COMMODORE 64

BEGINNER'S GUIDE TO PROGRAMMING

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The Delivery Truck and Animated Rocket programs are taken with permission from The World of Computers Workbook (John Wiley & Sons, 1983).

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IMPORTANT KEYS

On most computers there are keys essential for basic programming:

1. The CLR/HOME key.
2. The CURSOR keys.
3. The INST/DEL key.
4. SHIFT key.
5. COLOUR keys.

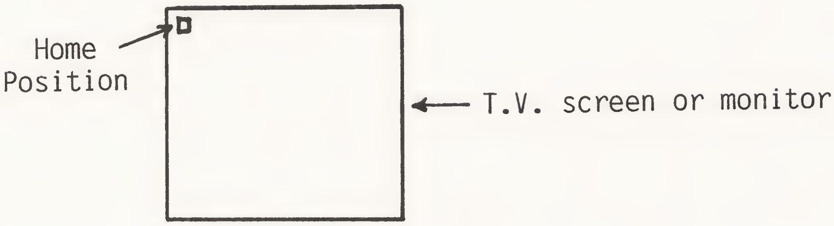
1. CLR/HOME KEY

CLR HOME — This key serves two purposes:

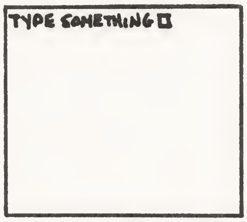
(a) To go to HOME position.
(b) To CLEAR the screen.

(a) Home Position

By pressing the key once the cursor appears at the top left corner of the screen. This is called the HOME position. The screen remains unchanged.



Try typing something on the screen.



Press CLR HOME key

What happened to the screen?

(b) Clear Screen

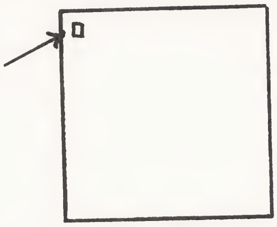
Hold down the SHIFT key and press the CLR HOME key.

What happened to the screen?

2. CURSOR KEYS

The cursor keys are an important part of programming because they help you correct mistakes and move characters on the screen.

This is the cursor



The blinking square is called a CURSOR. It indicates where you are on the screen.

The [↑CRSR↓] [←CRSR→] keys control the blinking cursor.

EXERCISE 1

1. Type: "THIS CURSOR IS MOVING."
2. Press the [↑CRSR↓] key and notice what happened to the cursor. In which direction did it move? - up, down, left or right ____________________
3. Try holding down the [↑CRSR↓] key a bit longer. What happened now?

   ____

4. Hold down the [SHIFT] key and press the [↑CRSR↓] key again. In which direction did the cursor move? ____________________

   The [↑CRSR↓] key moves the cursor up or down.

   The [←CRSR→] key moves the cursor left or right.

EXERCISE 2

Use your cursor keys to find your way through the maze.

REVIEW

1. To move cursor up press ____________________.
2. To move cursor down press ____________________.
3. To move cursor left press ____________________.
4. To move cursor right press ____________________.

3. INSERT/DELETE KEY

The INST/DEL INST DEL key is used for correcting mistakes, adding new characters or spaces which were left out or taking out characters or spaces.

EXERCISE 1

1. Type the sentence: CAN YOUR CORRECT THIS MISTAKES.
2. Press the INST DEL key. What happened? ______________________
3. Now, use the cursor keys to correct the second mistake in the word YOUR. Move the cursor to the spot just after the letter R and press INST DEL . What happened to the words to the right of the cursor? ____________

   ____
4. Clear the screen.

EXERCISE 2

1. Move the cursor half way down the screen and type the sentence: I MUST BE MISING SOMETHING HERE.
2. Move the cursor over the second i in mis$\boxed{\text{i}}$ng.
3. Hold down the SHIFT key and press the INST DEL key. What happened?

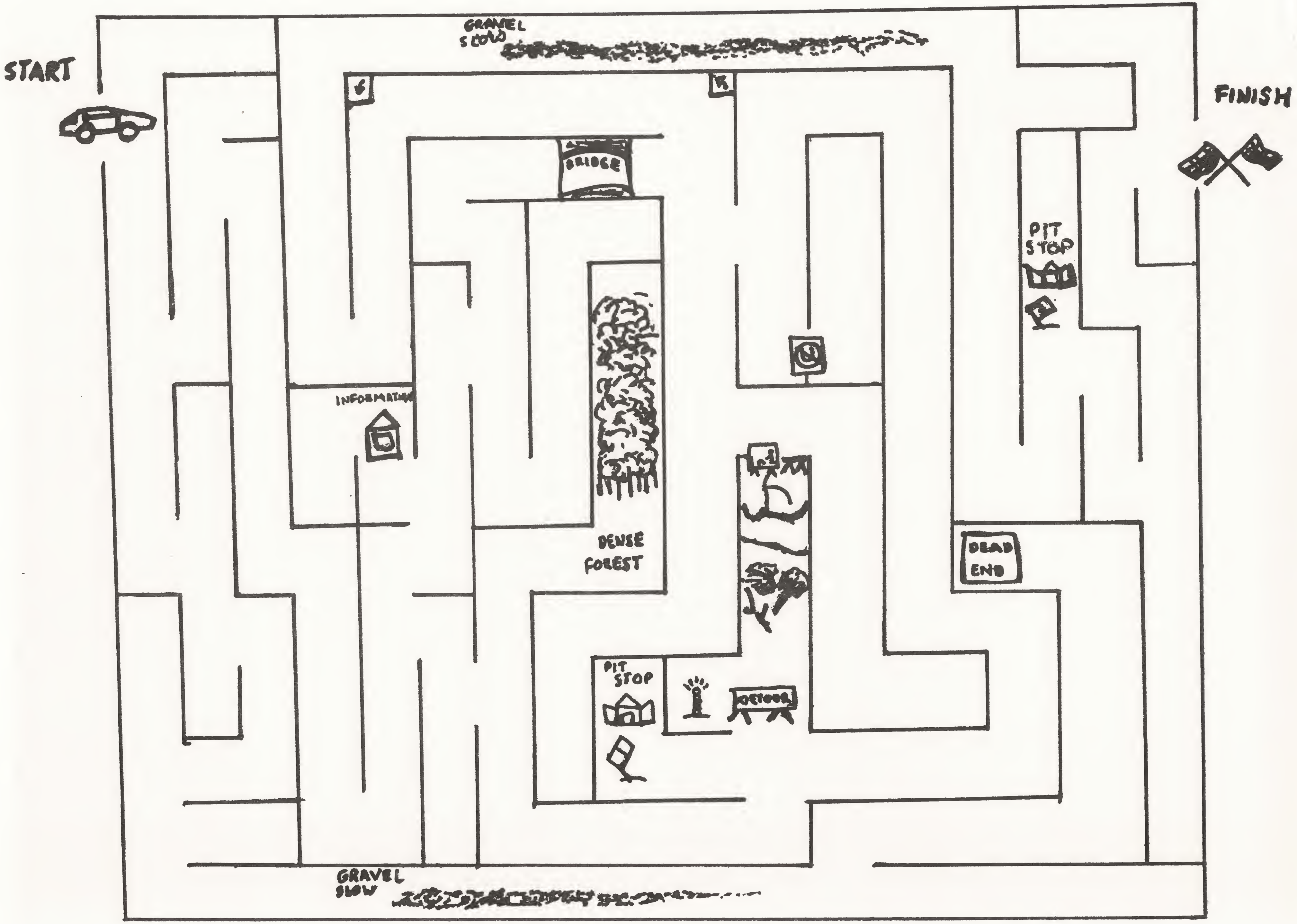
   ____
4. Type the letter s in the space you just made.

4. SHIFT KEY

The SHIFT key is mainly used when there is more than one function on a key.

Example - these keys have two functions:

CLR HOME	1. CLEAR the screen. 2. Send the cursor to the HOME position.
↑ CRSR ↓	1. Moves cursor up. 2. Moves cursor down.
← CRSR →	1. Moves cursor left. 2. Moves cursor right.


START
GRAVEL
SLOW
BRIDGE
FINISH
PIT
STOP
INFORMATION
DENSE
FOREST
DEAD
END
PIT
STOP
DETOUR
GRAVEL
SLOW

INST DEL   1. Inserts.
            2. Deletes.

All the functions at the bottom of the keys do not need to use the shift key. The ones at the top do.

Example

Press CLR HOME - moves the cursor to the top left corner of the screen.

Press SHIFT CLR HOME - clears the screen and moves cursor to home position (top left corner).

5. **COLOUR KEYS**

The C-64 is capable of using 16 different colours. This allows you to make colourful and exciting programs. Two keys, along with the number keys, control the cursor's colour.

Using the CTRL key and the number keys, the following colours are created:

1	2	3	4	5	6	7	8
Black	White	Red	Cyan	Purple	Green	Blue	Yellow

Hold down CTRL key and press one of the above keys.

The C= key controls the other 8 colours along with the number keys.

1	2	3	4	5	6	7	8
Orange	Brown	Lt. Red	Gray 1	Gray 2	Lt. Green	Lt. Blue	Gray 3

Hold down C= key and press one of the above keys.

EXERCISE

1. Try changing the cursor colour to black. Use the chart to help you.
2. Type your name. What happened? ________________________________
3. Change the cursor to GRAY 2 and type your friend's name.
4. Change the cursor to your favourite colour and type: THIS IS MY FAVOURITE COLOUR.
5. Try changing the cursor to different colours while you are typing your name.

IMPORTANT: If you happened to press the return key and got the message: ?SYNTAX ERROR - that's O.K. The computer just didn't understand what you typed. Later on, print statements and line numbers will be used.

KEYBOARD REVIEW

Fill in the blank spaces.

SPECIAL KEY	FUNCTION	WHAT IT DOES
RUN STOP (Hit key sharply)	Stop the program.	Halts a running program or a program listing.
CLR HOME		Positions the cursor to the top left corner of the screen. Any program in the computer's memory is not erased.
SHIFT CLR HOME		Clear the displays but not computer's memory.
INST DEL	Erases mistakes.	
SHIFT INST DEL	Inserting letters or spaces.	
Press ↑ CRSR ↓		The cursor will move vertically as long as it is held.
Press SHIFT and ↑ CRSR ↓		The cursor will move vertically in that direction.
Press ← CRSR →	Moves cursor right.	
Press SHIFT and ← CRSR →		

THE PRINT STATEMENT

IMMEDIATE MODE

The PRINT statement prints whatever is inside the quotation marks. Pressing the RETURN key tells the computer to do what you instructed. Cursor keys and the CLR/HOME key may be used in PRINT statements which allow the computer to control movements.

1. (a) Type the following:

PRINT "♡" (press SHIFT & CLR HOME)

Note: The heart symbol will show up as the CLEAR function in a PRINT statement.

(b) Press the RETURN key.

(c) What happened? ______________________________

2. (a) Use the cursor keys to print - HELLO DOWN THERE - three lines down.

PRINT"QQQHELLO DOWN THERE" (press CRSR)

(b) Press the RETURN key.

(c) What happened? ______________________________

3. (a) Use the other cursor key to print - I'M OVER HERE - four spaces to the right.

PRINT"]]]] I'M OVER HERE" (press CRSR)

(b) Press the RETURN key.

(c) What happened? ______________________________

4. Use the CLR/HOME key and the cursor keys to print a sentence near the top of the screen.

PRINT"♡QQ]]]]]]]]]]]]]]HI THERE"

EXERCISES

1. Print your name three lines down.
2. Print your name five spaces to the right.

PROGRAM MODE

Up to now only simple operations were performed by entering a single line of instructions. Once RETURN was pressed the print statement was performed. However, if we want the computer to operate more than a single line of instruction, a line number must come before each program statement. In this way, the statements remain in the computer's memory.

EXERCISES

1. Type this short program (REMEMBER TO PRESS RETURN AFTER EACH LINE):

```
    10 PRINT"♡ "
    20 PRINT"QQ I MADE MY FIRST PROGRAM."
```

   Type RUN and press the RETURN key.

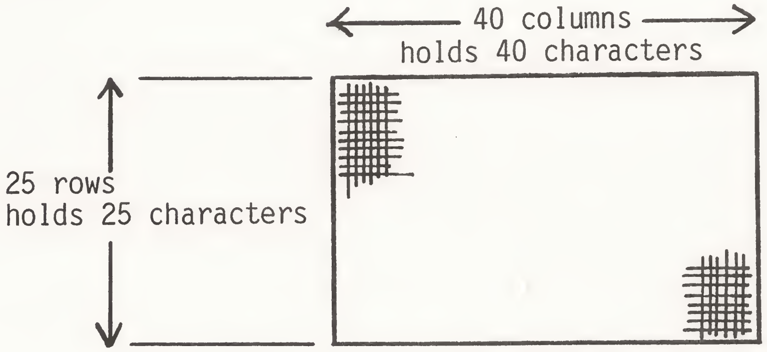
   What happened? ____________________

2. Type LIST and press RETURN . Your program will be displayed on the screen.

CENTERING A MESSAGE

A message can be centered vertically (up & down) and horizontally (left & right) on the screen for better viewing. All good programs contain this feature.

The Commodore computer screen holds 40 characters across and 25 characters down.



To print the message - THIS LINE IS CENTERED - on the middle of the screen, we must move 12 rows down from the top of the screen and 10 columns across.

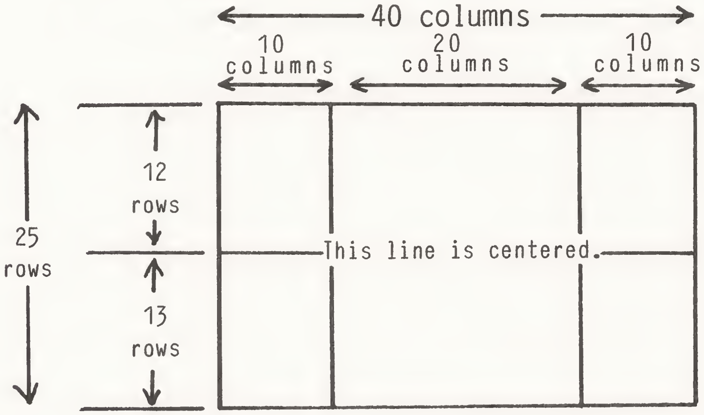
Example

```
10 PRINT"♡ "
20 PRINT"QQQQQQQQQQ]]]]]]]]]]]THIS LINE IS CENTERED"
```

10 times   11 times

Type RUN and press RETURN .

The screen will look like this:



TAB FUNCTION

Instead of typing all those ⇐CRSR⇒ , a special function is used on the computer - the TAB(X) function. The TAB(X) function is used in a PRINT statement where the cursor is positioned a specified number of columns from the left side of the screen.

Example

(a) PRINT TAB(3)"MOVE OVER"

(b) What happened to the sentence? ______________________________

(c) Use the cursor keys and insert key to change the number 3 in TAB to 20.

(d) Press RETURN .

(e) What happened? ______________________________

Try and centre the same message as before using the TAB(X) function.

1. NEW and RETURN .

```
10 PRINT"♡QQQQQQQQQQ "
20 PRINT TAB(10)"THIS LINE IS CENTERED"
```

2. After you have finished typing the program, RUN it.

3. The sentence is centered just like before. What are the benefits of the TAB(X) feature? ______________________________

____

FOR/NEXT LOOPS

Loops are used to execute program statements for a specified number of times.

EXAMPLE

```
FOR X = 1 TO 10
(program statements)
NEXT X
```

This will repeat the program statements inside the loop 10 times.

Here is a short program showing what the loop does. Type this in. What do you predict will happen? ______________________________

```
10 FOR Z = 1 TO 10
20 PRINT Z
30 NEXT Z
```

RUN the program.

The loop will start at Z = 1 and print the value of Z. Z increases to 2 and is printed on the screen. When line 30 is reached, the value of Z is increased again. This will continue until Z reaches the maximum value of 10.

Try changing line 30 from FOR Z = 1 TO 10 to FOR Z = 1 TO 20

What happened to the value of Z in the print statements? __________

____

PROGRAM: THE DELIVERY TRUCK

```
100 PRINT "♡ "
110 FOR X = 1 TO 30
120 ?:?:?:?:?:?:?:?
130 PRINT TAB(X)"    *** "
140 PRINT TAB(X)"****   *"
150 PRINT TAB(X)"********"
160 PRINT TAB(X)" 0    0 "
170 PRINT"♡ "
180 NEXT X
```

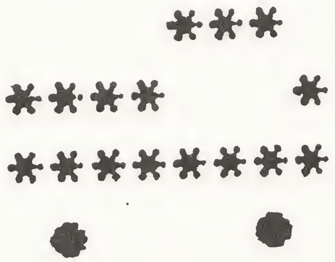
Explanations:

line 100 - Clears the screen.
line 110 - Sets the loop to execute 30 times. The variable X will increase by 1 each time NEXT X is reached. A variable is a name assigned to a memory location.
line 120 - The ? symbol is an abbreviation of the PRINT command.
The : symbol is used to separate statements so that a series of statements may be put on one line.
Line 120 sets the picture 8 lines down by printing 8 blank lines.

line 130
to 160 - The tab function moves the characters on the screen over the number of columns specified by the value of X.

line 170 - After the picture is printed, the screen will be cleared so that when X is increased by 1 the next picture will be shown to move across the screen one space.

THIS IS WHAT THE DELIVERY TRUCK SHOULD LOOK LIKE:



(enlargement)

COLOUR USING PRINT STATEMENTS

REVERSE VIDEO

To backlight a particular item, the codes for turning the effect on and off are embedded within quotation marks. For example:

```
Type in:  PRINT"🅁HELLO⊟ "
                ↑      ↑
             CTRL 9   CTRL Ø
```

The effect must be turned off for other items not to be affected. For example:

```
Type in:  PRINT"🅁HELLO";TAB(1Ø)"FRED"

Type in:  PRINT"🅁HELLO⊟ ";TAB(1Ø)"FRED"
```

EMBEDDING COLOUR

Colour can be temporarily embedded within quotation marks in the same way. Remember to turn the colour off by ending with a "white" colour command. For example:

```
Type in:  PRINT"▄HELLO FRED🄴"
                ↑          ↑
              CTRL 1     CTRL 2
```

SAMPLE TO TRY

Use a different colour each time. Note the combinations which work well.

```
     colour code   back to white
           ↓                ↓
10 PRINT"□ THIS IS BLACK□ "
20 PRINT"□ THIS IS WHITE□ "
30 PRINT"□ THIS IS GREEN□ "
40 PRINT"□ THIS IS BLUE□ "
50 PRINT"□ THIS IS PURPLE□ "
```

Then type in RUN.

BORDER AND BACKGROUND COLOURS

Besides changing the cursor to different colours, the background colour and the border colour may also be changed. In order to do this, you must use a command which actually changes the computer's memory. The POKE command will place your information into the computer's memory.

POKE 53281 - will set the computer's memory to the background colour

POKE 53280 - will set the computer's memory to the border colour

However, you need to tell the computer what colour you want.

Example

POKE 53281,Ø - will put the value 'Ø' (for black) into that part of the computer's memory

POKE 53280,2 - will change the border colour to red

The actual values to POKE for each colour are:

Ø	BLACK	8	ORANGE
1	WHITE	9	BROWN
2	RED	10	LIGHT RED
3	CYAN	11	GRAY 1
4	PURPLE	12	GRAY 2
5	GREEN	13	LIGHT GREEN
6	BLUE	14	LIGHT BLUE
7	YELLOW	15	GRAY 3

EXERCISES

1. Try POKEing values into the memory location and change the background, border colours to:

   RED border
   BLUE background
   WHITE characters

2. Change the background to your favourite colour. Change the border to your friend's favourite colour.

3. Use different combinations to see what you get.

DRAWING PICTURES

PRINT

Type this program and run it:

```
10 PRINT"♡ "
20 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
30 PRINT"  ****  "
40 PRINT"  *  *  "
50 PRINT"  *  *  "
60 PRINT"********"
70 END
```

What happened? ____

EXERCISE

1. Use the graph paper and draw a picture. Try printing your picture on the screen.

2. Change the colour of the background, border and the picture itself.

TAB

Type this program and run it.

```
10 PRINT"♡ "
20 PRINT:PRINT:PRINT:PRINT
30 PRINT TAB(5)"    *** "
40 PRINT TAB(5)"****   *"
50 PRINT TAB(5)"********"
60 PRINT TAB(5)" 0    0 "
70 END
```

What happened? ____

EXERCISE

Use the graph paper and draw a picture of a ball which is 5 columns wide and 4 rows high. Try printing your picture 10 spaces (columns) from the left side of the screen.

COLUMNS

ROWS

SMOOTHER PICTURE

The following program is a modified version of the truck program. The HOME key is used instead of the CLEAR function. This prevents the screen from blinking each time the truck is printed.

Change line 170 in the Delivery Truck program to:

PRINT"S " ← press CLR HOME key (moves the cursor to home position)

The program will look like this:

```
100 PRINT"♡ "
110 FOR X = 1 TO 30
120 ?:?:?:?:?:?:?:?
130 PRINT TAB(X)"    *** "
140 PRINT TAB(X)"****   *"
150 PRINT TAB(X)"********"
160 PRINT TAB(X)" 0    0 "
170 PRINT"S "
180 NEXT X
```

Run the program.

Explanation:

Instead of clearing the screen each time X is increased, the cursor is set to the "HOME" position. As a result, nothing gets cleared. A trail of asterisks was printed across the screen.

Now add a space on each line from line 130 to line 160. The program will look like this:

```
100 PRINT"♡ "
110 FOR X = 1 TO 30
120 ?:?:?:?:?:?:?:?
130 PRINT TAB(X)"     *** "
140 PRINT TAB(X)" ****   *"
150 PRINT TAB(X)" ********"
160 PRINT TAB(X)"  0    0 "
170 PRINT"S "
180 NEXT X
```

Run the program.

Explanation:

lines 130
to 160 - Each of these lines has an extra space which erases any characters left behind by the truck. These spaces erase any character which has been printed on the screen.
During the first loop, X = 1, everything within the quotes would be printed, and tabbed beginning at column 1.

col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9
B					*	*	*	
L	*	*	*	*				*
A	*	*	*	*	*	*	*	*
N		0					0	
K								

During the next loop, X = 2 and everything within the quotes would be printed and tabbed beginning at column 2.

col 1	col 2	col 3	col 4	col 5	col 6	col 7	col 8	col 9	col 10
B	B					*	*	*	
L	L	*	*	*	*				*
A	A	*	*	*	*	*	*	*	*
N	N		0					0	
K	K								

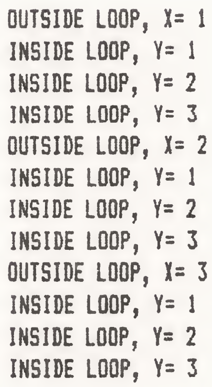
↖ A blank space printed over the asterisks in column 2, left by the truck.

NESTED LOOPS

Nested loops are basically loops within loops. Type in this short program:

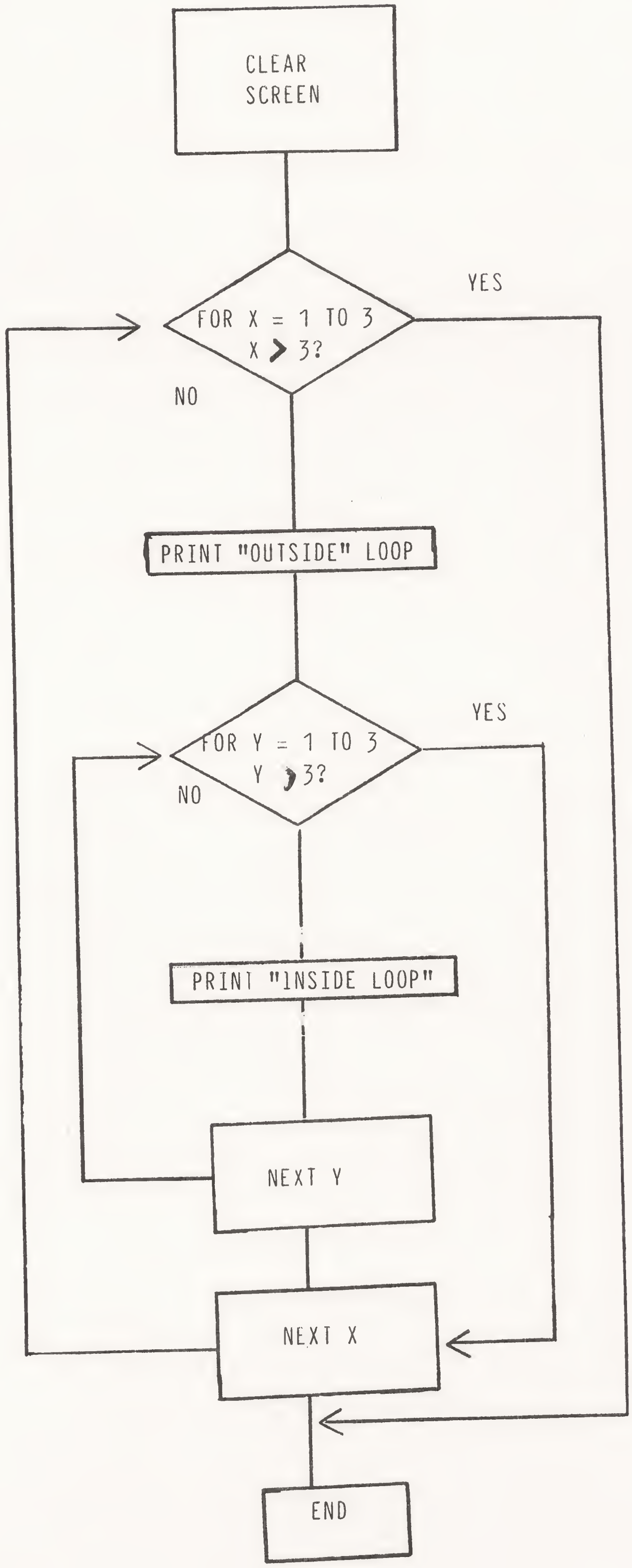
```
100 PRINT"♡ "
110 FOR X = 1 TO 3
120 PRINT"OUTSIDE LOOP,X=";X
130 FOR Y = 1 TO 3
140 PRINT"INSIDE LOOP,Y=";Y
150 NEXT Y
160 NEXT X
170 END
```

After running the program the screen will look like this:



```
OUTSIDE LOOP, X= 1
INSIDE LOOP, Y= 1
INSIDE LOOP, Y= 2
INSIDE LOOP, Y= 3
OUTSIDE LOOP, X= 2
INSIDE LOOP, Y= 1
INSIDE LOOP, Y= 2
INSIDE LOOP, Y= 3
OUTSIDE LOOP, X= 3
INSIDE LOOP, Y= 1
INSIDE LOOP, Y= 2
INSIDE LOOP, Y= 3
```

As you can see the "inside loop" gets repeated three times for every time X increases by one.



PROGRAM: ANIMATED ROCKET

Type in the following program and run it. Try to figure out what each line number does. If you get stuck, take a look at the explanations.

```
100 PRINT"♡ "
110 ?:?:?:?:?:?:?:?
120 FOR A = 1 TO 3
130 PRINT TAB(15)" * "
140 PRINT TAB(15)"***"
150 PRINT TAB(15)"* *"
160 PRINT TAB(15)"* *"
170 PRINT TAB(15)"* *"
180 PRINT TAB(15)"***"
190 PRINT TAB(15)"* *"
200 FOR C = 1 TO 30
210 ?
220 NEXT C
230 NEXT A
240 PRINT TAB(8)"HOUSTON, ALL SYSTEMS GO."
250 PRINT TAB(8)"JUPITER HERE WE COME!"
260 ?:?:?:?:?:?:?:?
270 END
```

Explanations:

line 110 - Positions the rocket 8 lines down from the top of the screen using the PRINT command.
line 120 - Sets the outer loop to run three times.
line 130
to 190 - Prints the picture of the rocket 15 spaces from the left side of the screen.
line 200
to 220 - Contains the nested loop. This loop prints 30 blank lines between each rocket.
line 260 - Prints 8 blank lines which causes the two sentences to "scroll" upwards.

Exercise

Try changing line 200 and notice what happens -

```
from:  FOR C = 1 TO 30
to:    FOR C = 1 TO 15
```

TIMER LOOPS

A timer loop is a one line statement in a program which makes the computer appear as if it has stopped. Actually, it's busy counting!

Timer loops are helpful if you wish to leave a set of instructions on the screen just long enough for the average reader, before going on to something else.

Example:

```
10 PRINT"♡QQQQQQQQQQ "
20 PRINT TAB(10)"THIS MESSAGE WILL"
30 PRINT TAB(10)"APPEAR FOR SEVERAL"
40 PRINT TAB(10)"SECONDS, THEN LIKE"
50 PRINT TAB(10)"MAGIC, DISAPPEAR!"
60 FOR C = 1 TO 3000:NEXT C  ←——————————— TIMER LOOP
70 PRINT"♡ "
80 END
```

YOUR TURN: Type in NEW. Press RETURN. Press SHIFT and CLR/HOME to clear the screen.

Design a program which will leave this message on the screen for several seconds, then disappear.

Insert your name → "__________, YOU'RE A"

"REALLY GREAT PERSON."

"I'M GLAD YOU'RE HERE!"

WORK SHEET TO PLAN YOUR PROGRAM

LINE
NUMBERS

INSTRUCTIONS

CREATING PAUSES IN PROGRAMS

Often, programmers need to have a method of displaying information on the screen for a specified length of time, long enough that people can read it, before it is replaced with new information. Because the pause in the program can be created for a for...next loop, it is referred to a **timer loop.** Consider the following timer loop.

```
50 FOR N = 1 TO 500
60 NEXT N
```

This causes a pause in the program of about six seconds. When the timer loop is completed, the computer continues on with the rest of the program. A colon (:) will allow us to connect two statements into one long one. The timer loop shown above can then be written as:

```
50 FOR N = 1 TO 500:NEXT N
```

The length of the pause is determined by the speed at which the microprocessor chip operates. Each manufacturer has its own computer chip. Some computer chips are more efficient, and therefore faster, than others. As a general guideline, the following number of loops will create these approximate pauses in the program.

NUMBER OF LOOPS	PROGRAM DELAY IN SECONDS
1000	1.5
2000	3.0
5000	7.5
8000	12.0

Timer Loop Chart

INTERACTIVE PROGRAMMING

INTERACTIVE PROGRAMMING refers to a programming technique which allows the user to key information into the computer while the program is operating. The messages which appear on the screen during the program are called USER PROMPTS because they "prompt" the person.

```
10 PRINT"KEY IN YOUR NAME" <-------- USER PROMPT
20 INPUT N$ <------------------------

                                     STORAGE LOCATION
```

When the instruction KEY IN YOUR NAME appears on the screen, the person at the keyboard will respond by typing in his/her name. The name is then stored in a storage location called N$.

Words require a $ sign with the storage location, but numbers do not. For example:

```
        N                    N$

     | 128 |             | RALPH |
```

EXAMPLE:

```
10 PRINT"KEY IN YOUR NAME"
20 INPUT N$
30 PRINT"♡QQQQQQQQ " <------------------ CRSR
40 PRINT TAB(10)"HELLO ";N$
50 PRINT TAB(10)"NICE TO MEET YOU."
```

After typing in this program, ask someone near you to run it. Interactive programs are used by someone other than the original programmer.

PROGRAM: THE GREETING

```
 10 REM THE GREETING
 20 PRINT"♡QQQQQQQQ"
 30 PRINT TAB(8)"KEY IN YOUR FIRST NAME"
 40 ?
 50 PRINT TAB(15):INPUT N$
 60 PRINT"♡QQQQQQQQ"
 70 PRINT TAB(9)"HELLO ";N$;" YOU SEEM"
 80 PRINT TAB(9)"TO LEARN PROGRAMMING"
 90 PRINT TAB(9)"VERY QUICKLY."
100 ?:?:?
110 PRINT TAB(10)"CONGRATULATIONS!"
120 END
```

YOUR TURN: Type in NEW and press the return key. Press SHIFT and CLR/HOME to clear the screen.

Design a program which will ask a person's age, clear the screen, then print the message ...

YOU LOOK VERY DISTINGUISHED FOR A PERSON WHO IS
_______ YEARS OLD.

WORKSHEET TO PLAN YOUR PROGRAM

LINE
NUMBERS

INSTRUCTIONS

PROGRAM QUIZ

```
 10 PRINT"♡ "
 20 INPUT"ENTER YOUR NAME";N$
 30 PRINT"♡QQQQQQQQQQ]]]]]]]]]] HI ";N$;",
    NICE TO MEET YOU."
 40 FOR X = 1 TO 1500:NEXT X
 50 PRINT"♡ "
 60 INPUT"HOW MANY TIMES DO YOU WANT TO RACE";T
 70 PRINT"♡ "
 80 FOR C = 1 TO T
 90 FOR B = 1 TO 30
100 PRINT"S "
110 ?:?:?:?:?:?:?
120 PRINT TAB(B)"  ***    "
130 PRINT TAB(B)" * 9     "
140 PRINT TAB(B)" ********"
150 PRINT TAB(B)"  0   0  "
160 NEXT B
170 PRINT"♡ "
180 NEXT C
```

Questions

1. What does the ♡ symbol do, within the quotes? ____________________

____

2. What is the purpose of using an input? ____________________

____

3. What does the Q symbol do? ____________________

4. What does the] symbol do? ____________________

5. What is the purpose of the semicolon (;) in a program statement?

____

6. What does line 40 do? ____________________

7. What is the difference between variables N$ and T? ____________________

____

8. What is the function of a colon (:)? ____________________

9. Would a TAB function work without a PRINT statement? ____________________

10. Describe the final output. ____________________

____

MORE CHALLENGING PROGRAMS

For those who want more challenging program, here are some examples to try.

PROGRAM #1

This program is a combination of old programs and some new concepts.

```
           C=     7
100 PRINT"◆":POKE 53281,0:POKE 53280,0
110 MAX = 28
120 INPUT"HOW MANY TIMES DO YOU WANT THE TRUCK TO BOUNCE BACK AND FORTH";A
130 IF A <= 0 OR A >= 20 THEN 100
140 FOR C = 1 TO A
150 PRINT"SE"________ CTRL    2
160 FOR X = 1 TO MAX
170 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
180 PRINT TAB(X)"      ***   "
190 PRINT TAB(X)" ****    * "
200 PRINT TAB(X)" ********* "
210 PRINT TAB(X)"  0     0  "
220 PRINT"S"
230 NEXT X
240 :
250 FOR X = MAX TO 1 STEP -1
260 PRINT"S"
270 FOR Y = 1 TO 8:PRINT:NEXT Y
280 PRINT TAB(X)"      ***   "
290 PRINT TAB(X)" ****    * "
300 PRINT TAB(X)" ********* "
310 PRINT TAB(X)"  0     0  "
320 NEXT X
330 NEXT C
340 PRINT TAB(7)"■QQQTHE TRUCK BOUNCED";A;"TIMES"
                 C=     6
```

Explanations:

line 100 - "◇" sets the cursor colour to dark blue by pressing the C= key and the 7 key. If any print statements are executed the letters will appear dark blue.
POKE 53281,0 - sets the background colour to black
POKE 53280,0 - sets the border colour to black

line 110 - Assigns the variable MAX equals to 28.

line 120 - Instead of using a print statement, an input statement may be used. However, the variable must follow the sentence with a semicolon.

line 140 - The loop counter repeats any program statements within lines 150 to 230. The variable A stores the number of times the truck will move back and forth.

line 150 - "S" homes the cursor without clearing the screen. "E" changes the cursor colour to white by pressing the CTRL key and the 2 key.

line 160 - Sets the loop to repeat MAX (28) number of times.

line 170
to 210 - These lines should look familiar. If not, take a look at the Delivery Truck program.

line 250 - This is another loop except that it counts down instead of counting up.
"FOR X = MAX to 1" counts down from 28 to 1.
"STEP 1" tells the computer to subtract one every time the loop repeats.
"STEP 2" would tell the computer to subtract 2 every time the loop repeats.

line 270 - Is the same as line 170 except that a FOR/NEXT loop is used to perform the PRINT statements instead of typing the eight PRINT statements.

line 220
to 250 - Same as lines 130 to 160.

line 290 - "▌" changes the cursor colour to green by pressing the C= key and the 6 key.
";" keeps the complete PRINT statement and the value of A on the same line.

PROGRAM #2

This program is similar to the ROCKET program, but there are a few tricks involved. Try and figure out what is happening.

```
100 PRINT"♥E":POKE 53281,0:POKE 53280,0
110 INPUT"HOW MANY TIMES DO YOU WANT THE ROCKET TO ORBIT";AN
120 FOR X = 0 TO 14
130 PRINT"S█"───────────── CTRL    7      (should look like this: ⬅ )
140 FOR C = 1 TO 10:PRINT:NEXT C
150 FOR H = 1 TO 50:NEXT H
160 PRINT TAB(X)"    *      "
170 PRINT TAB(X)"   ***     "
180 PRINT TAB(X)"   * *     "
190 PRINT TAB(X)"   * *     "
200 PRINT TAB(X)"   * *     "
210 PRINT TAB(X)"   ***     "
220 PRINT TAB(X)"   * *     ";"E"
230 PRINT TAB(X)" *-----*** "
240 PRINT TAB(X)" *     *--*"
250 PRINT TAB(X)" *********"
260 PRINT TAB(X)"  OO    O  "
270 NEXT X
280 FOR H = 1 TO 1000:NEXT H
290 PRINT"█":POKE 53281,1
300 FOR H = 1 TO 1000:NEXT H
310 FOR Z = 1 TO AN
320 FOR S = 1 TO 30:PRINT:NEXT S
330 PRINT TAB(16)" * "
340 PRINT TAB(16)"***"
350 PRINT TAB(16)"* *"
360 PRINT TAB(16)"* *"
370 PRINT TAB(16)"* *"
380 PRINT TAB(16)"***"
390 PRINT TAB(16)"* *"
400 NEXT Z
410 FOR H = 1 TO 1000:NEXT H
420 PRINT"SQQQQQQ"
430 PRINT TAB(13)"ETHE SPACESHIP"
440 PRINT TAB(12)"HAS LANDED !!"
450 POKE 53281,0:POKE 53280,0
460 FOR H = 1 TO 2000:NEXT H
500 END
```

STRING FUNCTIONS

Before going on to the next set of programs, we shall talk about string functions - MID$, LEFT$, and RIGHT$.

LEFT$

The string function LEFT$ must be of this format: LEFT$(X$,X), where X$ represents a variable string. E.g.: X$ = "TERRIBLE" and X represents the number of characters isolated from the leftmost position of X$.

EXAMPLE

```
     X$ = "TERRIBLE"
     X = 5

     LEFT$(X$,5) = TERRI
 OR  LEFT$(X$,X) = TERRI
 OR  LEFT$("TERRIBLE",5) = TERRI
 OR  LEFT$("TERRIBLE",X) = TERRI
```

The first answer is the most common. Type this short program and run it.

```
10 PRINT"♡ "
20 X$ = "TERRIBLE"
30 X = 5
40 PRINT LEFT$(X$,X)
50 END
```

What happened? ____

____

____

EXERCISE

1. Change the value of X in line 30 to X = 3. RUN the program. What happened?

   ____

   ____

2. Change the value of X$ in line 20 to your name. RUN the program.

RIGHT$

RIGHT$ (X$,X) does the same function as LEFT$ except the rightmost characters are returned.

EXAMPLE

```
X$ = "MONKEY"
X = 3

RIGHT$(X$,3) = KEY
RIGHT$(X$,X) = KEY
```

Type this short program and run it.

```
10 PRINT"♡ "
20 X$ = "MONKEY"
30 X = 3
40 PRINT RIGHT$(X$,X)
50 END
```

What happened?

EXERCISE

1. Change the value of X in line 30 to X = 5. RUN the program. What happened?

2. Change the value of X$ in line 20 to your name. RUN the program.

MID$

MID$(X$,X) selects X amount of characters starting from the S position of the string X$.

EXAMPLE

```
   X$ = "BEATRICE"
   S = 2
   X = 3

   MID$(X$,2,3) = EAT
OR MID$(X$,S,X) = EAT
```

MID$ finds the characters in the middle of a string. Type this short program and run it.

```
10 PRINT"♡ "
20 X$ = "BEATRICE"
30 S = 2
40 X = 3
50 PRINT MID$(X$,S,X)
60 END
```

What happened? ____

____

EXERCISES

1. Change the value of S in line 30 to S = 6. RUN the program. What happened?

   ____

   ____

2. Try changing the values of S and X to find the words "BEAT" and "RICE".

3. Change the value of X$ in line 20 to your name and try to find any "hidden" words. RUN the program.

IMPORTANT: The value of X$ must always be placed within quotes. Any changes in the program must be placed in the computer's memory by pressing the RETURN key.

PROGRAM #1

```
100 A$ = "SLO-MO PRINT"
110 FOR I = 1 TO LEN(A$)
120 FOR ZZ = 1 TO 200:NEXT ZZ
130 PRINT MID$(A$,I,1);:NEXT I
140 PRINT
```

Explanations:

line 110 - LEN(A$) returns the number of characters, including any spaces, in the string A$. E.g.: A$ = "SLO-MO PRINT"
LEN(A$) = 12
So, line 110 is just a loop from 1 to 12.
line 120 - Is a timer loop.
line 130 - Prints out one character at a time on the same line.

GLOSSARY

BASIC

A computer language used to program most microcomputers. BASIC stands for Beginner's All Purpose Symbolic Instruction Code.

BUG

Any mistake in a computer program is called a BUG.

CLEAR

The CLR key is used to clear all information from the screen. However, the information remains in the computer's memory.

CURSOR

The cursor is usually a blinking square. It indicates your position on the monitor.

DEBUG

The process of removing mistakes from a computer program is called debugging.

END

This is a command used to indicate the end of a program. It tells the computer not to read any more information.

FOR/NEXT

This command is used to limit the number of times a computer performs a loop, or to create a time delay.

HOME

The HOME key moves the cursor to the top left corner of the screen. This is known as the home position.

INPUT

This command asks the program user to type information into the computer to be used in the program.

INSERT

The INST key is used to correct errors by allowing you to insert forgotten information or spaces.

LIST

The LIST command allows you to see all the instructions in a computer program listed in order by line number.

LOOP

A loop is a section of a computer program that is repeated.

MEMORY

The computer has a memory where it can store information. The computer actually has two kinds of memory, RAM and ROM.

MEMORY LOCATION

A memory location is a specific spot in the computer's memory where one piece of information can be stored.

NEW

This command is used when you are beginning a new program. It erases any old programs from the computer's memory.

POKE

A POKE command is used to put information into a specific memory location.

PRINT

This command is used to tell the computer to display information on the screen or printer.

PROGRAM

A program is a list of instructions written for the computer in a special language such as BASIC.

RETURN

The RETURN key must be pressed to enter any information into the computer. For example, you must press RETURN after every line in a program and after making any corrections to a line of a program.

RUN

After a program has been loaded into the computer's memory, you must type the command RUN in order to start the program working.

SCROLL

The movement of the text up the screen after the screen is filled is called scrolling.

SOFTWARE

Computer programs are sometimes referred to as software.

STATEMENT

A line of a computer program or a command given to the computer is sometimes called a statement.

STEP

The STEP command is used when you want the computer to count by some increment, for example, counting by 5's would be STEP 5.

STRING

A string is a type of variable that may contain letters and symbols as well as numbers.

SYNTAX ERROR

The computer will sometimes print this error message on the screen. It is usually an error in spelling or punctuation in the line of the program indicated.

TAB

The TAB command is used in much the same way as on a typewriter, to automatically move the text horizontally to a certain spot on the screen.

VARIABLE

A variable is a name assigned to a memory location.