem. Hayes-compatible 1200-baud modems can be bought for under $200 now. You may find one small complication when connecting a modem to your Amiga. When purchasing a cable to connect the modem to your Amiga, you must pay close attention to the types of plugs on the cable. The Amiga serial port connector—where you plug in the modem cable—is the gender opposite that of the IBM serial port. (The Amiga port uses a female connector while the IBM uses a male.) Since IBM-style modem cables are more common than Amiga modem cables, you may find it simpler to use an IBM cable with a *gender-changer* module. I'm using one with my Amiga at home. A gender-changer is a small box that attaches to the female plug on the end of the modem cable, terminating in a male connection that plugs into the female connector on the Amiga. Be aware, though, that there is voltage on pins 14, 21, and 23 on the Amiga port, although these pins are not normally used in most RS-232 cables. Check your modem manual to make sure these pins are not connected or grounded on your modem's connector.

When using a direct-connect modem, you are required to call your local phone company to register the modem, as it becomes part of the phone system when you plug it in. Have at hand the FCC registration and ringer equivalence numbers, usually found on the bottom of the modem or in the manual.

Next comes terminal software. In its simplest form, this is a program that monitors the modem for input—displaying it on your screen—and checks the keyboard for your typing, sending it out over the phone lines. The Amiga BASIC "Extras" disk contains a simple terminal program in the BasicDemos folder. More complex terminal programs allow you to transmit a file (uploading) or store incoming data to disk (downloading).

Error-free And Automatic

Programs such as XMODEM allow error-free file transmission. XON/XOFF allows either computer to pause when necessary without missing any characters. Advanced modem software lets you create scripts to automate the process of calling a remote computer, entering your password, and seeking and downloading information—even if you aren't there to monitor your computer.

What can you do with a modem? First, you can call up local bulletin boards, including Amiga-specific ones. These boards offer services where callers discuss everything from the nuts and bolts of computing to controversial political issues. Usually, there are also public-domain programs for you to download. It's expected you'll upload some of your own programs in exchange.

Then there are the commercial information services such as CompuServe, The Source, Delphi, and GEnie. These services provide information such as stock quotes, daily news/weather/sports, and online encyclopedias and books. Via electronic mail, you can send and receive letters directly over the phone. Most of these services let you play games with other users. The popular CB simulation allows dozens of callers to talk via keyboard in a conversational free-for-all. You can also shop by phone, make airline and ticket reservations—even buy and sell commodities.

Always a popular part of these services is the forum specific to your machine. All these services have Commodore or Amiga forums, containing databases of the most popular public-domain software. The forums allow you to exchange messages with other members. It's like belonging to an electronic user group. It's a great way to get help with a problem—just send a question and you'll likely be surprised by how many answers you get.

The Twenty-first Century And Beyond

Perhaps the most powerful option you have with an *autoanswer* modem—one that can pick up the phone and establish a connection automatically when called by another modem—is to set up your own bulletin board. You can buy bulletin board software or download public-domain programs to help manage your own information service. You are the host here, providing your time and equipment to set up a local communications network. Callers will download software and expect to find interesting things to download. Of course, you must insure that you offer only noncopyrighted, public-domain software on your board. If in doubt, leave it out. (Programs published in most magazines, COMPUTE! included, are *not* public domain.) A public bulletin board is a great way to meet people.

Technology is now significantly expanding our communications; we live in an age where we can have our own computers and hook them into a global intelligence net, offering the greatest possibilities yet for personal expression and free choice. Although there are limitations, telecommunication offers us a hint of what life will be like as the global village becomes a reality in the twenty-first century, and beyond. ©

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INSIGHT: Atari

Bill Wilkinson

A Special RAMdisk For The 800XL

This is a continuation of my August column, wherein I discussed some of the ins and outs of memory bank selection on a 130XE computer and gave you a means of referring to your RAMdisk as something other than D8:. At the end of that article, I promised that the September issue would talk about why a 130XE has only 126K bytes of RAM, and other oddities. As you probably noticed, I got sidetracked last month. I hope you didn't mind too much my reminiscing, and I promise to get back to work with this issue.

In fact, let's start working now: You'll recall that I had posed the question "Is there a way to use the extra 16K memory of the 800XL as a RAMdisk?" My answer was a hesitant yes, because it isn't easy (it took me a relatively long time to prepare this article). For example, the extra memory of the XL is located from $C000 to $FFFF (the top 16K bytes of the 6502's address space), which is the same space used by the OS ROMs and the I/O hardware registers (another instance of bank selection). What's wrong with that, you ask? Why can't I just turn off the ROMs and I/O registers and start using the underlying RAM?

With Frightening Regularity

Well, to start with, any time an interrupt occurs, the 6502 looks in some locations in the top of memory (between $FFFA and $FFFF) to find the address of the routine which will process the interrupt. If we have turned off the OS in order to use the extra RAM, those locations surely will contain garbage. And interrupts occur on Atari computers with frightening regularity: once every 1/60 second for screen refresh, once every time a display list interrupt is encountered, once for each key press; the list goes on.

Still there are more problems. Remember all those references in the August issue to 62K of RAM and 126K of RAM, when you would expect the figures to be 64K and 128K? Well, it turns out that, even if we disable the OS ROMs in order to access the extra RAM, there is no way to disable the hardware I/O space (which occupies addresses $D000 through $D7FF). There simply is *no* RAM in these 2K. Period. So we are down to 14K of hard-to-use RAM with a nasty hole in the middle of it.

Any more nasties to contend with? Yes. When your Atari is displaying text of any kind (GRAPHICS 0, 1, or 2, or the text window in other modes), the ANTIC chip gets the shapes of the characters to display from one of two character sets in ROM (American version at location $E000, international set at $CC00). If we turn off the ROMs, either we must first copy the character sets to RAM (thus decreasing usable RAM still further) or we must turn them off only while no characters are being displayed (for example, during the vertical blank interval).

And let's throw in one more monkey wrench: With all versions of DOS 2, including DOS 2.5, the VTOC (Volume Table Of Contents) sector and the directory sectors are smack-dab in the middle of a 720-sector disk. That means they use sector numbers 360 through 368. Hmmm—if we have a 16K RAMdisk, we have 128 simulated sectors. And 360 is bigger than 128. *Kablooey.*

A Tall Order

So, without major surgery, DOS 2.5 cannot use the 800XL's extra RAM as even a small RAMdisk. Work to be done includes (1) changing DOS 2.5's RAMdisk handler to use a different 16K range of memory; (2) fixing the bank select logic so that it turns the OS ROMs on and off instead of actually selecting banks; (3) somehow changing the RAMdisk initialization code so that it knows we have only one bank of RAM and that even that bank has a 2K hole in it; (4) somehow moving the simulated VTOC and directory sectors into our limited 14K (112 pseudo-sector) range; (5) disabling all interrupts while we access the RAM; and (6) only accessing the RAM during the vertical blank interval.

Whew. Tall order, no? The only easy task here is item 6. When we first worked on DOS 2.5, the 130XE hardware had this same restriction, and there is still a flag buried in DOS 2.5 which tells it to wait for the vertical blank period before doing its simulated sector I/O.

Well, the listing accompanying this article does all of the above. When you enter and run this program, it creates a new version of RAMDISK.COM, the special boot file that DOS 2.5 uses, which indeed gives you a 14K RAMdisk. The program is only for 800XL owners, and only for DOS 2.5. It won't work with any other combination of computer or DOS. The program overwrites the existing RAMDISK.COM file on the DOS disk, so be sure you have a backup if you want to keep a copy of the original file.

Some other cautions are also in order:

1. *Don't* hit the RESET key while the RAMdisk is active. This is a sure way to scramble the contents of the RAMdisk.

2. *Don't* try to format the RAMdisk (and this means don't use a BASIC program which uses XIO 254). This version of RAMDISK.COM cheats a little: Because of the need for making a hole in the middle of the pseudodisk where the I/O

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registers are, and because we have to insure that the directory area is within the 16K bounds, we have to tell DOS that some sectors on the disk are already in use. We do this by modifying the VTOC of the RAMdisk *after* it has been formatted. If you reformat the RAMdisk, DOS may try to use those nonexistent pseudosectors and crash your computer.

3. This is a *very* small RAMdisk. If you use it, you'll find 105 free sectors is the maximum. Even to get that figure, I cheated: I allowed only 3 sectors for the directory instead of the customary 8, so you can have a maximum of 24 files on this RAMdisk (probably still overkill). However, DOS does not know about this limitation, and you can crash the system by creating 25 files.

4. *Don't* use DOS's Write DOS Files menu command after booting with the RAMDISK.COM created here. This program actually puts patches right in the middle of DOS, and trying to use an ordinary RAMdisk with the patched DOS could be disastrous.

Although the program here is written in BASIC and creates the RAMDISK.COM file directly, I've made the original assembly language source code available on CompuServe under the filename RAM14K.ASM in the Utilities section of the DownLoad libraries (also known as DL3). I know I promised to do that with the 1027 printer fixer program back in June, but the file never appeared. The explanation is sad, but simple: The disk with my June program on it went bad shortly after I wrote the article. Let that be a lesson: Back up *everything*. I promise to back up this program many times over.

Also, here's an idea for improving this program: It turns out that a total of 105 sectors is 18 sectors greater than the minimum needed to put DUP.SYS and MEM.SAV on the RAMdisk. So why not do so and aid the performance of DOS 2.5 tremendously? The source code is on CompuServe, so have at it.

Finally, there is an error in the 1027 printer fixer listing in my column in the June issue. Line 210 should read:

```
210 OPEN #3,MODE,0,"D:AUTORUN
    .SYS"
```

The error is mine; I gave a test version to COMPUTE! instead of the final one, hence the name "AUTOTEST" in the listing in June.

```
HN 1000 REM This program cre
        ates a
NJ 1010 REM DOS 2.5 RAMDISK.
        COM file
MK 1020 REM for 800XL owners
         to allow
ML 1030 REM use of RAM under
         OS ROMs
GO 1040 REM as a small (105
        sector)
GD 1050 REM RAMdisk.
KL 1060 REM
BE 1070 OPEN #1,8,0,"D:RAMDI
        SK.COM"
BC 1100 READ BYTE
BO 1110 IF BYTE>=0 THEN PUT
        #1,BYTE:CKSUM=CKSUM+
        BYTE:GOTO 1100
BH 1120 CLOSE #1:IF CKSUM<>1
        5523 THEN PRINT "ERR
        OR IN DATA STATEMENT
        S":STOP
JM 1130 END
LC 5000 DATA 255,255,223,7,2
        23,7,0,128
EP 5010 DATA 7,128,7,8,137,1
        1,137,11
EK 5020 DATA 8,63,21,63,21,4
        9,141,20
KO 5030 DATA 157,20,201,3,14
        4,4,40,160
PK 5040 DATA 139,96,32,203,1
        8,165,67,74
PB 5050 DATA 74,9,192,222,18
        ,235,18,106
KO 5060 DATA 106,106,8,173,1
        ,211,74,40
IC 5070 DATA 42,141,1,211,96
        ,0,128,58
LE 5080 DATA 128,173,10,7,9,
        128,141,10
OP 5090 DATA 7,32,224,7,162,
        112,169,254
JI 5100 DATA 157,66,3,169,55
        ,157,68,3
PM 5110 DATA 169,128,157,69,
        3,169,0,157
FP 5120 DATA 74,3,157,75,3,3
        2,86,228
ON 5130 DATA 48,13,160,74,18
        5,0,129,145
PO 5140 DATA 69,136,16,248,3
        2,148,16,96
GB 5150 DATA 68,56,58,0,0,12
        9,73,129
GI 5160 DATA 2,105,0,105,0,0
        ,0,0
BF 5170 DATA 0,0,15,255,255,
        255,0,0
MG 5180 DATA 255,255,255,255
        ,255,255,255,15
OA 5190 DATA 255,255,128,0,0
        ,0,0,0
JF 5200 DATA 0,0,0,0,0,0,0,0
JG 5210 DATA 0,0,0,0,0,0,0,0
JH 5220 DATA 0,0,0,0,0,0,0,0
JI 5230 DATA 0,0,0,0,0,0,0,0
JJ 5240 DATA 0,0,0,0,0,0,0,0
NK 5250 DATA 0,0,224,2,225,2
        ,0,128
EI 5260 DATA -1,(END OF DATA
        )
```

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COMPUTE!

Apple Hex War

There is an error in line 1140 of the Apple version of this game from the July issue (Program 5, p. 50). The last statement in that line should be NEXT L, not MEXT L. This should not have caused problems except in very long games where many armies were moved onto the playing grid. ©

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COMPUTE's Author Guide

Most of the following suggestions serve to improve the speed and accuracy of publication. COMPUTE! is primarily interested in new and timely articles on the Commodore 64/128, Atari, Apple, IBM PC/PCjr, Amiga, and Atari ST. We are much more concerned with the content of an article than with its style, but articles should be clear and well-explained.

The guidelines below will permit your good ideas and programs to be more easily edited and published:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to one make of computer, please state the brand name and, if applicable, the BASIC or ROM or DOS version(s) involved. In addition, *please indicate the memory requirements of programs.*

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. All lines within the text of the article must be double- or triple-spaced. A one-inch margin should be left at the right, left, top, and bottom of each page. No words should be divided at the ends of lines. And please do not justify. Leave the lines ragged.

6. Standard typing paper should be used (no erasable, onionskin, or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).

7. Sheets should be attached together with a paper clip. Staples should not be used.

8. If you are submitting more than one article, send each one in a separate mailer with its own tape or disk.

9. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* If your article was written with a word processor, we also appreciate a copy of the text file on the tape or disk. Please use high-quality 10 or 30 minute tapes with the program recorded on both sides. The tape or disk should be labeled with the author's name, the title of the article, and, if applicable, the BASIC/ROM/DOS version(s). Atari tapes should specify whether they are to be LOADed or ENTERed. We prefer to receive Apple programs on disk rather than tape. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

10. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

11. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. Articles can be of any length—from a single-line routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.

13. If you want to include photographs, they should be either 5×7 black and white glossies or color slides.

14. We do not consider articles which are submitted simultaneously to other publishers. If you wish to send an article to another magazine for consideration, please do not submit it to us.

15. COMPUTE! pays between $70 and $800 for published articles. In general, the rate reflects the length and quality of the article. Payment is made upon acceptance. Following submission (Editorial Department, COMPUTE! Magazine, P.O. Box 5406, Greensboro, NC 27403) it will take from four to eight weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. *Rejected manuscripts are returned to authors who enclose a self-addressed, stamped envelope.*

16. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing, "Revision" on the envelope and the article.

17. COMPUTE! does not accept unsolicited product reviews. If you are interested in serving on our panel of reviewers, contact the Review Coordinator for details.

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COMPUTE!'s Guide To Typing In Programs

Computers are precise—type the program *exactly* as listed, including necessary punctuation and symbols, except for special characters noted below. We have provided a special listing convention as well as a program to check your typing—"The Automatic Proofreader."

Programs for the IBM, TI-99/4A, and Atari ST models should be typed exactly as listed; no special characters are used. Programs for Commodore, Apple, and Atari 400/800/XL/XE computers may contain some hard-to-read special characters, so we have a listing system that indicates these control characters. You will find these Commodore and Atari characters in curly braces; *do not type the braces.* For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A complete list of these symbols is shown in the tables below. For Commodore, Apple, and Atari, a single symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. This will produce a reverse video character on the Commodore (in quote mode), a graphics character on the Atari, and an invisible control character on the Apple.

Graphics characters entered with the Commodore logo key are enclosed in a special bracket: [<A>]. In this case, you would hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S. One exception is {SHIFT-SPACE}. When you see this, hold down SHIFT and press the space bar. If a number precedes a symbol, such as {5 RIGHT}, {6 S}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (white on black) should be entered with the inverse video

Atari 400/800/XL/XE

When you see	Type	See	
{CLEAR}	ESC SHIFT <		Clear Screen
{UP}	ESC CTRL -		Cursor Up
{DOWN}	ESC CTRL =		Cursor Down
{LEFT}	ESC CTRL +		Cursor Left
{RIGHT}	ESC CTRL *		Cursor Right
{BACK S}	ESC DELETE		Backspace
{DELETE}	ESC CTRL DELETE		Delete character
{INSERT}	ESC CTRL INSERT		Insert character
{DEL LINE}	ESC SHIFT DELETE		Delete line
{INS LINE}	ESC SHIFT INSERT		Insert line
{TAB}	ESC TAB		TAB key
{CLR TAB}	ESC CTRL TAB		Clear tab
{SET TAB}	ESC SHIFT TAB		Set tab stop
{BELL}	ESC CTRL 2		Ring buzzer
{ESC}	ESC ESC		ESCape key

Commodore PET/CBM/VIC/64/128/16/+4

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL 9	
{OFF}	CTRL 0	
{BLK}	CTRL 1	
{WHT}	CTRL 2	
{RED}	CTRL 3	
{CYN}	CTRL 4	
{PUR}	CTRL 5	
{GRN}	CTRL 6	
{BLU}	CTRL 7	
{YEL}	CTRL 8	

When You Read:	Press:	See:
[<1>]	COMMODORE 1	
[<2>]	COMMODORE 2	
[<3>]	COMMODORE 3	
[<4>]	COMMODORE 4	
[<5>]	COMMODORE 5	
[<6>]	COMMODORE 6	
[<7>]	COMMODORE 7	
[<8>]	COMMODORE 8	
{F1}	f1	
{F2}	SHIFT + f1	
{F3}	f3	
{F4}	SHIFT + f3	
{F5}	f5	
{F6}	SHIFT + f5	
{F7}	f7	
{F8}	SHIFT + f7	
←	←	

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key (Atari logo key on 400/800 models).

Whenever more than two spaces appear in a row, they are listed in a special format. For example, {6 SPACES} means press the space bar six times. Our Commodore listings never leave a single space at the end of a line, instead moving it to the next printed line as {SPACE}.

Amiga program listings contain only one special character, the left arrow (←) symbol. This character marks the end of each program line. Wherever you see a left arrow, press RETURN or move the cursor off the line to enter that line into memory. Don't try to type in the left arrow symbol; it's there only as a marker to indicate where each program line ends.

The Automatic Proofreader

Type in the appropriate program listed below, then save it for future use. The Commodore Proofreader works on the Commodore 128, 64, Plus/4, 16, and VIC-20. Don't omit any lines, even if they contain unfamiliar commands or you think they don't apply to your computer. When you run the program, it installs a machine language program in memory and erases its BASIC portion automatically (so be sure to save several copies before running the program for the first time). If you're using a Commodore 128, Plus/4 or 16, do *not* use any GRAPHIC commands while the Proofreader is active. You should disable the Commodore Proofreader before running any other program. To do this, either turn the computer off and on or enter SYS 64738 (for the 64), SYS 65341 (128), SYS 64802 (VIC-20), or SYS 65526 (Plus/4 or 16). To reenable the Proofreader, reload the program and run it as usual. Unlike the original VIC/64 Proofreader, this version works the same with disk or tape.

On the Atari, run the Proofreader to activate it (the Proofreader remains active in memory as a machine language program); you must then enter NEW to erase the BASIC loader. Pressing SYSTEM RESET deactivates the Atari Proofreader; enter PRINT USR(1536) to reenable it.

The Apple Proofreader erases the BASIC portion of itself after you run it, leaving only the machine language portion in memory. It works with either DOS 3.3 or ProDOS. Disable the Apple Proofreader by pressing CTRL-RESET before running another BASIC program.

The IBM Proofreader is a BASIC program that simulates the IBM BASIC line editor, letting you enter, edit, list, save, and load programs that you type. Type RUN to activate. Be sure to leave Caps Lock on, except when typing lowercase characters.

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a hexadecimal number (on the Apple) or a pair of letters (on the Commodore, Atari, or IBM) appears. The number or pair of letters is called a *checksum*.

Compare the value displayed on the screen by the Proofreader with the checksum printed in the program listing in the magazine. The checksum is given to the left of each line number. Just type in the program a line at a time (without the printed checksum), press RETURN or Enter, and compare the checksums. If they match, go on to the next line. If not, check your typing; you've made a mistake. Because of the checksum method used, do not type abbreviations, such as ? for PRINT. On the Atari and Apple Proofreaders, spaces are not counted as part of the checksum, so be sure you type the right number of spaces between quote marks. The Atari Proofreader does not check to see that you've typed the characters in the right order, so if characters are transposed, the checksum still matches the listing. The Commodore Proofreader catches transposition errors and ignores spaces unless they're enclosed in quotation marks. The IBM Proofreader detects errors in spacing and transposition.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you enter NEW, the Proofreader prompts you to press Y to be especially sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program as usual (this replaces the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it load faster, but it can no longer be edited with the Proofreader. If you want to convert an existing BASIC program to Proofreader format, save it to disk with SAVE "*filename*",A.

Program 1: Atari Proofreader

By Charles Brannon, Program Editor

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:REA
    D A:POKE I,A:CK=CK+A:N
    EXT I
120 IF CK<>19072 THEN ? "E
    rror in DATA Statement
    s.  Check Typing.":END

130 A=USR(1536)
140 ? :? "Automatic Proofr
    eader Now Activated."
150 END
160 DATA 104,160,0,185,26,
    3,201,69,240,7
170 DATA 200,200,192,34,20
    8,243,96,200,169,74
180 DATA 153,26,3,200,169,
    6,153,26,3,162
190 DATA 0,189,0,228,157,7
    4,6,232,224,16
200 DATA 208,245,169,93,14
    1,78,6,169,6,141
210 DATA 79,6,24,173,4,228
    ,105,1,141,95
220 DATA 6,173,5,228,105,0
    ,141,96,6,169
230 DATA 0,133,203,96,247,
    238,125,241,93,6
240 DATA 244,241,115,241,1
    24,241,76,205,238
250 DATA 0,0,0,0,0,32,62,2
    46,8,201
260 DATA 155,240,13,201,32
    ,240,7,72,24,101
270 DATA 203,133,203,104,4
    0,96,72,152,72,138
280 DATA 72,160,0,169,128,
    145,88,200,192,40
290 DATA 208,249,165,203,7
    4,74,74,74,24,105
300 DATA 161,160,3,145,88,
    165,203,41,15,24
310 DATA 105,161,200,145,8
    8,169,0,133,203,104
320 DATA 170,104,168,104,4
    0,96
```

Program 2: IBM Proofreader

By Charles Brannon, Program Editor

```
10 'Automatic Proofreader Vers
   ion 3.0 (Lines 205,206 adde
   d/190 deleted/470,490 chang
   ed from V2.0)
100 DIM L$(500),LNUM(500):COLO
    R 0,7,7:KEY OFF:CLS:MAX=0:
    LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,C
    HR$(4)+CHR$(70):ON KEY(15)
     GOSUB 640:KEY (15) ON:GOT
    O 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PR
    INT"Proofreader Ready."
150 LINE INPUT L$:Y=CSRLIN-INT
    (LEN(L$)/W)-1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POK
    E 1052,34:POKE 1054,0:POKE
     1055,79:POKE 1056,13:POKE
     1057,28:LINE INPUT L$:DEF
     SEG:IF L$="" THEN 150
170 IF LEFT$(L$,1)=" " THEN L$
    =MID$(L$,2):GOTO 170
```


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```
180 IF VAL(LEFT$(L$,2))=0 AND
    MID$(L$,3,1)=" " THEN L$=M
    ID$(L$,4)
200 IF ASC(L$)>57 THEN 260 'no
     line number, therefore co
    mmand
205 BL=INSTR(L$," "):IF BL=0 T
    HEN BL$=L$:GOTO 206 ELSE B
    L$=LEFT$(L$,BL-1)
206 LNUM=VAL(BL$):TEXT$=MID$(L
    $,LEN(STR$(LNUM))+1)
210 IF TEXT$="" THEN GOSUB 540
    :IF LNUM=LNUM(P) THEN GOSU
    B 560:GOTO 150 ELSE 150
220 CKSUM=0:FOR I=1 TO LEN(L$)
    :CKSUM=(CKSUM+ASC(MID$(L$,
    I))*I) AND 255:NEXT:LOCATE
     Y,1:PRINT CHR$(65+CKSUM/1
    6)+CHR$(65+(CKSUM AND 15))
    +" "+L$
230 GOSUB 540:IF LNUM(P)=LNUM
    THEN L$(P)=TEXT$:GOTO 150
    'replace line
240 GOSUB 580:GOTO 150 'insert
     the line
260 TEXT$="":FOR I=1 TO LEN(L$
    ):A=ASC(MID$(L$,I)):TEXT$=
    TEXT$+CHR$(A+32*(A>96 AND
    A<123)):NEXT
270 DELIMITER=INSTR(TEXT$," ")
    :COMMAND$=TEXT$:ARG$="":IF
     DELIMITER THEN COMMAND$=L
    EFT$(TEXT$,DELIMITER-1):AR
    G$=MID$(TEXT$,DELIMITER+1)
     ELSE DELIMITER=INSTR(TEXT
    $,CHR$(34)):IF DELIMITER T
    HEN COMMAND$=LEFT$(TEXT$,D
    ELIMITER-1):ARG$=MID$(TEXT
    $,DELIMITER)
280 IF COMMAND$<>"LIST" THEN 4
    10
290 OPEN "scrn:" FOR OUTPUT AS
     #1
300 IF ARG$="" THEN FIRST=0:P=
    MAX-1:GOTO 340
310 DELIMITER=INSTR(ARG$,"-"):
    IF DELIMITER=0 THEN LNUM=V
    AL(ARG$):GOSUB 540:FIRST=P
    :GOTO 340
320 FIRST=VAL(LEFT$(ARG$,DELIM
    ITER)):LAST=VAL(MID$(ARG$,
    DELIMITER+1))
330 LNUM=FIRST:GOSUB 540:FIRST
    =P:LNUM=LAST:GOSUB 540:IF
    P=0 THEN P=MAX-1
340 FOR X=FIRST TO P:N$=MID$(S
    TR$(LNUM(X)),2)+" "
350 IF CKFLAG=0 THEN A$="":GOT
    O 370
360 CKSUM=0:A$=N$+L$(X):FOR I=
    1 TO LEN(A$):CKSUM=(CKSUM+
    ASC(MID$(A$,I))*I) AND 255
    :NEXT:A$=CHR$(65+CKSUM/16)
    +CHR$(65+(CKSUM AND 15))+"
     "
370 PRINT #1,A$+N$+L$(X)
380 IF INKEY$<>"" THEN X=P
390 NEXT :CLOSE #1:CKFLAG=0
400 GOTO 130
410 IF COMMAND$="LLIST" THEN O
    PEN "lpt1:" FOR OUTPUT AS
    #1:GOTO 300
420 IF COMMAND$="CHECK" THEN C
    KFLAG=1:GOTO 290
430 IF COMMAND$<>"SAVE" THEN 4
    50
440 GOSUB 600:OPEN ARG$ FOR OU
    TPUT AS #1:ARG$="":GOTO 30
    0
450 IF COMMAND$<>"LOAD" THEN 4
    90
460 GOSUB 600:OPEN ARG$ FOR IN
    PUT AS #1:MAX=0:P=0
470 WHILE NOT EOF(1):LINE INPU
    T #1,L$:BL=INSTR(L$," "):B
    L$=LEFT$(L$,BL-1):LNUM(P)=
    VAL(BL$):L$(P)=MID$(L$,LEN
    (STR$(VAL(BL$)))+1):P=P+1:
    WEND
480 MAX=P:CLOSE #1:GOTO 130
490 IF COMMAND$="NEW" THEN INP
    UT "Erase program - Are yo
    u sure";L$:IF LEFT$(L$,1)=
    "y" OR LEFT$(L$,1)="Y" THE
    N MAX=0:LNUM(0)=65536!:GOT
    O 130:ELSE 130
500 IF COMMAND$="BASIC" THEN C
    OLOR 7,0,0:ON ERROR GOTO 0
    :CLS:END
510 IF COMMAND$<>"FILES" THEN
    520
515 IF ARG$="" THEN ARG$="A:"
    ELSE SEL=1:GOSUB 600
517 FILES ARG$:GOTO 130
520 PRINT"Syntax error":GOTO 1
    30
540 P=0:WHILE LNUM>LNUM(P) AND
     P<MAX:P=P+1:WEND:RETURN
560 MAX=MAX-1:FOR X=P TO MAX:L
    NUM(X)=LNUM(X+1):L$(X)=L$(
    X+1):NEXT:RETURN
580 MAX=MAX+1:FOR X=MAX TO P+1
     STEP -1:LNUM(X)=LNUM(X-1)
    :L$(X)=L$(X-1):NEXT:L$(P)=
    TEXT$:LNUM(P)=LNUM:RETURN
600 IF LEFT$(ARG$,1)<>CHR$(34)
     THEN 520 ELSE ARG$=MID$(A
    RG$,2)
610 IF RIGHT$(ARG$,1)=CHR$(34)
     THEN ARG$=LEFT$(ARG$,LEN(
    ARG$)-1)
620 IF SEL=0 AND INSTR(ARG$,".
    ")=0 THEN ARG$=ARG$+".BAS"
630 SEL=0:RETURN
640 CLOSE #1:CKFLAG=0:PRINT"St
    opped.":RETURN 150
650 PRINT "Error #";ERR:RESUME
     150
```

Program 3: Commodore Proofreader

By Philip Nelson, Assistant Editor

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
    ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
```

Program 4: Apple Proofreader

By Tim Victor, Editorial Programmer

```
10 C = 0: FOR I = 768 TO 768 +
   68: READ A:C = C + A: POKE I
   ,A: NEXT
20 IF C < > 7258 THEN PRINT "ER
   ROR IN PROOFREADER DATA STAT
   EMENTS": END
30 IF PEEK (190 * 256) < > 76 T
   HEN POKE 56,0: POKE 57,3: CA
   LL 1002: GOTO 50
40 PRINT CHR$ (4);"IN#A$300"
50 POKE 34,0: HOME : POKE 34,1:
    VTAB 2: PRINT "PROOFREADER
   INSTALLED"
60 NEW
100 DATA 216,32,27,253,201,141
110 DATA 208,60,138,72,169,0
120 DATA 72,189,255,1,201,160
130 DATA 240,8,104,10,125,255
140 DATA 1,105,0,72,202,208
150 DATA 238,104,170,41,15,9
160 DATA 48,201,58,144,2,233
170 DATA 57,141,1,4,138,74
180 DATA 74,74,74,41,15,9
190 DATA 48,201,58,144,2,233
200 DATA 57,141,0,4,104,170
210 DATA 169,141,96
```

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MLX Machine Language Entry Program For Commodore 64 and Apple

Ottis Cowper, Technical Editor and Tim Victor, Editorial Programmer

"MLX" is a labor-saving utility that allows almost fail-safe entry of machine language programs. The Apple version runs on the II, II+, IIe, and IIc, with either DOS 3.3 or ProDOS.

"MLX" is a new way to enter long machine language (ML) programs without a lot of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter invalid characters or let you continue if there's a mistake in a line. It won't even let you enter a line or digit out of sequence. For the Commodore 64, this new version of MLX was first introduced in the December 1985 issue. No version of 64 MLX published before that date can be used to enter the MLX-format listings in this issue.

Using MLX

Type in and save some copies of whichever version of MLX is appropriate for your computer (you'll want to use it to enter future ML programs from COMPUTE!). Program 1 is for the Commodore 64, and Program 2 is for the Apple. For Apple MLX, it doesn't matter whether you save the program on a disk formatted for DOS 3.3 or ProDOS. Programs entered with Apple MLX, however, must be saved to a disk formatted with the same operating system as MLX itself. If you have an Apple IIe or IIc, make sure that the key marked *Caps Lock* is in the down position.

When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing. If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, the 64 version will offer you the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session. In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. In the 64 version, if you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" machine language listings you may be accustomed to, the extra checksum number on the end allows MLX to check your typing. (Apple users *can* enter the data from an MLX listing using the built-in monitor if the rightmost column of data is omitted, but we recommend against it. It's much easier to let MLX do the proofreading and error checking for you.)

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, the data is added to the workspace area, and the prompt for the next line of data appears (the 64 version gives a pleasant beep to indicate that the line was entered correctly). But if MLX detects a typing error, you'll be notified of the mistake. The 64 version will sound a low buzz and display an error message, then redisplay the line for editing. Apple MLX sounds a beep to alert you of the error and then erases the incorrect line and prompts you to reenter it correctly.

After you have entered the last number on the last line of the listing, the Apple version will return to the command menu. At this point you should immediately choose the option S to save your data. The 64 version automatically moves to the Save option after the last number is entered.

Invalid Characters Banned

In 64 MLX, only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; the new MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; the new MLX automatically enters and checks the line after you type the last digit.

Apple MLX is fairly flexible about how you type in the numbers. You can put extra spaces between numbers or leave the spaces out entirely, compressing a line into 18 keypresses. But be careful not to put a space between two digits in the middle of a number. MLX will read two single-digit numbers instead of one two-digit number (F 6 means F *and* 6, not F6). You must press RETURN to enter the line.

Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), nothing happens (the 64 version gives a warning buzz to indicate an invalid keypress). Even better, MLX checks for transposed characters. If you're supposed to type in *A0* and instead enter *0A*, MLX will catch your mistake.

Editing Features

To correct typing mistakes before finishing a line in the 64 version, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line number prompt.

More editing features are available when correcting lines in which 64 MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the

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screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Apple MLX also includes some editing features. The left- and right-arrow keys allow you to back up and go forward on the line you're entering so that you can retype data. Pressing the CONTROL (CTRL) and D keys at the same time (*delete*) removes the character under the cursor, shortening the line by one character. Pressing CONTROL-I (*insert*) puts a space under the cursor and shifts the rest of the line to the right, making the line one character longer. If the cursor is at the right end of the line, neither CONTROL-D nor CONTROL-I has any effect. To leave Enter mode, press the RETURN key when MLX prompts you with a new line address.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. With Apple MLX, you can stop the display and return to the menu by pressing any key. The 64 version allows you to stop the display and get back to the menu by pressing RETURN, or to pause the display by pressing the space bar (press space again to restart the display).

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE (SAVE DATA in the 64 version) and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. The 64 version will follow this by asking you to press either D or T to select disk or tape.

Those using the 64 version will notice the disk drive starting and stopping several times during a load or save. Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands. Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750), so this should *not* be included when entering the name. (This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name.)

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports any errors detected during the save or load. For the 64 version, the standard disk or tape error messages will be displayed. (Tape users should bear in mind that the Commodore 64 is never able to detect errors when saving to tape.) The 64 version also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The Apple version simply displays the message DISK ERROR if a problem is detected during a Save or Load. If you're not sure why a disk error has occurred, check the drive. Make sure there's a formatted disk in the drive and that it was formatted by the same operating system you're using for MLX (ProDOS or DOS 3.3). If you're trying to save a file and see an error message, the disk might be full. Either save the file on another disk or quit MLX (by pressing the Q key), delete an old file or two, then run MLX again. Your typing should still be safe in memory. If the error message appears during a Load, you may have specified a filename that doesn't exist on the disk.

The Quit menu option has the obvious effect—it stops MLX and enters BASIC. In the 64 version the RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP–RESTORE for the 64 or CONTROL-RESET for the Apple also gets you out.) The 64 version will ask for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option in 64 MLX.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some Commodore 64 ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk or LOAD *"filename"* for tape, and then RUN. (Such programs usually have 0801 as their MLX starting address.) Others must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. (On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000.) In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program. For the Apple, you need to BRUN the program, or you may BLOAD and start the program with a CALL. Again, refer to the article accompanying the machine language program for instructions.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you'll have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

In the Apple version, line 100 traps all errors to line 610. If MLX is typed in correctly, then only disk errors should normally be encountered. A disk error

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message when you're not trying to access the drive—for example, when you first start entering data—indicates a typing error in the MLX program itself. If this occurs, hit CONTROL-RESET to break out of MLX and carefully compare your entry against the printed listing.

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

Program 1: MLX For Commodore 64

Version by Ottis Cowper, Technical Editor

```
100 POKE 56,50:CLR:DIM IN$,I,J
    ,A,B,A$,B$,A(7),N$ :rem 34
110 C4=48:C6=16:C7=7:Z2=2:Z4=2
    54:Z5=255:Z6=256:Z7=127
                       :rem 238
120 FA=PEEK(45)+Z6*PEEK(46):BS
    =PEEK(55)+Z6*PEEK(56):H$="
    0123456789ABCDEF" :rem 118
130 R$=CHR$(13):L$="{LEFT}":S$
    =" ":D$=CHR$(20):Z$=CHR$(0
    ):T$="{13 RIGHT}" :rem 173
140 SD=54272:FOR I=SD TO SD+23
    :POKE I,0:NEXT:POKE SD+24,
    15:POKE 788,52     :rem 194
150 PRINT"{CLR}"CHR$(142)CHR$(
    8):POKE 53280,15:POKE 5328
    1,15               :rem 104
160 PRINT T$" {RED}{RVS}
    {2 SPACES}[8 @]{2 SPACES}"
    SPC(28)"{2 SPACES}{OFF}
    {BLU} MLX II {RED}{RVS}
    {2 SPACES}"SPC(28)"
    {12 SPACES}{BLU}" :rem 121
170 PRINT"{3 DOWN}{3 SPACES}CO
    MPUTE!'S MACHINE LANGUAGE
    {SPACE}EDITOR{3 DOWN}"
                       :rem 135
180 PRINT"{BLK}STARTING ADDRES
    S[4]";:GOSUB300:SA=AD:GOSU
    B1040:IF F THEN180:rem 113
190 PRINT"{BLK}{2 SPACES}ENDIN
    G ADDRESS[4]";:GOSUB300:EA
    =AD:GOSUB1030:IF F THEN190
                       :rem 173
200 INPUT"{3 DOWN}{BLK}CLEAR W
    ORKSPACE [Y/N][4]";A$:IF L
    EFT$(A$,1)<>"Y"THEN220
                        :rem 9
210 PRINT"{2 DOWN}{BLU}WORKING
    ...";:FORI=BS TO BS+EA-SA+
    7:POKE I,0:NEXT:PRINT"DONE
    "                  :rem 139
220 PRINTTAB(10)"{2 DOWN}{BLK}
    {RVS} MLX COMMAND MENU
    {DOWN}[4]":PRINT T$"{RVS}E
    {OFF}NTER DATA"    :rem 62
230 PRINT T$"{RVS}D{OFF}ISPLAY
     DATA":PRINT T$"{RVS}L
    {OFF}OAD DATA"     :rem 19
240 PRINT T$"{RVS}S{OFF}AVE FI
    LE":PRINT T$"{RVS}Q{OFF}UI
    T{2 DOWN}{BLK}"    :rem 238
250 GET A$:IF A$=N$ THEN250
                       :rem 127
260 A=0:FOR I=1 TO 5:IF A$=MID
    $("EDLSQ",I,1)THEN A=I:I=5
                       :rem 42
270 NEXT:ON A GOTO420,610,690,
    700,280:GOSUB1060:GOTO250
                       :rem 97
280 PRINT"{RVS} QUIT ":INPUT"
    {DOWN}[4]ARE YOU SURE [Y/N
    ]";A$:IF LEFT$(A$,1)<>"Y"T
    HEN220             :rem 189
290 POKE SD+24,0:END   :rem 95
300 IN$=N$:AD=0:INPUTIN$:IFLEN
    (IN$)<>4THENRETURN :rem 31
310 B$=IN$:GOSUB320:AD=A:B$=MI
    D$(IN$,3):GOSUB320:AD=AD*2
    56+A:RETURN        :rem 225
320 A=0:FOR J=1 TO 2:A$=MID$(B
    $,J,1):B=ASC(A$)-C4+(A$>"@
    ")*C7:A=A*C6+B     :rem 143
330 IF B<0 OR B>15 THEN AD=0:A
    =-1:J=2            :rem 132
340 NEXT:RETURN        :rem 240
350 B=INT(A/C6):PRINT MID$(H$,
    B+1,1);:B=A-B*C6:PRINT MID
    $(H$,B+1,1);:RETURN:rem 42
360 A=INT(AD/Z6):GOSUB350:A=AD
    -A*Z6:GOSUB350:PRINT":";
                       :rem 32
370 CK=INT(AD/Z6):CK=AD-Z4*CK+
    Z5*(CK>Z7):GOTO390:rem 131
380 CK=CK*Z2+Z5*(CK>Z7)+A
                       :rem 168
390 CK=CK+Z5*(CK>Z5):RETURN
                       :rem 159
400 PRINT"{DOWN}STARTING AT[4]
    ";:GOSUB300:IF IN$<>N$ THE
    N GOSUB1030:IF F THEN400
                       :rem 75
410 RETURN             :rem 117
420 PRINT"{RVS} ENTER DATA ":G
    OSUB400:IF IN$=N$ THEN220
                       :rem 85
430 OPEN3,3:PRINT      :rem 34
440 POKE198,0:GOSUB360:IF F TH
    EN PRINT IN$:PRINT"{UP}
    {5 RIGHT}";        :rem 6
450 FOR I=0 TO 24 STEP 3:B$=S$
    :FOR J=1 TO 2:IF F THEN B$
    =MID$(IN$,I+J,1)   :rem 226
460 PRINT"{RVS}"B$L$;:IF I<24T
    HEN PRINT"{OFF}";  :rem 15
470 GET A$:IF A$=N$ THEN470
                       :rem 135
480 IF(A$>"/"ANDA$<":")OR(A$>"
    @"ANDA$<"G")THEN540
                       :rem 100
490 IF A$=R$ AND((I=0)AND(J=1)
    OR F)THEN PRINT B$;:J=2:NE
    XT:I=24:GOTO550    :rem 46
500 IF A$="{HOME}" THEN PRINT
    {SPACE}B$:J=2:NEXT:I=24:NE
    XT:F=0:GOTO440     :rem 66
510 IF(A$="{RIGHT}")ANDF THENP
    RINT B$L$;:GOTO540:rem 107
520 IF A$<>L$ AND A$<>D$ OR((I
    =0)AND(J=1))THEN GOSUB1060
    :GOTO470           :rem 232
530 A$=L$+S$+L$:PRINT B$L$;:J=
    2-J:IF J THEN PRINT L$;:I=
    I-3                :rem 12
540 PRINT A$;:NEXT J:PRINT S$;
                       :rem 2
550 NEXT I:PRINT:PRINT"{UP}
    {5 RIGHT}";:INPUT#3,IN$:IF
     IN$=N$ THEN CLOSE3:GOTO22
    0                  :rem 106
560 FOR I=1 TO 25 STEP3:B$=MID
    $(IN$,I):GOSUB320:IF I<25
    {SPACE}THEN GOSUB380:A(I/3
    )=A                :rem 81
570 NEXT:IF A<>CK THEN GOSUB10
    60:PRINT"{BLK}{RVS} ERROR:
     REENTER LINE [4]":F=1:GOT
    O440               :rem 161
580 GOSUB1080:B=BS+AD-SA:FOR I
    =0 TO 7:POKE B+I,A(I):NEXT
                       :rem 245
590 AD=AD+8:IF AD>EA THEN CLOS
    E3:PRINT"{DOWN}{BLU}** END
     OF ENTRY **{BLK}{2 DOWN}"
    :GOTO700           :rem 207
600 F=0:GOTO440        :rem 84
610 PRINT"{CLR}{DOWN}{RVS} DIS
    PLAY DATA ":GOSUB400:IF IN
    $=N$ THEN220       :rem 146
620 PRINT"{DOWN}{BLU}PRESS:
    {RVS}SPACE{OFF} TO PAUSE,
    {SPACE}{RVS}RETURN{OFF} TO
     BREAK[4]{DOWN}"   :rem 241
630 GOSUB360:B=BS+AD-SA:FORI=B
    TO B+7:A=PEEK(I):GOSUB350:
    GOSUB380:PRINT S$; :rem 56
640 NEXT:PRINT"{RVS}";:A=CK:GO
    SUB350:PRINT       :rem 144
650 F=1:AD=AD+8:IF AD>EA THENP
    RINT"{DOWN}{BLU}** END OF
    {SPACE}DATA **":GOTO220
                       :rem 170
660 GET A$:IF A$=R$ THEN GOSUB
    1080:GOTO220       :rem 65
670 IF A$=S$ THEN F=F+1:GOSUB1
    080                :rem 28
680 ONFGOTO630,660,630:rem 224
690 PRINT"{DOWN}{RVS} LOAD DAT
    A ":OP=1:GOTO710   :rem 31
700 PRINT"{DOWN}{RVS} SAVE FIL
    E ":OP=0           :rem 32
710 IN$=N$:INPUT"{DOWN}FILENAM
    E[4]";IN$:IF IN$=N$ THEN22
    0                  :rem 229
720 F=0:PRINT"{DOWN}{BLK}{RVS}
    T{OFF}APE OR {RVS}D{OFF}IS
    K: [4]";           :rem 66
730 GET A$:IF A$="T"THEN PRINT
    "T{DOWN}":GOTO880  :rem 90
740 IF A$<>"D"THEN730  :rem 90
750 PRINT"D{DOWN}":OPEN15,8,15
    ,"I0:":B=EA-SA:IN$="0:"+IN
    $:IF OP THEN810    :rem 163
760 OPEN 1,8,8,IN$+",P,W":GOSU
    B860:IF A THEN220  :rem 66
770 AH=INT(SA/256):AL=SA-(AH*2
    56):PRINT#1,CHR$(AL);CHR$(
    AH);               :rem 221
780 FOR I=0 TO B:PRINT#1,CHR$(
    PEEK(BS+I));:IF ST THEN800
                       :rem 171
790 NEXT:CLOSE1:CLOSE15:GOTO94
    0                  :rem 230
800 GOSUB1060:PRINT"{DOWN}
    {BLK}ERROR DURING SAVE:[4]
    ":GOSUB860:GOTO220 :rem 61
810 OPEN 1,8,8,IN$+",P,R":GOSU
    B860:IF A THEN220  :rem 57
820 GET#1,A$,B$:AD=ASC(A$+Z$)+
    256*ASC(B$+Z$):IF AD<>SA T
    HEN F=1:GOTO850    :rem 155
830 FOR I=0 TO B:GET#1,A$:POKE
     BS+I,ASC(A$+Z$):IF ST AND
    (I<>B)THEN F=2:AD=I:I=B
                       :rem 180
840 NEXT:IF ST<>64 THEN F=3
                       :rem 20
850 CLOSE1:CLOSE15:ON ABS(F>0)
    +1 GOTO960,970     :rem 12
860 INPUT#15,A,A$:IF A THEN CL
    OSE1:CLOSE15:GOSUB1060:PRI
    NT"{RVS}ERROR: "A$:rem 114
870 RETURN             :rem 127
880 POKE183,PEEK(FA+2):POKE187
    ,PEEK(FA+3):POKE188,PEEK(F
    A+4):IFOP=0THEN920:rem 178
890 SYS 63466:IF(PEEK(783)AND1
    )THEN GOSUB1060:PRINT"
    {DOWN}{RVS} FILE NOT FOUND
```


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```
":GOTO690          :rem 34
900 AD=PEEK(829)+256*PEEK(830)
:IF AD<>SA THEN F=1:GOTO97
0                  :rem 201
910 A=PEEK(831)+256*PEEK(832)-
1:F=F-2*(A<EA)-3*(A>EA):AD
=A-AD:GOTO930      :rem 75
920 A=SA:B=EA+1:GOSUB1010:POKE
780,3:SYS 63338    :rem 107
930 A=BS:B=BS+(EA-SA)+1:GOSUB1
010:ON OP GOTO950:SYS 6359
1                  :rem 38
940 GOSUB1080:PRINT"{BLU}** SA
VE COMPLETED **":GOTO220
                   :rem 139
950 POKE147,0:SYS 63562:IF ST<
>64 THEN970        :rem 39
960 GOSUB1080:PRINT"{BLU}** LO
AD COMPLETED **":GOTO220
                   :rem 126
970 GOSUB1060:PRINT"{BLK}{RVS}
ERROR DURING LOAD:{DOWN}
{43}":ON F GOSUB980,990,100
0:GOTO220          :rem 233
980 PRINT"INCORRECT STARTING A
DDRESS (";:GOSUB360:PRINT"
)":RETURN          :rem 145
990 PRINT"LOAD ENDED AT ";:AD=
SA+AD:GOSUB360:PRINT D$:RE
TURN               :rem 159
1000 PRINT"TRUNCATED AT ENDING
 ADDRESS":RETURN :rem 166
1010 AH=INT(A/256):AL=A-(AH*25
6):POKE193,AL:POKE194,AH
                   :rem 95
1020 AH=INT(B/256):AL=B-(AH*25
6):POKE174,AL:POKE175,AH:
RETURN             :rem 122
1030 IF AD<SA OR AD>EA THEN105
0                  :rem 135
1040 IF(AD>511 AND AD<40960)OR
(AD>49151 AND AD<53248)TH
EN GOSUB1080:F=0:RETURN
                   :rem 104
1050 GOSUB1060:PRINT"{RVS} INV
ALID ADDRESS {DOWN}{BLK}"
:F=1:RETURN        :rem 224
1060 POKE SD+5,31:POKE SD+6,20
8:POKE SD,240:POKE SD+1,4
:POKE SD+4,33      :rem 19
1070 FOR S=1 TO 100:NEXT:GOTO1
090                :rem 90
1080 POKE SD+5,8:POKE SD+6,240
:POKE SD,0:POKE SD+1,90:P
OKE SD+4,17        :rem 182
1090 FOR S=1 TO 100:NEXT:POKE
{SPACE}SD+4,0:POKE SD,0:P
OKE SD+1,0:RETURN  :rem 8
```

Program 2: MLX For Apple

Version by Tim Victor, Editorial Programmer

```
100 N = 9: HOME : NORMAL : PRIN
    T "APPLE MLX": POKE 34,2: O
    NERR  GOTO 610
110 VTAB 1: HTAB 20: PRINT "STA
    RT ADDRESS";: GOSUB 530: IF
     A = 0 THEN  PRINT  CHR$ (7
    ): GOTO 110
120 S = A
130 VTAB 2: HTAB 20: PRINT "END
     ADDRESS  ";: GOSUB 530: IF
     S  >  = A OR A = 0 THEN  PR
    INT  CHR$ (7): GOTO 130
140 E = A
150 PRINT : PRINT "CHOOSE: (E)NT
    ER DATA";: HTAB 22: PRINT "
    (D)ISPLAY DATA": HTAB 8: PR
    INT "(L)OAD FILE  (S)AVE FI
    LE  (Q)UIT": PRINT
160 GET A$: FOR I = 1 TO 5: IF
    A$ < > MID$ ("EDLSQ",I,1) T
    HEN  NEXT : GOTO 160
170 ON I GOTO 270,220,180,200:
    POKE 34,0: END
180 INPUT "FILENAME: ";A$: IF A
    $ <  > "" THEN  PRINT  CHR$
     (4);"BLOAD";A$;",A";S
190 GOTO 150
200 INPUT "FILENAME: ";A$: IF A
    $ <  > "" THEN  PRINT  CHR$
     (4);"BSAVE";A$;",A";S;",L"
    ;E - S
210 GOTO 150
220 GOSUB 590: IF B = 0 THEN 15
    0
230 FOR B = B TO E STEP 8:L = 4
    :A = B: GOSUB 580: PRINT A$
    ;": ";:L = 2
240 FOR F = 0 TO 7:V(F + 1) = P
    EEK (B + F): NEXT : GOSUB 5
    60:V(9) = C
250 FOR F = 1 TO N:A = V(F): GO
    SUB 580: PRINT A$" ";: NEXT
     : PRINT : IF  PEEK (49152)
     < 128 THEN  NEXT
260 POKE 49168,0: GOTO 150
270 GOSUB 590: IF B = 0 THEN 15
    0
280 FOR B = B TO E STEP 8
290 HTAB 1:A = B:L = 4: GOSUB 5
    80: PRINT A$;": ";: CALL 64
    668:A$ = "":P = 0: GOSUB 33
    0: IF L = 0 THEN 150
300 GOSUB 470: IF F < > N THEN
    PRINT CHR$ (7);: GOTO 290
310 IF N = 9 THEN GOSUB 560: IF
     C < > V(9) THEN PRINT CHR$
    (7);: GOTO 290
320 FOR F = 1 TO 8: POKE B + F
    - 1,V(F): NEXT : PRINT : NE
    XT : GOTO 150
330 IF LEN (A$) = 33 THEN A$ =
    O$:P = O: PRINT CHR$ (7);
340 L = LEN (A$):O$ = A$:O = P:
    L$ = "": IF P > 0 THEN L$ =
     LEFT$ (A$,P)
350 R$ = "": IF P < L - 1 THEN
    R$ =  RIGHT$ (A$,L - P - 1)
360 HTAB 7: PRINT L$;: FLASH :
    IF P < L THEN PRINT MID$ (A
    $,P + 1,1);: NORMAL : PRINT
    R$;
370 PRINT " ";: NORMAL
380 K = PEEK (49152): IF K < 12
    8 THEN 380
390 POKE 49168,0:K = K - 128
400 IF K = 13 THEN HTAB 7: PRIN
    T A$;" ";: RETURN
410 IF K = 32 OR K > 47 AND K <
     58 OR K > 64 AND K < 71 TH
    EN A$ = L$ + CHR$ (K) + R$:
    P = P + 1
420 IF K = 4 THEN A$ = L$ + R$
430 IF K = 9 THEN A$ = L$ + " "
     +  MID$ (A$,P + 1,1) + R$
440 IF K = 8 THEN P = P - (P >
    0)
450 IF K = 21 THEN P = P + (P <
     L)
460 GOTO 330
470 F = 1:D = 0: FOR P = 1 TO L
    EN (A$):C$ = MID$ (A$,P,1):
     IF F > N AND C$ < > " " TH
    EN  RETURN
480 IF C$ < > " " THEN  GOSUB 5
    20:V(F) = J + 16 * (D = 1)
    * V(F):D = D + 1
490 IF D > 0 AND C$ = " " OR D
    = 2 THEN D = 0:F = F + 1
500 NEXT : IF D = 0 THEN F = F
    - 1
510 RETURN
520 J = ASC (C$):J = J - 48 - 7
    * (J > 64): RETURN
530 A = 0: INPUT A$:A$ = LEFT$
    (A$,4): IF LEN (A$) = 0 THE
    N RETURN
540 FOR P = 1 TO LEN (A$):C$ =
    MID$ (A$,P,1): IF C$ < "0"
    OR C$ > "9" AND C$ < "A" OR
     C$ > "Z" THEN A = 0: RETUR
    N
550 GOSUB 520:A = A * 16 + J: N
    EXT : RETURN
560 C = INT (B / 256):C = B - 2
    54 * C - 255 * (C > 127):C
    = C - 255 * (C > 255)
570 FOR F = 1 TO 8:C = C * 2 -
    255 * (C > 127) + V(F):C =
    C - 255 * (C > 255): NEXT :
     RETURN
580 I = FRE (0):A$ = "": FOR I
    = 1 TO L:T =  INT (A / 16):
    A$ =  MID$ ("0123456789ABCD
    EF",A - 16 * T + 1,1) + A$:
    A = T: NEXT : RETURN
590 PRINT "FROM ADDRESS ";: GOS
    UB 530: IF S > A OR E < A O
    R A = 0 THEN B = 0: RETURN
600 B = S + 8 * INT ((A - S) /
    8): RETURN
610 PRINT "DISK ERROR": GOTO 15
    0
```

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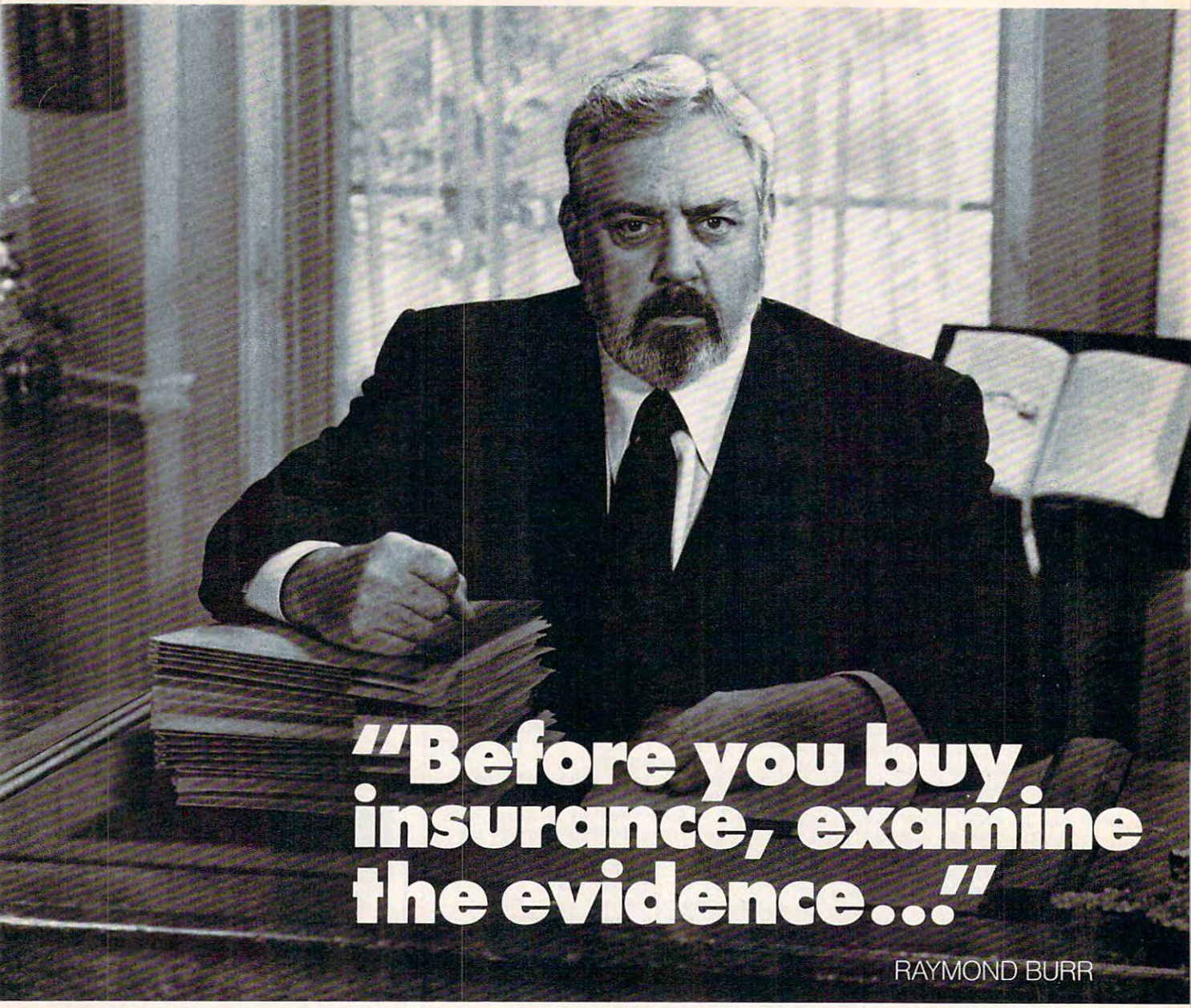

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News & Products

Microsoft Write For ST

Atari Corporation has announced an agreement with Microsoft to offer *Microsoft Write* for the Atari 520ST and 1040ST computers. *Microsoft Write* is based on the Macintosh version of the bestselling *Microsoft Word* word processing program. It takes advantage of the powerful monochrome and color graphics capabilities of the ST computers.

The agreement gives Atari the rights to sell, market, and distribute *Microsoft Write* worldwide.

Atari, 1196 Borregas Ave., Sunnyvale, CA 94086.

Circle Reader Service Number 198.

Eight-Bit Atari World War II Simulation

Rommel: Battles for Tobruk covers four crucial WWII tank battles between the German Afrika Korps and the British 8th Army. This detailed, historically accurate game covers every aspect of the desert war, including individual men, guns, and tanks, as well as minefields, morale, fatigue, supply, air power, and intelligence. A 32-page historical notes booklet is included. After resolving both players' moves simultaneously, *Rommel* displays a strategic map showing a "movie" of everything that happened in the turn.

Rommel can be played against the computer or another human opponent—even by mail or modem. For the Atari eight-bit line, it retails for $40.

Game Designers Workshop, P.O. Box 1646, Bloomington, IL 61702-1646.

Circle Reader Service Number 199.

Brøderbund Educational Program Available For Commodore

Brøderbund has announced that *Where in the World Is Carmen Sandiego?* is now available for the Commodore 64. It's a mystery game in which players track Carmen and her infamous gang of thieves around the world to recover stolen treasures. Players use *The World Alamanac* to decipher clues as they chase the thief from continent to continent. The program helps players learn world geography and reference skills in an exciting and challenging game setting.

The Commodore 64 version retails for $34.95.

Brøderbund Software, 17 Paul Dr., San Rafael, CA 94903-2101.

Circle Reader Service Number 200.

Talking Educational Software For Amiga

Speller Bee and *KidTalk* are the first titles in the Talking Notebook Series, a line of talking educational software from First Byte. Each program offers self-contained, unlimited text-to-speech capabilities, using First Byte's *SmoothTalker* speech technology.

Speller Bee improves children's spelling skills by providing them with practice routines, a variety of challenging games, and simulated test situations. The program helps preschool children improve their word recognition skills, and helps students from first grade through junior high levels increase their vocabulary by allowing them to enter their own spelling lists from school. *Speller Bee* is self-paced, making it especially attractive for students who have difficulties in learning, or who need extra spelling practice at home.

KidTalk is a talking word processor that helps children improve their reading and writing skills and guides them in communicating their ideas more effectively. Children learn the relationship between the sight and sound of individual letters, the relationship of letters to words, and that of words to sentences. Like *Speller Bee*, it contains graphics that help make learning more fun. *KidTalk* is also beneficial to young children who don't yet read because it provides them with a way to hear and recognize letters and words.

Each program retails for $59.95.

First Byte, 2845 Temple Ave., Long Beach, CA 90806.

Circle Reader Service Number 201.

Apple, TI Spelling Practice

Students can practice their spelling skills at home or in school with *Spellbound*, a Robinsoft program from Roberts Information Systems. This educational program for the Apple II series, Commodore 64, and TI-99/4A displays words from a list one at a time and waits for the student to type in the correct spelling underneath. Teachers and parents can enter any word list and save it to disk or tape.

Challenge levels make the spelling words disappear from the screen at faster rates so the student learns to spell from memory. Any misspelled words are recalled when the list is completed, and repeated until spelled correctly. When the student successfully spells the whole list, *Spellbound* scrambles the letters of each word and challenges the student to randomly unscramble them for learning reinforcement.

Spellbound keeps a record of successful attempts by each student.

Spellbound is not copy-protected. The Apple II-series version requires Applesoft BASIC, and the TI-99/4A version requires Extended BASIC.

Spellbound is available for $14.95. Schools may buy a site license for an additional $10.00.

Roberts Information Systems, 152 W. 4th, P.O. Box 666, Prineville, OR 97754.

Circle Reader Service Number 202.

New Stickybear Apple Software

Weekly Reader Software has announced four new Stickybear software packages to help youngsters develop reading, math, drawing, and music skills.

Children ages seven and up can be introduced to drawing with *Stickybear Drawing*, a menu-driven program that lets you use freehand DRAW, CIRCLE, BOX, LINES, BRUSHES, and COLORS features to create original pictures. You can erase portions of the picture or use the zoom feature to adjust individual pixels. All pictures can be saved to disk and printed out.

Stickybear Music teaches the fundamentals of music notation and composition to children seven and up. This program lets you compose a piece of music, play it, modify it, and save it to disk for future replay. With a printer, you can print out the composition and see the notes. There's also a music editing system and a selected group of tunes already on the disk.

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Teachers or parents can select from over 150 word problems in *Math Word Problems* to drill students ages eight and up in addition, subtraction, multiplication, and division. Plus, you can create your own word problems to suit individual needs. This program allows you to record and print out report sheets for up to 50 students, screen the calculator option, and print out problems for test master sheets.

More than 30 stories are stored on the *Stickybear Reading Comprehension* disk for 8- to 11-year-olds. Each story is followed by reading comprehension questions that automatically adjust to the user's skill level. You can also enter your own stories and questions. All the stories on the disk have been approved by Weekly Reader editors and can be printed out.

Stickybear Drawing, Stickybear Music, Math Word Problems, and *Stickybear Reading Comprehension* all work on the Apple II, II+, IIe, and IIc with 48K memory and DOS 3.3 or higher. Each package includes a disk, user's guide, poster, and Stickybear stickers.

The suggested retail price for each of the packages is $39.95.

Weekly Reader Family Software, 245 Long Hill Rd., Middletown, CT 06457.

Circle Reader Service Number 203.

More ST Software From Michtron

Michtron, one of the first companies to release software for the Atari ST, has introduced several new products.

Cornerman is a desk accessory offering features similar to those in Borland's *Sidekick,* plus a few additional ones. Features include a 16-digit calculator with binary, octal, decimal, and hexadecimal modes, scientific function, display formatting, and a printing tape display; a notepad with automatic word-wrap and automatic time and date stamping for every note you write; a telephone log and dialer; a print function; DOS window for instant access to other programs; and a setup function to customize the display. It retails for $49.95.

The Animator lets you take images from a drawing or painting program and bring them to life through animation. After having created the images you want to use, you design a short movie by selecting which frames to show and when and how long to show them. It retails for $39.95.

Mighty Mail contains an easy-to-use database manager that lets users store in each entry a personal name, a company name, two address lines, city, state, zip code, and a telephone number. There are 16 user-definable flags to mark customer types or mailings. *Mighty Mail* then lets the user print mailing labels or generate reports, using the program's search function. It retails for $49.95.

Michtron, 576 S. Telegraph, Pontiac, MI 48053.

Circle Reader Service Number 204.

Do You Have Tass?

Gramps has disappeared to Tonetown, a bizarre place full of snousers, doods, and tass cits. You have to find Gramps and get tass, because if you don't have tass, you'll be labeled a stupid tourist and booted out of Tonetown. Chaz, the keeper of the 'Tique, can help you up your tass level and improve your mental and physical health. But you have to watch out for Franklin Snarl, the green-scaled, furry, and fanged villain.

Tass Times in Tonetown from Activision combines action and animation into an interactive-fiction adventure game.

Tass Times in Tonetown is available for the Commodore 64/128 for $34.95, for the Apple II series and IBM PC/PCjr for $39.95, and for the Amiga and Macintosh for $44.95.

Activision, 2350 Bayshore Frontage Rd., Mountain View, CA 94043.

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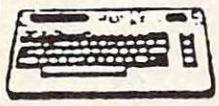

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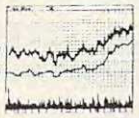

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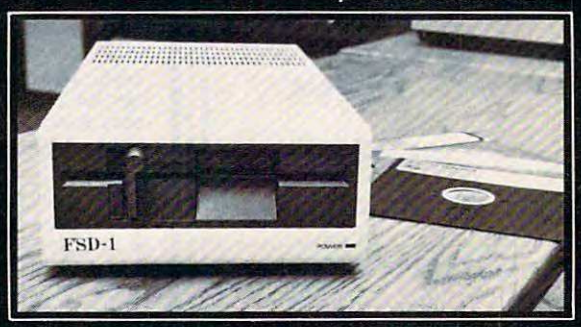

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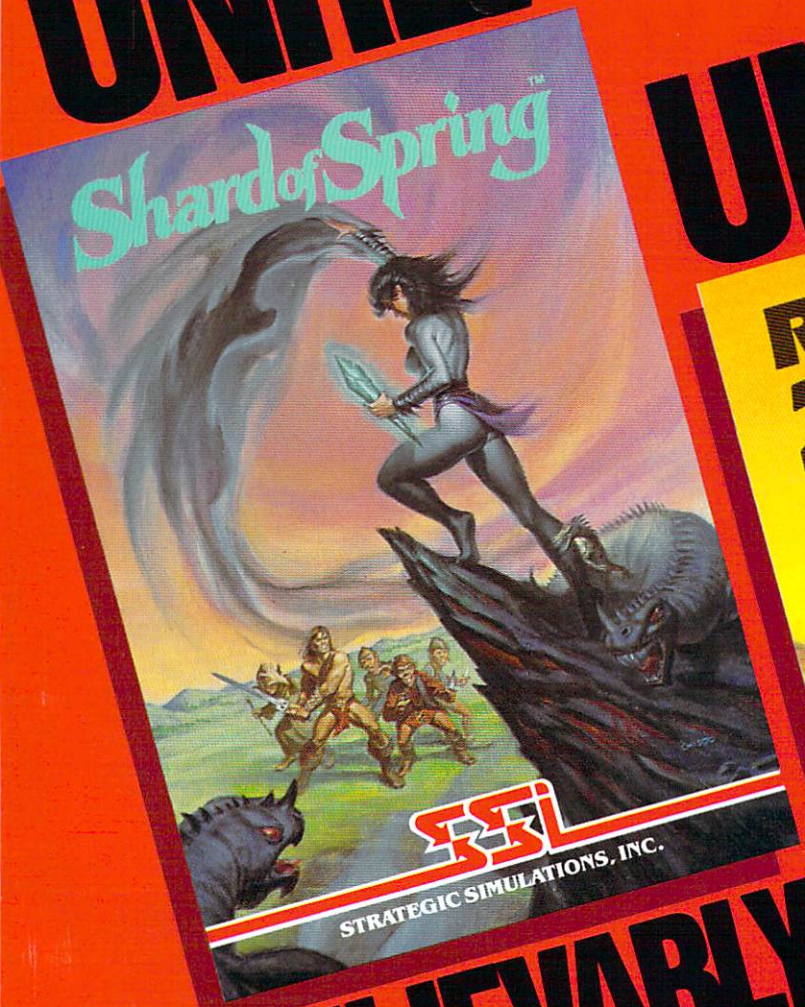

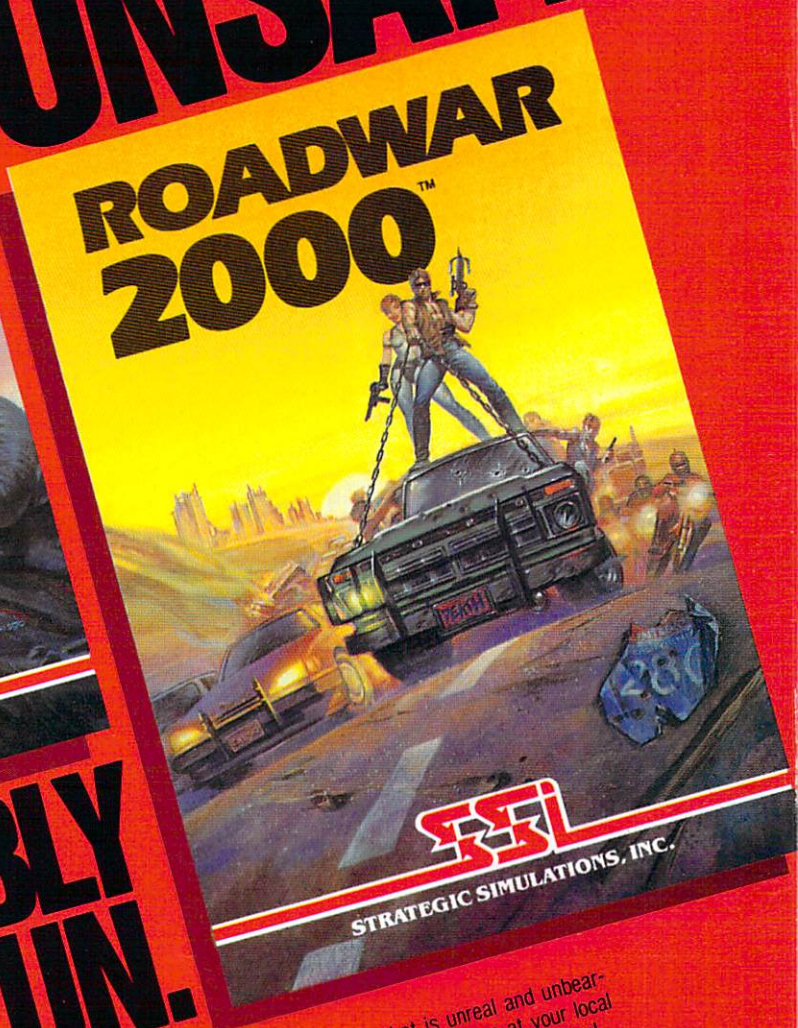

UNBELIEVABLY FUN.

SHARD OF SPRING™, the new multiple-character role-playing game from SSI, promises an adventure unbounded by the mundane constraints of reality. It is set in a world where magic overrides the laws of physics, where monsters, gnomes and elves outnumber mere humans. Your quest is to recover the wondrous Shard, the giver of eternal Springtime. This precious crystal has been stolen by a demonic sorceress. Assemble five characters and endow them with different combinations of speed, intellect, strength, endurance, and warrior/wizardry skills. Then guide them wisely through evil dungeons and treacherous lands as they search to regain the Shard.

This fantasy game boasts a unique feature: During combat, the tactical screen is an exact zoom-in shot of where you are on the overall map.

On disk for 64K Apple® II series and C-64™. IBM® version coming soon.

In ROADWAR 2000™, you get to break a new set of rules, namely the law of safe driving. In the year 2000, bacteriological warfare has ripped apart the very fabric of American civilization. Cities have turned into gangland prizes; the highways, into battlefields. As the patriotic leader of a road gang, you are asked by what is left of the Federal Government to locate eight scientists and return them to a secret underground lab to develop a cure for the dreaded disease. As you crisscross the nation's highways on your desperate mission, you must constantly battle mutants, cannibals, and rival road gangs for new recruits, vehicles, supplies, food, gas, guns, ammunition, and medicine. In this brutal land, they are more precious than gold.

On disk for 48K Apple® II series and C-64™.

For excitement that is unreal and unbearable, check out these games at your local computer/software or game store today!

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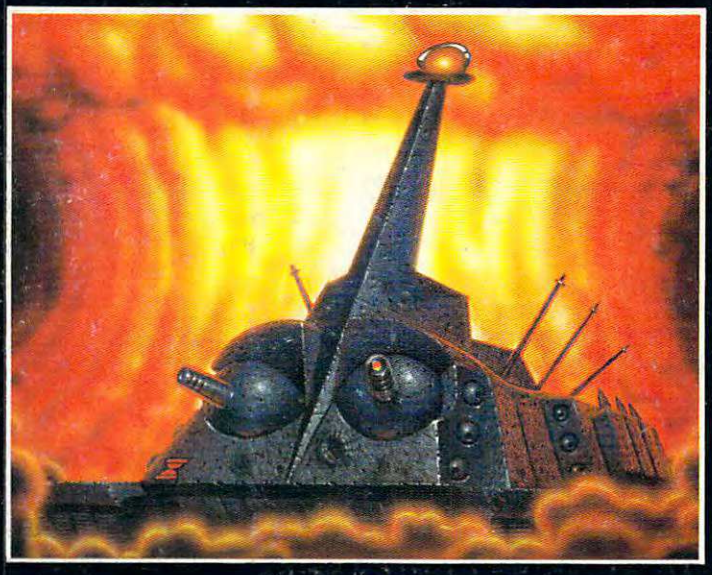
Origin Systems,
creators of the award-winning Ultima® series, presents:

OGRE

Total war against a juggernaut fighting machine

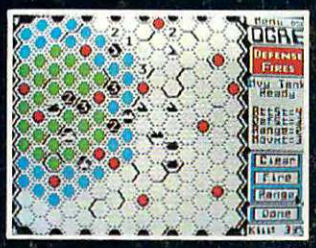
Available on Apple®

by Steve Meuse



A strategy game for one or two players, OGRE pits an array of infantry and armored forces against a single cybernetic supertank, bristling with weapons—the OGRE.

Adapted from the classic Steve Jackson board game, Computer OGRE epitomizes simplicity and play balance. Players can use standard game maps or design their own.



Using the RANGE option, a heavy tank considers its move and fire range.

OGRE—the challenge of a lifetime is waiting.

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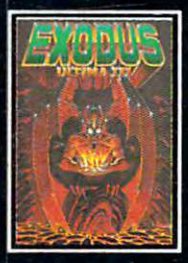
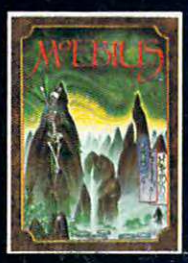


ULTIMA™ III sends you on an incredible fantasy role-playing journey through monster-plagued Sosaria in search of the elusive Exodus.

ULTIMA™ IV is the long-awaited sequel to Ultima™ III. The Quest of the Avatar is a quest to the final frontier—the self.



MOEBIUS™ takes you through the elemental planes of a colorful Oriental world of fantasy and adventure in search of the Orb of Celestial Harmony.

AUTODUEL™ is a futuristic fast-paced strategy role-playing game where the right of way goes to the biggest guns.

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