```
410 PRINT@459,CHR$(CM);"{5 SPACES}"
    ;CHR$(CM)
420 FOR I= 1 TO 2500:NEXT I:D=0:GOT
    O 220
430 REM YOU DID IT!!
440 FOR I=8 TO 0 STEP -1:SOUND I*30
    +5,2:CLS I:NEXT I
450 FOR I=0 TO 8:SOUND I*30+5,1:CLS
     I:NEXT I
460 CLS 7:PRINT@106,"YOU DID IT!!";
470 PRINT@167,"PLAY AGAIN (Y/N) ";:
    INPUT A$:IF A$="Y" THEN D=0:GOT
    O 130
480 CLS:END
```

Program 5: First Math – Apple Version

```
100  GOSUB 670
110  GOTO 260
120  DIM X(100),Y(100)
130 P = 2 * (355 / 113): FOR I = 1 TO 1
     00:ANGLE = P * (I / 100):X(I) = 15
      *  SIN (ANGLE):Y(I) = 15 *  COS (
     ANGLE): NEXT I
140  RETURN
150  POKE 230,32: CALL 62450: HGR : CALL
      - 1994: GR : COLOR= 7: PLOT 16,15
     : PLOT 24,15: COLOR= 4: PLOT 20,19
160  COLOR= 11: IF C1 = 0 THEN 190
170  PLOT 15,23: PLOT 25,23: PLOT 16,24
     : PLOT 24,24: PLOT 17,25: PLOT 23,
     25: HLIN 18,22 AT 26
180  GOTO 200
190  HLIN 18,22 AT 23: PLOT 17,24: PLOT
     23,24: PLOT 16,25: PLOT 24,25: PLOT
     15,26: PLOT 25,26
200  COLOR= 1
210  FOR I = 1 TO 100: PLOT X(I) + 20,Y
     (I) + 20: NEXT I
220  VTAB 22: HTAB 10: FLASH : IF C1 =
     1 THEN  PRINT "  G O O D   J O B !
     ! ": NORMAL : GOTO 250
230  NORMAL : VTAB 22: HTAB 6: PRINT "S
      O R R Y , B U T  ";B;" ";A$;" ";C
     ;"=";" ";: INVERSE : PRINT E: NORMAL

240  FOR I = 1 TO 2000: NEXT I
250  FOR I = 1 TO 1500: NEXT I: HOME : HGR
     : POKE 34,0: HOME : TEXT : RETURN

260  HOME : INVERSE : VTAB 10: HTAB 12:
      PRINT "F I R S T   M A T H": NORMAL
     : VTAB 18: HTAB 4: PRINT ". . . W
     A I T  A  S E C O N D"
270  GOSUB 120
280  HOME : VTAB 4: HTAB 7: PRINT "TO "
     ;: INVERSE : PRINT "ADD";: NORMAL
     : PRINT "       : TYPE +"
290  VTAB 6: HTAB 7: PRINT "TO ";: INVERSE
     : PRINT "SUBTRACT";: NORMAL : PRINT
     " : TYPE -"
300  VTAB 8: HTAB 7: PRINT "TO ";: INVERSE
     : PRINT "MULTIPLY";: NORMAL : PRINT
     " : TYPE *"
310  VTAB 10: HTAB 7: PRINT "TO ";: INVERSE
     : PRINT "DIVIDE";: NORMAL : PRINT
     " : TYPE /"
320  VTAB 13: HTAB 7: PRINT "YOUR CHOIC
     E= ";
330  INPUT A$: IF A$ <  > ("*") AND A$ <
      > ("+") AND A$ <  > ("-") AND A$ <
      > ("/") THEN 330
340  VTAB 17: HTAB 7: INPUT "HIGHEST NU
     MBER= ?";UL: VTAB 19: HTAB 7: INPUT
     "LOWEST NUMBER=  ?";LL
350 R = UL + 1 - LL
360 C =  INT ( RND (1) * R) + LL:B =  INT
     ( RND (1) * R) + LL
370  IF A$ = ("+") THEN  DEF  FN A(X) =
     B + C

380  IF A$ = ("-") THEN  DEF  FN A(X) =
     B - C
390  IF A$ = ("*") THEN  DEF  FN A(X) =
     B * C
400  IF A$ = ("/") AND C = 0 THEN 360
410  IF A$ = ("/") AND  INT (B / C) <  >
     B / C THEN 360
420  IF A$ = ("/") THEN  DEF  FN A(X) =
     B / C

430  HOME : VTAB 7: HTAB 8: PRINT "CORR
     ECT ANSWERS IN A ROW= ";: INVERSE
     : PRINT D: NORMAL
440 E =  FN A(X): VTAB 15: HTAB 15: PRINT
     B;" ";A$;" ";C;"= ";: INPUT F: IF
     F <  > E THEN 480

450  HOME :C1 = 1: GOSUB 150
460 D = D + 1: IF D = 10 THEN 500
470  GOTO 360
480  HOME :C1 = 0: GOSUB 150
490 D = 0: GOTO 430
500  REM  YOU WIN!!
510 D = 0: GOSUB 560
520  VTAB 22: HTAB 8: FLASH : PRINT "
     Y O U   D I D   I T !!"

530  FOR I = 1 TO 5: POKE 768,1: POKE 7
     69,200 - I * 30: CALL 770: NEXT I:
      FOR I = 1 TO 10: POKE 768,1: POKE
     769,40 + I * 20: CALL 770: NEXT I
540  NORMAL : VTAB 24: HTAB 10: PRINT "
     TRY AGAIN (Y/N) ?";: GET A$: IF A$
      = ("Y") THEN  TEXT : GOTO 280
550  TEXT : HOME : HTAB 5: VTAB 8: PRINT
     "...SEE YA LATER...": END

560  POKE 230,32: CALL 62450: HGR : CALL
      - 1994: GR
570  FOR J = 1 TO 3
580 CL = 0:L0 = 0:H1 = 19:S1 = 1: GOSUB
     620
590 CL = 17:L0 = 19:H1 = 0:S1 =  - 1: GOSUB
     620
600  NEXT J
610  RETURN
620  FOR I = L0 TO H1 STEP S1: COLOR=  INT
     ( RND (1) * CL):X1 = 19 - I:X2 = 2
     0 + I:Y1 = 19 - I:Y2 = 20 + I

630  HLIN X1,X2 AT Y1: VLIN Y1 + 1,Y2 AT
     X2
640  HLIN X2 - 1,X1 AT Y2: VLIN Y2 - 1,
     Y1 AT X1
650  NEXT I
660  RETURN
670  REM  LOAD MUSIC ROUTINE
680  FOR I = 770 TO 795: READ M: POKE I
     ,M: NEXT I
690  DATA  172,01,03,174,01,03,169,04,3
     2,168,252,173,48,192,232,208,253,1
     36,208,239,206,0,03,208,231,96
700  RETURN
```

©

BLOCKHEAD

Matt Giwer

The blockhead moves vertically, bouncing as he goes, and tries to pop the floating balloons. You must catch him as he comes down, but his wildly erratic movements make that very difficult. Versions for 64 and Atari – requires paddles.

"Blockhead" is similar to some of the early arcade games. You will need a paddle in position one to play. The knob controls the position, and the trigger bounces the blockhead. The objective is to pop the balloons and catch the blockhead when he comes back down. When the blockhead hits the balloons, there will be an explosion; he will be bounced around, hitting more balloons.

After you clear one screen of balloons, you will get a new set and advance to the next level of play. At each advancing level the blockhead moves more wildly as he comes down. More balloons will be punctured, but there is also a greater chance either of missing him or of his being thrown outside the area of play. There are five blockheads per game. When you miss the last one, you will be given the opportunity for a new game.

Subroutine Strategy

Although Blockhead seems like a simple game, there is more involved than might first be imagined. Let's take a look at the game logistics in the Atari version. The blockhead must move up and down. A calculated trajectory would slow down the game considerably, so the vertical motions are stored in strings, BU$ and BD$. The numbers in these strings, in groups of three, are the vertical positions that use VAL(BU$(x,x+2)) POKEd into PLY, which is the vertical position of the blockhead. Blockhead is Player 0 of the P/M graphics.

Since activities such as scoring are sometimes required to be called out of the normal game sequence, this is a subroutine-oriented program. For example, when the last blockhead is missed, the game goes to the subroutine at line 6000. The number of balloons broken still has to be counted, so the subroutine SCORE is called here also. At line 1910, the start of the first game, or at line 6030, the start of a new game, the program waits for a trigger pull by calling the subroutine TRGR. But when it goes to a new level, line 5840, there is no need to wait for a trigger pull, so it is not called. Line 2175 sets up a new game, but only after the player has agreed by pulling the trigger as called in line 6030.

The rest of the game is straightforward. The P/M graphics are set up starting at line 30000. From this line on, REMs are used to indicate significant routines, statements, or definitions. The Vertical Blank Interrupt routine defines player movement. The definition of each player is also noted by REMs.

The lines discussed below are of special interest.

Lines 5012 and 5512 evaluate the BU$ and BD$ to determine the vertical positions.

Line 5109 determines the horizontal position of the blockhead with respect to the position of the graphics.

Lines 5110-5114 pop balloons two or four at a time depending on the size of the player. The eight bits of the player control eight color clocks, while the eight bits of a character in GRAPHICS 0 control only half-color clocks. The result is that eight bits in P/M graphics are twice as wide as eight bits in normal graphics.

Line 5810 calls the machine language string written in line 51. This routine reads the top lines of the screen and counts the number of occurrences of the CTRL T "balloons" at the top of the screen. The 23rd character in this string, the uppercase T, determines which character is searched for. To search for a different character, the T must be replaced. First look at Table 9.6 (p. 55) of the *Atari BASIC Reference Manual* and find the number of the character you want to search for. Then look at Appendix C and find the ATASCII character for that number, and substitute the ATASCII character for the T. This machine language string works for only the first 256 locations on the screen, or for about six and one-half lines.

Note the POKE PLX+1, PADDLE(0) used in most subroutines. This is the catching platform; you are asked to update its position whenever possible. This is required so the platform won't end up off of the screen as you turn the knob.

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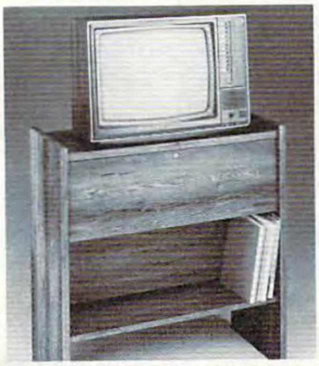

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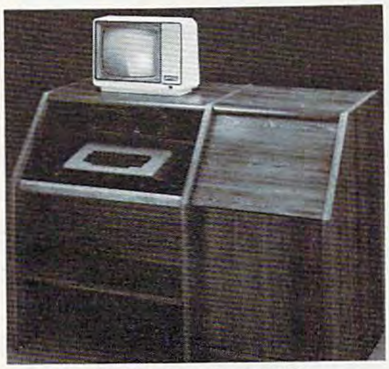

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Notes For 64 Version Of Blockhead

Gregg Peele, Programming Assistant

The Commodore 64 version of "Blockhead" utilizes the eight available sprites and an interrupt-driven routine which continues running even when the BASIC program is stopped. Using this machine language routine provides for optimal motion within the game and provides a means to constantly monitor the position of the sprites and set or unset the most significant bit of each sprite depending on which side of the "seam" the sprite is on.

This game works using a timer. The object of the game is to "pop" the balloons as they float across the sky. The more balloons that you pop within your time limit, the more points you receive. Not only must you continually attempt to pop balloons, but you must also catch the blockhead before he falls below his home base. If you miss catching him, points are deducted until you can bring him back to the surface (using the fire button).

The original version of this game is written to be used with Atari-style paddles. If you have Commodore paddles, you must change lines 1070 and 1080 to read as follows:

```
1070 DATA 216,24,173,164,194,105,28,141
1080 DATA 161,194,56,173,164,194,233,217
```

This alteration leaves a slight glitch in the paddle movement around the seam but provides for optimal range for movement around the screen.

Blockhead utilizes the collision register to detect when one sprite "touches" another sprite. Since the collision register is changed only temporarily when sprites collide, the contents representing the collision must be saved until an event occurs which may again make the sprite collide with another sprite. The stored register is then cleared and the sprite is again ready for collision. Collision detection between the blockhead and the balloons is handled through BASIC. Since BASIC runs at a relatively slow rate, the blockhead must hit the balloon squarely to initiate a collision. A glancing blow will not generally "pop" a balloon.

BEFORE TYPING...
If you're new to computing, please read "How To Type COMPUTE!'s Programs" and "A Beginner's Guide To Typing In Programs."

Program 1: Atari Blockhead

```
50 DIM B$(40)
51 B$="h▒Y{E}▒▒X{E}UD{,}{E}T{E}U"
   {,}■{,}1VTT P{A}hH{H}I{,}PS{J}{E}T
   ‘"
90 DIM T1$(35),BU$(60),BD$(60),N$(10
   )
95 BU$="182152127107092072067062057
   052045"
96 BD$="045052057062067072092107127
   152182192212255"
97 N$="1 2 3 4 5 "
100 BOUNCEUP=5000:HITTEST=5100:MOVE2
    =5200:SETUP=5300:START=5400:BOUN
    CEDOWN=5500:CATCH=5600:MISS=5700
110 SCORE=5800:START1=5450:LEVEL=590
    0:LOSS=6000:EXPLO=6100:TRGR=6200
150 LEV=3:C=1:PPP=9
1900 GOSUB 30000
1910 GOSUB START:GOSUB TRGR:GOSUB ST
     ART1
2000 REM CONTROL LOOP
2100 FOR IJK=0 TO 1 STEP 0
2150 GOSUB MOVE2
2160 GOSUB BOUNCEUP
2170 GOSUB BOUNCEDOWN
2175 IF NGAME=1 THEN GOSUB START:GOS
     UB START1:NGAME=0:GOTO 2900
2180 GOSUB SCORE
2900 NEXT IJK
5000 REM BOUNCEUP
5005 I=-1:B=A
5007 C=-C
5010 FOR IJK=0 TO 1 STEP 0:I=I+1:POK
     E 53278,0
5012 TRAP 5090:R=VAL(BU$(I*3+1,I*3+3
     )):TRAP 40000
5020 POKE PLY,R:SOUND 0,R+A,10,15
5022 IF PEEK(53252)<>0 THEN IF B<58
     OR B>190 THEN POKE 53278,0:C=-C
     :B=B+(10*C):POKE PLX,B
5030 POKE PLX,B:IF PEEK(53252)<>0 TH
     EN GOSUB HITTEST:GOTO 5080
5070 A=PADDLE(0):POKE PLX+1,A
5080 NEXT IJK
5090 RETURN
5100 REM HITTEST
5105 POKE PLX+3,0:POKE 53278,0:IF B<
     54 OR B>192 THEN 5190
5109 BB=INT((B-46)/4):POKE PLX+1,PAD
     DLE(0)
5110 IF R=67 THEN POSITION BB,4:? "
     ";:GOTO 5140
5111 IF R=62 THEN POSITION BB,4:? "
     {DOWN}{2 LEFT}  ";:GOTO 5140
5112 IF R=57 THEN POSITION BB,3:? "
     {DOWN}{2 LEFT}  ";:GOTO 5140
5113 IF R=52 THEN POSITION BB,2:? "
     {DOWN}{2 LEFT}  ";:GOTO 5140
5114 IF R=45 THEN POSITION BB,1:? "
     {DOWN}{2 LEFT}  ";
5140 POKE PLX+2,B:POKE PLY+2,R:SOUND
```

```
      1,R+BB,6,15:B=B+4*INT(3*RND(0)
     -1):I=I-INT(2*RND(0)):SOUND 1,0
     ,0,0
5150 POKE PLX+2,0:POKE PLY+2,0
5190 RETURN
5200 REM MOVE2 CLOWN AND PLATFORM
5210 FOR IJK=0 TO 1 STEP 0
5218 A=PADDLE(0)
5230 TRAP 5240:POKE PLX,A:POKE PLX+1
     ,A:TRAP 40000
5240 IF PTRIG(0)=0 THEN 5290
5280 NEXT IJK
5290 POKE PLX+3,A:POKE PLY,172:Q=1*1
     :POKE 77,0:RETURN
5300 REM SETUP
5320 POKE PLX,100:POKE PLY,180
5322 POKE PLX+1,100:POKE PLY+1,192
5324 POKE PLX+3,0:POKE PLY+3,183
5390 RETURN
5400 REM START
5410 T1$="{32 T}"
5420 FOR I=1 TO 4:POSITION 4,I:? T1$
     :NEXT I
5430 FOR I=0 TO 20:POSITION 1,I:? "
     {B}";:NEXT I
5431 FOR I=0 TO 20:POSITION 38,I:? "
     {V}";:NEXT I:POSITION 2,21:? N$
     ;
5432 POSITION 2,22:? "PUSH TRIGGER T
     O START{10 SPACES}";
5439 RETURN
5450 POSITION 2,21:? N$;" LEVEL:";LE
     V;"  SCORE: ";SC;
5454 POSITION 2,22:? "{31 SPACES}";:
     POSITION 10,21:? " ";:Q=1^1
5460 POKE 77,0:N$(9,9)=" "
5470 POSITION 12,22:? "HIGH SCORE ";
     HSCR
5490 RETURN
5500 REM BOUNCEDOWN
5505 I=-1:POKE 53278,0
5510 FOR IJK=0 TO 1 STEP 0:I=I+1:POK
     E 53278,0
5512 TRAP 5585:R=VAL(BD$(I*3+1,I*3+3
     )):TRAP 40000
5520 POKE PLY,R:SOUND 0,R+A,10,15
5521 POSITION 4,22:? I;
5522 IF PEEK(53252)<>0 THEN IF B<58
     OR B>190 THEN POKE 53278,0:C=-C
     :B=B+(10*C):POKE PLX,B
5528 TRAP 5529:B=B+(LEV*C):POKE PLX,
     B:TRAP 40000
5529 IF PEEK(53252)<>0 THEN GOSUB HI
     TTEST:GOTO 5080
5530 IF PEEK(53261)<>0 THEN GOSUB CA
     TCH:SOUND 0,0,0,0:GOTO 5590
5570 POKE PLX+1,PADDLE(0):GOTO 5580
5580 NEXT IJK
5585 GOSUB MISS:SOUND 0,0,0,0
5590 RETURN
5600 REM CATCH
5610 POKE PLY,182:POKE 53278,0
5690 RETURN
5700 REM MISS
5710 SOUND 0,0,0,0:POKE 53278,0:GOSU
     B EXPLO
5720 PPP=PPP-2:IF PPP=-1 THEN GOSUB
     LOSS:GOTO 5790
5722 N$(PPP,PPP)=" "
5724 GOSUB START1
5780 POKE PLY,182
5790 RETURN
```

```
5800 REM SCORE
5805 JUMPS=JUMPS+2
5810 S=USR(ADR(B$))
5820 SCR=128-S:SC=SCR*5-JUMPS+SCC
5830 POSITION 29,21:? SC;
5840 IF S=0 THEN GOSUB LEVEL:GOSUB S
     TART:GOSUB START1:POKE 53761,16
     0
5890 RETURN
5900 REM LEVEL
5910 LEV=LEV+3
5920 SCC=SC
5990 RETURN
6000 REM LOSS
6005 GOSUB SCORE
6010 IF SC>HSCR THEN HSCR=SC
6020 POSITION 10,10:? "SORRY, YOU LO
     SE";
6030 POSITION 9,11:? "PUSH TRIG FOR
     ANOTHER GAME";:SCC=0:SOUND 0,0,
     0,0:JUMPS=0:LEV=3:SC=0:PPP=9
6035 GOSUB TRGR
6040 POSITION 2,21:? "{35 SPACES}";
6080 POSITION 10,10:? "{15 SPACES}";
6082 POSITION 9,11:? "{26 SPACES}";:N
     GAME=1:N$="1 2 3 4 5 "
6090 RETURN
6100 REM EXPLO
6105 FOR IKK=14 TO 0 STEP -2
6110 SOUND 3,200/(IKK+1),0,15:Q=1^1
6112 A=PADDLE(0):POKE PLX,A:POKE PLX
     +1,A
6115 NEXT IKK
6120 SOUND 3,0,0,0
6190 RETURN
6200 REM TRGR INPT
6210 IF PTRIG(0)=1 THEN 6210
6290 RETURN
30000 REM *****PM SETUP*****
30010 GRAPHICS 0:POKE 106,PEEK(106)-
      16:GRAPHICS 0:POKE 752,1
30204 POKE 53277,3:REM *****GRACTL P
      LAY&MISS*****
30206 POKE 559,62:REM *****DMACTL,1L
      INE,PLAY,MIS,NORM FIELD*****
30208 POKE 54279,PEEK(106):REM *****
      32PAGE RESERVE*****
30210 POKE 53256,0:POKE 53257,0:POKE
       53258,0:POKE 53259,0:REM ****
      *PLAY SIZES*****
30212 POKE 623,33:REM *****PRIORITY
      PF OVER PL*****
30214 MYPMBASE=256*PEEK(106):REM ***
      **NEW PM BASE*****
30230 POKE 704,150:POKE 705,199:POKE
       706,15:POKE 707,199:POKE 1788
      ,(PEEK(106)+4):REM *****START
      OF PM DATA*****
30232 POKE 710,52:POKE 709,58:POKE 7
      11,29:POKE 712,0
30236 REM *****VBLANK INTERUPT ROUTI
      NE*****
30238 FOR I=1536 TO 1706:READ A:POKE
       I,A:NEXT I
30240 FOR I=1774 TO 1787:POKE I,0:NE
      XT I
30242 DATA 162,3,189,244,6,240,89,56
      ,221,240,6,240,83,141,254,6,10
      6,141
30244 DATA 255,6,142,253,6,24,169,0,
      109,253,6,24,109,252,6,133,204
      ,133
```

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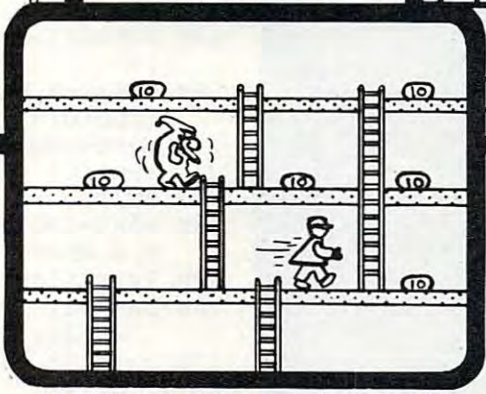

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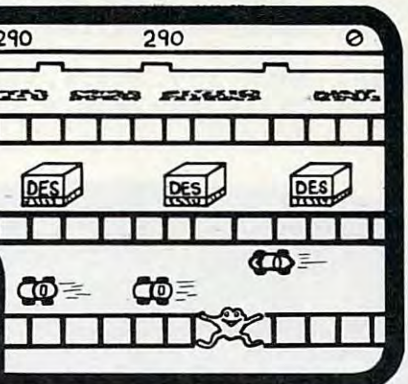

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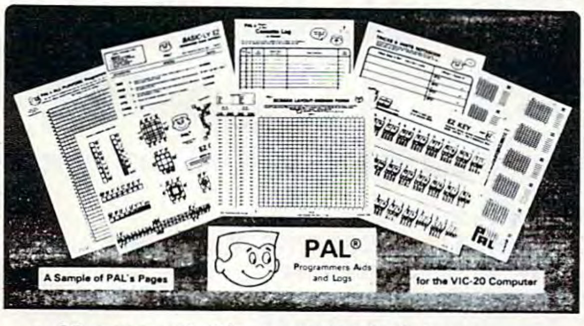

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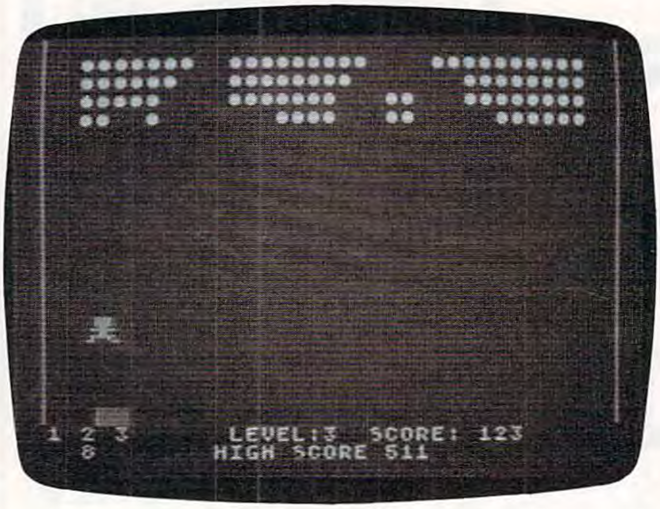
```
30246 DATA 206,189,240,6,133,203,173
      ,254,6,133,205,189,248,6,170,2
      32,46,255
30248 DATA 6,144,16,168,177,203,145,
      205,169,0,145,203,136,202,208,
      244,76,87
30250 DATA 6,160,0,177,203,145,205,1
      69,0,145,203,200,202,208,244,1
      74,253,6
30252 DATA 173,254,6,157,240,6,189,2
      36,6,240,48,133,203,24,138,141
      ,253,6
30254 DATA 109,235,6,133,204,24,173,
      253,6,109,252,6,133,206,189,24
      0,6,133
```



In "Blockhead," the figure bounces to the top of the screen to pop balloons – Atari version.

```
30256 DATA 205,189,248,6,170,160,0,1
      77,203,145,205,200,202,208,248
      ,174,253,6
30258 DATA 169,0,157,236,6,202,48,3,
      76,2,6,76,98,228,0,0,104,169
30260 DATA 7,162,6,160,0,32,92,228,9
      6
30262 S=USR(1696)
30276 PLX=53248:PLY=1780:PLL=1784
30278 POKE PLL,11:POKE PLL+1,8:POKE
      PLL+2,16:POKE PLL+3,9
30282 FOR I=MYPMBASE+1024 TO MYPMBAS
      E+1034:READ A:POKE I,A:NEXT I:
      REM *****BLOCKHEAD PLAYER 0***
      **
30283 DATA 60,60,60,60
30284 DATA 24,126,24,24,126,68,195
30285 FOR I=0 TO 7:POKE MYPMBASE+128
      0+I,255:NEXT I:REM *****PLATFO
      RM PLAYER 1*****
30299 REM *****EXPLOSION PLAYER 2***
      **
30300 FOR I=MYPMBASE+1280+256 TO MYP
      MBASE+256+1295:READ A:POKE I,A
      :NEXT I
30305 DATA 17,196,67,24,157,102,126,
      60,60,126,102,153,24,74,32,146
30309 REM *****SPRING PLAYER 3*****
30310 FOR I=MYPMBASE+1280+512 TO MYP
      MBASE+1288+512:READ A:POKE I,A
      :NEXT I
30315 DATA 255,255,32,16,8,4,8,16,32
30330 GOSUB SETUP
30590 RETURN
```

Program 2: Blockhead For 64

```
90 REM BLOCKHEAD FOR 64
100 POKE49152,0
110 DIM HA(12),HB(12),HC(12),LA(12),LB(1
    2),LC(12)
120 FORQ=1TO11:READHA(Q),LA(Q),HB(Q),LB(
    Q),HC(Q),LC(Q):NEXT
130 S=54272:FORE=STOS+28:POKEE,0:NEXT
140 POKE54296,15 :POKE54277,56 :POKE5427
    8,212
150 POKE54284,56 :POKE54286,212
160 POKE54291,56 :POKE54292,212
170 POKE S+4,17:POKES+16,17:POKES+18,17
180 FORD=1TO11
190 POKES+1,HA(D):POKES,LA(D):POKES+8,HB
    (D)
200 POKES+9,LB(D):POKES+15,HC(D):POKES+1
    4,LC(D)
210 FORT=1TO100:NEXT
220 IFHC(D) =7THENFORT=1TO100:NEXT
230 NEXT
240 FORT=1TO 450 :NEXT:FORE=STOS+28:POKE
    E,0:NEXT
250 IFPEEK(49152)=173ANDTH=1THENRETURN
260 DATA33,135,21,31,8,97,31,165,21,31,8
    ,225,29,223,22,96,9,104
270 DATA 28 ,49,22,96,9,247,26,156,21,31
    ,10,143
280 DATA28,49,21,31,9,247,29,223,22,96,9
    ,104,31,165,22,96,8,225
290 DATA33,135,21,31,8,97,25,30,22,96,7,
    233,33,135,21,31,8,97
300 GOTO330
310 S=54272
320 POKES+24,15:POKE54276,65:POKE54275,1
    0:POKE54274,10:POKES+24,0:RETURN
330 POKE53281,7:HI=134:GOSUB930
340 DATA1,255,0,7,255,192,15,239,224,31,
    1,240,63,109,248,63,111,248,63,1,248
    ,63
350 DATA237,248,63,109,248,31,1,240,31,2
    39,240,15,239,224,15,255,224,7,255,1
    92,3
360 DATA255,128,1,255,0,0,254,0,0,124,0,
    0,56,0,0,16,0,0,56,0
370 V=53248
380 FOR J=960TO1022:READ WQ:POKE J,WQ:NE
    XT
390 POKEV+21,0
400 POKEV+41,6:POKEV+42,0:POKEV+43,1:POK
    EV+44,2:POKEV+4,70
410 POKE53264,0
420 POKEV+45,4:POKEV+46,8
430 FORT=2042TO2047:POKET,15:NEXT:POKEV+
    21,255
440 IFPEEK(V+2)<50AND(PEEK(V+16)AND2)=0T
    HENPOKEV+2,254
450 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0,0,0,0,255,255,255,25
    5,255
460 DATA255,255,255,255,255,255,255,255,
    255,255,255,255,255,255,255,255,255,
    255
470 DATA255,255,255,255,255,255,255,255,
    255,255
```

```
480 V=53248
490 FORI=832TO894:READJ:POKEI,J:NEXT
500 FORK=834+64TO892+66:READL:POKEK,L:NE
    XT:POKE2041,14:POKEV+40,6
510 POKE2040,13:POKEV+39,2:POKEV,150:POK
    EV+1,200
520 IFPEEK(49152)<>173THENGOSUB1050
530 POKEV+3,191
540 IFHI<70THENHI=59
550 TH=1:GOSUB130
560 POKEV+2,PEEK(V):POKEV+21,255
570 FORG=V+5TO V+15STEP2:POKEG,HI:NEXT
580 SYS49658
590 DATA0
600 DATA0,0,0,0,0,0,3,255,240,3,63,48,3,
    51,48,3,243,240,3,63,48,3,204,240,3,
    243
```

The balloons in the 64 version of "Blockhead" float across the screen.

```
610 DATA240,3,255,240,0,127,128,127,243,
    255,127,255,255,255,255,255,128,115
620 DATA128,0,127,128,0,127,128,0,251,19
    2,1,241,224,3,224,240,7,192,120
630 IF(PEEK(56321)AND4)<>0THEN790
640 X2=0:POKE49829,0
650 FORT=(PEEK(V+3))TO50STEP-4:POKEV+3,T
660 IFPEEK(V+30)>3THENPOKEV+21,(PEEK(V+2
    1)ANDNOT(PEEK(V+30))):SC=SC+10:GOSUB
    310
670 POKE(V+21),(PEEK(V+21)OR3)
680 NEXT:GOTO700
690 GOTO790
700 POKE49829,0
710 FORJ=(PEEK(V+3))TO255STEP10:POKEV+3,
    J:IFPEEK(49829)=3THENX2=1:GOTO790
720 PI=INT(RND(0)*40)-20:IF(PEEK(53250)+
    PI)<60AND(PEEK(53264)AND2)=0THENPI=0
730 IF(PEEK(V+2)+PI)<50AND(PEEK(V+16)AND
    2)=0ORPEEK(V+2)>254THENPI=0
740 IF(PEEK(53264)AND2)<>0AND(PEEK(53250
    )+PI)>20THENPI=0
750 IF PEEK(53250)+PI<245AND PEEK(53250)
    +PI>10THENPOKE53250,PEEK(53250)+PI
760 IFPEEK(V+3)<201THEN780
770 PRINT"{HOME}{3 DOWN}{7 RIGHT}OOPS!"
    :SC=SC-5:FORT=1TO100:NEXT:PRINT"
    {HOME}{7 RIGHT}{3 DOWN}{5 SPACES}"
780 NEXT
790 IF PEEK(V+21)=3THEN:HI=HI-15:POKEV+3
    ,190:GOTO530
800 IFX2=1ANDPEEK(V+3)>180THENPOKEV+3,19
    0
810 P=INT(RND(0)*40)-20:IFPEEK(53250)+P<
    15THENP=0
820 PRINT"{HOME}{15 RIGHT}SCORE";"
    {5 SPACES}";
830 PRINT"{HOME}{15 RIGHT}SCORE";SC
840 IFVAL(TI$)>5900THENTI$="000000"
850 IFTI$>="000200"THEN870
860 PRINT"{HOME}{DOWN}{3 RIGHT}TIME ";RI
    GHT$(TI$,4);"{HOME}{DOWN}{3 RIGHT}TI
    ME ";:GOTO630
870 PRINT"{HOME}{15 RIGHT}{8 DOWN}GAME O
    VER":POKE198,0
880 PRINT"{HOME}{DOWN}{3 RIGHT}TIME ";RI
    GHT$(TI$,4);"{HOME}{DOWN}{3 RIGHT}TI
    ME ";
890 PRINT"{HOME}{10 RIGHT}{10 DOWN}PLAY
    AGAIN? Y OR N "
900 IFPEEK(197)=25THENCLR:RESTORE:GOTO11
    0
910 IFPEEK(197)=39THENSYS2048
920 GOTO890
930 PRINT"";:FORBO=1024TO1984STEP40:POK
    EBO,224:POKEBO+39,224
940 POKEBO+54272,2:POKEBO+54311,2
950 POKEBO+1,224:POKEBO+38,224
960 POKEBO+1+54272,4:POKEBO+54310,4
970 POKEBO+2,224:POKEBO+37,224
980 POKEBO+2+54272,15:POKEBO+54309,15
990 NEXT
1000 FORFL=1864TO2023:POKEFL,224:POKEFL+
     54272,8:NEXT
1010 TI$="235952"
1020 FORTE=1025TO1062:POKETE,224:POKETE+
     54272,3:NEXT
1030 POKE53280,1
1040 RETURN
1050 POKEV+21,0:FORV1=49152TO49673:READJ
     2:POKEV1,J2:NEXT:RETURN
1060 DATA 173, 25, 212, 73, 255, 141, 16
     4, 194
1070 DATA 216, 24, 173, 164, 194, 105, 4
     0, 141
1080 DATA 161, 194, 56, 173, 164, 194, 2
     33, 215
1090 DATA 141, 162, 194, 173, 164, 194,
     201, 216
1100 DATA 176, 17, 173, 161, 194, 141, 1
     63, 194
1110 DATA 173, 16, 208, 41, 254, 141, 16
     , 208
1120 DATA 76, 65, 192, 173, 16, 208, 9, 1
1130 DATA 141, 16, 208, 173, 162, 194, 1
     41, 163
1140 DATA 194, 173, 163, 194, 141, 0, 20
     8, 173
1150 DATA 30, 208, 141, 160, 194, 240, 3
     , 141
1160 DATA 165, 194, 173, 160, 194, 41, 1
     , 240
1170 DATA 23, 169, 190, 173, 163, 194, 1
     41, 2
1180 DATA 208, 173, 16, 208, 41, 1, 141,
      6
1190 DATA 202, 10, 13, 6, 202, 141, 16,
     208
```

```
1200 DATA 173, 16, 202, 56, 233, 210, 14
     1, 17
1210 DATA 202, 173, 16, 202, 24, 105, 45
     , 141
1220 DATA 18, 202, 173, 16, 202, 201, 21
     0, 176
1230 DATA 17, 173, 16, 208, 41, 251, 141
     , 16
1240 DATA 208, 173, 18, 202, 141, 4, 208
     , 76
1250 DATA 168, 192, 173, 16, 208, 9, 4,
     141
1260 DATA 16, 208, 173, 17, 202, 141, 4,
     208
1270 DATA 173, 19, 202, 56, 233, 210, 14
     1, 20
1280 DATA 202, 173, 19, 202, 24, 105, 45
     , 141
1290 DATA 21, 202, 173, 19, 202, 201, 21
     0, 176
1300 DATA 17, 173, 16, 208, 41, 247, 141
     , 16
1310 DATA 208, 173, 21, 202, 141, 6, 208
     , 76
1320 DATA 224, 192, 173, 16, 208, 9, 8,
     141
1330 DATA 16, 208, 173, 20, 202, 141, 6,
     208
1340 DATA 173, 22, 202, 56, 233, 210, 14
     1, 23
1350 DATA 202, 173, 22, 202, 24, 105, 45
     , 141
1360 DATA 24, 202, 173, 22, 202, 201, 21
     0, 176
1370 DATA 17, 173, 16, 208, 41, 239, 141
     , 16
1380 DATA 208, 173, 24, 202, 141, 8, 208
     , 76
1390 DATA 24, 193, 173, 16, 208, 9, 16,
     141
1400 DATA 16, 208, 173, 23, 202, 141, 8,
     208
1410 DATA 173, 25, 202, 56, 233, 210, 14
     1, 26
1420 DATA 202, 173, 25, 202, 24, 105, 45
     , 141
1430 DATA 27, 202, 173, 25, 202, 201, 21
     0, 176
1440 DATA 17, 173, 16, 208, 41, 223, 141
     , 16
1450 DATA 208, 173, 27, 202, 141, 10, 20
     8, 76
1460 DATA 80, 193, 173, 16, 208, 9, 32,
     141
1470 DATA 16, 208, 173, 26, 202, 141, 10
     , 208
1480 DATA 173, 28, 202, 56, 233, 210, 14
     1, 29
1490 DATA 202, 173, 28, 202, 24, 105, 45
     , 141
1500 DATA 30, 202, 173, 28, 202, 201, 21
     0, 176
1510 DATA 17, 173, 16, 208, 41, 191, 141
     , 16
1520 DATA 208, 173, 30, 202, 141, 12, 20
     8, 76
1530 DATA 136, 193, 173, 16, 208, 9, 64,
     141
1540 DATA 16, 208, 173, 29, 202, 141, 12
     208
1550 DATA 173, 31, 202, 56, 233, 210, 14
     1, 32
1560 DATA 202, 173, 31, 202, 24, 105, 45
     , 141
1570 DATA 33, 202, 173, 31, 202, 201, 21
     0, 176
1580 DATA 17, 173, 16, 208, 41, 127, 141
     , 16
1590 DATA 208, 173, 33, 202, 141, 14, 20
     8, 76
1600 DATA 192, 193, 173, 16, 208, 9, 128
     , 141
1610 DATA 16, 208, 173, 32, 202, 141, 14
     , 208
1620 DATA 238, 16, 202, 238, 16, 202, 24
     , 173
1630 DATA 16, 202, 105, 43, 141, 19, 202
     , 173
1640 DATA 19, 202, 105, 43, 141, 22, 202
     , 173
1650 DATA 22, 202, 105, 43, 141, 25, 202
     , 173
1660 DATA 25, 202, 105, 43, 141, 28, 202
     , 173
1670 DATA 28, 202, 105, 43, 141, 31, 202
     , 173
1680 DATA 30, 208, 240, 3, 141, 160, 194
     , 76
1690 DATA 49, 234, 120, 169, 0, 141, 20,
     3
1700 DATA 169, 192, 141, 21, 3, 88, 96,
     0
1710 DATA 255, 255, 0, 0, 255, 255, 0, 0
```

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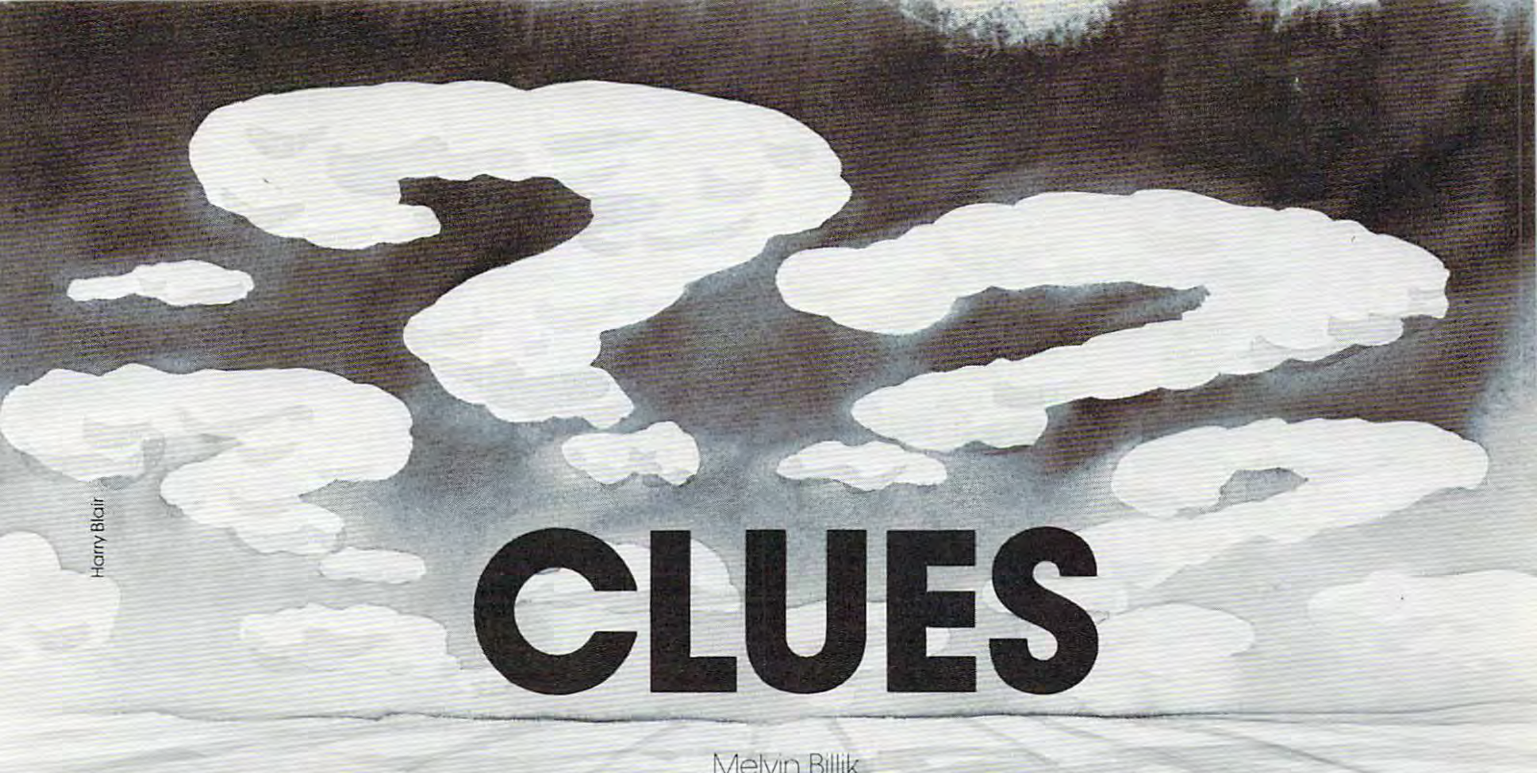

CLUES

Melvin Billik

An excellent teaching tool for preschoolers on up – with options to tailor the program for different age groups. For TI-99/4A and all Commodore computers.

As a teacher-administrator, I have found my PET extremely useful in creating programs for courses I teach, such as BASIC Programming and Statistics. In addition, other programs help me with administrative tasks, such as grading, transcript evaluation, teacher scheduling, and attendance.

However, as a parent of two preschoolers, I get the most satisfaction from writing programs for them. One such program is "Clues." It is fairly simple and can easily be modified for other microcomputers.

The youngster is asked his or her name, followed by a series of questions. A correct response by my son will yield a flashing message, "OKAY – GREAT, KEITH!" For an incorrect response, the question will be repeated. For two consecutive incorrect responses, the answer will be given and a new question will be asked.

For the Commodore version, the data is listed (question first, then answer) from line 700 on up. Line 1, the DIM statement, sets a maximum of 200 questions and answers. You can change this as your computer's memory size dictates. The program itself counts the number of questions and answers. Note the flag in line 1940.

Modifications

The program picks the questions at random. However, you can easily adjust the program so that no question is asked more than once by adding a new array variable as a flag (a value of 0 indicates the question has not yet been asked). For the Commodore version, add:

```
1  DIM C$(200), CA$(200), FL(200)
45 IF FL(X%)<>0 THEN 40
55 FL(X%)=1
```

As more and more questions are asked, program execution time is slowed considerably (as the program searches for unasked questions). However, as long as you've asked less than 90 percent of your available questions, time delay is not a problem.

The game will continue until the player decides to quit, either by pressing the RETURN key in response to a question or by turning off the machine. If you made the previous program modification, the game can continue until all the questions have been asked. You can modify the Commodore version of the program to ask a specific number of questions as follows:

```
230 PRINT "HOW MANY QUESTIONS, MAX
    OF ";N
240 INPUT NQ: IF NQ>N THEN 230
250 RETURN
19  FOR II=1 TO NQ
70  IF A$= CA$(X%) THEN I=10:GOSUB 500:
    GOTO 100
100 NEXT II
```

You can also adjust the level of questions to be suitable for a user's educational level. The subroutine starting in line 500 of the Commodore version, while exciting for a preschooler, might not be appropriate for an older child. An alternative might be to include a number of cute sayings and print one at random for a correct response. For example, we can replace the subroutine with:

```
500 Z=INT(3*RND(TI)+1)
510 ON Z GOSUB 520,530,540
515 FOR I=1 TO 1000: NEXT
519 PRINT “CLR”: RETURN
520 PRINT “NOT BAD”
525 RETURN
530 PRINT “BET YOU CAN’T DO IT AGAIN”
535 RETURN
540 PRINT “BOY, ARE YOU LUCKY TODAY!”
545 RETURN
```

Also, Clues can be a good teaching tool: you can store a few hundred questions and using the modifications, generate a 10-25 question quiz. No two students would have the same quiz.

BEFORE TYPING...

If you're new to computing, please read "How To Type COMPUTE!'s Programs" and "A Beginner's Guide To Typing In Programs."

Program 1: Clues – TI Version

```
90 RESTORE
100 RANDOMIZE
110 DIM C$(201)
111 DIM CA$(201)
120 GOSUB 440
130 CALL CLEAR
140 CALL SCREEN(5)
150 INPUT "WHAT IS YOUR NAME?":N$
160 PRINT ::
170 CALL CLEAR
180 PRINT "OKAY, ";N$;" USE THE FOLL
    OWING CLUE"
190 PRINT "TO SPELL THE WORD"
200 I=0
210 XE=INT(N*RND+1)
250 PRINT ::
260 PRINT C$(XE)
270 INPUT A$
280 IF A$<>CA$(XE)THEN 320
290 I=10
300 GOSUB 510
310 GOTO 160
320 I=I+1
330 IF I<>1 THEN 370
340 PRINT "NO, ";N$;
350 PRINT " TRY AGAIN"
360 GO TO 270
370 IF I<>2 THEN 410
380 PRINT "NO, ";N$
390 PRINT "THE CORRECT ANSWER WAS ";
400 PRINT CA$(XE)
410 FOR M=1 TO 1000
420 NEXT M
430 GOTO 170
440 FOR K=1 TO 200
450 READ C$(K)
460 IF C$(K)<>"END" THEN 485
470 N=K-1
480 K=200
482 GOTO 490
485 READ CA$(K)
490 NEXT K
500 RETURN
510 FOR I=1 TO 11
520 CALL CLEAR
530 PRINT TAB(10)
540 PRINT ::
550 PRINT "OKAY GREAT--";N$
560 FOR T=1 TO 50
570 NEXT T
580 NEXT I
590 RETURN
600 DATA YOUR DAD'S NAME IS
610 DATA MEL
620 DATA YOUR SISTER'S NAME IS
630 DATA TARA
640 DATA YOUR MOM'S NAME IS
650 DATA CHERYL
660 DATA YOUR DOG'S NAME IS
670 DATA BRANDY
680 DATA THE OPPOSITE OF YES IS
690 DATA NO
700 DATA SOMETHING YOU SLEEP ON
710 DATA BED
720 DATA SOMETHING YOUR DOG LIKES TO
     CHEW ON
730 DATA BONE
740 DATA WHERE YOU LEAVE A STORE OR
    {4 SPACES}RESTAURANT THE SIGN SA
    YS
750 DATA EXIT
760 DATA SOMETHING YOU LIKE TO CHEW
765 DATA GUM
770 DATA WHAT DOES A CRANKY KID DO
780 DATA CRY
790 DATA HOW MANY FINGERS DO YOU HAV
    E?
800 DATA TEN
810 DATA END
```

Program 2: Clues — For All Commodore Computers

```
1 DIM C$(200),CA$(200)
10 X= RND(-TI)
15 GOSUB 200
18 INPUT "{CLR}WHAT IS YOUR NAME";N$
20 PRINT:PRINT "{CLR}OKAY, ";N$;", USE T
   HE FOLLOWING CLUE
30 PRINT"TO SPELL THE WORD."
40 I=0:X%= N*RND(TI)+1
50 PRINT:PRINT:PRINTC$(X%)
60 PRINT:PRINT:INPUT A$
70 IF A$= CA$(X%) THEN I =10:GOSUB 500:G
   OTO 20
80 I=I+1: IF I=1 THEN PRINT:PRINT"NO, ";
   N$;" TRY AGAIN":GOTO 60
90 IF I = 2 THEN PRINT"NO, ";N$;", THE C
   ORRECT ANSWER":PRINT"WAS "; CA$(X%)
97 FOR M = 1 TO 3500:NEXT
100 GOTO 20
200 FOR I = 1 TO 200
210 READ C$(I)
212 IF C$(I) ="END" THEN N=I-1:GOTO 230
215 READ CA$(I)
220 NEXT
230 RETURN
500 FOR I = 1 TO 11
505 PRINT"{CLR}"{2 SPACES}: FOR J = 1 TO
     100:NEXT
510 PRINT"{12 DOWN}{10 RIGHT}OKAY--GREAT
    , ";N$
520 FOR J = 1 TO100:NEXT J
530 NEXT I
540 RETURN
600 PRINT"{CLR}{7 DOWN}"
700 DATA YOUR DAD'S NAME IS
710 DATA MEL
```

AARDVARK L.T.D.

TRS-80 COLOR COMMODORE 64 VIC-20 SINCLAIR/TIMEX TI99/4A

QUEST – A NEW IDEA IN ADVENTURE GAMES! Different from all the others. Quest is played on a computer generated map of Alesia. Your job is to gather men and supplies by combat, bargaining, exploration of ruins and temples and outright banditry. When your force is strong enough, you attack the Citadel of Moorlock in a life or death battle to the finish. Playable in 2 to 5 hours, this one is different every time. TRS-80 Color, and Sinclair, 13K VIC-20. Extended BASIC required for TRS-80 Color and TI99/A. $14.95 each.

32K TRS 80 COLOR Version $24.95.

Adds a second level with dungeons and more Questing.

WIZARDS TOWER – This is very similar to Quest (see above). We added wizards, magic, dragons, and dungeons to come up with a Quest with a D&D flavor. It requires 16k extended color BASIC. 13k VIC, Commodore 64, TRS-80 16k Extended BASIC, TI99/A extended BASIC. $14.95 Tape, $19.95 Disk.

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ZEUS – It's fast and furious as you become the WIZARD fighting off the Thurderbolts of an angry ZEUS. Your Cone of Cold will destroy a thunderbolt and your shield will protect you – for a while. This is the best and highest speed arcade action we have ever done. Difficulty increases in wave after wave, providing hours of challenging fun and a game that you may never completely master. Commodore 64, Vic20 (16k expander), and 16k TRS-80 Color Computer. (ALL MACHINE CODE!)
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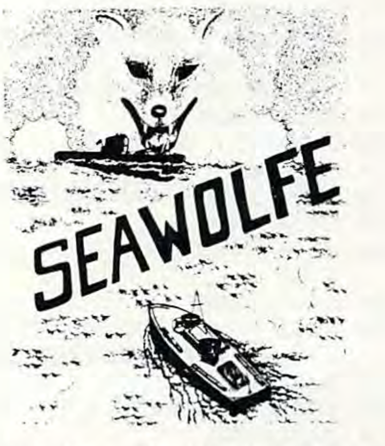
PYRAMID (by Rodger Olsen)
This is our most challenging ADVENTURE. It is a treasure hunt in a pyramid full of problems. Exciting and tough!



SEAWOLFE – ALL MACHINE CODE In this high speed arcade game, you lay out patterns of torpedoes ahead of the attacking PT boats. Requires Joysticks, at least 13k RAM, and fast reflexes. Lots of Color and Sound. A fun game. Tape or Disk for Vic20, Commodore 64, and TRS-80 Color. NOTE: tape will not transfer to disk!
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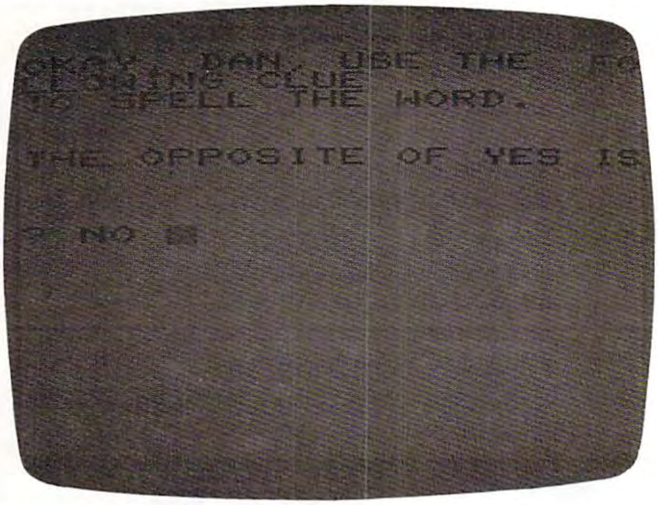
```
720 DATA YOUR NAME IS
730 DATA KEITH
740 DATA YOUR SISTER'S NAME IS
750 DATA TARA
760 DATA YOUR MOM'S NAME IS
770 DATA CHERYL
780 DATA YOUR DOG'S NAME IS
790 DATA BRANDY
800 DATA THE OPPOSITE OF YES IS
810 DATA NO
820 DATA SOMETHING YOU SLEEP ON
830 DATA BED
840 DATA SOMETHING YOUR DOG LIKES TO CHE
    W ON
850 DATA BONE
860 DATA WHERE YOU LEAVE A STORE OR REST
    AURANT{3 SPACES}THE SIGN SAYS
870 DATA EXIT
900 DATA SOMETHING YOU LIKE TO CHEW
910 DATA GUM
920 DATA WHAT DOES A CRANKY KID DO
930 DATA CRY
940 DATA HOW MANY FINGERS DO YOU HAVE?
950 DATA TEN
1940 DATA{3 SPACES}END
```

Program 3:
Clues – Program Adjustment For VIC Version

Change this line of the Commodore version for use with VIC-20.

```
510 PRINT "{10 DOWN}{2 RIGHT}OKAY--GREAT
       ";N$
```



```
OKAY, DAN, USE THE FO
LLOWING CLUE
TO SPELL THE WORD.

THE OPPOSITE OF YES IS

? NO
```

A question and answer sequence appropriate for preschoolers. "Clues," VIC version.

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Gold Miner For TI-99/4A

James Dunn

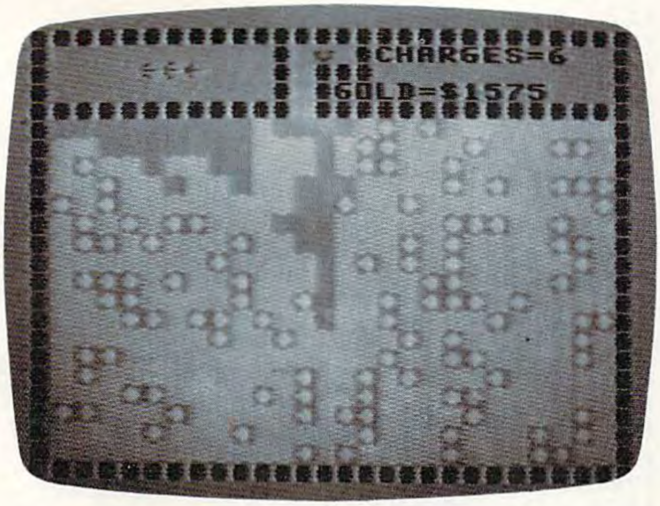
Dig your way into the Lost Mine and search for gold in this exciting TI-99/4A translation of a game first published in **COMPUTE!**, *July 1982.*

"Gold Miner" will run in TI BASIC, using about 5K. It won't run in Extended BASIC because of the character definition using ASCII 144 and above.

Most of the program was translated quite easily from Joseph Weber's original VIC-20 version except for formatting the display of the score and the charges. Extended BASIC contains commands to display at any position on the screen. But TI BASIC will print only at the bottom of the screen, which scrolls the whole display up. Since I wanted this program to run in TI BASIC, I had to use string manipulation to format the score and charges using their ASCII representations. Then, using HCHAR, printing at specific screen locations was possible without disturbing the rest of the display (see lines 1450-1640).

The only other modification is to the main character. I designed a small pick-ax to represent the miner, and animated it, so it would seem to chop its way into the mine. This is done in the main loop, lines 640 - 660, and slows execution only slightly. But it doesn't matter in this game because speed is unimportant. In fact, you can walk away from the game, come back an hour later, and take up where you left off.

One other point: You must hold down the key, joystick, or fire button until the program calls the routine to read the input. It makes the joystick a bit awkward, but this doesn't affect the game because reflex time is unimportant with "Gold Miner."



Digging for golden nuggets in the TI version of "Goldminer."

BEFORE TYPING...
If you're new to computing, please read "How To Type COMPUTE!'s Programs" and "A Beginner's Guide To Typing In Programs."

Gold Miner For TI-99/4A

```
50 REM  INITIALIZE
60 CALL CLEAR
70 GOSUB 730
80 GOSUB 880
90 M=4
100 S=0
110 W=0
120 GO SUB 1090
130 T=250
140 REM  MAIN LOOP
150 CALL HCHAR(B,A,32)
160 IF X=4 THEN 210
170 IF X=-4 THEN 230
180 IF Y=4 THEN 300
190 IF Y=-4 THEN 320
200 GOTO 460
210 A=A+1
220 GOTO 390
230 A=A-1
240 CALL GCHAR(B,A,Q)
250 IF Q=126 THEN 280
260 IF Q=35 THEN 280
270 GOTO 460
280 A=A+1
290 GOTO 600
300 B=B-1
310 GOTO 430
320 B=B+1
330 CALL GCHAR(B,A,Q)
340 IF Q=126 THEN 370
350 IF Q=35 THEN 370
360 GOTO 460
370 B=B-1
380 GOTO 600
390 CALL GCHAR(B,A,Q)
400 IF Q<>35 THEN 460
410 A=A-1
420 GOTO 460
430 CALL GCHAR(B,A,Q)
440 IF Q<>35 THEN 460
```

```
450 B=B+1
460 CALL GCHAR(B,A,Q)
470 IF Q=126 THEN 520
480 IF Q=152 THEN 580
490 IF Q=144 THEN 540
500 IF Q=136 THEN 560
510 GOTO 600
520 GO SUB 2140
530 GOTO 600
540 S=S+1
550 GOTO 600
560 GO SUB 1650
570 GOTO 600
580 S=S+1
590 CALL SOUND(50,4000,0)
600 IF RV<>18 THEN 640
610 GOSUB 1810
620 GOSUB 2190
630 GO SUB 1450
640 FOR Z=128 TO 131
650 CALL HCHAR(B,A,Z)
660 NEXT Z
670 CALL SOUND(100,200,0)
680 GO SUB 1020
690 IF C<1 THEN 710
700 GOTO 150
710 GOSUB 2390
720 GOTO 150
730 REM  DEF SP CHARS
740 CALL CHAR(126,"AA55AA55AA55AA55"
    )
750 CALL COLOR(12,15,1)
760 CALL CHAR(152,"00183C7E7E3C1800"
    )
770 CALL COLOR(16,12,1)
780 CALL CHAR(136,"000000E742427E18"
    )
790 CALL COLOR(14,13,1)
800 CALL CHAR(144,"00107C1010101010"
    )
810 CALL COLOR(15,2,1)
820 CALL CHAR(128,"3854921010000000"
    )
830 CALL CHAR(129,"000402011F010204"
    )
840 CALL CHAR(130,"0000001010925438"
    )
850 CALL CHAR(131,"204080F880402000"
    )
860 CALL COLOR(13,5,1)
870 RETURN
880 REM  PRINT INSTRUCTIONS
890 PRINT TAB(9);"GOLD MINER"
900 PRINT :::
910 PRINT TAB(4);CHR$(131);"= MINER"
    ::
920 PRINT TAB(4);CHR$(152);"= GOLD":
    :
930 PRINT TAB(4);CHR$(144);"= DEAD M
    INER"::
940 PRINT TAB(4);CHR$(126);"= DIRT":
    :
950 PRINT TAB(4);CHR$(136);"= ASSAY
    OFFICE":::
960 PRINT "USE FIRE BUTTON TO BLAST"
    ::
970 PRINT "HIT ANY KEY TO PLAY":::
980 CALL KEY(3,RV,ST)
990 IF ST=0 THEN 980
1000 CALL CLEAR
1010 RETURN
1020 REM  CHECK JOY STICK
1030 CALL JOYST(2,X,Y)
1040 IF ABS(X)+ABS(Y)=4 THEN 1070
1050 X=0
1060 Y=0
1070 CALL KEY(2,RV,SV)
1080 RETURN
1090 REM  DRAW BOARD
1100 CALL HCHAR(1,3,35,28)
1110 CALL HCHAR(5,4,35,11)
1120 CALL HCHAR(5,16,35,14)
1130 CALL HCHAR(24,4,35,26)
1140 CALL VCHAR(1,3,35,24)
1150 CALL VCHAR(1,30,35,24)
1160 CALL VCHAR(2,14,35,3)
1170 CALL VCHAR(3,16,35,2)
1180 CALL VCHAR(3,17,35)
1190 CALL VCHAR(2,18,35,2)
1200 FOR X=6 TO 23
1210 CALL HCHAR(X,4,126,26)
1220 NEXT X
1230 FOR GL=1 TO 180
1240 RANDOMIZE
1250 X=RND*25+4
1260 Y=RND*17+6
1270 CALL HCHAR(Y,X,152)
1280 NEXT GL
1290 REM
1300 GOSUB 1340
1310 GOSUB 1450
1320 CALL HCHAR(6,4,32,12)
1330 RETURN
1340 REM  PLACE MINERS
1350 IF M<1 THEN 2570
1360 CALL HCHAR(3,7,32,5)
1370 CALL HCHAR(3,8,131,M-1)
1380 CALL HCHAR(4,15,131)
1390 C=10
1400 S=0
1410 CALL HCHAR(2,16,136)
1420 A=15
1430 B=4
1440 RETURN
1450 REM  PRINT SCORE/CHARGES
     {5 SPACES}
1460 A$="CHARGES="
1470 FOR I=0 TO 7
1480 B$=SEG$(A$,I+1,1)
1490 CALL HCHAR(2,19+I,ASC(B$))
1500 NEXT I
1510 FOR I=0 TO LEN(STR$(C))-1
1520 CG$=SEG$(STR$(C),I+1,1)
1530 CALL HCHAR(2,27+I,ASC(CG$))
1540 NEXT I
1550 A$="GOLD=$"
1560 FOR I=0 TO 5
1570 B$=SEG$(A$,I+1,1)
1580 CALL HCHAR(4,17+I,ASC(B$))
1590 NEXT I
1600 FOR I=0 TO LEN(STR$(W))-1
1610 SC$=SEG$(STR$(W),I+1,1)
1620 CALL HCHAR(4,23+I,ASC(SC$))
1630 NEXT I
1640 RETURN
1650 REM  TALLY GOLD
1660 CALL HCHAR(2,19,32,11)
1670 CALL HCHAR(4,17,32,13)
1680 CALL SOUND(1,500,0)
1690 FOR DELAY=1 TO 5
1700 NEXT DELAY
1710 CALL SOUND(1,500,0)
1720 C1=C
1730 IF C1<>0 THEN 1750
```

```
1740 C1=1
1750 W=S*C1+W
1760 M=M-1
1770 GOSUB 1340
1780 GO SUB 1450
1790 CALL HCHAR(2,4,32,10)
1800 RETURN
1810 REM  EXPLOSION
1820 CALL HCHAR(B,A,131)
1830 FOR I=0 TO 30 STEP 5
1840 CALL SOUND(100,-5,1)
1850 NEXT I
1860 CALL GCHAR(B+1,A,Q)
1870 IF Q=35 THEN 1890
1880 CALL HCHAR(B+1,A,88)
1890 CALL GCHAR(B-1,A,Q)
1900 IF Q=35 THEN 1920
1910 CALL HCHAR(B-1,A,88)
1920 CALL GCHAR(B,A+1,Q)
1930 IF Q=35 THEN 1950
1940 CALL HCHAR(B,A+1,88)
1950 CALL GCHAR(B,A-1,Q)
1960 IF Q=35 THEN 1980
1970 CALL HCHAR(B,A-1,88)
1980 REM
1990 CALL GCHAR(B+1,A,Q)
2000 IF Q=35 THEN 2020
2010 CALL HCHAR(B+1,A,32)
2020 CALL GCHAR(B-1,A,Q)
2030 IF Q=35 THEN 2050
2040 CALL HCHAR(B-1,A,32)
2050 CALL GCHAR(B,A+1,Q)
2060 IF Q=35 THEN 2080
2070 CALL HCHAR(B,A+1,32)
2080 CALL GCHAR(B,A-1,Q)
2090 IF Q=35 THEN 2110
2100 CALL HCHAR(B,A-1,32)
2110 C=C-1
2120 CALL HCHAR(2,19,32,11)
2130 RETURN
2140 REM  SFX EXPLOSION
2150 FOR I=0 TO 30 STEP 5
2160 CALL SOUND(20,-1,I)
2170 NEXT I
2180 RETURN
2190 REM  CAVE IN
2200 FOR I=1 TO 10
2210 RANDOMIZE
2220 B1=INT(RND*17)+6
2230 A1=INT(RND*25)+4
2240 CALL GCHAR(B1,A1,Q)
2250 IF Q=152 THEN 2280
2260 IF Q=131 THEN 2300
2270 CALL HCHAR(B1,A1,126)
2280 NEXT I
2290 RETURN
2300 GOSUB 2330
2310 RV=0
2320 GO TO 150
2330 REM  SQUASH MINER
2340 M=M-1
2350 CALL HCHAR(B,A,144)
2360 S1=S
2370 GOSUB 1340
2380 RETURN
2390 REM  GET OUT COUNTER
2400 IF T<128 THEN 2500
2410 A$="GET OUT"
2420 FOR I=0 TO 6
2430 B$=SEG$(A$,I+1,1)
2440 CALL HCHAR(2,4+I,ASC(B$))
2450 NEXT I
2460 CALL SOUND(-50,300,0)
2470 T=T-4
2480 RV=0
2490 RETURN
2500 CALL HCHAR(B,A,32)
2510 M=M-1
2520 IF M=0 THEN 2570
2530 GOSUB 1340
2540 GOSUB 1450
2550 CALL HCHAR(2,4,32,10)
2560 GOTO 130
2570 REM  PLAY AGAIN LOOP
2580 GO SUB 1450
2590 FOR DELAY=1 TO 2000
2600 NEXT DELAY
2610 CALL CLEAR
2620 PRINT "PLAY AGAIN?"
2630 PRINT "Y OR N"
2640 CALL KEY(3,X,ST)
2650 IF ST=0 THEN 2640
2660 IF X=89 THEN 90
2670 IF X=78 THEN 2690
2680 GOTO 2610
2690 CALL CLEAR
2700 END
```

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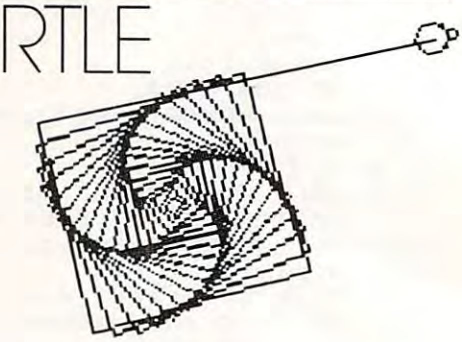
FRIENDS OF THE TURTLE



David D. Thornburg, Associate Editor

Travels With TOPO

The San Diego CUE (Computer Using Educators) conference was one speaking engagement I looked forward to with eager anticipation. My talk was on the use of robots in the classroom, and Androbot's TOPO was my star attraction. (If you don't know about TOPO, see the "Friends of the Turtle" and "Computers and Society" columns in the May 1983 issue of **COMPUTE!**.) Since I like to travel light, I had arranged for TOPO to be sent ahead of me to the hotel.

A few hours before my scheduled departure, I found that TOPO was not going to be delivered as scheduled and that it had to travel on the plane with me.

My frantic call to the airline went something like this:

"PSA reservations. May I help you?"

"Yes, I need another round-trip ticket between San Jose and San Diego."

"Of course, and the passenger's last name, please?"

"TOPO."

"Fine, his first name please?"

I paused. What was his first name?

"Uh, Peter."

"Thank you. Is Peter a child?"

"Uh, Peter is under six."

"Excellent! He can travel for half fare."

"Good. Oh, by the way, there is something I think you should know."

"What's that?"

"Uh, Peter isn't human."

This time it was the agent who paused.

"Is it a dog?"

"No, it's a robot."

"A robot! How exciting! I'll make sure the airport personnel know to expect him."

And thus began an adventure that will be commonplace in a few years – taking the domestic robot on a trip.

We arrived at the airport with time to spare, picked up TOPO's ticket, and went through X-ray without a hitch. The response of other passengers was quite varied. One woman looked at TOPO, clasped her hands, and said, "I think I'm in love!" A four-year-old moppet named Alison approached TOPO with hesitation, but by the end of the trip she and TOPO were great friends.

The stewardess asked what TOPO would like to drink.

"WD-40 on the rocks," I replied.

Although TOPO was the subject of much attention, one can envision such scenes becoming commonplace in the not too distant future. And as domestic robots become more common, software will be developed to make them more useful. Today, TOPO is a tremendously valuable tool for education. By controlling TOPO through Logo's turtle graphics commands, children become highly motivated to learn programming. In the future we can expect ever more sophisticated programs to be developed around practical applications.

Whether TOPO or its offspring vacuum carpets, mow the lawn, watch the kids, or help carry groceries, it is clear to me that domestic robots will soon become as common as personal computers. As a result, we can expect the airlines to offer special seating (robot class?) in which our mechanical companions can travel together, perhaps getting recharged during their travel time. When this happens, we will know that the age of robotics has arrived.

Notes From All Over

The use of Logo with children has been the subject of university research since the language was developed. Dennis Harper at the University of California at Santa Barbara has a research project with a new twist. He is embarking on a special project in Papua, New Guinea, to teach PILOT and Logo to teachers. With the assistance of the government of New Guinea and the use of equipment supplied by Atari, Dennis will be studying the use of Atari PILOT and Logo by teachers who have, in many cases, only elementary educations themselves. The fact that some of these teachers will not have seen a television before should make their response to turtle graphics quite interesting.

Mr. Harper has quite a few objectives to accomplish during this project. He will be demonstrating existing computer-aided instructional materials, and will then let the teachers learn both Logo and PILOT. He hopes to see what effect the computer will have on positive attitudes toward technology, increased literacy, teacher training, effectiveness in teaching, the dropout rate, the overproduction of humanities graduates, indigenous research and development efforts, and discrimination in primary schools.

In his research proposal Mr. Harper states:

> Whether or not logical thinking among the students will increase by learning programming will be part of these observations. Although such gains are assumed almost as a cultural truism, there is a paucity of research either supporting or not justifying that hypothesis. The lack of empirical testing of cognitive gains following computer training is understandable and results from the fact that much research dealing with Logo has been constrained until recently by expensive hardware and small, nonequivalent controls.

I expect that Dennis will have some interesting observations to share with us, and look forward to hearing reports from the field.

Chuck E. Cheese Learns Logo

I dropped into my local Pizza Time Theater last night and was quite pleasantly surprised to see a half-dozen Apple computers being used to teach Logo to members of the Pizza Time Theater computer club. This step-up from the arcade games comes as a pleasant rejoinder to those who claim that such places have no redeeming social value. I haven't found out if this is a purely local phenomenon, but I endorse the idea of locating computer clubs in pizza parlors and arcades and would like to hear from those of you who have seen or used such facilities in your area.

A Final Note

Some of you may have guessed that I am a technology junkie. Well, you are right. I have composed this entire column on a word processor that sits on my lap as I rest under a tree in the middle of a park. I have been using the Radio Shack Model 100 computer, and it has been working beautifully. I may write a review on it for the next issue. Meanwhile, keep those cards and letters coming.

Send me your turtle graphics discoveries so we can share them with other Friends of the Turtle! ©

Learning With Computers

Glenn M. Kleiman

After The Basics Of BASIC...

One of the questions I'm often asked is: "What do I do after I've learned the basics of BASIC?" Many people have taken introductory classes or read books about BASIC programming. They have mastered using PRINT, INPUT, GOTO, FOR-NEXT, IF-THEN, and other commands of the BASIC language and have written some simple programs. These introductions to BASIC help people gain a better understanding of computers and the nature of programming. However, they are not sufficient for learning to write the types of programs most people want to use. It's a lot like learning a foreign language: learning some of the vocabulary and grammar in school or from a book does not make you a fluent speaker of the language.

Humanized Programs

In this month's column, let's examine two books designed to help you become fluent in BASIC. Both books are for people who already know the fundamentals and want to learn more, and both teach you to develop well-structured, easy-to-use programs. These books are designed to be read while you work at the computer – the only way to learn a language, whether a human language or a computer language, is to practice using it.

Apple Backpack: Humanized Programming in BASIC, by Scot Kamins and Mitchell Waite. Byte Books, 1982, $14.95.

This book aims to help you learn to write *humanized* programs – the authors' term for what others call "user-friendly programs." Humanized or user-friendly programs make the computer adapt to the people who use it, rather than force the people to adapt to the computer. Humanized programs provide easy-to-understand screen displays and clear instructions. They give prompts when users are to enter responses and let users correct or change responses. They wait until users signal they are ready to proceed, and provide help if users become confused or forget some of the instructions.

After a brief introduction about humanized programming, *Apple Backpack* contains four chapters which explain many of the techniques for creating well-designed programs. Each chapter starts with simple components of programs and gradually builds more complex and powerful routines. Although the examples are written in Applesoft BASIC, they are all easily modified for other versions of BASIC, and the authors are careful to point out when they use commands that are idiosyncratic to Applesoft. Therefore, this book will also be useful to those who are using Commodore, TRS-80, Atari, and other computers.

Chapter 1 shows how to create well-formatted screen displays. It begins with algorithms for centering and right justifying text and for drawing borders. It then proceeds to more sophisticated routines. These include an "anti-splitting" routine for formatting text so that words are not split between lines, a routine which presents long sections of text, one screen-full at a time, and routines for formatting numbers into columns.

Chapter 2 is about "crashproofing" programs – designing them so that they behave reasonably when users give unexpected responses. This chapter shows how to create programs which check for incorrect input – a number when a letter is expected or vice versa, too large or small a number, a name with too many letters, a response that begins with a space, or one of the many other possibilities that can wreak havoc on programs that are not crashproofed.

Chapter 3 shows how to write programs which let users check and change information they have entered. It covers programming to allow users to make immediate corrections and to make

UNIQUE MULTI-USER SOFTWARE BRINGS NEW EXCITEMENT TO GROUP LEARNING.

The results are always the same. Put a computer in a classroom and children are drawn to it like steel to a magnet. And even though only one child actually uses the computer, the others coach or offer encouragement. Involving as this activity may be, it fails to take advantage of one of the best known principles of learning. But more about this later.

A simple idea.

When two educational researchers, Dr. Matilda Butler and Dr. William Paisley, studied the interaction of children around microcomputers they had an interesting, yet simple, idea. Instead of one user and several observers, why not give every child the opportunity to learn simultaneously. This idea sparked an entire line of unique educational software and gave birth to a new company, Edupro.

Learning through cooperation and competition.

Each one of Edupro's Microgroup™ computer programs presents your students with a different learning environment. It may be a visit with storybook friends. A trip through American history. Or an exploration of the world around us.

In any case, the principles are the same. Mathematical, language arts, social studies, and science problems are presented as contests, races, and puzzles. Using joysticks or paddles up to eight children work together, either competitively or cooperatively. They race against time, each other, or both.

Forgotten principle.

Now about that principle of learning other educational software ignores.

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changes after all the information has been entered and processed.

Chapter 4 covers providing directions and helpful information on the computer screen. It describes the need for clear instructions within the program and the value of providing prompts when people are to enter information. It also covers techniques for making extra help available when the user presses a special key.

These four chapters on programming provide an excellent blend of general discussion, examples of programming routines and complete modules, and very clear, line-by-line explanations of how each program works. While you can simply plug the provided modules into your own programs, the authors' main aim is to help you understand the modules presented and learn to create your own.

There is a fifth chapter which is not about programming at all, but about principles of writing good documentation. This chapter discusses both tutorials which help beginners get started and reference aids which serve as reminders for those who have learned to use the program.

The appendix contains two complete programs, a States and Capitals educational game and an Electronic Phone pad for storing and retrieving telephone messages. These programs demonstrate how the modules discussed in Chapters 1 through 4 can be combined into useful, humanized programs. Each program has complete written instructions which demonstrate the principles in Chapter 5.

Apple Backpack is a valuable guide for anyone who has mastered the fundamentals of BASIC and wants to become a fluent user of the language. It is at the right level for those who have been introduced to the BASIC commands and written a short program or two. Careful study of this book will help novice programmers advance a long way toward creating their own sophisticated, humanized programs.

Graphics And Sound

Techniques for Creating Golden Delicious Games for the Apple Computer, by Howard M. Franklin, Joanne Koltnow, and Leroy Finkel. John Wiley & Sons, Inc., 1982, $12.95.

This book focuses on programming the graphics and sounds that are such an important part of computer games. Its philosophy is similar to *Apple Backpack* in that it explores principles of good program design and coding, example program modules, and actual programs. However, the sound and graphics programming examples are unique to Applesoft BASIC, so this book is only for those who are programming Apple computers.

Entering many of the programming examples requires a great deal of typing and, of course, everything has to be exactly correct. Fortunately, a set of two disks containing all the routines is available from the publisher for $34.95.

The first of the seven chapters covers musical notes and sounds. It begins with simple routines which use the "bell" sound built into the Apple. On the Apple, more sophisticated sounds require a machine language routine. The authors provide a suitable one to be used as a musical "black box" – you are told how to use it, but not how it works. Since the book is about BASIC, but a machine language routine is required to play musical notes on the Apple, this is a good approach.

Several interesting programs make use of the black box. One plays simple tunes, another turns the Apple into a toy piano in which each key plays a different note, and a third lets you experiment with different sound effects. The sound effect program can be valuable for developing sounds to fit your games.

Chapter 2 introduces the fundamental commands for using low resolution color graphics. Chapter 3 offers an image module which lets you display low resolution images on the screen in any position and color. It also provides a set of uppercase letters and numbers created with low resolution graphics. In addition, this chapter explains how to design new images and incorporate them into the program, and it gives several example pictures.

Chapter 4 is on high resolution graphics. More on this chapter later.

Chapter 5 covers routines for handling data entry. A sophisticated, general-purpose input module is presented. By using this input subroutine within your program and setting certain variables, you can control whether the computer will accept letters (and the maximum length of the response), integer or decimal numbers (even setting the lowest and highest acceptable values), Y or N only (for yes/no questions), or any single keypress.

The input subroutine also signals when the ESC key is pressed, so you can use ESC within your programs to let the user ask for help, return to an earlier part, quit, or request other special functions. This input module is powerful and can greatly simplify writing programs requiring different types of responses from the user. It will also help you crashproof your programs.

Chapters 6 and 7 include fully developed games which use the modules from Chapters 1, 2, 3, and 5. The programs include: (1) a story game in which the computer asks a series of questions and then inserts the answers in a previously constructed story format; (2) a nonviolent version of the hangman word game; (3) a word-matching game; (4) a concentration game which uses

matching color patterns; (5) a number-guessing game; and (6) a version of the memory game Simon. While none of these games will put *Pac-Man* out of business, they are all good examples of the types of educational games many people could learn to program, and they provide useful examples of how to incorporate the modules into programs.

Routine Libraries

The sound, low resolution graphics, and input modules in this book are valuable components which can simplify creating many programs. These modules, and the discussion in the book, encourage people to develop their own libraries of general-purpose subroutines and to develop well-structured programs. In addition, a great deal can be learned by studying how the games are programmed and making your own revisions and extensions of them.

Since *Golden Delicious Games* focuses on sound and graphics while *Apple Backpack* focuses on text and number processing, the two books complement each other very well. In fact, the only way they overlap significantly is that both provide routines for accepting input. A comparison of the similarities and differences of the two input routines is interesting in itself, since it lets you compare different approaches to the same goal of making it easy for people to enter information.

However, the *Golden Delicious Games* book contains very little discussion of how each module works. Also, there isn't an adequate discussion of high resolution graphics. The chapter on high resolution graphics is by far the shortest one in the book, and about one-third of it is spent discussing the problem of color conflicts on the Apple screen. Unfortunately, the simple solutions to this problem are never mentioned. We can conclude this month's column with an overview of hi-res graphics.

Software For High Resolution Graphics

There are three general types of software tools for using high resolution graphics from Applesoft BASIC. One type is high resolution character generators, which let you create your own character sets and display them on the high resolution screen. Such sets are useful for combining text and pictures, for using characters of different sizes and colors, for having non-English alphabets in your programs, and for adding lowercase letters to the Apple II and II+ screens. High resolution character generators are designed so that the standard BASIC print command is used to display characters from your program. You can also create characters of different shapes and combine them on the screen to form pictures. By printing, erasing, and reprinting these characters, you can even create simple animations.

The second type of high resolution tool lets you create pictures that cover all or part of the screen, save them on a disk, and bring them back to the screen from your program. Some of these tools use commands typed on the keyboard, some use joysticks or game paddles, and some use graphics tablets. In the November 1982 "Learning With Computers" column I reviewed picture-creating programs. My focus there was computer art, but the pictures created with those tools could be easily incorporated into programs.

The third type of high resolution tool facilitates working with shape tables. Shape tables save instructions to the computer for re-creating a shape you have drawn. Commands in BASIC let you place the shape anywhere on the screen, as well as change its size, orientation, and color. Shape table pictures can be placed over a full screen picture and can be used to create animations.

The following is a list of companies which market programs to help you incorporate sophisticated high resolution graphics into your programs. This list doesn't cover all those available, but I have used all the programs listed below, and each serves its intended purpose well. With these tools, you can program professional quality high-resolution graphics. In fact, the *High Text* and *Graphics Magician* programs listed below are widely used in commercial educational programs:

1. Synergistic Software (5221 12th Ave. S.E., Bellevue, WA 98006) offers *High Text*, an advanced high resolution character generator which lets you use characters of different sizes and colors. It also produces a good tool, called Higher Graphics, for working with shape tables.

2. Penguin Software (830 4th Ave., Geneva, IL 60134) sells the well named *Graphics Magician*. It combines picture creating, shape table, and animation capabilities.

3. Beagle Brothers (4315 Sierra Vista, San Diego, CA 92103) has several high resolution character generator, picture-creating, and shape table programs.

4. Edu-Soft (P.O. Box 2560, Berkeley, CA 94702) markets an inexpensive high resolution character generator program.

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ATMONA-2

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Order # 7099	disk version	$89.00
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Order # 7098	32k RAM	$49.95
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FORTH for the ATARI

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Works with gameports. No additional power supply needed. Comes compl. assembled with software (2716, 2732, 2532).

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Develop-20

Tina Halcomb

Without a knowledge of assembly language, it can be an impossible task to turn a great idea into a fast, smooth game. One solution to the problem is *Develop-20*, a collection of software tools designed to help the VIC-20 programmer advance beyond BASIC.

Develop-20 consists of an Editor, Assembler, Loader, Monitor, and Decoder. A similar collection, *Develop-64*, is available for the Commodore 64.

An informative guide is included with the package. If you are not already acquainted with 6502 assembly language, you will find this guide a very good introduction. It describes the architecture and functions of the 6502 chip from a user's viewpoint. The definitions and examples clearly explain the use of the addressing modes, register set, and instruction set.

The Editor

The original (Source) programs are created and modified with the Editor program. As you enter your program, it checks the validity of the mnemonics, and checks to see if the correct addressing modes are being used with respect to the mnemonics.

When you run the Editor, you will see a CPLDIMS prompt. You can then choose one of the seven functions of the Editor program. C is the create mode, used to enter new programs. P prints a listing of the program to the screen. L loads a program on cassette or disk into memory. S saves the source file in memory to cassette or disk. The editing capabilities of the Editor program are limited to D, which deletes lines; I, which inserts lines; and M, which lets you modify any line. Modifications can be made only one line at a time.

There are two unusual aspects to this Editor. When you use zero-page addressing, you must identify the address with a left arrow.

```
STA← $00
```

Most assemblers are capable of determining that you intend zero-page addressing if the specified address is in zero page ($00-$FF).

Also, during program entry, there is no space allowed between the opcode field and the operand field. However, once each line of the program is entered and you press RETURN, the line is displayed in the standard 6502 assembly format with one space between each field.

In an unexpanded VIC, you can write programs with up to 89 statements. With any size memory expansion, the program size can increase by 50-75 statements per K of memory.

Assembling The Program

To translate your source program into executable machine (object) language, it must be loaded in with the Assembler program, assembled, and saved as an object file. The actual *saving* process is identical to that of the Editor program. You must remember that the two output files are different. The source is saved like any other text file, and the object is saved as a binary file. A distinguishing extension for the file name is not automatic. Perhaps setting a standard of extensions like a .BIN or .OBJ for binary object files and .TXT of .SRC for the text source files will make it easier for you to identify them.

Due to the limited amount of memory, the programs are assembled to a file on disk or cassette instead of directly into memory. In order to run the object code that you have just created with the Assembler program, you must save the object file and load it back into memory with the Loader program.

RUN In Single Steps

The Monitor is a very useful tool for debugging your software. It allows you to load your program and run it in single steps (one instruction at a time). As each instruction is executed, the instruction is displayed along with the status of all registers. This allows those just learning the language to watch what happens in each register and what changes occur in the status register (the flags) as a program runs.

The fifth tool of this package is the Decoder, which is a disassembler. This program takes machine language (executable object files) and translates them back into source files (mnemonics). The program produced by the Decoder will only resemble the original source program because it does not produce labels. For example, in a loop, instead of seeing branches to labels, you will see jumps to absolute addresses.

What would a game programmer's tool kit be without

graphics tools? The manual includes information concerning screen and character management, color modes, joystick controllers, and sound and musical effects.

This collection of software tools is an effective, reasonably priced way to develop your machine language ideas into working VIC programs.

Develop-20
French Silk Smoothware
P.O. Box 207
Cannon Falls, MN 55009
$49.95

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Astro Chase

John Blackford,
Assistant Features Editor

Astro Chase, by Fernando Herrera, is a lively space-action game with impressive graphics and sound. Written for Atari, it contains several innovative features that distinguish it from others on the market.

The object of the game is to defend Earth from aliens of the Megard Empire. The playfield, which is a two-dimensional (map-style) depiction of the galaxy, is several times larger than the area visible on the screen. As you move your ship – Earth's sole defender – toward the edges of the screen, the background scrolls to reveal other portions of the galaxy. You can't visit the entire galaxy, however. The Megardians have thrown up an invisible force field that keeps you in the vicinity of Earth.

That's just as well, for to succeed at *Astro Chase*, it's best to cruise near Earth, intercepting the robot-like Mega Mines as they move in. If one of the mines reaches the home planet, the result is a spectacular, game-ending explosion.

The Mega Mines have only one objective: to reach Earth. They never deviate from their path and cannot attack your ship, but the attack fighters can and will. As you advance to the higher levels, the fighters become more numerous and wield more impressive power. Some of them try to ram your ship; others fire lasers; some can even pass through planets in their relentless search for your craft. If you spend too much time going after the fighters, the Mega Mines will surely get through.

Maneuvering Hints

One of the most challenging aspects of the game is learning to control your spaceship. You can set your course, then aim and fire your lasers independently – all with the joystick and fire button. The result is a very versatile craft, but one that's difficult for beginners to handle. The secret is that when the fire button is depressed, the joystick controls the direction of the lasers. When the fire button is up, the joystick controls the ship. It sounds simple, but practice is required.

If you bump into a planet or the force field, you'll bounce back – perhaps adding to the confusion until you get the hang of maneuvering the ship. Another pitfall is the *hot stars*. These are bright stars scattered around the galaxy. If you run into one, you'll be stopped until you back up and go around. Running into either the hot stars or the force field drains energy from your ship, as does moving and firing lasers. You can recharge your energy by flying back and forth over one of the four energy generators. There's one at each corner of the square

In Astro Chase, *you defend Earth against aliens of the Megard Empire.*

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Meaningless number codes for account set-up	No	Yes
Easy-to-understand letters for account set-up	Yes	No
All programs big, slow loading, compiled	No	Yes
Working programs in flexible, *fast loading* BASIC	Yes	No
Backup to inexpensive tape?	Yes	No
Backup to disk available?	Yes	Yes
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force field.

Shield depots are also located around the force field perimeter. When you fly through one, your ship turns from solid white to flashing colors – and you are invulnerable for ten seconds. You can even ram and destroy the attack fighters. But don't neglect your main mission: eliminating the Mega Mines.

For Experts Only

When you begin *Astro Chase*, you are in level eight. With the Select button, you can choose any one of 24 levels. Each time Earth is destroyed, you move down one level. But if you destroy all 16 Mega Mines, you move up to the next higher level. And if you go beyond level 24, you reach the master level (24-34); it's definitely for experts only.

The graphics in the game opening and the intermissions after each group of seven levels strikingly depict the spaceport on Earth. In the first sequence, you, the pilot, walk out and beam onto the spacecraft, which lifts off in a blaze of rocket fire.

The pilot returns to the spaceport in the first intermission, looks around, and asks, "Where is everybody?" Each scene that follows is slightly different. If you move from the lowest levels all the way to the expert grade, the intermissions provide a little story line within the game.

The action in *Astro Chase* can get pretty frantic as you dodge the fighters, bouncing into planets and stars – all the while trying to stop the undeviating Mega Mines. But you can succeed by mastering your ship's movement and developing a prudent strategy for engaging the Mega Mines. If you like space-action games, this is one to look for.

Astro Chase
Parker Brothers
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Galactic Blitz For The VIC-20

Tony Roberts, Assistant Managing Editor

You're sitting alone in your spaceship when, suddenly, swarms of aliens, daring you to shoot them down, appear in the darkened sky. The aliens swirl, dart, and loop-the-loop before streaming off out of sight. Seconds later they return to taunt you again.

The game is *Galactic Blitz*, produced by Tronix for the unexpanded VIC-20. The instructions are simple: shoot down the aliens, pile up the points.

Galactic Blitz, programmed by Jimmy Huey, is a smooth, fast machine language game that looks deceptively easy. But it turns out to be devilishly frustrating and mildly addicting. Throw in the eerie whine of the aliens and the game takes on a hypnotic quality.

With a joystick, you move your ship back and forth along the bottom of the screen. You fire in only one direction – straight up.

The aliens, which attack in groups of 15, could easily find work in the National Football League. They run patterns more precisely than any wide receiver. They swirl, climb, and dive one after the other until all 15 have either been shot down or have completed their pattern.

But even as the colorful alien squadron dazzles you with its precision flying, its members are on the attack. They drop a barrage of bombs that keep your ship on the move.

Be Prepared To Dodge

The 15 patterns the aliens employ are easy enough to learn, but discovering the best defense against each is more difficult.

If you find yourself cowering in the corners to avoid the bombs raining down at center screen, you may lull yourself into thinking you've found the answer. Check the score counter, and you'll find many of the aliens are blinking off the screen before your hits are recorded.

As the game progresses, the aliens move lower and lower, giving you less time to react to their bombs. In one pattern the crafty attackers fly off the bottom of the screen, then reappear right where you're likely to have positioned your ship. Just when you thought you were in control, you've lost another vessel.

Galactic Blitz is easy to play, but not easy to beat. And you'll find yourself trying to win again and again.

Galactic Blitz
Tronix Publishing, Inc.
701 West Manchester
Inglewood, CA 90301
$24.95

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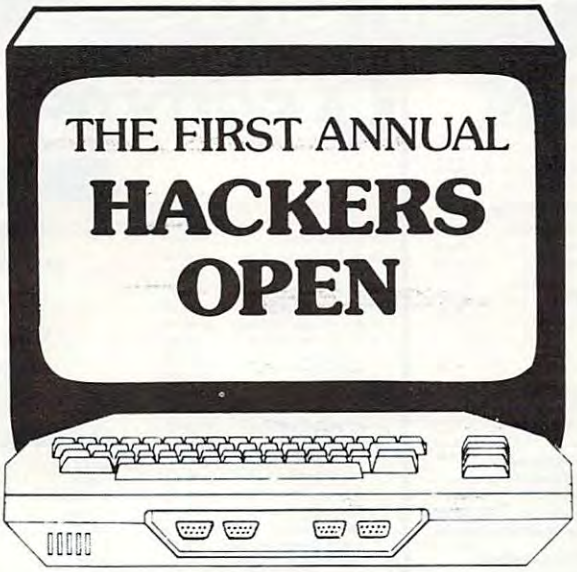

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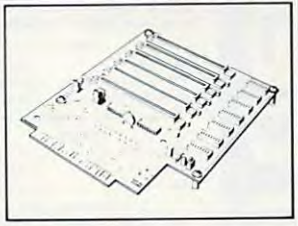

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Space Station I For The TI

Tony Roberts,.Assistant Managing Editor

Space Station I mixes the sprite movement and sound abilities of the TI-99/4A with an interesting space-attack scenario to produce a fluid and challenging arcade-quality game.

The program, available on disk or cassette from Data Force, requires that your TI be equipped with Extended BASIC and extra memory.

The action takes place in the year 2020. An invisible alien force has attacked and defeated a secret military outpost orbiting Saturn, and has turned its attention to Earth, which you must defend. The battle at Saturn, however, took its toll on the alien force, weakening its firepower, damaging its tactical computers, and making its drones visible 99 percent of the time.

Once the battle began, the Saturn outpost lasted only 34 seconds, but during that time, the station's tactical defense computer was able to transmit information back to Earth. The computer's report, which is printed in the instruction pamphlet, includes clues for developing the strategy you'll need to stave off the attackers.

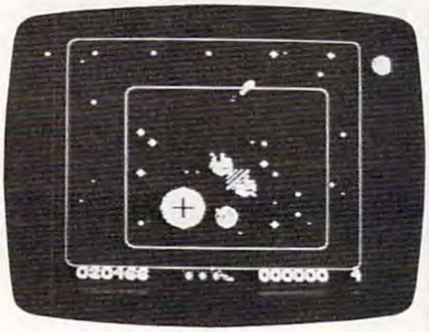
Watch Battle On Scanner

On your scanner screen, you see Space Station I, orbiting quietly. Two green boxes are drawn around it. Press ENTER, and the sprite display begins. The alien drones, attacking in groups of three, swoop in; misguided missiles and bombs fly past; an orange alien command ship may appear from out of nowhere.

Using the keyboard or a joystick, you bring your target beam into play. Place it over an alien ship or missile and fire a torpedo. The torpedo, which is released from the bottom of the screen, flies to the point designated by the target beam and detonates. The beam can be moved to a new target before the first torpedo detonates.

Most of the alien missiles are harmless. Those released by the drone ships or the command ship, however, are not. Your main concern is stopping the drones. They attack in groups of three, and sometimes hide off the edges of the screen. You'll learn to listen for the characteristic sound that tells you the drones are nearby.

The drones will fire only from within the inner green boundary, and once a missile is fired, the drones are helpless until the missile hits Space Station I or flies past the boundary area. If a missile is off course, it is best to attack the drones while they are helpless, then drop back on defense. Your station can survive five hits before the game ends.



The green targeting beam is used to zero in on the aliens in Space Station I.

The Command Ship

Your other concern, the command ship, has neither lost its invisibility nor its long-range firing ability. It must become visible to launch an attack, but after it fires, it disappears again. The command ship's foghorn-like sound, however, is its weakness. When you hear it coming, search for it with your targeting beam (you'll see its shadow if you find it), and fire.

Space Station I starts out rather slowly, giving you a chance to find your way around. But with each 10,000 points you accumulate, the aliens step up the attack. If you manage to accumulate 100,000 points, your hit counter will be reset to one, giving you four chances to play at high speed.

To play the game successfully, you'll have to develop a sound strategy, and you'll have to be capable of reacting to assaults from all parts of the screen. It's quite a challenge.

Space Station I
Data Force Incorporated
10 S. 312 Hampshire Lane East
Hinsdale, IL 60521
(312)323-0179
$34.95

©

Calc Result

August Schau

"Spreadsheet" programs have proven to be among the most popular software for microcomputers over the past several years. Essentially, a spreadsheet is a specialized language – complete with rules and commands – designed to help with simulations and modeling. They let you set up complex arrays of interrelated information and then, by changing one aspect of the model, you can watch the effects throughout the entire structure. Spreadsheets are especially useful in analyzing budgets, finance, and other systems which are based upon mathematical relationships.

Calc Result is a spreadsheet program for the Commodore 64. It organizes information on a grid made up of 63 columns labeled A-BK, by 254 rows. Individual cells within the grid are identified by referring to the column and row that intersect at

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the cell location. For example, the cell located at the intersection of column M and row 19 has coordinates M19. One 63 by 254 matrix of cells is called a page, and a *Calc Result* file can contain up to 32 pages.

Calc Result will store data in these cells as labels or values. Labels are descriptive text, and values are numbers that can be entered directly or calculated according to a formula that is stored in the cell. The program assumes that a value or formula is being input, and unless told otherwise it will not allow a label to be entered as a value. By referring to the coordinates of other cells, the program can incorporate their present values into a formula. Formulas operate according to normal mathematical laws and may include trigonometric functions.

When the value in a cell is changed, the values in all cells containing formulas that refer to the changed value are automatically recalculated. All formulas are protected so that a value cannot be entered and replace the formula in the cell. If this occurred, future recalculations would be affected. This protection can be removed so that formulas can be edited.

Special Functions

Formulas including special functions such as MEAN can be used instead of the lengthy formula that would otherwise be necessary to find the average of the values from a large number of cells. Other functions can search through a specified group of cells and locate the largest or smallest value within these cells.

The IF-THEN...ELSE function allows a formula to take one of two forms depending on whether a predefined condition has been met. For example, the formula can test the value in a cell, multiply the value by 3 percent if the number falls below $250 or multiply by 6 percent if the value is $250 or greater.

The three-part manual, bound in a 7-by-9-inch ring binder, uses color-coded pages for easy identification. Part one contains instructions for the initial start-up and preparation of program and data disks. The master disk prompts the user through the creation of a program disk. In the process, information is entered about the printer and number of disk drives.

English is selected for the help screens from the eight languages available, and colors are selected for the border, background, and foreground. The newly created program disk is used to create a data disk for use with dual disk drive setups.

Part two is a five-lesson tutorial that introduces the user to *Calc Result*. The instructions are keystroke by keystroke at the beginning, but in subsequent lessons, the instructions become less specific. During a lesson you can check your progress against the numerous color illustrations. The values in key cells are also given as a self-check.

Part three is a reference containing descriptions of all of *Calc Result*'s commands and functions. In my copy of the manual, I have inserted a divider at the beginning of this section for quick access to the reference index.

Help Always At Hand

Calc Result contains a series of help screens to replace the pocket reference cards that often come with software packages. When the system commands are accessed with the F7 key, you are prompted across the top of the screen with the symbols of the available commands. If you do not recall what each symbol stands for, the F5 key will display a list of the symbols and the commands they represent along with a brief explanation of the command.

The desired symbol can be entered directly from the help screen.

The help screens, which operate quickly and efficiently with only a momentary interruption in the operation of the program, eliminate the need for repeated use of the reference manual.

Duplicating Pages

Once labels and formulas have been entered on a page, the page can be used to create additional pages with the identical format. Labels and formulas will be transferred to the new pages. The newly created pages can be called to the screen and titled so they are easier to tell apart.

The values from each cell of an individual page can be added to the values in the corresponding cells of other pages. These sums are placed in corresponding cells on page 32. When pages are added in this fashion, the cells on page 32 will have formulas identical to the individual pages, and the summary page will have the same recalculation power. Pages also can be added so that the values of the corresponding cells are added without carrying the formulas to the summary page.

The addition function would support the design of an annual budget that accepts monthly data and provides an end-of-year summary.

When *Calc Result* files are called up from the data disk, all of the pages are temporarily stored in a work area on the program disk. With a single disk drive, files must be saved on the program disk since data stored in files can be brought into internal memory only via the work area.

Two pages at a time can be loaded into the computer's internal memory, where data is entered onto the page and calculations made. Either of the pages currently stored in internal memory can be worked on by calling it to the screen. If a third page is called up, the page currently

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This is a user friendly database that makes any information easy to store and retrieve. The user defines the fields and then can add change, delete and search for any category he wants. When combined with the SCRIPT-64 Executive Word Processor you can search out any category (zip codes, hair color, etc.) and print super personalized letters. List $89.00. Sale $69.00. (plus postage) Disk Only.

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Requires 32K Please specify configuration.

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Editor, Assembler, Relocater, Linker

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4K or 8K bytes of soft ROM with optional battery backup.

RAM-ROM is compatible with any large keyboard machine. Plugs into one of the ROM sockets above screen memory to give you switch selected write protectable RAM.

Use RAM/ROM as a software development tool to store data or machine code beyond the normal BASIC range. Use RAM/ROM to load a ROM image where you have possible conflicts with more than one ROM requiring the same socket. Possible applications include machine language sort (such as SUPER-SORT), universal wedge, Extramon, etc.

RAM/ROM — 4K	$75
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Battery Backup Option	20

SUBSORT for PET/CBM $35

Excellent general purpose machine language sort routine.

THE WHOLE PET CATALOG $9

A two year 320 page compendium of the Midnite Software Gazette for Commodore computer users. Contains 500 reviews of commercial products, 700 education programs (reviewed and organized by course), 200 reviews of free games, info on over 1800 free programs, list of PET and VIC user groups, and many pages of helps and hints.

COMAL Package for CBM **$25**

Includes software on disk, and Comal Handbook

SuperGraphics 2.0

NEW Version with TURTLE GRAPHICS

SuperGraphics, by John Fluharty, provides a 4K machine language extension which adds 35 full featured commands to Commodore BASIC to allow fast and easy plotting and manipulation of graphics on the PET/CBM video display, as well as SOUND Commands. Animations which previously were too slow or impossible without machine language subroutines now can be programmed directly in BASIC. Move blocks (or rocketships, etc.) or entire areas of the screen with a single, easy to use BASIC command. Scroll any portion of the screen up, down, left or right. Turn on or off any of the 4000 (8000 on 8032) screen pixels with a single BASIC command. In high resolution mode, draw vertical, horizontal, and diagonal lines. Draw a box, fill a box, and move it around on the screen with easy to use BASIC commands. Plot curves using either rectangular or polar co-ordinates (great for Algebra, Geometry and Trig classes.)

The SOUND commands allow you to initiate a note or series of notes (or even several songs) from BASIC, and then play them in the background mode without interfering with your BASIC program. This allows your program to run at full speed with simultaneous graphics and music.

Seven new TURTLE commands open up a whole new dimension in graphics. Place the TURTLE anywhere on the screen, set his DIRECTION, turn him LEFT or RIGHT, move him FORWARD, raise or lower his plotting pen, even flip the pen over to erase. Turtle commands use angles measured in degrees, not radians, so even elementary school children can create fantastic graphic displays.

Specify machine model (and size), ROM type (BASIC 3 or 4)

SuperGraphics in ROM ($A000 or $9000) $45

Volume discounts available for schools.

FLEX-FILE

for PET/CBM Computers

NEW VERSION 2

now for C64

FLEX-FILE is a set of flexible, friendly programs to allow you to set up and maintain a data base. Includes versatile Report Writer and Mail Label routines, and documentation for programmers to use Data Base routines as part of other programs.

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Record size limit is 256 characters. The number of records per disk is limited only by record size and free space on the disk. File maintenance lets you step forward or backward through a file, add, delete, or change a record, go to a numbered record, or find a record by specified field (or partial field). Field lengths may vary to allow maximum information packing. Both subtotals and sorting may be nested up to 5 fields deep. Any field may be specified as a key. Sequential file input and output, as well as file output in WordPro and PaperMate format is supported. Record size, fields per record, and order of fields may be changed easily.

MAILING LABELS

Typical mail records may be packed 3000 per disk on 8050 (1400 in 4040). Labels may be printed any number wide, and may begin in any column position. There is no limit on the number or order of fields on a label, and complete record selection via type code or field condition is supported.

REPORT WRITER

Flexible printing format, including field placement, decimal justification and rounding. Define any column as a series of math or trig functions performed on other columns, and pass results such as running total from row to row. Totals, nested subtotals, and averages supported. Complete record selection, including field within range, pattern match, and logical functions can be specified.

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Backup disk available, $10 additional.

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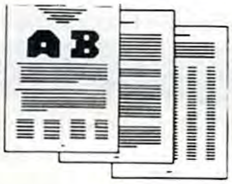

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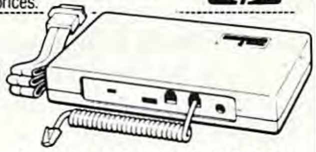

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A full-screen chart containing eight bars is created with a labeled scale along the left margin. The chart can be scrolled left and right with the cursor keys to display the bars for the entire column or row.

The portion of the chart displayed on the screen can be printed.

I have used another spreadsheet program with a Commodore 8032 to introduce this type of computing to my data processing students. *Calc Result* compares quite favorably with the other program and includes additional features such as color, graphics, and multiple pages. I highly recommend it.

Calc Result
Computer Marketing Services, Inc.
300 W. Marlton Pike
Cherry Hill, NJ 08002
$149.95

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Atari *Airstrike*

James V. Trunzo

The creators of *Airstrike* warn you in their advertisements that *Airstrike* is "very, very difficult" and that it is "The definitive, super-fast, multiple-skill, shoot-out game for Atari 400/800...." This warning is the last mercy the game designers do for you. *Airstrike* turns you into the "Rocky" of game players; it keeps knocking you down and you keep coming back for more.

At first glance, *Airstrike* appears to be little more than a typical see 'em and shoot 'em arcade-style game. Like *Scrambler* and *Cosmic Avenger*, *Airstrike* puts the player in the cockpit of a fighter bomber and sends him careening across the screen, firing at anything that moves. Surface to air missiles must be destroyed before they destroy you. Like *Caverns of Mars* turned on its side, *Airstrike* forces you to navigate through a field of fission bombs that move randomly up and down the display screen. Unlike other games, however, *Airstrike* takes these ideas one step further, moving them from the realm of the difficult to the almost impossible. And *Airstrike* throws in more than a few original ideas and variations of its own.

Quark Bombs

When play begins, the player is given three Mark V fighter bombers capable of one-way flight (though it can be jockeyed up and down) and armed with both a laser cannon and quark bombs. The cannon is front-mounted and is controlled by the fire button on the joystick, the shot traveling horizontally; the bombs, controlled by the space bar, arch out of the vessel, dropping on targets below.

Several things should be mentioned concerning the weapons. Unlike other games, pressing the fire button does not fire the cannon while simultaneously releasing a bomb. What this means is that the player who typically keeps both hands on the joystick must adjust to the necessity of freeing one hand to drop bombs. Also, because the bombs arch away from the ship, timing becomes a bit more precise. And it is crucial that the space bar be completely depressed or the bomb will not be released, and the amount of ammunition you have is limited.

On the easiest of the five levels, you begin with 10 quark bombs and 40 shots in the laser cannon. You cannot simply fire shot after shot and release bomb after bomb. Accuracy becomes essential to completing a mission and achieving a good score. Actually, the destruction of most ships will be the direct result of having missed a shot. This is due, for the most part, to the fact that successful play occurs after the player has established a pattern of sorts and fallen into a rhythm. Missing a crucial shot upsets the pattern and disrupts that rhythm, and then another Mark V goes up in a nicely done graphic explosion.

Incidentally, though you begin the mission with a limited amount of fire power, you can gain extra missiles and bombs by destroying ammo dumps. (Don't miss the last ammo dump before entering the meteor shower; that's almost certain doom.)

Several Screens

To complete one full mission, you must traverse a number of screens. The first two screens are made up of basic mountain-type terrain. These ranges are defended by surface to air missiles and fission bombs, the latter of which are really nasty because of their erratic movement.

Once you're past the mountain ranges, the next display forces you to navigate across an entire screen of descending

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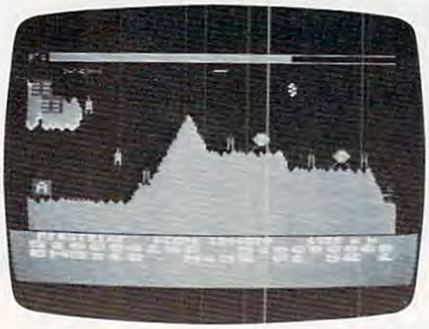

Airstrike.

meteors whose slightest touch spells instant extinction. The meteor shower looks suspiciously like a lot of fission bombs raining down upon your ship, but in any case, this screen is no easier than the first two.

Assuming you pass safely through the meteors, you approach a series of sliding airlocks which must be blown open (achieved by hitting an area about the size of a pinhead – while it's moving) in order to complete your first pass. And did I mention that all the airlocks after the first are guarded by alien ships that must be circumvented in order to survive? Or that the locks are in various positions on the screen and not a straight shot so joystick maneuvering is a must? Very, very difficult, and this is level one.

If there's anything after this, I wouldn't know because I've never made it through a complete pass. The instructions indicate that once through the sliding airlocks, the player proceeds to the next color-coded level at which point, I assume, the mission repeats itself. The added difficulty, from what information could be gleaned by selecting a higher complexity level to begin with, stems from the fact that the enemy defenses move much faster and the player's vessel begins its run with less ammunition.

Airstrike comes with several options. For openers, there are five difficulty levels at which to begin play. In addition, the game can be played by either one or two players, alternating turns. Also, a game may be interrupted during the course of play by depressing the CTRL key and 1 together.

A minor annoyance occurs after you lose one of your three ships: the next one appears so fast that there is little time to regroup. The only other complaint that might be registered is that until you are within the sliding locks area, any destruction of your ship sends you back to the very beginning of the program. Because it's so difficult to advance from screen to screen, especially for novices, this can be a tad frustrating.

All in all, *Airstrike* is exactly what it claims to be – a very demanding program. If you want a challenge, *Airstrike* is the game for you.

Mechanically, the game is quite strong. The scrolling and the graphics are very well done. The player's ship, missiles, bombs, and targets are clearly defined and, with the exception of the spaceship itself, all graphics are flicker-free. In addition, colors are vivid and the sound effects, though limited to explosions of one type or another, are more than adequate.

Airstrike
English Software Company
P.O. Box 3185
Redondo Beach, CA 90277
$39.95

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HESCAT For PET/CBM

Steve Leth

Soon after getting my PET, I realized I had a problem: cassettes. Hundreds of them. All over the place. After buying a disk drive, I thought my troubles were over. But now I have a new problem: diskettes. Hundreds of them, and, worse yet, they each hold one to two dozen programs. What I needed was a way of cataloging all these programs and the disks they're on: an inventory program, for programs. Enter *HESCAT*, a disk catalog program written by Jerry Bailey and distributed by Human Engineered Software.

HESCAT is available on disk for versions of PET/CBM with Upgrade ROMs or 4.0 BASIC, 40- or 80-column screens, and at least 16K of memory (32K preferred). It works with 2040, 4040, and 8050 disk drives.

How *HESCAT* Works

HESCAT is a series of programs accessed via a menu that appears when you run the main program. To perform a particular function, you just enter its number and the appropriate program is loaded. After each function is complete, you return to the main menu. Because every function except HELP is implemented as a separate program, *HESCAT* packs a lot of power into a 16K PET/CBM.

The first step in using *HESCAT* is to catalog your diskettes with the CATALOG function. CATALOG copies information from the directory of the disk being cataloged, which is in drive #1, and records it on the *HESCAT* disk, which must always be left in drive #0. After it has retrieved all the data from one disk, *HESCAT* asks you to insert the next disk. This continues until information from all your disks has been recorded on the *HESCAT* disk.

Exactly what kind of information is kept for each disk? The two-digit disk ID, the disk name, the number of free and allocated sectors, and the number of files on the disk are stored in a file called HEADERS. Then, for each diskette, *HESCAT* creates a file with the same name as the two-digit disk ID. This file contains a list of all the files on that disk, the type of file (Sequential, Program, Relative, or User), and the size of each file. On a 2040 or 4040 disk, you can catalog as many as 120 disks with 3300 to 6000 files; an 8050 disk will keep

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After cataloging new disks or recataloging an old disk that has been changed, the SORT NAMES function is used to create the ALPHA.NAMES file. This is a list of all your cataloged files, sorted alphabetically. It also contains the type of each file and the ID of the disk it's on. The sort routine itself is a heapsort and is written in machine language. All the names that will fit into memory can be sorted in a second or so. Usually, however, the list of names is too long to fit in memory. In this case, *HESCAT* uses a scratch disk for work files that are sorted individually and then merged together. It will only sort file names from disks that have been recataloged since the last sort and will merge them into the new ALPHA.NAMES file.

Once the names have been sorted, a number of reports can be generated using the PRINT function. You can request a listing of file names, showing the file type and what disk it's on; a listing of the directories of the individual disks; or a summary of the disk header information. All of these will list on a CBM or other printer. The program also contains a subroutine for Epson and Base 2 printers.

Another practical use for *HESCAT* becomes apparent when you use the LOCATE function. This function searches through the file names cataloged by *HESCAT* for a string specified by the user and displays all the names that contain that string along with their disk ID's.

This is really a most valuable function when you forget where you stored your *Space Invaders* game.

Complete Documentation

HESCAT comes with two manuals totaling 37 pages. The first is the *User Manual* that guides you step by step through the process of cataloging disks and getting reports. The manual is clearly written and points up a number of spots where things might go wrong (especially disk I/O errors) and how to recover without losing your data. The second is the *Program Manual*, which covers technical information about the actual *HESCAT* programs. Included are detailed line-by-line narratives and variable dictionaries for each program. There is a section on how to safely modify parts of *HESCAT* and a complete description of all of *HESCAT*'s file formats. In addition, the *Program Manual* includes complete, commented listings of all the programs, even an assembly listing of the heapsort routine. Because Jerry Bailey has used a lot of "tricks" to make *HESCAT* fast and compact, you can learn a lot by reading the *Program Manual*.

It is apparent that much thought went into making *HESCAT* as easy to use as possible. All user interaction with the programs is via menus, and *HESCAT* seems reasonably crashproof. One of my favorite features is the HELP function in the main menu program. HELP displays a brief description of each of *HESCAT*'s major functions. The information provided by HELP was often enough to keep me from having to refer to the manual.

To use *HESCAT* properly, you must update the catalog every time you start a new disk or add files to an old disk. If you don't do this, then *HESCAT* won't do you much good. However, if you are the sort of person who will keep the catalog updated, and you want an automated tool to help you, *HESCAT* is the program for you.

HESCAT
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Book Review

TRS-80 Color Computer BASIC

Tony Roberts, Assistant Managing Editor

If you have a Color Computer and are taking your first steps in BASIC, Richard Haskell's book, *TRS-80 Extended Color BASIC*, can help make sure your feet are firmly planted.

Like its companions for the Apple, Atari, and PET computers, this book is designed as a textbook. It starts out assuming the reader knows nothing about the TRS-80 Color Computer (or BASIC) and builds from there.

Although the title implies that the contents refer only to Extended Color BASIC, the book serves equally well as a Color BASIC tutorial. Only a few, short references are made to commands or functions not available in Color BASIC.

Though written to be used with a computer at hand, *TRS-80 Extended Color BASIC* can be a useful study guide when no computer is available. The 170-page book is packed with screen photos that show what happens when the sample programs are run. The photos also show what happens when common programming or input errors are made. The text carefully explains why the mistakes happened and shows the novice programmer how to avoid the problem in the future.

Start With The Basics

Once you have been introduced to the TRS-80 Color Computer and have learned to print your name on the screen, *TRS-80 Extended Color BASIC* takes on the BASIC statements one by one.

Many of the example programs in the book's early chapters have a mathematical bent. You learn to compute the area of

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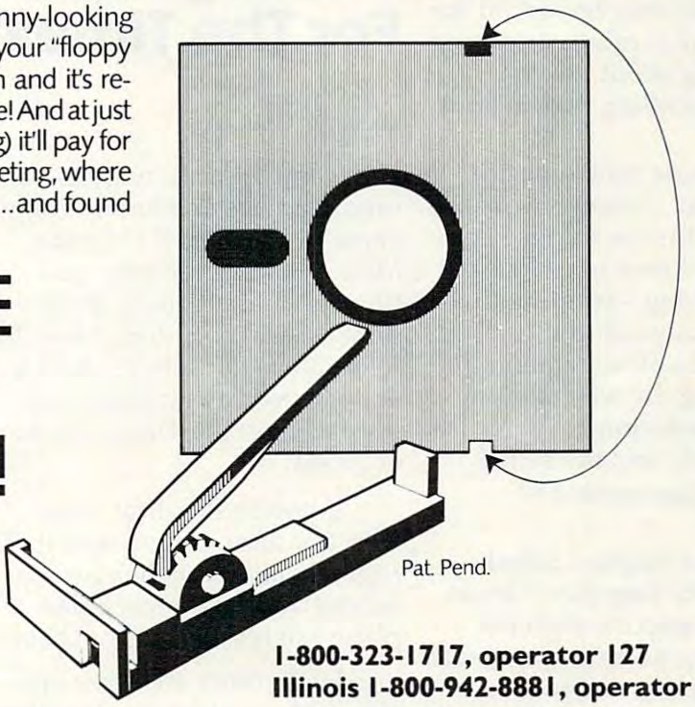

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various geometric shapes, and you are treated to an explanation of the trigonometric functions. Some of these may be lost on the beginner who is more concerned with learning about the computer than recalling high school math.

Once those problems are out of the way, however, Haskell clearly explains the things beginners need to know to get started in programming – printing to the screen, loops, and the IF…THEN, ELSE statements. Further along the way, simple and high-resolution graphics, sound, arrays, and the PEEK and POKE statements are covered.

The final chapter, called "Putting It All Together," leads you step-by-step through the programming necessary to create a hangman game and to turn your computer into a color organ.

No Machine Language

Though the book makes no attempt to teach any machine language, one of the nine appendices discusses, in a few short paragraphs, how to use a machine language subroutine in a BASIC program. Other appendices include information on BASIC's reserved words, ASCII codes, error messages, hexadecimal numbers, the EDIT statement, the PRINT USING statement, and screen locations.

TRS-80 Extended Color BASIC allows beginning programmers to build their knowledge of BASIC in a logical, understandable way. By following the examples and studying the dozens of illustrations provided, it should be a quick transition from taking your first steps to running your own BASIC programs.

TRS-80 Extended Color BASIC
Prentice-Hall, Inc.
Englewood Cliffs, NJ 07632
$12.95 paper, $19.95 cloth ©

The Flight Simulator For The Timex/Sinclair

Michael B. Williams

First came *Mazogs*, with its stunning graphics and entertaining game play. Then *3D Monster Maze*, boasting realistic, real-time movement along three-dimensional corridors. Now *The Flight Simulator* is here. And it supersedes any graphics I've ever seen on the Timex/Sinclair or ZX-81.

If you're skeptical, you won't be after you've seen it. *The Flight Simulator* challenges you to land a small, twin-engine plane safely – and it's not easy.

In all, there are three displays. The cockpit display shows the control panel and simulates the view from the inside of the airplane. As you dive and bank, you see the horizon shift through the cockpit window. On the control panel are rate-of-climb, fuel, power, and flap indicators, along with an RDF (radio direction finder) clock, and speed and gear readings.

The map display shows the area in which you are flying, including your present position, the runway, various beacons, and a mountain range rising 1500 feet above sea level. The purpose of this display is to show you your position relative to a beacon or the runway.

The third display – and the most important – is the visual display. It contains the information you will need in landing the aircraft: the altitude, speed, ILS (instrument landing system) and, of course, the cockpit display. Despite the rather low pixel resolution on the Sinclair – only 48 x 64 – the realism is outstanding. If you approach the runway at an angle, you will see it pass to your right or left with astonishing accuracy. It is even possible to notice that you are slightly off-center, due to some remarkable machine code programming.

During landing, you have complete control of the airplane, and you must make minor adjustments to align yourself with the runway. Once down, you must pull the plane to a complete stop. If, on touchdown, the screen disintegrates (indicating a crash), you have probably forgotten the landing gear. Some sort of warning that the landing gear is up would spare dozens of aircraft and who knows how many lives.

The Flight Simulator takes six to ten minutes to load, but the wait is worth it. The game so accurately simulates the flight (and for me the plight) of an aircraft that you almost feel as if you're actually piloting a plane.

The Flight Simulator
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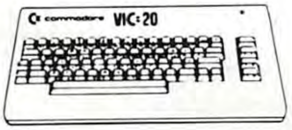

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INSIGHT: Atari

Bill Wilkinson

I've been a bit remiss about my column recently. The editorial staff at **COMPUTE!** has covered nicely for me, splitting some of my larger articles into two parts and cutting and pasting. I shall try to make life easier for them for the next few months, since I have finally accumulated a mental backlog of material which I feel is suitable for this column.

Mind you, I can still use some input from you readers on what you would like to see, so don't stop writing. As I have stated often in the past, it doesn't seem ethical for me to review software; but that shouldn't keep me from commenting on books, hardware, and who knows what else.

And, in that vein, this isn't truly a "review," since I have not had a chance to actually try it yet, but the most interesting new product for the "serious" Atari owner that I have seen lately is the new 64K byte memory card from Mosaic Electronics. With it you can make your 800 behave just like a 1200 so far as the bank selecting of RAM versus ROM goes. Mosaic rightly points out that there is zero software currently available to take advantage of the RAM which must lie where the OS ROMs are, so perhaps the other configuration of their RAM board makes more sense. How about up to 192K bytes of RAM in an Atari 800, with all but the first 48K being bank selected in 4K hunks that reside at $C000 through $CFFF. That gives you 36 little 4K byte banks, so just imagine the graphics switching you might do (in modes 7 and below only, though)! It's not cheap, but it certainly seems like a solution looking for a problem.

Predictions Revisited

I was right on two counts! First, I said the 1200 was overpriced. But look at the prices now. I am seriously considering buying one. Or I *was*. Because I just heard that Atari is *dropping* the 1200! Welcome, welcome, Atari 600, 1400, and 1450, which were introduced at the Summer Consumer Electronics Show. All will have expansion capability like nothing Atari has built before. So watch out world: here come the add-ons. [For more on the new Atari products at CES, see Tom Halfhill's article "The Fall Computer Collection At The Summer Consumer Electronics Show" elsewhere in this issue.]

Since, by the time you read this, the announcements will have been made, you will be able to see how good my rumor sources and crystal ball gazers are. Me? I'm sitting on the edge of my chair for another week or two.

One more thing before we get to the meat of this month's column. It would appear that I fooled more than a few people with my April column. If you were fooled, I apologize. But not much. After all, April Fool articles in computer magazines are a tradition that goes back to the first days of *Datamation* (a magazine sent free to anyone who owns a computer worth more than a quarter million dollars, heavily loaded with IBM mainframe articles, but it wasn't always so). Be assured that if you were fooled you were in good company: I showed the article to a COBOL programmer with ten years experience, and she didn't get it either. (To be fair to me, though, didn't you notice the title of the column that month, "Outasight: Atari"?)

Well, enough chitchat. Shall we tackle BAIT one more time? I am not sorry to see this series end, but looking at the finished product I can honestly say that those who understand it (and know at least a smattering of machine language) should be able to tackle **COMPUTE!**'s *Atari BASIC Sourcebook,* wherein we detail the workings of a *real* interpreter.

BAIT, Part 4

This month we present the listing of BAIT in its entirety. It is not a small listing, and there is no room in a single column to recap all the details of its creation and function. So, you really need Parts 1 through 3 (which appeared in March, May, and June) if you want the full design principles.

As a very brief summary, though, let's mention the following:

1. BAIT is a very simple pseudo-BASIC interpreter which has been written in Atari BASIC.

2. BAIT accepts only single-letter statement names (as shown in the table) and single-letter variable names (A through Z).

3. BAIT allows BASIC-style screen editing, line numbering, etc., with the restriction that line numbers must be from 1 to 99.

4. There is no precedence of operators, parentheses, functions, or any other amenities. This is a *primitive* language.

Does it work? Yes. Is it useful? Only as a learning tool. Could it be made useful? If we wrote a compiler for the same language, maybe.

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New Goodies

This month, I have finally implemented the rest of the statements listed in the table. In particular, we now have Accept, Call, Fetch, New, Return, and Store available to us.

New and Return function exactly like their BASIC counterparts of the same names. Accept, Call, and Store are simply different names for BASIC's INPUT, GOSUB, and POKE, respectively. They had to be named as they are to implement the single-letter statement names.

Fetch, then, is the only strange statement. It owes its existence to the fact that BAIT doesn't allow functions. Generally, Fetch is equivalent to PEEK, but its format is that of POKE (and, naturally, Store). It does, however, require a variable to store its Fetched value in (much like GET in Atari BASIC).

The statements are fairly straightforward, and we shall see more of them a little later on. For now, though, let's analyze the additions and changes made to BAIT this month on a line-by-line basis. The lines discussed below are those which have changed or been added since the June column. If you have typed in BAIT as we have proceeded through parts 1, 2, and 3, you may enter just those lines.

- **Line 1130.** This is the stack we will use for "remembering" where Calls (GOSUBs) were made from. The size is arbitrary, but I cheated and used a fixed number, so don't change it unless you also change line 10910.
- **1720.** This makes screen editing of BAIT programs very, very much easier. See line 2300.
- **2200.** We always reset the Call stack pointer because program editing could invalidate any or all pending Return locations.
- **2300.** See line 1720. This is how we eliminate the "?" prompt from the screen when using the INPUT statement. A clever trick: use it in all your programs. It comes to you courtesy of Howard Fishman. Thanks, Howard.
- **2360.** Notice that this line (which used to strip off the question mark) is now gone. You won't miss it.
- **1540, 5520, and 5530.** The TRAP to BADVALUE was added just in case your BAIT program generated an overflow.
- **8310 and 8410.** Cosmetic changes only.
- **8500 and 8510.** A new error message. It's used for all BAIT numeric data problems.
- **10210.** A minor change to allow Print (without a following expression) to be followed by a colon statement separator.
- **10530-10550.** A fix. Without it, the Goto doesn't occur until the end of the line. Thus 'G 10 : P "oops" ' would indeed print the "oops" until now. But this fixes it.
- **10810-10860.** Finally, some new code! Actually, Accept is fairly simple and closely follows the format of Let. Instead of requiring an expression after an equals sign, though, Accept wants the user to INPUT something from the keyboard. Thanks to the TRAP, only numeric data will be allowed.
- **10910-10960.** We process the Call statement. Line 10910 seems unnecessary: who would *want* to go 50 levels deep in a BAIT program? But it works. Notice that all three vital pointers must be saved on the stack. Could it have been done more compactly? Yes, but this way is much simpler. Finally, we allow Goto to do the real work of transferring control to a new line number.
- **11110-11150.** Fetch also follows the form of Let, but in reverse. First we get an address (line 11110), then a comma (line 11120), and finally a variable to put the Fetched value into (line 11130). The TRAP of line 11140 insures that the address given was a legal one.
- **11310-11370.** Return is the opposite of Call. Again, line 11310 is for safety only; good programmers can't make mistakes like this, right? Lines 11320 to 11350 restore the information saved by Call in lines 10920 to 10950. Finally, since we saved CURLOC before we joined the Goto processing, we must skip over the line number expression to find out if there is a colon (":") waiting for us.
- **11410-11450.** Store is almost identical to Fetch. The exception: the item after the comma can be any expression at all; it does not need to be a simple variable. Again, the TRAP in line 11440 insures against illegal addresses and/or data.

Sampling The BAIT

Well, we can presume that you typed all of BAIT in properly, yes? So let's quickly try some BAIT programs, to see what you can do in the language.

Caution: The lowercase letters shown in these listings are there for clarity only! BAIT accepts *only* single-letter commands, so just leave out all lowercase letters. Do *not* convert them to uppercase. For example, the first line of Program 1 should actually be typed in as '1 S 20,0' (and even the spaces may be left out if desired).

Program 1: Tick-Tock

```
1 Store 20,0
2 Print "SHOWING HOW SLOW BAIT IS"
3 Fetch 20,T
4 Print "THAT TOOK ";: Print T;: Print "CLOCK
  TICKS"
5 End
D
B
```

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Program 2: Recursion

```
 1 Print "GIVE ME AN INTEGER NUMBER";:
   Accept N
 2 Let A=1 : Call 10
 3 Print "THE FACTORIAL OF YOUR NUMBER
   IS "; : Print A
 4 Print : Print : Goto 1
10 If N<2 : Return
11 Let A=A*N : Let N=N -1
12 Call 10
13 Return
D
B
```

Challenge: Can you modify BAIT so that it will, indeed, ignore the lowercase letters? If so, your BAIT programs could be more readable.

Whew!

And there you have it. BAIT in all its glory. Or is that gory? Some carpers may claim that the only thing it proves is that people will try to write *anything* in BASIC. I like to think it may have provided a way for some of you to understand the mechanics of an interpreter. If it helps turn even one or two people into systems-level programmers, it will have done its job.

But if BAIT didn't interest you, don't worry. There are even a few out there that don't like to program games. (I certainly like to play them. I'm hooked on – oops, can't review software here, sorry.)

Self-relocatable Machine Language, Part 2

Last time we were on this subject, I promised to give a reason why we would want to write self-relocatable machine language. And sometimes I even keep my promises.

The primary advantage of self-relocatable code is, obviously, that you can load it and run it anywhere in memory. But why would you want to do that? Why not just decide where the code will go and leave it at that? Well, let's try to answer those questions.

First of all, none of what I am about to say pertains to programs which "take over" the system. After all, if you *know* that your code will run in such and such a way because, for example, you only give it out on a heavily protected game disk, then you can obviously place various hunks of machine language exactly where you want them. And they'll stay put.

But a large proportion of my readers are, I believe, attempting to either write machine language programs which interface to BASIC or are attempting to add on to the operating system in some way. In both these instances, self-relocatable code is invaluable.

Why? Because there simply isn't very much room in the Atari memory map that isn't used for something or other. In point of fact, the only clear portion of memory seems to be the infamous "Page Six." But, remember, even Atari BASIC can clobber the lower half of that page. And BASIC A+, Microsoft BASIC, Atari PASCAL, and several other products use portions or all of Page Six. What to do?

Well, if you have been following my articles, you will know that I advocate placing your program at LOMEM, moving LOMEM up to cover your program, and hooking into the system reset chain so that you can preserve your program if the user hits the reset key.

All well and good, but suppose LOMEM moves? And it will and it does. Depending on the number of disk drives and/or files you need to support, LOMEM can be anywhere from $A20 (with OSS PicoDOS) to $1D00 (standard Atari DOS) to $2C00 (OS/A+ version 4.1). And, if the RS-232 drivers are to be loaded (for the 850 interface), you can count on LOMEM being even higher still.

What's a poor old machine language programmer supposed to do? Follow my directions, natch. Put your program at LOMEM, no matter where it is. And that's easy to do if your program is self-relocatable.

And, before we get into discussing *how* to write this magic kind of program, I would like to point out one other significant instance where self-relocatable programs are handy. Putting programs at LOMEM and moving LOMEM up is all very well and good if you can do that before BASIC gets control. But once the language is entered, it has already noted the contents of LOMEM and used them for its own initialization purposes. Changing LOMEM will not necessarily force BASIC to move its own internal LOMEM, and you may wind up with a conflict of usage.

But there is a hunk of memory which is properly handled by BASIC as far as we are concerned: strings. Any data, including a machine language program, placed in a dimensioned string is guaranteed to be moved around intact (for example, when a new program line is entered or when a new variable is introduced).

Indeed, there have been many articles published which put a machine language routine or two in a string and then call the routine via USR(ADR(strings$),...). In fact, I have even seen a few adventuresome souls who have used ADR("some graphics and other characters here"). That is, it is perfectly O.K. to take the address of a literal string, also.

For the rest of this series, I will presume that we are writing programs which are designed to reside in Atari BASIC strings. I think that is sufficient, since there is little, if any, difference in concept between placing programs in strings and placing them at a potentially movable LOMEM.

From Why To How

Let's begin by listing the things you *don't* have to worry about when writing self-relocatable programs. Some of these things were discussed briefly last month; others are new but should be fairly obvious. The following, then, are intrinsically "safe" types of machine language:

1. All instructions which involve only one or more registers (e.g., TAX, PHA, INY, etc.).
2. All load immediate instructions which do *not* involve the address of a location as the immediate value (e.g., LDA #5, but not LDY #LOCATION/256).
3. All branch instructions (BNE, BCC, etc.).
4. All instructions involving *fixed* operating system or language specific locations, either in ROM or RAM (e.g., STA LEFTMARGIN, JSR CIO).
5. Several miscellaneous instructions which do not reference memory addresses, such as SED, SEI, CLC, NOP, RTS, etc.

What about the intrinsically unsafe instructions? Here is one of them:

> Any instruction which references an absolute memory location within your own code (or another block of relocatable code) or which references a fixed RAM location which is not dedicated to the purpose intended.

Now, that's not so bad. There are a lot more safe conditions than unsafe ones, aren't there? And, yet, it takes only one unsafe instruction to clobber you, so let's concentrate on some techniques for avoiding the unsafe conditions.

Safe Relocatable Techniques

1. Change JMPs to branches. Usually, you can do a CLC followed by a BCC to substitute for a JMP. Sometimes, the target of the jump is too far away, though. In that case, add an intermediate branch point, so that the first BCC branches to a second BCC, etc.

2. Save register values on the stack (via TAX, PHA, etc.) rather than in fixed RAM locations. If you need to save a value in between calls from a higher level routine (e.g., the BASIC program), though, you will *have* to find some safe place to put it. Watch out! There are only four safe locations in zero page and only a handful in other parts of memory. More about such safe locations in the next part in this series.

3. If you need to reference bytes in a table, string, or other portion of memory, why not let BASIC handle the addressing for you? For example, consider this BASIC line:

```
TEST = USR( ADR(CODE$), ADR(TABLE$) )
```

Presuming that your machine language routine is in CODE$, it can then reference TABLE$ as follows:

```
PLA                 ;parameter count
PLA
STA  ZTEMP+1        ;high byte of address
PLA
STA  ZTEMP          ;low byte of address
LDY  #0
LDA  (ZTEMP),Y      ;get first byte of the table ...
```

That program fragment is certainly intrinsically relocatable (except for the location of ZTEMP, but it needn't be preserved in between calls to the fragment). And BASIC will certainly move TABLE$ around as it needs, giving you the address when you need it.

4. If you absolutely *have* to use a hunk of nonrelocatable programming, and you don't have space to keep it on a permanent basis, why not temporarily move it from a relocatable location (e.g., TABLE$ in our example above) to a fixed location (e.g., BASIC's input buffer at $580 or some such). Then you can use it safely there, without worrying about relocatability. Of course, each time you are called from BASIC you would have to move the routine. But, as slow as BASIC is, you might never notice the extra overhead.

Next time we will continue right here. We will try to develop some even more useful techniques, including one which can only be used with USR calls from BASIC. Stay tuned.

BAIT Statements

A	Accept ‹variable›	(INPUT)
B	Begin	(RUN)
C	Call ‹line-number›	(GOSUB)
D	Display	(LIST)
E	End	
F	Fetch ‹address›, ‹variable›	(pseudo-PEEK)
G	Goto ‹line-number›	
I	If ‹expression›, ‹statement›	
L	Let ‹variable› = ‹expression›	
N	New	
P	Print ‹string-literal›	
	Print ‹variable›	
	Print	
R	Return	
S	Store ‹address›, ‹expression›	(POKE)

BAIT

```
1000 REM ..INITIALIZATION..
1001 REM .................
1010 MAXLINE=99
1020 DIM BUFFER$(5000),LINE$(128)
1030 DIM LINES(MAXLINE)
1040 FOR LP=0 TO MAXLINE:LINES(LP)=0:NEX
     T LP
1050 BUFFER$="*"
1100 DIM C$(1),VARIABLES(26)
1110 FOR ALPHA=0 TO 26:VARIABLES(ALPHA)=
     0:NEXT ALPHA
```

```
1120 DIM ERR$(40)
1130 DIM STACK(50,2):REM MAX CALLS THUS
     IS 50
1500 REM LINE NUMBERS OF EXECUTION ROUTI
     NES
1510 PROMPT=2100:INNEXT=2300
1515 DIRECT=4700:BADLINE=8400
1520 LET GETNC=8100
1530 SYNTAX=8300:ERROR=8200:EXEXP=5000
1540 BADVALUE=8500
1550 DODISPLAY=10100:DOPRINT=10200
1560 DOBEGIN=10400:DOGOTO=10500:DOLET=10
     600:DOIF=10700
1570 DOACCEPT=10800:DOCALL=10900:DOEND=1
     1000:DOFETCH=11100
1580 DONEW=11200:DORETURN=11300:LET DOST
     ORE=11400
1700 REM MISCELLANY
1710 UNTRAP=40000
1720 OPEN #5,12,0,"E:":REM SO THERE IS N
     O ? PROMPT
2000 REM ..INTERACTION..
2001 REM ...............
2100 PRINT "READY"
2200 STACK=0:REM CLEAN UP 'CALL' STACK
2300 INPUT #5,LINE$
2350 IF LEN(LINE$)=0 THEN GOTO INNEXT
    <<< DELETED OLD LINE 2360 >>>
2370 LL=LEN(LINE$)
2500 REM CHECK FOR LINE NUMBER
2510 FOR LP=1 TO LL
2520 IF LINE$(LP,LP)<="9" AND LINE$(LP,L
     P)>="0" THEN NEXT LP
2550 REM LP HAS POSITION OF FIRST NON-NU
     MERIC CHARACTER
2560 CURLINE=0
2570 IF LP>1 THEN CURLINE=VAL(LINE$(1,LP
     -1))
2600 REM NOW SKIP LEADING SPACES, IF ANY
2610 IF LP>LL THEN 2700
2620 FOR LP=LP TO LL
2630 IF LINE$(LP,LP)=" " THEN NEXT LP
2700 REM REMOVE LINE NUMBER AND LEADING
     SPACES
2710 IF LP>LL THEN LINE$="":GOTO 3000
2720 LINE$=LINE$(LP)
3000 REM ..EDITING..
3001 REM ...........
3010 REM IF HERE, LINE NUMBER IS IN CURL
     INE
3020 LL=LEN(LINE$):REM AND LL IS LENGTH
     THEREOF
3030 IF CURLINE=0 AND LL=0 THEN GOTO PRO
     MPT
3040 IF CURLINE<>INT(CURLINE) THEN 3060
3050 IF CURLINE<=MAXLINE THEN 3100
3060 GOTO BADLINE
3100 REM FIRST, DELETE CURLINE IF IT ALR
     EADY EXISTS
3110 LENGTH=LINES(CURLINE):IF LENGTH=0 T
     HEN 3200
3120 START=INT(LENGTH/1000)
3130 LENGTH=LENGTH-1000*START
3140 BUFFER$(START)=BUFFER$(START+LENGTH
     )
3150 LINES(CURLINE)=0
3160 FOR LP=1 TO MAXLINE:TEMP=LINES(LP)
3170 IF TEMP>=START*1000 THEN LINES(LP)=
     TEMP-LENGTH*1000
3180 NEXT LP
```

```
3200 REM NOW ADD LINE TO END OF BUFFER
3210 IF LL=0 THEN GOTO INNEXT
3220 START=LEN(BUFFER$)
3230 BUFFER$(START)=LINES$
3240 BUFFER$(LEN(BUFFER$)+1)="*"
3250 LINES(CURLINE)=START*1000+LL
3300 REM NOW LINE IS IN BUFFER...WHAT DO
      WE DO
3310 IF CURLINE THEN GOTO INNEXT
3320 REM NOTE THAT CURLINE=0 AS WE FALL
     TO LINE 4000
4000 REM ..EXECUTE CONTROL..
4001 REM ...................
4010 LENGTH=LINES(CURLINE):IF LENGTH=0 T
     HEN 4600
4020 CURLOC=INT(LENGTH/1000):LENGTH=LENG
     TH-1000*CURLOC
4030 CUREND=CURLOC+LENGTH-1
4040 IF CURLINE=0 THEN CURLINE=-1
4100 REM READY TO EXECUTE A LINE
4200 REM EXECUTE A SINGLE STATEMENT
4210 GOSUB GETNC:IF NOT ALPHA THEN GOTO
     SYNTAX
4220 GOSUB 4900
4230 IF PEEK(53279)<>7 THEN GOSUB DOEND
4240 IF C$=":" THEN 4200
4250 IF C>=0 THEN GOTO SYNTAX
4600 REM COME HERE FOR NEXT LINE
4610 CURLINE=CURLINE+1
4620 IF CURLINE>0 AND CURLINE<=MAXLINE T
     HEN 4000
4700 REM ===COME HERE ON END OF DIRECT L
     INE EXECUTE===
4710 IF LINES(0) THEN BUFFER$(INT(LINES(
     0)/1000))="*"
4720 LINES(0)=0
4730 GOTO PROMPT
4900 REM THE STATEMENT CALLER
4910 ERR$="BAD STATEMENT NAME"
4920 ON ALPHA GOTO DOACCEPT,DOBEGIN,DOCA
     LL,DODISPLAY,DOEND
4930 ON ALPHA-5 GOTO DOFETCH,DOGOTO,ERRO
     R,DOIF,ERROR,ERROR
4940 ON ALPHA-11 GOTO DOLET,ERROR,DONEW,
     ERROR,DOPRINT
4950 ON ALPHA-16 GOTO ERROR,DORETURN,DOS
     TORE
4960 GOTO ERROR
5000 REM ..EXECUTE EXPRESSION..
5001 REM .....................
5010 EVAL=0:LASTOP=-1
5020 VALID=0
5100 GOSUB GETNC:IF ALPHA THEN 5300
5110 IF C$>="0" AND C$<="9" THEN 5400
5120 REM WHICH OPERATOR?
5121 IF C$="+" THEN OP=1:GOTO 5200
5122 IF C$="-" THEN OP=2:GOTO 5200
5123 IF C$="*" THEN OP=3:GOTO 5200
5124 IF C$="/" THEN OP=4:GOTO 5200
5125 IF C$=">" THEN OP=5:GOTO 5200
5126 IF C$="<" THEN OP=6:GOTO 5200
5127 IF C$="=" THEN OP=7:GOTO 5200
5128 IF C$="#" THEN OP=8:GOTO 5200
5160 IF VALID THEN RETURN
5170 GOTO 5900
5200 REM GOT AN OPERATOR
5210 IF LASTOP>0 THEN 5170
5220 IF LASTOP<0 AND OP>2 THEN 5170
5230 LASTOP=OP:VALID=0:GOTO 5100
5300 REM GOT A VARIABLE
```

```
5310 VAL2=VARIABLES(ALPHA):GOTO 5500
5400 REM GOT A NUMERIC
5410 CURLOC=CURLOC-1:REM BACKUP TO FIRST
      NUMERIC
5420 FOR LL=CURLOC TO CUREND:C$=BUFFER$(
     LL)
5430 IF (C$>="0" AND C$<="9") OR C$="."
     THEN NEXT LL
5440 VAL2=VAL(BUFFER$(CURLOC,LL-1))
5450 CURLOC=LL
5500 REM VAR OR NUMERIC
5510 IF LASTOP=0 OR ABS(LASTOP)>8 THEN 5
     900
5520 TRAP BADVALUE:GOSUB 5600+10*ABS(LAS
     TOP)
5530 TRAP UNTRAP:LASTOP=0:VALID=1:GOTO 5
     100
5600 REM EXECUTE OPERATORS
5610 EVAL=EVAL+VAL2:RETURN
5620 EVAL=EVAL-VAL2:RETURN
5630 EVAL=EVAL*VAL2:RETURN
5640 EVAL=EVAL/VAL2:RETURN
5650 EVAL=(EVAL>VAL2):RETURN
5660 EVAL=(EVAL<VAL2):RETURN
5670 EVAL=(EVAL=VAL2):RETURN
5680 EVAL=(EVAL<>VAL2):RETURN
5900 ERR$="INVALID EXPRESSION":GOTO ERRO
     R
8000 ..MISCELLANEOUS SUBROUTINES..
8001 REM ........................
8100 REM GETNC
8110 IF CURLOC>CUREND THEN C=-1:C$=CHR$(
     155):GOTO 8140
8120 C=ASC(BUFFER$(CURLOC)):C$=CHR$(C)
8130 CURLOC=CURLOC+1
8140 IF C=32 THEN GOTO GETNC
8150 ALPHA=(C$>="A" AND C$<="Z")*(C-64)
8160 RETURN
8200 REM ERROR ROUTINE
8210 PRINT :PRINT "***";ERR$;"***";
8220 IF CURLINE>0 THEN PRINT " AT LINE "
     ;CURLINE
8230 PRINT :TRAP 8250
8240 POP :POP :POP :POP :POP :POP :POP :
     POP
8250 TRAP UNTRAP
8290 GOTO DIRECT
8300 REM SYNTAX ERROR
8310 ERR$="SYNTAX ERROR":GOTO ERROR
8400 REM BAD LINE NUMBER
8410 ERR$="BAD LINE NUMBER":GOTO ERROR
8500 REM VALUE OUT OF RANGE ERROR
8510 ERR$="BAD VALUE":GOTO ERROR
10000 REM ..EXECUTE THE VARIOUS STATEMEN
      TS..
10001 REM ............................
      ....
10100 REM ==EXECUTE DISPLAY==
10110 FOR LP=1 TO MAXLINE
10120 LENGTH=LINES(LP):IF LENGTH=0 THE 1
      0150
10130 START=INT(LENGTH/1000):LENGTH=LENG
      TH-1000*START
10140 PRINT LP;" ";BUFFER$(START,START+L
      ENGTH-1)
10150 NEXT LP
10190 GOTO GETNC
10200 REM ==EXECUTE PRINT==
10210 GOSUB GETNC:IF C<0 OR C$=":" THEN
      PRINT :RETURN
```

```
10220 IF C=34 THEN 10300
10230 CURLOC=CURLOC-1
10240 GOSUB EXEXP:PRINT EVAL;
10250 IF C$=";" THEN GOTO GETNC
10260 IF C$="," THEN PRINT ,:GOTO GETNC
10270 PRINT :RETURN
10300 FOR LL=CURLOC TO CUREND:C$=BUFFER$
      (LL)
10310 IF ASC(C$)<>34 THEN PRINT C$;:NEXT
       LL:PRINT :RETURN
10320 CURLOC=LL+1:GOSUB GETNC
10330 GOTO 10250
10400 REM ===EXECUTE BEGIN===
10410 FOR ALPHA=0 TO 26:VARIABLES(ALPHA)
      =0:NEXT ALPHA
10420 CURLINE=0:C=-1:RETURN
10500 REM ===EXECUTE GOTO===
10510 GOSUB EXEXP
10520 IF LINES(EVAL)=0 THEN ERR$="NO SUC
      H LINE":GOTO 8200
10530 CURLINE=EVAL-1
10540 C=-1:C$=""
10550 RETURN
10600 REM ===EXECUTE LET===
10610 GOSUB GETNC:IF NOT ALPHA THEN GOTO
       SYNTAX
10620 DESTVAR=ALPHA
10630 GOSUB GETNC:IF C$<>"=" THEN GOTO S
      YNTAX
10640 GOSUB EXEXP:VARIABLES(DESTVAR)=EVA
      L
10650 RETURN
10700 REM ===EXECUTE IF===
10710 GOSUB EXEXP
10720 IF NOT EVAL THEN C=-1:C$=""
10730 RETURN
10800 REM ===EXECUTE ACCEPT===
10810 GOSUB GETNC:IF NOT ALPHA THEN GOTO
       SYNTAX
10820 TRAP 10850:INPUT EVAL:TRAP UNTRAP
10830 VARIABLES(ALPHA)=EVAL
10840 GOTO GETNC
10850 PRINT "??? MUST INPUT A NUMBER, RE
      PEAT..."
10860 GOTO 10820
10900 REM ===EXECUTE CALL===
10910 IF STACK=50 THEN ERR$="TOO MANY CA
      LLS":GOTO ERROR
10920 STACK(STACK,0)=CURLOC
10930 STACK(STACK,1)=CUREND
10940 STACK(STACK,2)A=CURLINE
10950 STACK=STACK+1
10960 GOTO DOGOTO
11000 REM ===EXECUTE END===
11010 PRINT"===END AT LINE ";CURLINE;"==
      ="
11020 C=-1:CURLINE=C:C$=""
11030 RETURN
11100 REM ===EXECUTE FETCH===
11110 GOSUB EXEXP
11120 IF C$<>"," THEN GOTO SYNTAX
11130 GOSUB GETNC:IF{2 SPACES}NOT ALPHA
      THEN GOTO SYNTAX
11140 TRAP BADVALUE:VARIABLES(ALPHA)=PEE
      K(EVAL)
11150 TRAP UNTRAP:GOTO GETNC
11200 REM ===EXECUTE NEW===
11210 RUN
11300 REM ===EXECUTE RETURN===
11310 IF STACK=0 THEN ERR$="NO MATCHING
```

```
      CALL":GOTO ERROR
11320 STACK=STACK-1
11330 CURLOC=STACK(STACK,0)
11340 CUREND=STACK(STACK,1)
11350 CURLINE=STACK(STACK,2)
11360 GOSUB EXEXP:REM IGNORE...ALREADY P
      ROCESSED
11370 RETURN
11400 REM ===EXECUTE STORE===
11410 GOSUB EXEXP:ADDRESS=EVAL
11420 IF C$<>"," THEN GOTO SYNTAX
11430 GOSUB EXEXP
11440 TRAP BADVALUE:POKE ADDRESS,EVAL
11450 TRAP UNTRAP:RETURN
```

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Converting VIC And 64 Programs To PET

Jim Butterfield, Associate Editor

This handy, short program will automatically fix VIC or 64 programs so they will run correctly on the PET/CBM.

BASIC programs move freely from PET, VIC, or Commodore 64 to the VIC or 64. But they don't flow easily to the PET from the other machines.

If you have a disk, this "Program Converter" will convert your BASIC programs easily and quickly. It will run on PET, VIC, or Commodore 64. The programs must be free from special PEEKs and POKEs, of course; but regular BASIC will work fine on any machine. Program Converter just helps you load it to the PET.

Programs which have been converted will load to any machine: PET, VIC (any memory configuration), and Commodore 64. Before conversion, the PET wasn't in the list; the other machines were capable of adjusting to "foreign" programs.

Type in Program Converter and run. It will ask you for the name of the program you wish to convert (say, a BASIC program written on the 64). Enter the name, and it will then ask you for the new name you wish to give to the converted program. Supply the name, and the job's under way.

If you have a dual drive, the new program will always be written to drive zero. After you have converted the program, the new version will still load without problems to the VIC or 64, but will also load to a standard PET.

The Program

```
100 PRINT "VIC/64 TO PET"
110 PRINT "PROGRAM CONVERTER"
120 PRINT
130 X=150:POKE X,127
140 IF ST<>127 THEN X=144
150 DATA 162,1,32,198,255,32,228,255,166
    ,150,8,72,32,204,255
160 DATA 162,2,32,201,255,104,32,210,255
    ,32,204,255,40,240,226,96
170 FOR J=828 TO 858 :READ A:POKE J,A:T=T
    +A:NEXT J
180 POKE 837,X:IF T<>4396 THEN STOP
200 CLOSE1:CLOSE2:CLOSE15
210 OPEN 15,8,15
220 INPUT "BASIC PROGRAM";B$
230 OPEN 1,8,3,B$+",P,R"
240 INPUT #15,E,E$,E1,E2
250 IF E THEN PRINT E$:GOTO 200
260 GET #1,A$,B$
270 IF A$<>CHR$(1) THEN PRINT "OOPS!":GO
    TO 200
280 INPUT "NEW NAME";N$
290 OPEN 2,8,4,"0:"+N$+",P,W"
300 INPUT #15,E,E$,E1,E2
310 IF E THEN PRINT E$:GOTO200
320 PRINT #2,A$;CHR$(4);
330 SYS 828
340 CLOSE2:CLOSE1:CLOSE15
350 PRINT"DONE."
```

The Machine Language

It may be instructive to examine the simple machine language program which does the job. Machine language isn't vital, of course; it just speeds things up. Let's look at it. At the time this part of the program runs, the files have been opened.

Get a character from the input:

```
      (connect the input)
033C  A2 01      LDX   #$01
033E  20 C6 FF   JSR   $FFC6
      (get the character)
0341  20 E4 FF   JSR   $FFE4
      (get ST and stack it away)
      (on VIC/64, STATUS is hex 90)
0344  A6 96      LDX   STATUS
0346  08         PHP
      (stack the input character)
0347  48         PHA
      (disconnect the input)
0348  20 CC FF   JSR   $FFCC
      (connect the output)
034B  A2 02      LDX   #$02
034D  20 C9 FF   JSR   $FFC9
      (get character and send)
0350  68         PLA
0351  20 D2 FF   JSR   $FFD2
      (disconnect the output)
0354  20 CC FF   JSR   $FFCC
      (recall ST from stack)
0357  28         PLP
0358  F0 E2      BEQ   REPEAT
      (quit if ST non-zero)
035A  60         RTS
```

If you type Program Converter into a VIC or 64, you might like to have it convert itself. That way, you'll have a universal program converter, one that will work on the PET. By the way, the machine language won't get in the way, since it's POKEd into place by the BASIC program.

©

How To Create A Data Filing System

Part II. Planning The Output

Jim Fowler

Part I of this article covered the goals to keep in mind and the kinds of disk files that could be used in a data filing system. From painful experience, I can tell you that the most important planning begins with the output functions of a program. This will determine the best way to file the data. That will, in turn, define the nature of the input functions. There are two aspects to the problem: how to encode the data and how to search the file. Again, it's best to work backwards. Let's look at searching first.

Searching Takes Time

Let's say you want to search your file. You have data that you want to match up with data in the file – maybe an author's name – and you want the titles of the books by that author. The author's name will be used as the *key*, and you want to retrieve all the records having an author's name identical to the key.

First, you have arranged the data within the records so the program can find the author's name. Maybe it is the first 16 bytes in the record. You can read that from the disk and compare it to the key. If they match, you have a *hit*, otherwise you have a *miss*. Maybe you want all the hits to be printed or displayed on the screen. Maybe you want both, or, as I arranged to do in one of my programs, you can preview a hit on the screen and opt to have it printed for later use.

However, there is a serious problem here. It may take only a second or two to get the author's name from the disk, and the comparison with the key runs quite fast. But if you have a thousand records to search through at one second each, it's going to take about 20 minutes to go through the file – and that's not allowing any time for the printer to print or the user to preview records on the screen. You could flip through a lot of cards in a card file in 20 minutes. How can you get around this?

Creating An Index File

The answer is an *index file*; see Figure 1. You keep a separate file of authors' names, probably in the same order as the records on the disk. Because this file sits in RAM, searching is much faster. Furthermore, you may be able to make the program search while contemplating the last hit on the screen, or while the printer is printing. Then, the only delay is in retrieving the first hit. After that, the search appears instantaneous. Index files are almost a necessity if you have many records and want to retrieve them in anything other than top-to-bottom order. Even a mailing list ought to be retrievable in alphabetical order or by zip code, for example.

This brings up another problem: the index file (or files) will have to be recorded on the disk, too. The longer the file, the longer it will take to save it when you are through entering data – and the more space you will need in RAM. So give thought to keeping index files as short as you can and as easy to save as possible. This means using index words (entries into the index file) which are both short and packed with information. Look at your data with this in mind.

I found that last names can usually be reduced to the first eight letters. The number of false hits is quite tolerable, especially if you plan to preview the hits for other reasons. Now and then you will look for WADSWORTH and get WADSWORTHENSON, but that has to be traded off against using a nine-letter index word which makes a thousand-record index a thousand bytes longer. You will have to compromise somewhere.

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Two Kinds Of Search

Another consideration is that there are two fundamentally different kinds of search. One is a match: like the author's name, it's an identity match. The other is a *topic* match. An example of this is looking for books on certain subjects. In this second case, the subjects are "contained in" the record, but the book might also include subjects you haven't asked for and don't care about. The match isn't an identity; let's call it a "contained-in" match. How you implement this depends on how you encode the information on subjects.

I recommend that you use a bitmap type of code as illustrated in Figure 2. Program 1 gives a sample "identity search" in both BASIC and machine language. Program 2 does the same for the "contained-in" search.

There are a few techniques you need to use. First, you set up a general buffer to use in inputting keys and index words. The same routine used for generating an index word (say, from an author's last name) can be used to put the comparable index word into this buffer. Carefully consider how you encode the data in light of your retrieval problems. A few hours at this stage can make a tremendous difference in the result.

If your key for an identity search is not as long as the index words compared with it, fill the rest of the space with nulls. In the search routine (as shown in the programs) the program returns as soon as it hits a null. That way you can input "SMITH" and find all the Smiths or even just "S" and get all the authors whose names start with S.

If you want to retrieve records by a combination of these search methods, you can do it by using them in sequence. For example, do an identity search first. Then, when you have a hit, check for the second kind, the contained-in search. If the record passes both tests, you have a full hit. This allows you to set up keys that are a mixture of "must-have" and "don't-care" data.

Record Formatting

Now it is time to decide how your records are to be set up. If you are using relative records (each record the same length – like pigeonholes), you have the same arrangement problem within a record as you had deciding the type of record to use.

Your record can be divided up into "fields." Each record will have the same size fields. One field will be the author's name, another the year of publication (four bytes can encode a four-digit year, or you can subtract 1792 from the year and encode all the years from 1792 to 2047 with only one byte). Each field will have to be big enough to hold the largest string of data you will ever want to store there. Book titles in my file take 80 bytes, and even then I have to condense the longer titles.

Take your time deciding your record format. Since you will be reading a record from the disk only to display it (not for searching purposes), it is best to have the data in a few long strings rather than in shorter chunks. Author and year could be one ASCII string – then the input from the disk and the display on the screen (or printer) is easy to program. Numeric data can be either floating point or integer.

Working with output is the next step, and we'll cover that in the next issue.

Figure 1: **Index files contain parts of records for rapid searching.**

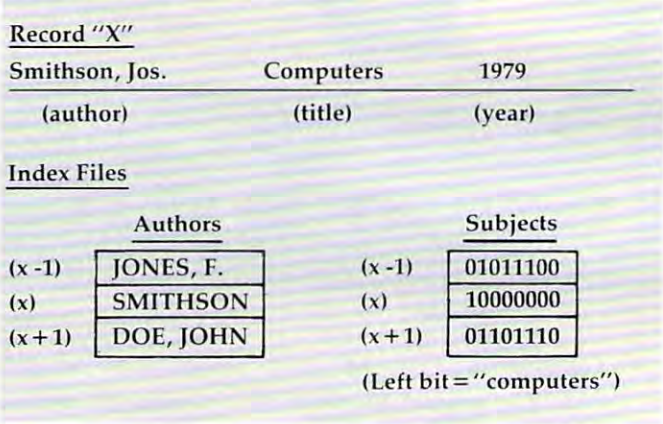
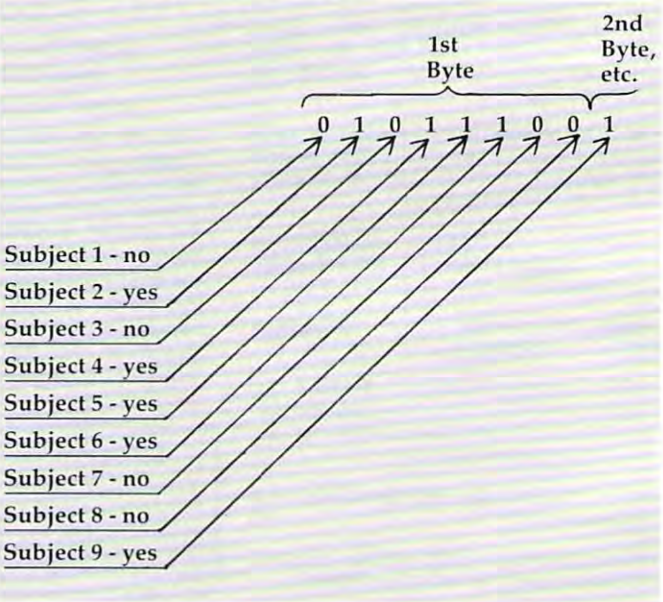


Figure 2: **Subjects or other yes-no data can be coded by individual bits.**



Program 1:
Identity Search In BASIC And Machine Language

Start with SYS (or JSR) to "BEGIN"; routine will return with number of record hit in register. If that

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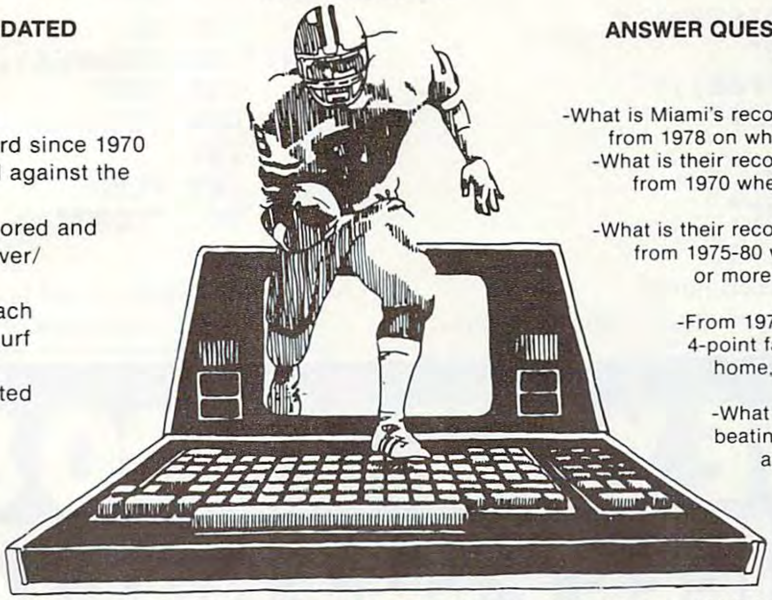

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- What is their record against the spread from 1970 when they play any team on natural turf?
- What is their record against the spread from 1975-80 when they are 5 point or more favorites and playing at home?
- From 1976 on, if any team is a 4-point favorite and playing at home, what is its chance of beating the spread?
- What is a team's chance of beating the spread at home after three consecutive wins against the spread?

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number is zero, then no more hits. After a hit, continue search with SYS (or JSR) to "DECPT."

"BEGIN"	Put KEY into BUFFER. Set POINTER from NEXT EMPTY RECORD No.
"DECPT"	Decrement POINTER by one. If zero, then RETURN.

(in BASIC)

```
10  AD=POINTER*LEN+OFFSET
20  FOR I=0  TO LEN-1
30  X=PEEK(BUFFER+I)
40  IF X=0 THENRETURN
50  IF PEEK(AD+I)<>X  GOTO"DECPT"
60  NEXTI:RETURN
```

(in machine language)

Put POINTER*LEN in REGISTER
Add OFFSET to REGISTER

```
      LDY #0
"CONT"LDA (REGISTER),Y
      BEQ "END"
      CMP (BUFFER),Y
      BNE "DECPT"
      INY
      CPY #LEN
      BCC "CONT"
 "END"RTS
```

Note: LEN = index word length
OFFSET = address of zero'th index word

Program 2:
Contained-in Search In BASIC And Machine Language

The operation is similar to routine in Program 1.

"BEGIN"	Put KEY into BUFFER. Set POINTER from NEXT EMPTY RECORD No.
"DECPT"	Decrement POINTER by one. If zero, then RETURN.

(in BASIC)

```
10  AD=POINTER*LEN+OFFSET
20  FOR I=0  TO LEN-1
30  X=PEEK(BUFFER+I)
40  IF(PEEK(AD+I)ANDX)<>X THEN RETURN
50  NEXTI:RETURN
```

(in machine language)

Put POINTER*LEN in REGISTER
Add OFFSET to REGISTER

```
      LDY #0
"CONT"LDA(POINTER),Y
      EOR #$FF
      EOR (BUFFER),Y
      INY
      CPY #LEN
      BCC "CONT"
      RTS
```

Note: LEN is index word length
OFFSET is address of zero'th index word. ©

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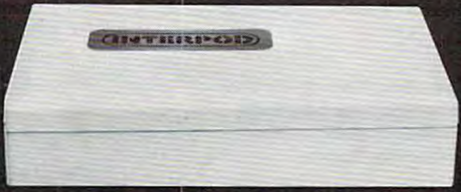

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Neat Numbers On The VIC

Daniel E. Dick

These subroutines will print numbers and display calculations on a TV or a printer in easily read columns. There are several solutions here to common formatting problems.

I use a VIC-20 and VIC-1515 printer in designing programs for my work in energy studies. I find that the familiar TAB and the CHR$(16) functions leave something to be desired when you are sending numbers to a monitor or printer. Both TAB and CHR$ left justify columns of numbers. The VIC-20 also does not include a PRINT USING statement for right justifying columns of numbers or for placing commas between numerical units in the thousands.

As you can see from these examples:

99999 is more easily read as 99,999
12345678 is more easily read as 12,345,678

And a column of numbers is more easily read (and checked for addition) if it is right justified as well. The column of numbers to the right is easier to read and total:

```
50.65        50.65
1.10          1.10
250.40      250.40
2500.00    2500.00
```

Program 1 is a short and simple program to right justify and display real numbers on the screen.

```
Input        Output
.01             .01
.1              .1
1               1
1.2             1.2
1.21            1.21
11             11
11.2           11.2
11.21          11.21
111           111
111.21        111.21
```

Program 2 right justifies and prints integers up to 999999999 (999,999,999) – VIC's limit of standard notation.

```
INPUT              OUTPUT
9                       9
99                     99
999                   999
9999                9,999
99999              99,999
999999            999,999
9999999         9,999,999
99999999       99,999,999
999999999     999,999,999
```

Program 3 right justifies and prints real numbers up to 9999999.99 (9,999,999.99) which is the limit of standard notation in the VIC-20.

```
INPUT              OUTPUT
.09                   .09
.9                    .90
9                    9.00
9.99                 9.99
99                  99.00
99.99               99.99
999                999.00
9999             9,999.00
99999.5         99,999.50
999999         999,999.00
9999999      9,999,999.00
```

Program 4 displays and prints specific data and calculated results in a tabular form that is legible and understandable. Programs 2 and 3 have been integrated into the main program in lines 5000-5050 and 5100-5180.

Lines 10000-10050 are a helpful subroutine for renumbering lines (published in **COMPUTE!**, April 1982).

```
Your Energy Consumption For Space Heat  During Year Chosen:

     NO. UNITS   UNIT    FUEL                    UNIT COST       FUEL COST
      1,100.00   GALS    OIL                          1.27        1,397.00
      1,450.00   CCF     NATURAL GAS                   .65          942.50
     12,345.00   KWH     ELECTRICITY                   .09        1,111.05
          5.50   CORDS   WOOD                        95.00          522.50
          4.75   TONS    COAL                       166.00          788.50
                                              TOTAL COST     $ 4,761.55

     NO. UNITS   UNIT    FUEL                     BTU/UNIT   BTU'S CONSUMED
      1,100.00   GALS    OIL                       140,000     154,000,000
      1,450.00   CCF     NATURAL GAS               100,000     145,000,000
     12,345.00   KWH     ELECTRICITY                 3,414      42,145,830
          5.50   CORDS   WOOD                   20,000,000     110,000,000
          4.75   TONS    COAL                   20,000,000      95,000,000
                                                TOTAL          546,145,830
```

Program 5 brings us back full circle to Program 1, with line 15 transferring control to the printer.

```
                OUTPUT
                 .01
                  .1
                 1
                10
               100
              1000
```

Program 1:
Right-Justified Real Numbers Displayed On Screen

```
10 REM..RIGHT JUSTIFY TO SCREEN
20 INPUT"A NUMBER";N
30 IF N=>1 THEN PRINT TAB(15-LEN(STR$(IN
   T(N))))N
40 IF N<1 THEN PRINT TAB(14)N
50 GOTO 20
60 END
```

Program 2:
Right-Justified Integers Up To 999999999

```
10 REM..RIGHT JUSTIFY2
20 OPEN1,4
25 PRINT#1,CHR$(16)"07INPUT";CHR$(16)"46
   OUTPUT"
27 PRINT#1,CHR$(16)"07⁅5 T⁆";CHR$(16)"
   46⁅6 T⁆":PRINT#1
30 INPUT"A NUMBER";N
40 IF N<1 THEN PRINT TAB(14)N
50 BL$="{11 SPACES}"
60 GOSUB 900
70 PRINT#1,CHR$(16)"06"N;CHR$(16)"40"S$
80 GOTO 30
90 CLOSE1,4
900 N=INT(N):S$=STR$(N)
910 L=LEN(S$):S$=MID$(S$,1,L)
920 S$=RIGHT$(BL$,10-L)+S$
930 IF N<=999 THEN S$=LEFT$(S$,7)+"
    {2 SPACES}"+RIGHT$(S$,3)
940 IF N>999 AND N<=999999 THEN S$=" "+L
    EFT$(S$,7)+","+RIGHT$(S$,3)
950 IF N>999999 THEN S$=LEFT$(S$,4)+","+
    MID$(S$,5,3)+","+RIGHT$(S$,3)
970 RETURN
```

Program 3:
Right-Justified Real Numbers up to 9999999.99

```
10 REM..RIGHT JUSTIFY3
20 OPEN1,4
25 PRINT#1,CHR$(16)"07INPUT";CHR$(16)"46
   OUTPUT"
27 PRINT#1,CHR$(16)"07⁅5 T⁆";CHR$(16)"
   46⁅6 T⁆":PRINT#1
30 INPUT"A NUMBER";N
32 DEF FNR(N)=(INT(100*N+0.5))/100
34 N=FNR(N)
40 W=N*100
50 BL$="{13 SPACES}"
60 GOSUB 900
70 PRINT#1,CHR$(16)"06"N;CHR$(16)"37"S$
80 GOTO 30
90 CLOSE1,4
900 S$=STR$(W)
910 L=LEN(S$):S$=MID$(S$,1,L)
913 IF L=2 THEN S$=MID$(BL$,1,12)+".0"+R
    IGHT$(S$,1):RETURN
915 D$="."+RIGHT$(S$,2)
917 S$=LEFT$(S$,L-2)+D$
920 S$=RIGHT$(BL$,12-L)+S$
930 IF N<=999.99 THEN S$=LEFT$(S$,7)+"
    {2 SPACES}"+RIGHT$(S$,6)
940 IF N>999.99 AND N<=999999.99 THEN S$
    =" "+LEFT$(S$,7)+","+RIGHT$(S$,6)
950 IF N>999999.99 THEN S$=LEFT$(S$,4)+"
    ,"+MID$(S$,5,3)+","+RIGHT$(S$,6)
970 RETURN
```

Program 4:
Numerical Data Displayed And Printed In Tabular Format

```
20 REM..ENERGY ANALYSIS1
30 OPEN1,4
40 PRINT#1:PRINT#1
50 GOTO 290
```

Standard VIC 20

no additional memory needed

(CG008) Alien Panic $12.95
Race against time as your guy digs holes to trap aliens in 4 floor laddered, brick construction site. Requires joystick.

(CG096) Antimatter Splatter $24.95
This game is as good as its name. Another pure machine code game, this one is fast! The alien at the top of the screen is making a strong effort to rid the world of humankind by dropping antimatter on them. The splatter cannon and you are our only hope as more and more antimatter falls. Joystick again is optional equipment.

(CG026) Collide $12.95
"Vic" controls one, you the other as cars go opposite directions on 4 lane track. Requires joystick.

(CG094) Exterminator $24.95
Recently scoring a rating of 10 out of a possible 10 this game was praised as "one of the best I've seen on any computer" by a prominent reviewer in a leading magazine. The idea is to shoot a centipede before it overuns you, the problem being every time you hit it, it divides into two separate shorter ones. Several other little creatures bounce around during this struggle. All of them lethal. 100% machine language makes the rapid fire action very smooth. A joystick is optional, but as always, recommended, (a trac ball is also very nice!).

(CG054) Krazy Kong $12.95
Three screens, a gorilla, barrels, and changing difficulty levels help to make this one of our most popular. Joystick optional.

(CG098) Racefun $19.95
Extensive use of multicolored character capabilities of the "Vic" make this one very appealing to the eye. Fast all machine language action, quick response to the stick or keyboard controlled throttle, combine with the challenge of driving in ever faster traffic to make it appeal to the rest of the body. Joystick controlling is an option.

(CG058) Rescue From Nufon $12.95
Must find 30 hostages in this 100 room, 5 story, alien infested, graphic adventure game. A continual big seller. Keyboard only (n. = north w = west etc.)

(CG068) The Catch . . . $12.95
Another all machine language game based on the principle that one person with one joystick guiding one catch/shield can catch everything that one alien can throw at one. The action comes slowly at first but by the fourth wave you'll be aware of . . . "The Catch" . . .

Expanded Memory Vic 20 Games

(CG090) Defender On Tri $19.95
Pilot a defender style ship on mission to save trapped scientists from a fiery fate (they are aboard an alien vessel deep in the gravity well of sol). Excellent graphics. Short scene setting story in the instructions. "Defender On Tri" requires at least 3K added memory.

(CG092) 3D Man $19.95
The maze from probably the most popular arcade game ever, with perspective altered from overhead to eye level. The dots, the monsters, the power dots, the side exits, the game is amazing. "3D Man" requires at least 3K added memory.

(CG088) Space Quest $19.95
Our first 8K memory expander game and its a beauty. The scene (a short story is included) is far in the future, a time when man's knowledge has reduced an entire galaxy into a mapped series of quadrants. This game has stratagy (you plot your own hyperspace jumps on Galaxy map), action (against a starry background you find yourself engaged in a dogfight, laser style), exploration (you must fly your ship deep into caverns to pick up necessary fuel). "Space Quest" requires at least 8K memory expansion and a joystick.

Commodore 64

(CG602) 3D-64, Man $19.95
This available on the expanded "Vic 20" game, has been completely rewritten for the 64 and uses sprites, sounds, and other features not available on the "Vic". This one requires a joystick.

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```
290 PRINT#1,"YOUR ENERGY CONSUMPTION FOR
     SPACE HEAT DURING YEAR CHOSEN:"
300 DIM QUAN(5),QUAN$(5),UNIT$(5),FUEL$(
    5),CST(5),CST$(5),ENCST(6),ENCST$(6)
310 PRINT#1
320 PRINT#1,CHR$(16)"08NO.UNITS";CHR$(16
    )"20UNIT";CHR$(16)"30FUEL";
330 PRINT#1,CHR$(16)"51UNIT COST";CHR$(1
    6)"66FUEL COST"
340 PRINT#1,CHR$(16)"08⁅8 T⁆";CHR$(16)
    "20⁅4 T⁆";CHR$(16)"30⁅11 T⁆";
350 PRINT#1,CHR$(16)"51⁅9 T⁆";CHR$(16)
    "66⁅9 T⁆"
360 PRINT#1
370 PRINT"{CLR}INPUT GALS OF FUEL OIL":I
    NPUT QUAN(1)
380 PRINT"INPUT DECIMAL COST PER GAL":IN
    PUT CST(1)
390 PRINT"INPUT CCF OF NATURAL GAS":INPU
    T QUAN(2)
400 PRINT"INPUT DECIMAL COST PER CCF":IN
    PUT CST(2)
410 PRINT"INPUT KWH OF ELECTRICITY":INPU
    T QUAN(3)
420 PRINT"INPUT DECIMAL COST PER KWH":IN
    PUT CST(3)
430 PRINT"INPUT CORDS OF WOOD":INPUT QUA
    N(4)
440 PRINT"INPUT DECIMAL COST PER CORD":I
    NPUT CST(4)
450 PRINT"INPUT TONS OF COAL":INPUT QUAN
    (5)
460 PRINT"INPUT DECIMAL COST PER TON":IN
    PUT CST(5)
470 PRINT"WANT TO CHANGE ANY INPUTS(Y/N)
    ":INPUT C$
480 IF C$="Y" THEN GOTO 370
490 BS$="{12 SPACES}"
500 FOR R=1 TO 5
510 READ UNIT$(R),FUEL$(R)
520 ENCST(R)=QUAN(R)*CST(R)
530 ENCST(6)=ENCST(6)+ENCST(R)
540 N=QUAN(R):W=N*100:GOSUB 5100:QUAN$(R
    )=S$
550 N=CST(R):W=N*100:GOSUB 5100:CST$(R)=
    S$
560 N=ENCST(R):W=N*100:GOSUB 5100:ENCST$
    (R)=S$
570 PRINT#1,CHR$(16)"01"QUAN$(R);CHR$(16
    )"20"UNIT$(R);CHR$(16)"30"FUEL$(R);
580 PRINT#1,CHR$(16)"45"CST$(R);CHR$(16)
    "60"ENCST$(R)
590 NEXT R
600 DATA GALS,OIL,CCF,NATURAL GAS,KWH,EL
    ECTRICITY,CORDS,WOOD,TONS,COAL
610 PRINT#1
615 N=ENCST(6):W=N*100:GOSUB 5100:ENCST$
    (6)=S$
620 PRINT#1,CHR$(16)"64⁅12 T⁆"
630 PRINT#1,CHR$(16)"45TOTAL COST
    {2 SPACES}$";CHR$(16)"60"ENCST$(6)
640 PRINT#1
650 GOTO 920
920 PRINT"WAIT FOR PRINTER TO COMPLETE T
    HIS SECTION":PRINT
930 DIM UBTU(5),UBTU$(5),BTUC(6),BTUC$(6
    )
940 PRINT#1,CHR$(16)"08NO.UNITS";CHR$(16
    )"20UNIT";CHR$(16)"30FUEL";
950 PRINT#1,CHR$(16)"49BTU/UNIT";CHR$(16
    )"65BTU'S CONSUMED"
960 PRINT#1,CHR$(16)"08⁅8 T⁆";CHR$(16)
    "20⁅4 T⁆";CHR$(16)"30⁅12 T⁆";
970 PRINT#1,CHR$(16)"49⁅8 T⁆";CHR$(16)
    "65⁅14 T⁆"
980 PRINT#1
990 FOR R=1 TO 5
1000 UBTU(1)=140000:UBTU(2)=100000:UBTU(
     3)=3414:UBTU(4)=20000000
1010 UBTU(5)=20000000
1020 BTUC(R)=QUAN(R)*UBTU(R)
1030 BTUC(6)=BTUC(6)+BTUC(R)
1040 N=QUAN(R):W=N*100:GOSUB 5100:QUAN$(
     R)=S$
1050 N=UBTU(R):GOSUB 5000:UBTU$(R)=S$
1060 N=BTUC(R):GOSUB 5000:BTUC$(R)=S$
1070 PRINT#1,CHR$(16)"01"QUAN$(R);CHR$(1
     6)"20"UNIT$(R);
1080 PRINT#1,CHR$(16)"30"FUEL$(R);CHR$(1
     6)"45"UBTU$(R);CHR$(16)"65"BTUC$(R)
1090 NEXT R
1095 N=BTUC(6):GOSUB 5000:BTUC$(6)=S$
1100 PRINT#1,CHR$(16)"65⁅14 T⁆"
1110 PRINT#1,CHR$(16)"50TOTAL";CHR$(16)"
     65"BTUC$(6)
1120 PRINT#1
1130 PRINT#1
1140 PRINT
1145 END
5000 N=INT(N):S$=STR$(N)
5010 L=LEN(S$):S$=MID$(S$,1,L):S$=RIGHT$
     (BS$,10-L)+S$
5020 IF N<=999 THEN S$=LEFT$(S$,7)+"
     {2 SPACES}"+RIGHT$(S$,3)
5030 IF N>999 AND N<=999999 THEN S$=" "+
     LEFT$(S$,7)+","+RIGHT$(S$,3)
5040 IF N>999999 THEN S$=LEFT$(S$,4)+","
     +MID$(S$,5,3)+","+RIGHT$(S$,3)
5050 RETURN
5100 S$=STR$(W):L=LEN(S$):S$=MID$(S$,1,L
     )
5110 IF L=2 THEN S$=MID$(BS$,1,12)+".0"+
     RIGHT$(S$,1):RETURN
5120 D$="."+RIGHT$(S$,2)
5130 S$=LEFT$(S$,L-2)+D$
5140 S$=RIGHT$(BS$,12-L)+S$
5150 IF N<=999.99 THEN S$=LEFT$(S$,7)+"
     {2 SPACES}"+RIGHT$(S$,6)
5160 IF N>999.99 AND N<=999999.99 THEN S
     $=" "+LEFT$(S$,7)+","+RIGHT$(S$,6)
5170 IF N>999999.99 THEN S$=LEFT$(S$,4)+
     ","+MID$(S$,5,3)+","+RIGHT$(S$,6)
5180 RETURN
9000 REM PAUSE TO READ SCREEN
9010 PRINT"HIT 'RETURN' KEY TO CONTINUE"
9020 INPUT CONT$:RETURN
9990 END
10000 REM..RENUMBER LINES1
10010 Y6=4096:Y7=10
10020 IF PEEK(Y6+3)=6 AND PEEK(Y6+4)=39
      THEN END
10030 Y8=INT(Y7/256):Y9=Y7-256*Y8:POKE Y
      6+3,Y9:POKE Y6+4,Y8
10040 IF PEEK(Y6+5)<>0 THEN Y6=Y6+1:GOTO
       10040
10050 Y7=Y7+10:Y6=Y6+5:GOTO 10020
```

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Program 5:
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```
10 REM..RIGHT JUSTIFY TO PRINTER
15 OPEN1,4:CMD1
18 PRINT TAB(40)"OUTPUT"
19 PRINT TAB(40)"{6 T}":PRINT
20 INPUT N
30 IF N=>1 THEN PRINT TAB(40-LEN(STR$(IN
   T(N))))N
40 IF N<1 THEN PRINT TAB(39)N
50 GOTO 20
60 END                                  ©
```

Atari Verify

Michael J. Barkan

Using less than 1K of memory, this utility program for cassette can save you a lot of time and frustration.

I had recently made a CSAVE *and* a LIST"C:" (after about five hours of typing) and *neither* of them had saved the program. This sort of thing is more than distressing. My solution is neither elaborate nor entirely original, but it works.

Ed Stewart's article in *COMPUTE!'s Second Book of Atari* on backing up machine language tapes served as the inspiration for my program. Stewart's program reads a block of data from the cassette tape, puts it in a string, reads another block, adds it to the string, and so on. The string eventually contains the entire program. Of course, the string needs to be as big as the computer's memory, so I couldn't use the method directly.

I know absolutely nothing about machine language except that when I try to change something, the system crashes – so I didn't change anything. The trick was to fool the machine language program. Locations 203 and 204 (decimal) contain the starting address of string A$. All I had to do (sounds easy, now) was reset these locations so that the machine language subroutine would "forget" that it had already put something into A$. This means that A$ needs to hold a maximum of only 128 bytes, the size of one cassette data block. Therefore, this program, once running, takes up less than 1K of memory; A$ just keeps reusing the same 128 bytes.

To use this utility, type it in and save it with LIST"C:". Load the program you want to save, or start typing in a new program. Make sure your program starts at line 10 or higher. CSAVE it. Now ENTER"C:" this utility and run it. It will ask you to start loading the tape with your new program. If the tape runs all the way through and ends with an end-of-file flag, you'll get a "GOOD TAPE" message. If the tape is not readable, you'll get an error message (my favorite is 143), but *your program is still in the computer*, so you can try again. Delete lines 0 through 9 first, though.

If your tape is of the ENTER"C:" variety, just change the 255 in line 4 to 0, and the program will verify it, too.

That's all there is to it. Not quite like having a disk drive, but at least now tape storage will be far less likely to cause you distress.

Atari Verify

```
1 CLR :DIM A$(128):POKE 203,ADR(A$)-
  (INT(ADR(A$)/256)*256):POKE 204,IN
  T(ADR(A$)/256):REM POKE START LOCA
  TION OF A$
2 FOR I=1536 TO 1565:READ A:POKE I,A
  :NEXT I:TRAP 7:REM POKE IN M.L. RO
  UTINE AND SET TRAP FOR END OF FILE
   FLAG
3 ? CHR$(125);"INSERT TAPE TO TEST":
  ? "PRESS ANY KEY TO BEGIN"
4 CLOSE #1:OPEN #1,4,255,"C:":REM CH
  ANGE 255 TO 0 FOR TAPES WITH LONG
  INTER-RECORD GAPS
5 FOR I=1 TO 100000:GET #1,B:X=USR(1
  536):REM LOOP THROUGH THIS MORE TI
  MES THAN ANYONE WILL EVER NEED
6 POKE 203,ADR(A$)-(INT(ADR(A$)/256)
  *256):POKE 204,INT(ADR(A$)/256):NE
  XT I:REM EUREKA!  RESET POINTER TO
   START OF A$
7 IF PEEK(195)=136 THEN CLOSE #1:? C
  HR$(125);"GOOD TAPE":END :REM LOOK
   FOR END OF FILE FLAG
8 ? "ERROR - ";PEEK(195):END :REM TA
  PE IS NOT READABLE
9 DATA 104,174,138,2,134,61,160,0,16
  2,0,185,0,4,129,203,200,230,203,20
  8,2,230,204,196,61,240,3,76,10,6,9
  6                                 ©
```

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PLOTting On The Apple

Thomas P. Anderson

How to plot and handle the screen on Apple's high resolution screen. Requires 16K RAM. This machine language routine simplifies screen graphics.

This little study of mine, which began about three months ago, first started after I had written a short BASIC program to plot pictures on the high resolution screen with four lines of text at the bottom. The entire screen memory had to be saved to store the picture on the disk. To avoid this waste of space, I decided to find out the memory locations of the four bottom screen lines. I could then devise a method of saving all screen memory except for those four lines.

I quickly found the necessary addresses, but in the process I also noticed how strangely the screen memory was laid out. There had to be a way of decoding the inconsequent order of screen memory, so that a specific point on the screen could be referenced easily.

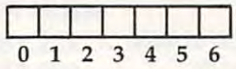
How does Applesoft do it? I found absolutely no documentation of this subject. I could have waded through about 8K of disassembled code and still not found the answer, so I was on my own in figuring this one out. In this article, I am relating to you what I have found out about PLOTting on the high resolution screen in machine language.

Base Addresses

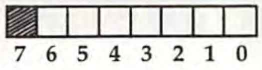
First of all, a review of the hi-res screen layout. The screen has a resolution of 192 lines by 280 dots. The lines are referenced by the decimal values 0-191, and the dots are referenced by the decimal values 0-279. The position of (0,0) is in the upper left-hand corner.

Seven consecutive dots of a line are controlled by the value stored in one byte of memory, so 40 bytes are required to control one line. These 40 bytes, referenced by the decimal values 0-39, I will call the column position. The zero column position is the base address in memory of the line. To see what values are necessary to turn on a dot, we have to look at the bit patterns of the controlling byte.

Screen Column Position



Controlling Memory Byte



Shown above are seven consecutive dots on the screen and the controlling byte. If bit three of the controlling byte is on, then the dot in position three within the column will be on. Bit seven of the controlling byte will be zero for this article, since I am not concerned here with manipulating the screen colors.

What To Calculate

Once I had reviewed the basics of screen memory, my problem became defined for me. The routines I had to write would take two decimal values: 1) a line number in the range of 0-191, and 2) a dot position in the range of 0-279. From these values the routines would calculate:

1) The 16-bit hexadecimal *base address*,

2) The *column position* in the range of 0-39, and

3) The *dot position within* the *column* in the range of 0-6.

I will explain the calculation of the base address first, since it is the complicated one. To understand this, I had to know what all the possible base addresses of page two could be. I used page two during the testing because PLOTting on page one wrote over my source file in memory, and it had to be reloaded after every test.

All base addresses lie within the range of $4000-$7FD0. This means that the high byte of our address will be in the range of $40-$7F, and the only possibilities for the low byte are $00, $28, $50, $A8, or $D0. To see how this works exactly, I assigned variables to the bit positions of the line number.

Since we know the maximum and minimum value of the base address, we know that certain bits of the base address will always be off or on no matter what the line number is. Shown below are the assigned variables of the line and the starting framework of the base address.

Line Number

A	B	C	D	E	F	G	H
7	6	5	4	3	2	1	0

Base Address

0	1	0	?	?	?	?	?
7	6	5	4	3	2	1	0

High Byte

?	?	?	?	?	0	0	0
7	6	5	4	3	2	1	0

Low Byte

Figuring Bit Positions

The steps that follow are the ones that I used to figure the bit position of the line that would determine the value of a bit position in the base address.

1. Choose a questionable bit position of the base address.
2. Determine all the possible values of that byte if the bit is on.
3. Determine all the possible values of that byte if the bit is off.
4. Determine all the possible values of the line number based on the values found in Step 2.
5. Determine all the possible values of the line number based on the values found in Step 3.
6. By examining the binary values of the line numbers, the bit patterns are easily seen. There will be one bit position in the values from Step 4 that is always the complement of that same bit position in the values from Step 5. Therefore, this bit position of the line number is the determining bit for the questionable bit in Step 1.

Using these steps for all questionable bits of the base address, I ended up with the representation of the base address as shown below.

Base Address

0	1	0	F	G	H	C	D
7	6	5	4	3	2	1	0

High Byte

E	A	B	A	B	0	0	0
7	6	5	4	3	2	1	0

Low Byte

Now that I had figured out the starting and ending representations, I wrote the routine HBASCALC to perform this operation. This routine is shown in Program 1. The routine is entered with the line number in location HCV and exits the routine with the base address in locations HBASL and HBASH. The documentation explains the process and shows how the variable representations are manipulated by each instruction. This routine can be easily changed to use page one by changing the instruction ORA#$40 to ORA#$20 and setting the appropriate soft switches for page one.

That may have been a bit complex; but now that you have the HBASCALC routine, you won't have to follow those steps as I did.

Calculating the column position and the dot position within the column was a simpler task for me. Since there are 280 dots to represent with 40 bytes of memory, I needed to divide the dot position by seven. The quotient would be the column position, and the remainder would be the dot position within the column. At first I used the standard 16-bit by 16-bit division routine, but this process seemed a little slow for PLOTting.

So I tried another routine which simply subtracted seven from the dot position until it went to less than zero. An index register was used to count the number of times seven could be subtracted, which gave me the column position, and then adding seven back to the now negative dot position gave me the dot position within the column.

Being unsure of the speed of this routine, I calculated the time required by each routine to plot 280 positions, one full line, and I found that the second routine used about 120,000 machine cycles less than the standard routine. The faster routine is called DIVIDE and is shown with the demo program (Program 2).

Plotting A Grid

This division process is the most time consuming aspect of hi-res plotting. I learned quickly that if the main driving routine consists of nested loops, as Hi-res Grid Demo does, then the division routine should be used in the outer routine, or the entire routine will be greatly slowed. If the division is performed in the inner loop, it will be executed for every dot plotted. If the division is performed in the outer loop, it will be executed only when the dot position changes.

Program 2, Hi-res Grid Demo, will accept input from the user in the range of 1-9. It then draws the grid with the number input as the number of spaces between each line of the grid. The program PLOTs the grid until it goes off the edge of the screen, and then it goes back and erases the excess plots to make a neater appearing grid. The program will terminate with a CONTROL-C.

Hi-res Grid Demo is fairly simple, but its purpose is to show you the basic routines used in PLOTting with machine language. Perhaps it will stimulate you to look further to other possibilities, such as color PLOTting, line drawing routines, animation, and faster game design than BASIC will allow. I know it has me working on other ideas. As for my original objective, the saving of hi-res pictures without the four bottom lines, I forgot all about that once I discovered the other interesting possibilities at my fingertips.

Program 1: Base Address Calculation

```
* LISTING 1.
*
********************************************
*HIRES BASE ADDRESS CALCULATION ROUTINE,PAGE 2*
********************************************
HBASCALC PHA
         LDA  HCV      ;ABCDEFGH; GET VERT. POS.(0-191).
         ASL           ;BCDEFGH0; SHIFT LEFT UNTIL BITS
         ASL           ;CDEFGH00; "FGH" ARE  IN CORRECT POSITION.
         AND  #$1C     ;000FGH00; TURN OFF ALL BUT BITS "FGH".
         ORA  #$40     ;010FGH00; BIT SIX IS ALWAYS ON.
         STA  HBASH    ;010FGH00; SAVE THIS PORTION.
         LDA  HCV      ;ABCDEFGH; START AGAIN.
         LSR           ;0ABCDEFG; SHIFT RIGHT UNTIL THE
         LSR           ;00ABCDEF; "E" BIT SHIFTS TO CARRY.
         LSR           ;000ABCDE; AND BITS "CD"
         LSR           ;0000ABCD; ARE IN CORRECT POSITION.
         AND  #3       ;000000CD; TURN OFF ALL BUT "CD" AND
         ORA  HBASH    ;010FGHCD; MERGE TO COMPLETE HI-BYTE
         STA  HBASH    ;010FGHCD;
         LDA  HCV      ;ABCDEFGH; WORK ON LO-BYTE.
         AND  #$C0     ;AB000000; TURN OFF ALL BUT BITS "AB".
         PHA           ;AB000000; SAVE IT.
         ROR           ;EAB00000; GET "E" BIT BACK FROM CARRY.
         STA  HBASL    ;EAB00000; SAVE THIS PORTION.
         PLA           ;AB000000; PULL BACK BITS "AB" AND
         LSR           ;0AB00000; SHIFT RIGHT UNTIL THEY
         LSR           ;00AB0000; ARE IN CORRECT POSITION.
         LSR           ;000AB000;
         ORA  HBASL    ;EABAB000; MERGE TO COMPLETE LO-BYTE.
         STA  HBASL    ;EABAB000;
         PLA
         RTS
```

Program 2: Hi-res Grid Demo

```
* LISTING 2
*
*******************
* HIRES GRID DEMO *
* BY TOM ANDERSON *
*******************
*
* SYSTEM SOFT SWITCHES
*
KBD      EQU  $C000  ;READ KEYBOARD
KBDSTR   EQU  $C010  ;CLEAR KEYBOARD
GRAPHICS EQU  $C050  ;GRAPHICS MODE
HIRES    EQU  $C057  ;HI-RESOLUTION GRAPHICS
PRIMARY  EQU  $C054  ;PAGE ONE
ALLGR    EQU  $C052  ;FULL SCREEN GRAPHICS
TXTMODE  EQU  $C051  ;TEXT MODE
SECOND   EQU  $C055  ;PAGE TWO
*
*PAGE ONE LOCATIONS USED
*
CH       EQU  $24    ;TEXT COLUMN POSITION(0-39)
CV       EQU  $25    ;TEXT LINE POSITION(0-23)
HCV      EQU  $25    ;HIRES LINE POSITION(0-191)
HPOSLO   EQU  $26    ;HIRES DOT POSITION(0-279)
HPOSHI   EQU  $27
HBASL    EQU  $28    ;HIRES LINE BASE ADDRESS
HBASH    EQU  $29
REMLO    EQU  $2C    ;REMAINDER IN DIVISION ROUTINE
REMHI    EQU  $2D
GRIDSZ   EQU  $2E    ;VALUE OF GRID SIZE
RTMARG   EQU  $2F
```

```
                *
                *MONITOR ROUTINES
                *
                COUT     EQU  $FDED    ;CHARACTER OUTPUT ROUTINE IN MONITOR
                HOME     EQU  $FC58    ;MONITOR ROUTINE TO CLEAR TEXT PAGE
                BASIC    EQU  $3D0     ;VECTOR TO RETURN TO CURRENT BASIC
7000: 20 C2 70  START    JSR  PRDISP   ;DISPLAY INPUT PROMPT
7003: 20 9B 70           JSR  INPUT    ;GET USER INPUT
7006: 20 4A 71           JSR  INHRES   ;INITIALIZE HIRES MODE
                ************************
                * DRAW VERTICAL LINES *
                ************************
7009: A9 00              LDA  #0       ;START AND RESET DOT POSITION TO ZERO
700B: 85 26              STA  HPOSLO
700D: 85 27              STA  HPOSHI
700F: A9 00     VERT     LDA  #0       ;START LINE ZERO
7011: 85 25              STA  HCV
7013: 20 EF 70           JSR  DIVIDE   ;CALCULATE HORIZONTAL OFFSET
7016: 20 21 71  VERT1    JSR  HBASCALC ;CALCULATE LINE BASE ADDRESS
7019: 20 10 71           JSR  DISPLAY  ;TURN ON ONE DOT
701C: E6 25              INC  HCV      ;LINE=LINE+1
701E: A5 25              LDA  HCV
7020: C9 C0              CMP  #192     ;BOTTOM OF SCREEN?
7022: 90 F2              BCC  VERT1    ;NO, GO BACK
7024: 18                 CLC
7025: A5 26              LDA  HPOSLO   ;DOT POSITION=DOT POSITION+GRIDSZ
7027: 65 2E              ADC  GRIDSZ
7029: 90 02              BCC  OVERV
702B: E6 27              INC  HPOSHI
702D: 85 26     OVERV    STA  HPOSLO
702F: A5 27              LDA  HPOSHI   ;END OF LINE?
7031: 4A                 LSR
7032: 90 DB              BCC  VERT     ;NO, GO BACK
7034: A5 26              LDA  HPOSLO
7036: C9 18              CMP  #$18
7038: 90 D5              BCC  VERT
703A: E5 2E              SBC  GRIDSZ   ;RTMARG=LAST DOT POSITION PLOTTED
703C: 85 2F              STA  RTMARG
                **************************
                * DRAW HORIZONTAL LINES *
                **************************
703E: A9 00              LDA  #0       ;START DOT POSITION ZERO
7040: 85 26              STA  HPOSLO
7042: 85 27              STA  HPOSHI
7044: A9 00     HORIZ    LDA  #0       ;START AND RESET LINE TO ZERO
7046: 85 25              STA  HCV
7048: 20 EF 70           JSR  DIVIDE   ;CALCULATE HORIZONTAL OFFSET
704B: 20 21 71  HORIZ1   JSR  HBASCALC ;CALCULATE LINE BASE ADDRESS
704E: 20 10 71           JSR  DISPLAY  ;DISPLAY VALUE TO TURN ON ONE DOT
7051: 18                 CLC
7052: A5 25              LDA  HCV
7054: 65 2E              ADC  GRIDSZ   ;LINE=LINE+GRIDSZ
7056: 85 25              STA  HCV
7058: C9 C0              CMP  #192     ;BOTTOM OF SCREEN?
705A: 90 EF              BCC  HORIZ1   ;NO, GO BACK
705C: E6 26              INC  HPOSLO   ;YES,DOT POS.=DOT POS.+1
705E: D0 02              BNE  OVERH
7060: E6 27              INC  HPOSHI
7062: A5 27     OVERH    LDA  HPOSHI
7064: 4A                 LSR
7065: 90 DD              BCC  HORIZ
7067: A5 26              LDA  HPOSLO
7069: C5 2F              CMP  RTMARG   ;REACHED RIGHT MARGIN?
706B: 90 D7              BCC  HORIZ    ;NO, GO BACK
706D: A5 25              LDA  HCV      ;DETERMINE BOTTOM CUTOFF POINT
706F: E5 2E              SBC  GRIDSZ
7071: 85 25              STA  HCV
7073: A9 00              LDA  #0
```

```
7075: E6 25                INC  HCV
7077: 20 21 71    CLRBTM   JSR  HBASCALC ;CLEAR UNNESSECARY PLOTS AT
707A: A0 28                LDY  #40     ;BOTTOM OF THE SCREEN
707C: 88          NXTBYT   DEY
707D: 91 28                STA  (HBASL),Y
707F: D0 FB                BNE  NXTBYT
7081: E6 25                INC  HCV
7083: A6 25                LDX  HCV
7085: E0 C0                CPX  #192
7087: D0 EE                BNE  CLRBTM
7089: AD 00 C0    RDKEY    LDA  KBD     ;GRID DRAWN, A CONTROL-C AT THIS
708C: 10 FB                BPL  RDKEY   ;POINT WILL TERMINATE
708E: 8D 10 C0             STA  KBDSTR  ;ANY OTHER KEYSTROKE WILL RESTART
7091: C9 83                CMP  #$83
7093: D0 03                BNE  RESTART
7095: 4C A7 70             JMP  EXIT
7098: 4C 00 70    RESTART  JMP  START
                  ***************
                  * USER INPUT *
                  ***************
709B: AD 00 C0    INPUT    LDA  KBD     ;SINGLE KEY INPUT
709E: 10 FB                BPL  INPUT
70A0: 8D 10 C0             STA  KBDSTR
70A3: C9 83                CMP  #$83    ;CONTROL-C WILL TERMINATE
70A5: D0 0C                BNE  DIG     ;NOT CNTRL-C
70A7: 20 58 FC    EXIT     JSR  HOME
70AA: AD 51 C0             LDA  TXTMODE
70AD: AD 54 C0             LDA  PRIMARY
70B0: 4C D0 03             JMP  BASIC
70B3: C9 B1       DIG      CMP  #$Bi    ;IS IT < i?
70B5: 90 E4                BCC  INPUT   ;YES,INVALID GO BACK
70B7: C9 BA                CMP  #$BA    ;IS IT > 9?
70B9: B0 E0                BCS  INPUT   ;YES,INVALID GO BACK
70BB: 29 0F                AND  #$0F    ;MASK OFF 4 MSB'S
70BD: 69 01                ADC  #1
70BF: 85 2E                STA  GRIDSZ  ;THIS IS SIZE OF GRID
70C1: 60                   RTS
                  *************************
                  * DISPLAY INPUT PROMPT *
                  *************************
70C2: AD 51 C0    PRDISP   LDA  TXTMODE ;SET SWITCHES FOR TEXT MODE PAGE ONE
70C5: AD 54 C0             LDA  PRIMARY
70C8: 20 58 FC             JSR  HOME    ;CLEAR SCREEN
70CB: A9 0C                LDA  #12     ;SET DISPLAY FOR HTAB 10,VTAB 12
70CD: 85 25                STA  CV
70CF: A9 0A                LDA  #10
70D1: 85 24                STA  CH
70D3: A2 0F                LDX  #15
70D5: BD DF 70    NXTCHR   LDA  PROMPT,X ;GET CHARACTER
70D8: 20 ED FD             JSR  COUT    ;DISPLAY
70DB: CA                   DEX
70DC: D0 F7                BNE  NXTCHR
70DE: 60                   RTS
70DF: A0 BF A0    PROMPT   ASC  "   ? )9-1(EZISDIRG"
                  *********************************
                  *DIVIDE DOT POSITION BY SEVEN *
                  *********************************
70EF: A5 26       DIVIDE   LDA  HPOSLO
70F1: 85 2C                STA  REMLO
70F3: A5 27                LDA  HPOSHI
70F5: 85 2D                STA  REMHI
70F7: 38                   SEC
70F8: A0 FF                LDY  #$FF
70FA: C8          DIV1     INY
70FB: A5 2C                LDA  REMLO
70FD: E9 07                SBC  #7
70FF: 85 2C                STA  REMLO
7101: A5 2D                LDA  REMHI
```

```
7103: E9 00     168           SBC   #0
7105: 85 2D     169           STA   REMHI
7107: 10 F1     170           BPL   DIV1
7109: A5 2C     171           LDA   REMLO
710B: 69 07     172           ADC   #7
710D: 85 2C     173           STA   REMLO
710F: 60        174           RTS
                175 *******************
                176 * DISPLAY ROUTINE *
                177 *******************
7110: A6 2C     178 DISPLAY   LDX   REMLO  ;DOT POSITION WITHIN COLUMN(0-6)
7112: BD 1A 71  179           LDA   ONBIT,X ;GET VALUE TO TURN BIT ON
7115: 11 28     180           ORA   (HBASL),Y ;MERGE WITH VALUE ALREADY THERE
7117: 91 28     181           STA   (HBASL),Y ;DISPLAY NEW VALUE
7119: 60        182           RTS
711A: 01 02 04  183 ONBIT     HEX   01020408102040
                184 ********************************************
                185 *HIRES BASE ADDRESS CALCULATION ROUTINE,PAGE 2*
                186 ********************************************
7121: 48        187 HBASCALC PHA
7122: A5 25     188           LDA   HCV
7124: 0A        189           ASL
7125: 0A        190           ASL
7126: 29 1C     191           AND   #$1C
7128: 09 40     192           ORA   #$40
712A: 85 29     193           STA   HBASH
712C: A5 25     194           LDA   HCV
712E: 4A        195           LSR
712F: 4A        196           LSR
7130: 4A        197           LSR
7131: 4A        198           LSR
7132: 29 03     199           AND   #3
7134: 05 29     200           ORA   HBASH
7136: 85 29     201           STA   HBASH
7138: A5 25     202           LDA   HCV
713A: 29 C0     203           AND   #$C0
713C: 48        204           PHA
713D: 6A        205           ROR
713E: 85 28     206           STA   HBASL
7140: 68        207           PLA
7142: 4A        209           LSR
7143: 4A        210           LSR
7144: 05 28     211           ORA   HBASL
7146: 85 28     212           STA   HBASL
7148: 68        213           PLA
7149: 60        214           RTS
                215 ************************
                216 * CLEAR HIRES PAGE TWO *
                217 ************************
714A: A9 00     218 INHRES    LDA   #0       ;START LINE ZERO
714C: 85 25     219           STA   HCV
714E: 20 21 71  220 SCREEN    JSR   HBASCALC ;NEW BASE ADDR. WHEN HCV CHANGES
7151: A0 28     221           LDY   #40      ;NUMBER OF COLUMNS
7153: 88        222 LINE      DEY          ;COLUMN=COLUMN-1
7154: 91 28     223           STA   (HBASL),Y ;DISPLAY VALUE ZERO
7156: D0 FB     224           BNE   LINE     ;COLUMN=ZERO?
7158: E6 25     225           INC   HCV      ;YES, LINE=LINE+1
715A: A6 25     226           LDX   HCV
715C: E0 C0     227           CPX   #192     ;LAST LINE CLEARED?
715E: D0 EE     228           BNE   SCREEN ;NO, GO BACK
                229 *******************************
                230 * SET SOFT SWITCHES FOR HIRES *
                231 *******************************
7160: AD 57 C0  232           LDA   HIRES
7163: AD 50 C0  233           LDA   GRAPHICS
7166: AD 55 C0  234           LDA   SECOND
7169: AD 52 C0  235           LDA   ALLGR
716C: 60        236           RTS
```

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 VIC, Apple, PET/CBM, Commodore 64, Atari, Timex/Sinclair, TI/99-4A, and Radio Shack Color Computer. We are much more concerned with the content of an article than with its style. Above all, 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.* 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. On the other hand, tapes are preferred for the Radio Shack computer. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

It is far easier for others to type in your program if you use CHR$(X) values and TAB(X) or SPC(X) instead of cursor manipulations to format your output. For five carriage returns, FOR I = 1 TO 5:PRINT:NEXT is far more "portable" to other computers with other BASICs and also easier to type in. And, instead of a dozen right-cursor symbols, why not simply use PRINT SPC(12)? A quick check through your program – making these substitutions – would be greatly appreciated by your editors and by your readers.

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 5x7, 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.

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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.

Relocating VIC Loads

Tony Valeri

When you need to relocate a program in the VIC's memory, you can use this simple technique.

As most VIC users know, the VIC relocates all programs to the start of BASIC memory unless told otherwise. For example, LOAD 1,1 tells the computer to load the program into the area of memory specified by the tape.

So we have two choices; we can either load a program into the start of BASIC memory (usually $1000 hex) or load a program back into its original location in memory (using a monitor like TINYMON). But what if we want to place a previously prepared subroutine at the end of a program, or relocate a machine language program to some novel place in memory? There's not much we could do short of retyping it.

Basically, what happens during a LOAD is that, after a few pointers are stored (buffer location, program name, etc.), a routine is called that searches the tape for the next program header, and then reads it into the cassette buffer. The load routine next checks the buffer to find out whether the program being loaded is to be placed into the locations specified in the buffer or is to be relocated to the start of BASIC. Now, if we could by-pass the routine that does this, things would be much simpler.

In the figure, you'll see the locations necessary to relocate a program *anywhere* in the VIC's memory.

Use a SYS 63407. The computer will prompt with the usual PRESS PLAY ON TAPE. The difference is that the computer now prints READY as soon as the program is found. What has happened is that the SYS 63407 tells the computer to load the next program header and store the information in the cassette buffer.

To find out the original start and end locations of your program, type in PRINT PEEK(829)+PEEK(830)*256, PEEK(831)+256*PEEK(832).

Increasing the value in locations 829 and 831 by one will place the program one byte higher in memory. Increasing the value in locations 830 and 832 by one will place the program 256 bytes higher in memory. Decreasing the values in these locations will have the opposite effect.

After the buffer has been changed, a SYS 62980 will return control of the computer to the load routine. Now load the main body of the program into memory, but load it into the *new* locations just specified.

See It Work

To demonstrate this technique, we'll fill the screen with data from tape. The demonstration is for the unexpanded VIC, so you'll need to remove or disable any memory expansion. To prepare, type in the following line in direct mode:

```
POKE 46,PEEK(46)+2
```

This reserves two pages (512 bytes) at the end of your BASIC program for data.

Type in the following one-line program *exactly* as it appears. Any additional spaces will cause errors. The program will fill the space between the end of the program and the start of variables with the screen POKE value for the ball character.

```
10 FORA=4124TO4629:POKEA,81:NEXT
```

After checking your typing, RUN the program then SAVE it to cassette.

Next, rewind the tape and reset the VIC with a SYS 64802. Start the relocatable load by typing:

```
SYS 63407
```

After the VIC reads the tape header into its buffer you can check the original start and end addresses by PEEKing addresses 829 - 832 as indicated above. The starting and ending addresses should be 4097

	HEX	DEC
Routine To Load Header	$F7AF	63407
Buffer Start Of Prog.	$033D & $033E	829 & 830
Buffer End Of Prog.	$033F & $0340	831 & 832
Continue Load	$F607	62980

Locations necessary to place a program anywhere in the VIC's memory.

and 4636. Instead we want to put the block of 506 ball characters into screen memory, which starts at location 7680. To accomplish this, type in the following series of POKEs:

```
POKE 829,229:POKE 830,29:POKE 831,0:POKE 832,32
```

You'll need to prepare the screen by changing the colors to make the balls visible. Try POKE 36879,76. Finally, complete the tape LOAD by typing:

```
SYS 62980
```

The data coming in from tape will be directed to the screen memory area and will fill the display with ball characters. ©

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Part VII

Commodore 64 Video – A Guided Tour

Jim Butterfield, Associate Editor

In this, the final installment of our exploration of the Commodore 64's unique video design, we look at a solution to the pesky "hiccup" screen glitch.

Last time, we looked at a simple program to split the screen of the Commodore 64. It was similar, but not identical, to this one:

```
100 FOR J=828 TO 862:READ X
110 T=T+X:POKE J,X
120 NEXT J
130 IF T<>3929 THEN STOP
200 DATA 173,25,208,41,1,240,25,141,25,2
    08,162,146,160,6,173,18
210 DATA 208,16,4,162,1,160,0,142,18,208
    ,140,33,208,76,188,254,76,49,234
300 POKE 56333,127
310 POKE 788,60:POKE 789,3
320 POKE 56333,129:POKE 53274,129
```

Our previous example split the screen into two sections: graphics and text. This one splits the screen into two background color areas. It makes it easier for us to see the glitch – the hiccup that occasionally disturbs our screen split. By the way, it's easier to see the problem when you are using the keyboard.

Why The Problem?

Here's where the problem comes from: the timer interrupt strikes about every 1/60 of a second. The screen display, too, runs at a rate of about 60 times a second. But they are not synchronized. The two processes run at similar, but not identical, speeds.

Now, every once in a while, the timer interrupt hits just before the raster interrupt. The timer interrupt has quite a few jobs to do: update the TI$ clock, check the cassette motor, flash the cursor, and check the keyboard. It takes time to do these jobs, and extra time is required if a key is being pressed.

Suppose we have just started on the timer interrupt, and the raster scan says, "I'm ready!" Sorry, raster, we're already into an interrupt routine, and other interrupts are locked out until we have finished. By that time, the screen scan might have moved along a few lines, and our split screen has crept from its normal position.

Some Possible Fixes

There are several possible approaches to fixing this jitter. The ones that come to mind first are complex; in a moment, we'll move on to an easy one.

When the timer interrupt strikes, we could ask it to look at the raster and see if the scan was close to the interrupt point. If so, we might wait things out, or skip part of the timer interrupt jobs. Messy.

The timer interrupt could "unlock" the interrupt very quickly, using a CLI command. That way, we could interrupt the interrupt program itself to do the split screen job. Better, but some programmers feel it's dangerous to allow this kind of thing to happen.

A Better Way

There is an easier way: shut the timer interrupt off completely, and do its various jobs with our own programs. This *seems* complex, but it's not. We can call the timer interrupt routines ourselves, whenever it's time.

Let's look a little more closely into the timing of these interrupts. We expect to cause a raster scan interrupt about 120 times a second. That's twice as often as the timer interrupt needs to be handled. So our raster program could occasionally call in the timer interrupt program.

It seems that we could accomplish the task easily by calling the timer interrupt routines every second raster interrupt. That would certainly do the job, but there's a better way.

Even though we've shut off the timer inter-

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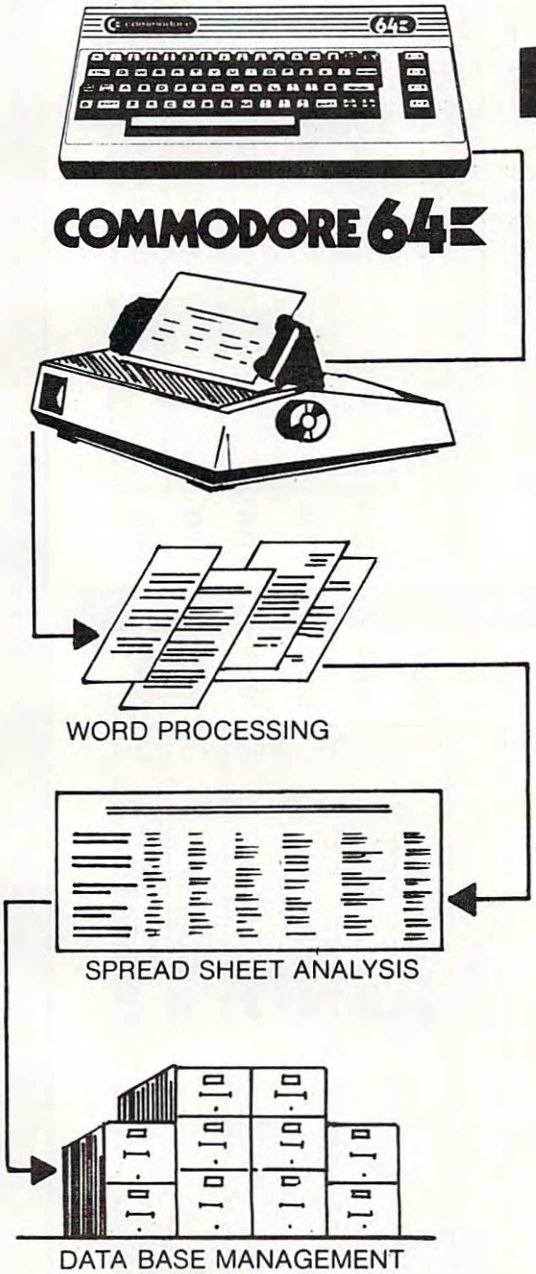

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Table 1:

6566 Video Chip
C64 Control and Miscellaneous Registers

D011		Extended Color Mode	Bit Map	Display Enable	Row Select	Y-Scroll	53265
D012	Raster Register						53266
D013	Light Pen Input					X	53267
D014						Y	53268
D016	X	X	Reset	Multi Color	Col Select	X-Scroll	53270

	Screen				Character Base					
D018	VM13	VM12	VM11	VM10	CB13	CB12	CB11	X		53272
D019	IRQ	Interrupt ←Sense→			LP	SSC	SBC	RST		53273
D01A	Interrupt Enable →				Light Pen	Sprite Collision with Sprite	Back	Raster		53274

Color Registers

D020	X	Exterior	53280
D021	X	Background #0	53281
D022	X	Background #1	53282
D023	X	Background #2	53283
D024	X	Background #3	53284
D025	X	Sprite Multicolor #0	53285
D026	X	Sprite Multicolor #1	53286

Table 2:

6566 Video Chip
C64 Sprite Registers

Sprite 0	Sprite 7			Sprite 0	Sprite 7
D000	D00E	Position	X	53248	53262
D001	D00F		Y	53249	53263
D027	D02E	X	Color	53287	53294

	Sprite 7	Sprite 6	Sprite 5	Sprite 4	Sprite 3	Sprite 2	Sprite 1	Sprite 0	
D010	X-Position High								53264
D015	Sprite Enable								53269
D017	Y-Expand								53271
D01B	Background Priority								53275
D01C	Multicolor								53276
D01D	X-Expand								53277
D01E	Interrupt: Sprite Collision								53278
D01F	Interrupt: Background Collision								53279

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rupt, it's still signaling when the time is ready. Let's review: the timer leaves a signal in hex address $DC0D (56333) whenever it counts down to zero. Normally, this signal triggers the interrupt line (IRQ) and causes the processor to be interrupted. But we may "break" the connection between the timer signal and the interrupt line. In this case, the timer will not cause an interrupt, but the signal bit will still flash when the appropriate time has come.

We can see the plan in Figures 1 and 2. We will disconnect the timer from interrupt, and service it ourselves when it flashes. Easier done than said. Let's look at the machine language coding:

```
033C  A9 01     INTR  LDA #$01
033E  8D 19 D0        STA $D019
```

Raster interrupt is now the only game in town, so we don't need to test for it. We must, of course, turn off the raster interrupt flag.

```
0341  A2  92          LDX   #$92
0343  A0  06          LDY   #$06
```

Setup for top of screen. Next interrupt, line 92 hex; new color, number 6.

```
0345  AD 12  D0       LDA   $D012
0348  10  04          BPL   MID
```

If it's really the top of screen, we can skip ahead. Otherwise, we change for mid-screen – line 1, new color, number 0:

```
034A  A2  01          LDX   #$01
034C  A0  00          LDY   #$00
```

Now we're ready to do the job, wherever the screen is:

```
034E  8E  12  D0  MID  STX   $D012
0351  8C  21  D0       STY   $D021
```

The job is done. Now let's see if the timer interrupt is calling for action:

```
0354  AD 0D  DC       LDA   $DC0D
0357  29  01          AND   #$01
0359  F0  03          BEQ   SKIP
```

If we didn't skip, the timer wants attention. Call it in:

```
035B  4C  31  EA      JMP   $EA31
```

If we did skip, the timer isn't needed. Quit with:

```
035E  4C  BC  FE  SKIP  JMP   $FEBC
```

We must remember, of course, to: turn off the timer interrupt; set the IRQ vector to our new code; and turn on the raster interrupt. We'll do all that in BASIC. Speaking of which....

BASIC-ally Yours

Here's the same program in BASIC.

```
100 FOR J=828 TO 864:READ X
110 T=T+X:POKE J,X
120 NEXT J
130 IF T<>4077 THEN STOP
200 DATA 169,1,141,25,208,162,146,160,6,
    173,18,208,16,4,162,1
210 DATA 160,0,142,18,208,140,33,208,173
    ,13,220
220 DATA 41,1,240,3,76,49,234,76,188,254
300 POKE 56333,127
310 POKE 788,60:POKE 789,3
320 POKE 53274,129
```

Now we have a rock-solid color change at the appropriate screen point. No creeping, no jittering, no hiccups.

We've only touched upon the techniques of raster interrupt. A whole host of new possibilities open up with its use.

But we've shown it can be done, and some of the techniques that can be used to do it.

Figure 1:

"Conventional" coding requires the program to distinguish between the two live timing sources. It may also cause timing jitter.

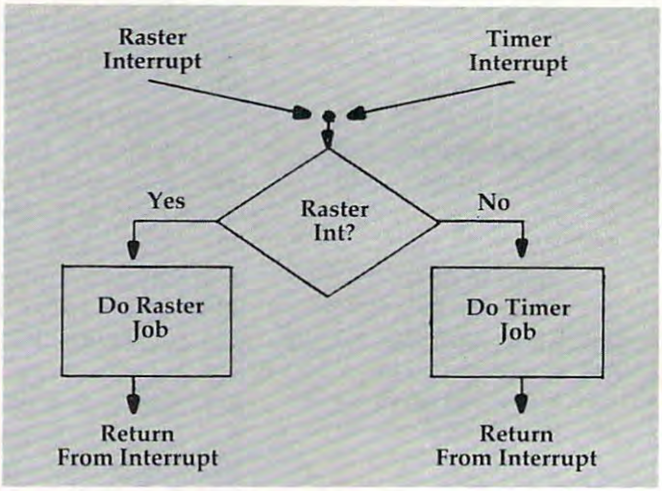
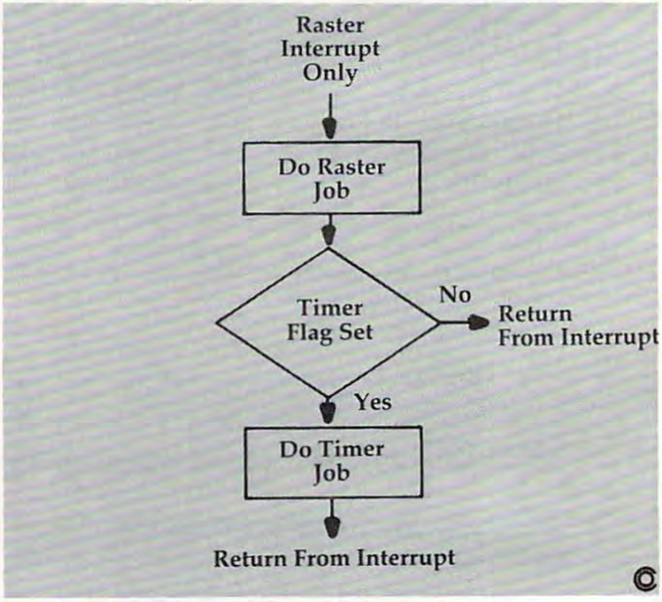


Figure 2:

Single interrupt coding gives priority to the time-sensitive raster job.



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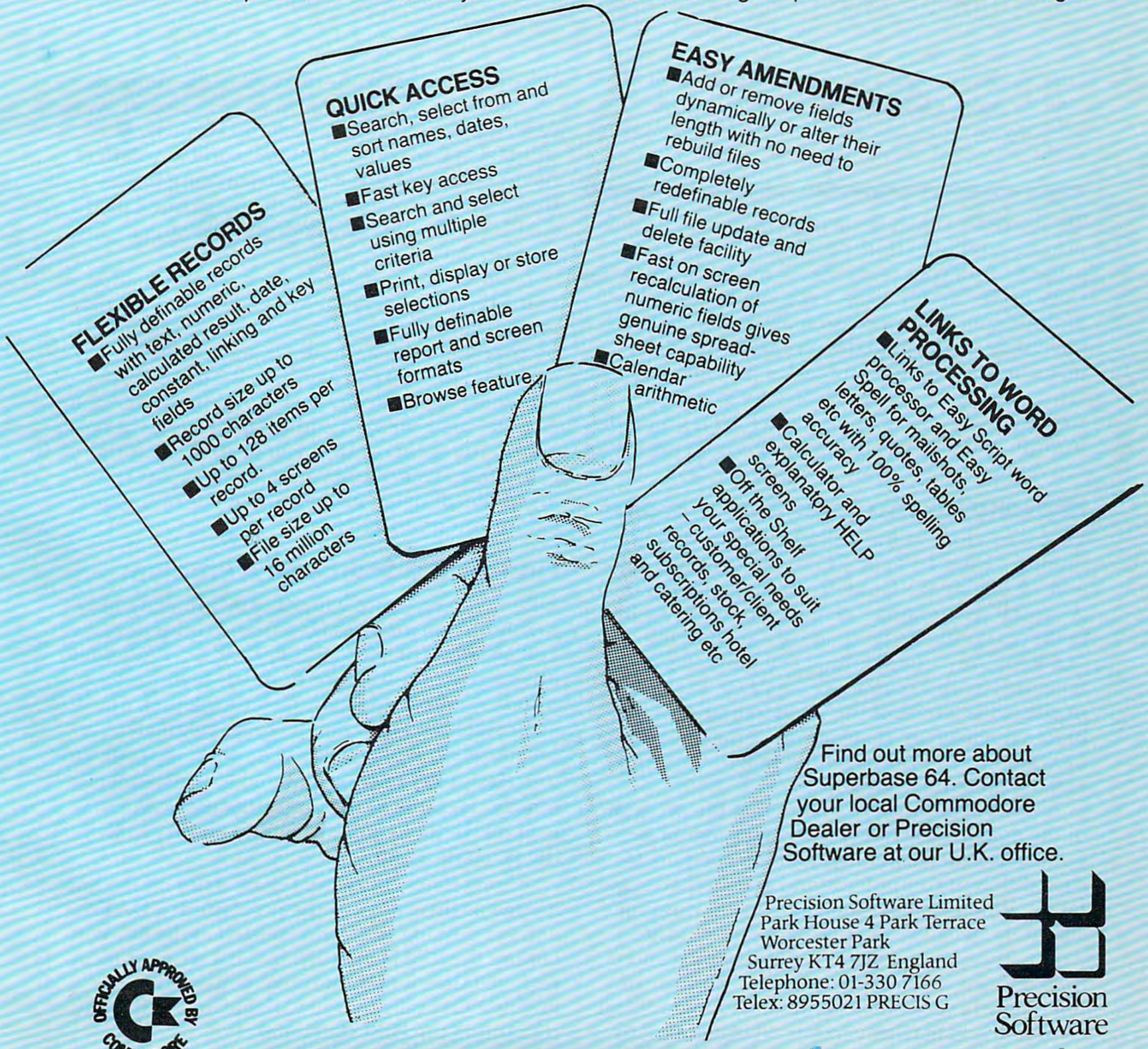

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Troubleshooting A Program

John Blackford, Assistant Features Editor

Suppose you've typed a program into your computer from the pages of **COMPUTE!**, *and it doesn't run. The following checklist should help you find the problem in a jiffy.*

There are two likely sources of trouble in a typed program: typing errors made as you enter the program into your computer or mistakes involving *COMPUTE!'s conventions* – the symbols used to indicate special keystroke combinations. If you have successfully typed in programs from the magazine before, the problem is probably a typing error. But if this is your first try (or if you are working with a new computer which is unfamiliar to you), you may be having trouble with the listing conventions.

Knowing How To Enter The Program

First take a look at the articles published each month, "How To Type COMPUTE!'s Programs," and "A Beginner's Guide To Typing In Programs." As you'll see, finding a character or word enclosed in braces is either a *function key* – such as the "CLEAR" key – or a normal key pressed simultaneously with a *control* or *escape* key. *Don't* type in either the letters of the word in braces, or the braces themselves. Instead, press the key or keys indicated by the words within braces. {CLEAR} means, press the CLR key.

What about the possibility that the program in the magazine is incorrect? Each program we publish is tested carefully, and the versions for each different computer brand are checked separately. When we have a given version running smoothly, we LIST the program directly onto paper. This paper version is photocopied and then appears as is in the magazine. Because of this, there is very little chance of a typographical error in the magazine version – it is identical to the program that was pretested in the computer.

Still, we *have* made mistakes. In almost every case, though, a program *will* run correctly as printed. If you continue to have problems after having followed these troubleshooting procedures, check the section of the magazine called CAPUTE! the next issue or two following the program in question.

On the other hand, there is a good chance that a typing error crept in as you keyed the program listing into your computer. The result can be anything from a slightly quirky display (such as square trees) to no game at all – just a cryptic error message or even a lock-up. When a computer *locks up*, the keyboard and RESET keys have no effect. To regain control, you must turn off the computer. Everything you typed in is lost. To avoid this disaster, always SAVE your program before you try to RUN it.

Finding The Source Of A Problem

Often, you can trace a mistake by knowing how to interpret error messages. Some computers give you a statement such as "OUT OF DATA," while others give only an error number. If you get a number, look it up in your user's manual. The error statement or number is accompanied by a line number, which helps in locating the problem.

First, LIST the line and make sure that it is exactly the same as the one in the magazine. If it isn't, make the required changes and try to RUN the program again.

Sometimes, the actual error is not on the line named as the source of the problem. If a DATA entry is missing, the error is listed at the line containing the READ instructions. If a string is incorrectly DIMensioned, the error will occur in the line that first calls for the variable, not in the line containing the DIM statement.

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Likewise, if you forget to use RETURN to end a subroutine or tell the program to jump to a nonexistent line, the error message will refer to where the computer failed to carry out your instructions, not to where the mistake actually is located. Thus, interpreting this kind of error message requires some imagination, but at least the messages narrow your search to two areas.

If you go through the above steps and still don't find a mistake, you'll have to check the program line by line to be certain that each character is exactly the same as the original text. First, check the line numbers themselves, comparing number by number. Make sure none are missing and that there are no extra ones which never appeared in the magazine.

Now, check the program line by line. As you go, recheck the line numbers. A common mistake is to enter correct information on the wrong line, and it is very easy to miss this when checking because your eye tends to jump from what you read on the screen to the same thing on the page. You may not notice when a program line is matched up with the wrong line number.

Look For Omissions

Another common problem is skipping part of a line or repeating part. A small omission of this sort can produce dramatic results. In the following example, leaving out part of the line creates an "endless loop" that will stop the program in its tracks:

```
10 X=0
20 X=X+1
30 PRINT X
40 GOTO 20
```

This program will never get beyond line 40. Line 20 should have read:

```
20 X=X+1: IF X>10 THEN GOTO 50
```

The second part of line 20 allows the program to get out of the loop. Keep on the lookout for such omissions when you compare the listing line by line.

Once you have cleared up the major problems that keep the program from running at all, you can fine tune any glitches in the display. These can be tedious, but at least you have something to work with and can see right on the screen how your changes are affecting the program.

Troubleshooting can be frustrating. But when you check things out step by step – starting with the most likely sources of trouble – you will reduce your "debugging" time dramatically. ©

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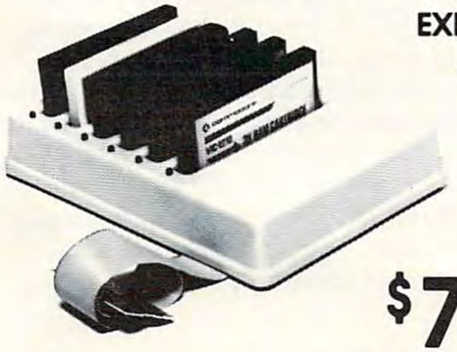

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PROGRAMMING THE TI

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DATA, READ, And RESTORE Statements

Let's look at DATA and READ – what do these statements do and how do you use them? Using DATA statements in a program can save memory and may be more efficient than using many equivalent lines of code. However, a DATA statement can be more difficult to decode or understand because it can look like just a random group of numbers.

DATA statements are used in conjunction with READ statements. Together they assign numbers or strings to variable names.

```
100 READ N
110 DATA 5      is equivalent to      100 N=5
```

The DATA-READ concept becomes efficient when you assign several values to a variable name for a particular procedure. Let's look at an example:

```
100 READ A
110 PRINT A,A*A
120 IF A=7 THEN 140 ELSE 100
130 DATA 3,2,6,8,7
140 END
```

When the program comes to READ A, the computer looks for the first DATA statement and assigns the first value, 3, to the variable A. The program continues, then comes to the statement READ A again. The computer has already read the first number, so it assigns the very next number, 2, to A. The process continues. Each time a READ statement is encountered, the *very next* data item in the DATA list is read, whether it is in the same DATA statement or the next DATA statement.

DATA Varieties

DATA statements may be placed anywhere in the program. They are ignored until a READ statement is executed. A "marker" is remembered by the computer so it knows exactly which data item has most recently been READ – and therefore which item the next READ statement will act upon.

A DATA statement may contain one item only or several items separated by commas. Data items may be numeric constants (numbers) or strings. Numbers may be positive or negative and may contain a decimal. Numbers may not be variable names and may not contain operators (such as 5/3). String variables do not need to be in quote marks unless there are leading spaces, trailing spaces, or embedded commas as part of the string. You may specify a null string by " ", or ,, in a series. Example:

```
300 DATA " ",JOHN,,,JIM," "
```

Line 300 contains six data items – null, JOHN, null, null, JIM, and null.

You may combine numbers and strings in the same DATA statements, but you must be careful that the data items in order match the READ statements. If the READ statement specifies a numeric variable, a string will not be accepted. You must have at least as many data items as the READ statements will try to access (or you will get an OUT OF DATA error). If you happen to have extra data items, they will be ignored.

A READ statement may specify one or several items. The items may be a combination of numeric and string variables. Keep in mind that READ statements only read the data and assign values to variables – later program lines would actually print, calculate, sort, or manipulate the data.

Following are some examples:

String Variables

```
100 FOR C=1 TO 5
110 READ A$
120 PRINT A$
130 NEXT C
140 DATA ED,BILL,JOHN,JIM,KELLY
150 END
```

Subscripted Numeric Variables

```
200 FOR I=1 TO 4
210 READ A(I)
220 PRINT "A(";I;")=";A(I)
230 NEXT I
240 DATA 32,-42,48,69,-73,89
250 END
```

Multiple Variables

```
300 FOR I=1 TO 3
310 READ A,B,C
```

```
320 CALL HCHAR(A,B,C)
330 NEXT I
340 DATA 12,24,42,8,8
350 DATA 35,20,15,38
360 END
```

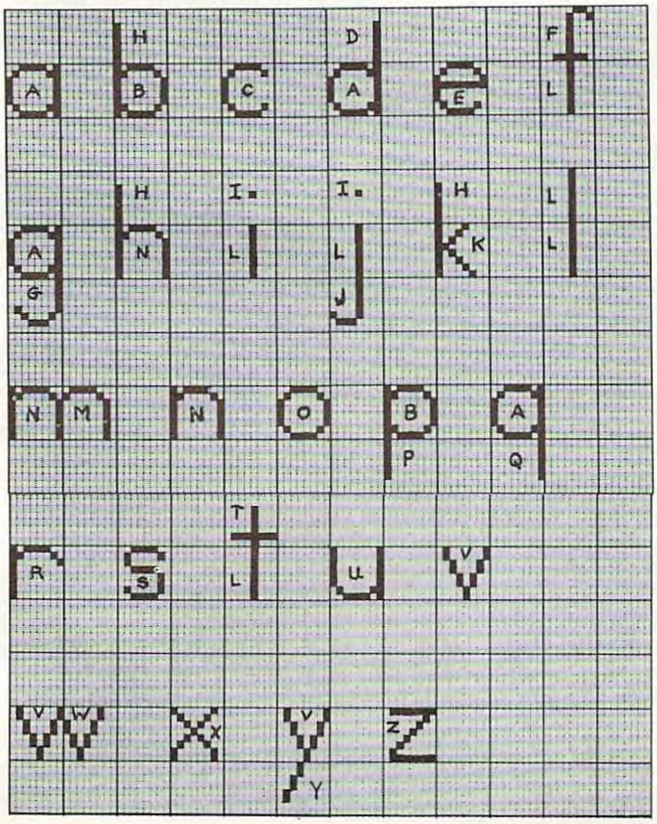
To help conserve memory, a DATA statement can be up to four screen lines long (112 characters). You can edit and insert to make the line even longer. One exception is that if you have quite a few items separated by a lot of commas, the computer will accept only a little over three lines.

Printing Lowercase As An Example

The following program illustrates how DATA and READ statements are used to save memory in defining graphics characters. To specify each character number and definition in a separate CALL CHAR statement would require 26 statements. Using DATA and READ, four lines READ and define the graphics characters, and five data lines are used.

Program 1 redefines the small capital letters in characters 97 through 122 to graphics characters which can print actual lowercase letters. Letters with ascenders or descenders will require two letters to be printed. The chart shows which small capital letter (release the alpha lock key to print these) represents which graphic character. Lines 200-300 in the program illustrate how to print the lowercase letters.

Small Capital Letters And The Graphics Characters They Represent.



Program 1: Lowercase Letters

```
100 CALL CLEAR
110 FOR C=97 TO 122
120 READ C$
130 CALL CHAR(C,C$)
140 NEXT C
150 DATA 3D43818181814 33D,BCC2818181
    81C2BC,3C4280808080423C,00000101
    01010101,3C4281FF8080423C
160 DATA 060908080808083E,0101010141
    221C,0000080808080808,00000008,08
    080808808887,8890A0C0A0908884
170 DATA 0808080808080808,7884020202
    020202,BCC2818181818181,3C428181
    8181423C,8080808080808,0101010101 01
180 DATA BCC2818080808080,3C42403C020
    2423C,000080808087F08,818181818
    181433D,4141222214140808,0404888
    85050202
190 DATA 8244281028448282,101020204 0
    4,7F0204081020407F
200 PRINT TAB(4);"l"
210 PRINT TAB(4);"l o vw e r
    {3 SPACES}c a s e"
220 PRINT :TAB(9);"l{3 SPACES}h
    {3 SPACES}h{3 SPACES}t"
230 PRINT TAB(7);"a l b n a b e l"
240 PRINT TAB(11);"p"
250 PRINT :::"  h{3 SPACES}d
    {3 SPACES}f{3 SPACES}h i i h l"
260 PRINT "a b c a e l a n l l k l n
    m"
270 PRINT TAB(13);"g{5 SPACES}j"
280 PRINT :TAB(13);"t"
290 PRINT "n o b a r s l u v vw x v
    z"
300 PRINT TAB(5);"p q";TAB(24);"y"
310 GOTO 310
320 END
```

RESTOREing

Now let's say you want to use a DATA statement to list some numbers. First you want to add the numbers, and then you want to multiply the numbers. The list of numbers for both processes is the same. To save memory (and typing effort), the TI allows you to RESTORE data. The RESTORE statement indicates that for the very next READ statement the computer will go back to the first DATA item in the program. RESTORE *resets* that "marker" to zero.

```
100 FOR I=1 TO 5
110 READ M,N
120 PRINT M;"+";N;"=";M+N
130 NEXT I
140 PRINT
150 DATA 3,2,5,7,4,4,2,1,9,7
160 RESTORE
170 FOR I=1 TO 5
180 READ A,B
190 PRINT A;"*";B;"=";A*B
200 NEXT I
210 END
```

RUN this sample program to see how the data items are used, then RESTOREd, then used again.

RESTORE can be very useful. TI BASIC also allows you to RESTORE to *a certain line of data* by specifying a line number. If you have a long program with lots of DATA statements, you can use a RESTORE *n* where *n* is a line number to make sure that each READ statement will read the correct data starting with the specified line of data.

This sample program illustrates the use of the RESTORE command. The DATA statements here contain duration factors and frequencies to be used in CALL SOUND statements. Ordinarily the first READ statement would read the first data items from the very first DATA statements. However, line 130 says to start reading the data in line 260 with the very next READ statement. Ten sounds are played; then we RESTORE 260 again so the ten sounds are repeated. Line 190 says RESTORE 240 so the data will start with line 240 for the very next READ statement.

Program 2: Sounds

```
100 CALL CLEAR
110 PRINT "SOUNDS"
120 FOR A=1 TO 2
130 RESTORE 260
140 FOR I=1 TO 10
150 READ T,F
160 CALL SOUND(T*50,F,2)
170 NEXT I
180 NEXT A
190 RESTORE 240
200 FOR I=1 TO 22
210 READ T,F
220 CALL SOUND(T*100,F,2)
230 NEXT I
240 DATA 2,1046,2,784,2,659,4,523,2,
    440
250 DATA 2,392,2,349,3,392,2,330,4,2
    62
260 DATA 6,330,4,262,4,330,6,392,4,5
    23,4,494,6,523
270 DATA 4,392,4,330,6,392
280 DATA 4,330,8,262
290 END
```

This "Southern States" program illustrates a variety of uses of DATA and READ statements. Keep in mind that the DATA statements can go anywhere in the program and are ignored until a READ statement is executed.

Note: As you are typing in programs from listings, the most likely place for *bugs* (errors) is in DATA statements. Be sure you copy DATA statements carefully. Watch particularly the placement of commas. Do not accidentally put a comma at the end of a DATA statement. If your data list consists of graphics definitions, those rounded characters are zeros, not the letter O. If your program stops with a BAD VALUE message, you can PRINT some of the variable names to see if you can pinpoint which DATA statement may be causing an error.

In any case, Southern States is an educational program that draws a map of the United States. One of the Southern States is outlined, and the user must type the name of the state. If the state is correct, the user must then type the name of the capital city. States are chosen in a random order. If you get the state and the capital right, that state will not appear again. However, if you miss an answer twice, the correct answer will be given and the state will appear again.

The data in lines 270-310 defines graphics characters for the map. We're using small capital letters so they can be printed, a faster method of drawing than using CALL HCHAR or CALL VCHAR. Be sure to release the alpha lock key to type in lines 320 and 480-510.

Line 330 (RESTORE 370) is not necessary the first time through the program because the data in line 370 would be the next data anyway. However, the program branches back to line 330 to RESTORE data if you'd like to try a "new" quiz. Lines 340-390 read the names of the states and the capital cities as the S$ array and C$ array.

Outlining States

Lines 540-560 randomly choose one of the states that has not previously been chosen and identified. The S$ value is set to " " (null) if the state is identified correctly. Depending on which state is chosen, certain data is RESTOREd (line 570 then lines 1500-2070).

Each state's data contains first a number representing the number of graphics characters that need to be defined. This number is READ in line 590 (READ N). Lines 600-630 then read the next data items to define the graphics characters. Line 640 reads N, the number of graphics characters that need to be placed on the map, and then lines 650-680 read the row coordinate, column coordinate, and character number from data to outline the state. To erase the state, line 1250 reads N, the number of characters needed to erase the state, and lines 1260-1290 read from the data the row coordinate, column coordinate, erasing graphic character, and number of repetitions. Most of the clearing is done with character 96, the plain yellow square, so repetitions can be used.

Program 3 Explained

Lines	
110	Clear screen.
120-170	Define colors for graphics.
180-210	Print title screen.
230-310	Define graphics characters for map.
320	Define L$ for use in printing the map.
330-390	Read names of states in S$ array and corresponding capital cities in C$ array.
400-460	Print instruction screen and wait for user to press ENTER.
470-510	Clear screen and print map of United States.
520	Perform quiz for 11 states.
530	Initialize T, which keeps track of errors.

540-560	Randomly choose a state which has not previously been identified correctly.
570	Depending on state chosen, branch to appropriate RESTORE statement.
580	Clear four lines under map where answers will be typed.
590-630	Define graphics characters for particular state.
640-680	Outline state on map.
690-710	Ask for state.
720	Clear previous answer if incorrect.
730-810	Receive user's answer.
820-830	Beep then test answer.
840-940	If answer is incorrect, sound "uh-oh" and return for another answer. If answer is incorrect twice, print correct answer, wait for user to press ENTER.
950	If answer is correct, play arpeggio.
960-1230	Similar to state, ask for capital city, receive answer, test answer, branch appropriately.
1240	If state and capital are correct, S$(R) is set equal to null, " ", so the state will not be chosen again.
1250-1290	Erase the state.
1300	Return for next state to be identified.
1310	Clear printing.
1320-1370	Print option to try again and branch appropriately.
1380-1440	Subroutine to print "PRESS ENTER" and wait for user to press ENTER.
1450-1490	Subroutine to play music for correct answer.
1500-1560	RESTORE data for Texas.
1570-1620	RESTORE data for Oklahoma.
1630-2060	RESTORE data for Arkansas, Louisiana, Tennessee, Mississippi, Alabama, Florida, Georgia, South Carolina, and North Carolina.
2070	END.

If you prefer to save typing effort, you may receive a copy of Program 3 by sending $3, a blank cassette or diskette, and a stamped, self-addressed mailer to C. Regena, P.O. Box 1502, Cedar City, UT 84720. Be sure to specify "Southern States" for the TI-99/4A computer.

Program 3: Southern States

~~~
100 REM  SOUTHERN STATES
110 CALL CLEAR
120 FOR G=9 TO 12
130 CALL COLOR(G,12,1)
140 NEXT G
150 CALL COLOR(13,1,12)
160 CALL COLOR(14,1,12)
170 CALL COLOR(15,2,11)
180 PRINT "   ***********************
    ":"   *";TAB(25);"*"
190 PRINT "   * IDENTIFY THE STATES *
    ":"   *";TAB(25);"*"
200 PRINT "   ***********************
    "
210 PRINT :::TAB(7);"SOUTHERN STATES
    "
230 FOR G=96 TO 123
240 READ G$
250 CALL CHAR(G,G$)
260 NEXT G
270 DATA FFFFFFFFFFFFFFFF,3F1F0F0707
    030301,7F3F1F0F,FFFF7F7F3F3F3F3F
    ,FFFFF3C,F0F0F0E0E0C0C08,0F0F0F0
    F0F0F0F0F
280 DATA 0F0F070703030101,0101030307
    070F0F,0F0F0F0FFFFFFFFF,FFFFFFFF
    7F1F0701,FF3F0F03,FFFFFFFFFFF0F0F
290 DATA F8FCFEFE7F3E,FFFFFFFFFEFCF8
    F,F0F8F8FCFCFEFEFF,008080C0C0E0E
    0F,F0E0C08,FCFCF8F8F0F0F0F
300 DATA 8080C0C0E0E0F0F,0F1F3F7FFFF
    FFFFF,00000000030F3FFF,000000000
    0010307,E0E0E0F0F8FCFEFF,0000000
    00080C0E
310 DATA 00E0F0FEFFFFFFFF,0000000000
    E0F8FE,E0E0E1E3FFFFFEFC
320 L$="``````````````````"
330 RESTORE 370
340 FOR G=0 TO 10
350 READ S$(G),C$(G)
360 NEXT G
370 DATA TEXAS,AUSTIN,OKLAHOMA,OKLAH
    OMA CITY,ARKANSAS,LITTLE ROCK,LO
    UISIANA,BATON ROUGE,TENNESSEE,NA
    SHVILLE
380 DATA MISSISSIPPI,JACKSON,ALABAMA
    ,MONTGOMERY,FLORIDA,TALLAHASSEE,
    GEORGIA,ATLANTA
390 DATA SOUTH CAROLINA,COLUMBIA,NOR
    TH CAROLINA,RALEIGH
400 CALL CLEAR
410 PRINT "ONE OF THE UNITED STATES"
    ::"WILL BE OUTLINED.":::"TYPE TH
    E NAME OF THE STATE"
420 PRINT :"THEN PRESS <ENTER>.":::"
    IF THE STATE IS CORRECT,"
430 PRINT :"TYPE THE CAPITAL CITY"::
    "THEN PRESS <ENTER>."
440 PRINT :::"NAMES MUST BE SPELLED"
    ::"CORRECTLY TO BE ACCEPTED.":::
    TAB(15);"PRESS <ENTER>";
450 CALL KEY(0,K,S)
460 IF K<>13 THEN 450
470 CALL CLEAR
480 PRINT TAB(27);"ts":" i````````
    ````yz{7 SPACES}u`e":" ";L$;"yx
    {3 SPACES}t`r":"h";L$;"`w vt``{"
490 PRINT "f";L$;"`` t``nq":"f";L$;"
    ``t```":"f";L$;"``````x":"f";L$;
    "``````e":"g";L$;"```````"
500 PRINT " c";L$;"````n":" g";L$;"`
    ``nq":"  j";L$;"``e":"
    {4 SPACES}kj``l`````````````````":T
    AB(10);"a`````````ndj``p"
510 PRINT TAB(11);"bdc`ndddm
    {3 SPACES}co":TAB(13);"a`
    {8 SPACES}a`":TAB(14);"b";TAB(24
    );"b":::::
520 FOR C=0 TO 10
530 T=0
540 RANDOMIZE
550 R=INT(11*RND)
560 IF S$(R)="" THEN 550
570 ON R+1 GOTO 1500,1570,1630,1690,
    1730,1780,1840,1890,1930,1980,20
    20
580 CALL HCHAR(20,1,96,160)
590 READ N
600 FOR I=128 TO 127+N
610 READ G$
620 CALL CHAR(I,G$)
630 NEXT I
640 READ N
650 FOR I=1 TO N
660 READ X,Y,G
670 CALL HCHAR(X,Y,G)
680 NEXT I
690 FOR I=1 TO 7
~~~

```
700 CALL HCHAR(21,2+I,ASC(SEG$("STAT
    E ?",I,1)))
710 NEXT I
720 CALL HCHAR(21,11,96,15)
730 S1$=""
740 CALL SOUND(150,1397,2)
750 FOR L=1 TO 15
760 CALL KEY(0,K,S)
770 IF S<1 THEN 760
780 IF K=13 THEN 820
790 CALL HCHAR(21,10+L,K)
800 S1$=S1$&CHR$(K)
810 NEXT L
820 CALL SOUND(100,880,2)
830 IF S$(R)=S1$ THEN 950
840 CALL SOUND(100,330,2)
850 CALL SOUND(100,262,2)
860 T=T+1
870 IF T<2 THEN 720
880 CALL HCHAR(21,11,96,15)
890 FOR L=1 TO LEN(S$(R))
900 CALL HCHAR(21,10+L,ASC(SEG$(S$(R
    ),L,1)))
910 NEXT L
920 GOSUB 1380
930 C=C-1
940 GOTO 1250
950 GOSUB 1450
960 FOR I=1 TO 9
970 CALL HCHAR(23,2+I,ASC(SEG$("CAPI
    TAL ?",I,1)))
980 NEXT I
990 T=0
1000 CALL HCHAR(23,13,96,15)
1010 S1$=""
1020 CALL SOUND(150,1397,2)
1030 FOR L=1 TO 15
1040 CALL KEY(0,K,S)
1050 IF S<1 THEN 1040
1060 IF K=13 THEN 1100
1070 CALL HCHAR(23,12+L,K)
1080 S1$=S1$&CHR$(K)
1090 NEXT L
1100 CALL SOUND(100,880,2)
1110 IF C$(R)=S1$ THEN 1230
1120 CALL SOUND(100,330,2)
1130 CALL SOUND(100,262,2)
1140 T=T+1
1150 IF T<2 THEN 1000
1160 CALL HCHAR(23,12,96,15)
1170 FOR L=1 TO LEN(C$(R))
1180 CALL HCHAR(23,12+L,ASC(SEG$(C$(
     R),L,1)))
1190 NEXT L
1200 GOSUB 1380
1210 C=C-1
1220 GOTO 1250
1230 GOSUB 1450
1240 S$(R)=""
1250 READ N
1260 FOR I=1 TO N
1270 READ X,Y,G,J
1280 CALL HCHAR(X,Y,G,J)
1290 NEXT I
1300 NEXT C
1310 CALL HCHAR(21,1,96,96)
1320 PRINT "TRY AGAIN? (Y/N)";
1330 CALL KEY(0,K,S)
1340 IF K=89 THEN 330
1350 IF K<>78 THEN 1330
1360 CALL CLEAR
1370 STOP
1380 FOR I=1 TO 11
1390 CALL HCHAR(24,20+I,ASC(SEG$("PR
     ESS ENTER",I,1)))
1400 NEXT I
1410 CALL KEY(0,K,S)
1420 IF K<>13 THEN 1410
1430 CALL HCHAR(24,21,96,11)
1440 RETURN
1450 CALL SOUND(100,262,2)
1460 CALL SOUND(100,330,2)
1470 CALL SOUND(100,392,2)
1480 CALL SOUND(200,523,2)
1490 RETURN
1500 RESTORE 1510
1510 DATA 11,0000001F10F0C0C,000000F
     F,8080808,80808080808080808,FF808
     0808080808,F80808080808080808,080
     80601
1520 DATA 00000000C03807,0000000000
     00FF,00000000000000F00C,020201010
     1010101,12,14,12,128,14,13,129
1530 DATA 14,14,130,13,14,131,12,14,
     132,12,15,133,13,15,134,13,16,1
     35,13,17,136,13,18,137
1540 DATA 14,18,138,15,18,138,4,12,1
     4,96,2,13,14,96,5,14,12,96,7,15
     ,18,96,1
1550 DATA 5,5,96,2,3,6,96,1
1560 GOTO 580
1570 RESTORE 1580
1580 DATA 10,000000FF8080808,000000F
     F,000000FC04040404,04040404040404
     0404,040404040404FC,00000000000
     00FF
1590 DATA 00000000C03807,08080601,F8
     0808080808080808,FF,12,11,14,128,
     12,14,137,11, 15,129,12,15,136

1600 DATA 13,15,135,11,16,129,13,16,
     134,11,17,129,13,17,133,11,18,1
     30,12,18,131,13,18,132,3
1610 DATA 11,14,96,5,12,14,96,5,13,1
     5,96,4
1620 GOTO 580
1630 RESTORE 1640
1640 DATA 9,0000000000001F101,00000000
     00FF,0000000000000F80404,08080F010
     1010102,04040808101010101,2020E
1650 DATA 0000FF,1C0201,101010101010
     101,10,11,18,128,11,19,129,11,2
     0,130,12,20,131,13,20,132
1660 DATA 14,20,133,14,19,134,14,18,
     135,13,18,136,12,18,136,4,11,18
     ,96,3,12,18,96,3,13,18,96,3

1670 DATA 14,18,96,3
1680 GOTO 580
1690 RESTORE 1700
1700 DATA 5,0000FF808080808,0000F010
     10080808,08080403,000000E0110B0
     F0F,40404040808080808,5
1710 DATA 14,19,128,14,20,129,15,20,
     130,15,21,131,15,19,132,3,14,19
     ,96,2,15,19,96,2,15,21,110,1
1720 GOTO 580
1730 RESTORE 1740
1740 DATA 7,0000000F1010204,003FC,00
     FF,00FF020404080810E,010102FC,000
     000FF,408080FF,9,11,19,128
1750 DATA 11,20,129,11,21,130,11,22,
```

```
      130,11,23,131,12,22,132,12,21,1
      33,12,20,133,12,19,134
1760 DATA 2,11,19,96,5,12,19,96,4
1770 GOTO 580
1780 RESTORE 1790
1790 DATA 9,0000000101010204,000000F
      F,000000F01010101,101010101010101
      010,10101010FFFFFFFF
1800 DATA 0000F010111317 0F,20203F,08
      080808 0810202,0808080810101 01,1
      0,12,20,128,12,21,129,12,22,130
1810 DATA 13,22,131,14,22,131,15,22,
      132,15,21,133,15,20,134,14,20,1
      35,13,20,136,6,12,20,96,3
1820 DATA 13,20,96,3,14,20,96,3,15,2
      0,96,1,15,21,110,1,15,22,100,1
1830 GOTO 580
1840 RESTORE 1850
1850 DATA 6,0000007F40404 04,000000F0
      10080804,0404040202020101,02020
      201010101FF,44444444FFFFFFFF
1860 DATA 4040404040404 04,7,12,22,12
      8,12,23,129,13,23,130,14,23,131
      ,15,22,132,14,22,133,13,22,133
1870 DATA 4,12,22,96,2,13,22,96,2,14
      ,22,96,2,15,22,100,1
1880 GOTO 580
1890 RESTORE 1900
1900 DATA 5,0F080808FFFFFFFF,FF00000
      0C0F0FCFF,00FF00000000060E,00F9
      06,EFDFBF00BFDFEFFF,5,15,22,128
1910 DATA 15,23,129,15,24,130,15,25,
      131,16,27,132,4,15,22,100,1,15,
      23,106,1,15,24,96,2,16,27,32,1
1920 GOTO 580
1930 RESTORE 1940
1940 DATA 7,0000001F10080804,000000F
      808040203,8040202018040202,00F9
      06,80FF00000000060E,0202020101 0
      10101
1950 DATA 0404040202020101,7,12,23,1
      28,12,24,129,13,25,130,15,25,13
      1,15,24,132,14,23,133,13,23,134
1960 DATA 4,12,23,96,2,13,23,96,3,14
      ,23,96,1,15,24,96,2
1970 GOTO 580
1980 RESTORE 1990
1990 DATA 4,0000030C08040203,003CC3,
      10EC040201010307,8040202018040 2
      02,4,12,24,128,12,25,129,12,26,
      130
2000 DATA 13,25,131,3,12,24,96,2,12,
      26,110,1,13,25,96,1
2010 GOTO 580
2020 RESTORE 2030
2030 DATA 8,000102040408 10E,00FF,FF,
      00000000000000FF,10EC01020101 03
      07,003CC3,000003FC,01010207,8
2040 DATA 11,24,128,11,25,129,11,26,
      130,10,27,131,12,26,132,12,25,1
      33,12,24,134,12,23,135,4
2050 DATA 11,24,96,3,10,27,96,1,12,2
      3,96,3,12,26,110,1
2060 GOTO 580
2070 END
```

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VIC And 64 Escape Key

Thomas Henry

While programming, there are lots of ways to get trapped inside quotes and be unable to use the cursor controls. Until now, your only recourse was to hit RETURN and try the line again. With this handy utility, you can escape from "quote mode" traps by just hitting the pound sign key. The routine also serves as an example of machine language programming for those who are interested in trying their hand at it.

How many times has this happened to you? You're sitting at your VIC-20 or Commodore 64, entering or editing a program, and through a series of keystrokes that you probably don't even remember, get into the following trap. When you push a cursor movement key, instead of the cursor actually moving, you get a reverse field symbol on the screen. Frustrating, isn't it? As you have probably learned, about the only way to get free of the trap is to hit RETURN to get out of the line, and then start over.

Here's an easier way: a program that adds a valuable "escape" option to your computer. With this feature, the seldom used British pound symbol (£) becomes an escape key. When you are stuck in the "cursor trap" mentioned above, simply push the key; you will be released from what's called *the quote mode* and will be free to move the cursor as desired. Before looking at the program, let's examine the problem in greater detail.

Store Or Perform The Action

Some of the computer's keys are able to perform two distinct jobs, depending on whether the computer is in the immediate mode or program mode. These keys include LEFT, RIGHT, UP, DOWN, REV, OFF, CLEAR, HOME, INSERT, DELETE, and all of the color selection keys. In the immediate mode, you push one of these keys and the action is performed immediately. For example, depress the RIGHT key and the cursor moves one space to the right.

But one of the truly impressive features of all Commodore computers is their ability to store or save the action implied by the key. For example, here is a one-line program:

```
10 PRINT "{RIGHT} HELLO"
```

The string contains the word "HELLO" preceded by a cursor-right. When you type this line into the computer, the cursor-right movement is not performed; instead it is stored in the string. The cursor-right will be performed only when the program is run. We are storing a cursor movement to be executed later in the program mode. To indicate that a cursor-right movement is stored in the string, the computer will leave a reverse field brace symbol inside the quotes. In fact, every one of the keys mentioned above has a reverse field character which stands for it when it's inside quotes.

The trouble comes in when the computer thinks you're trying to store an action, but you want to perform it. There are a number of ways this can happen. One way is if you've typed in an odd number of quote marks while entering a line. Another way is pushing the insert key more times than you expected.

Escape By Machine Language

Having defined the problem, let's look at a program that will take care of it. Examine Program 1. This is the assembler listing of the VIC-20 "escape key" program. Since assemblers are now becoming quite common for the VIC and 64, enterprising users might wish to enter the source code in directly and assemble their own version. If you're an experimenter, you'll find that this is a great program to begin with. It's not too long, and yet not so short as to be a trivial exercise.