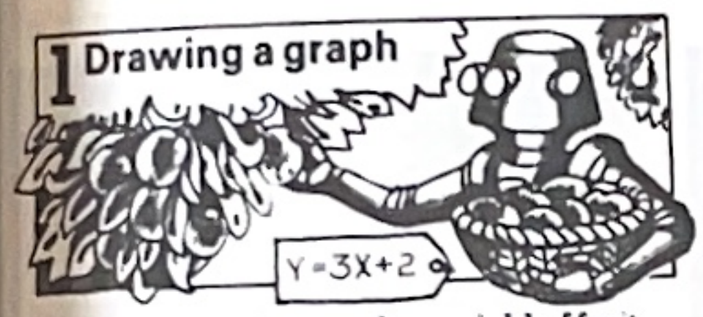
Graphs and symbols

You can program a computer to present information in all kinds of different ways, for instance, as words, numbers, pictures or graphs. Complicated information can be made much easier to understand if you illustrate it with graphs, pictures and symbols.

1 Drawing a graph



Imagine a peach tree whose yield of fruit increases each year in relation to its age. This can be expressed as an equation, say Y=3X+2 (Y is the yield and X is the age). It is hard to grasp what this means, though, and drawing a graph would help.

2

With a computer it is very easy to draw a graph of the way Y changes in relation to X. To plot the graph you need to find the value of Y for each value of X. You can do this very easily in a program using the statement LET Y=3*X+2.

3

The commands for CLS and PLOT vary.

In this graph the maximum value for X is 14 and the maximum value for Y is 3×14+2.

```
5 CLS
10 FOR X=1 TO 14
20 LET Y=3*X+2
30 PLOT (X,Y)
40 NEXT X
50 END
```

This is the program for drawing this graph. The loop sets X at all the values from 1 to 14. Each time the loop is repeated, line 20 uses the value of X to calculate Y and line 30 plots X and Y on the screen. In graphs programs, you must make sure the maximum values for X and Y will fit on the screen or you will get a bug.

4

This is the graph for Y=3X+2.

Computers and maths

In calculations which have several parts, such as 3×X+2, the computer always does the multiplications or divisions before it adds or subtracts. This means that the computer would give the same answer for these two sums:

```
PRINT 4*6+8        PRINT 8+4*6
32                 32
```

If you want the computer to do the sum in a different order you use brackets, like this:

```
PRINT (8+4)*6
72
```

This time the computer adds 8 and 4, then multiplies by 6.

Program puzzle

```
THINK OF A NUMBER
DOUBLE IT, ADD 4
DIVIDE BY 2, ADD 7
MULTIPLY BY 8, SUBTRACT 12
DIVIDE BY 4 AND TAKE AWAY 11
TELL ME THE RESULT
THE NUMBER YOU FIRST THOUGHT
OF IS
```

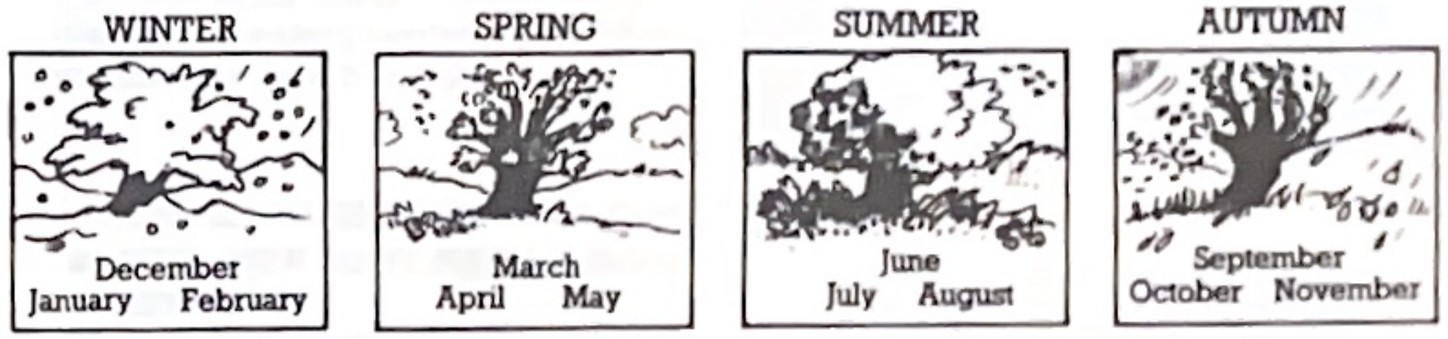
Can you write a program to get the computer to carry out this well known number trick? (To find the number you first thought of you subtract 4 from the result, then divide by 2.)

Birthdays program

This program uses another way to display information on the screen. It uses symbols to compare the number of people who were born in different seasons of the year. You could use a program like this to compare, say, sightings of a certain bird in different seasons, or the number of wins of different football teams. Before writing a long program like this it is a good idea to write a program plan.

Program plan

Aim: To compare the number of people with birthdays in winter, spring, summer and autumn.



1. Give the computer the data (i.e. the seasons when the people were born) for a survey of 20 people.
2. Store the data in the computer.
3. Present the data on the screen.

Sample run

```
RUN
WINTER  TOTAL*******
SPRING  TOTAL***
SUMMER  TOTAL*****
AUTUMN  TOTAL*****
```

The program

```
5 LET A=0
6 LET B=0
7 LET C=0
8 LET D=0
```
Empty variables ready to use for running totals for each season.

```
10 FOR I=1 TO 20
20 PRINT "PERSON ";I;" WAS BORN IN"
30 PRINT "WINTER, SPRING, SUMMER OR AUTUMN"
40 PRINT "TYPE W, SP, SU OR A"
50 INPUT B$
```
Loop to make computer ask question once for each person in survey.

```
60 IF B$="W" THEN LET A=A+1
70 IF B$="SP" THEN LET B=B+1
80 IF B$="SU" THEN LET C=C+1
90 IF B$="A" THEN LET D=D+1
```
Lines 60 to 100 check the answer in B$ and add one to the variable for that season.

```
100 NEXT I
```
Sends computer back to repeat question.

```
110 PRINT "WINTER TOTAL";
115 LET N=A
120 GOSUB 200
130 PRINT "SPRING TOTAL";
135 LET N=B
140 GOSUB 200
150 PRINT "SUMMER TOTAL";
155 LET N=C
160 GOSUB 200
170 PRINT "AUTUMN TOTAL";
175 LET N=D
180 GOSUB 200
190 STOP
```
The subroutine makes the computer print a number of stars equal to the number in each variable.

By putting the total into N each time, the computer can use the same routine for each season.

Makes the computer stay on the same line to print the stars.

```
200 REM: SUBROUTINE TO PRINT STARS
210 IF N=0 THEN GOTO 250
220 FOR I=1 TO N
230 PRINT "*";
240 NEXT I
250 PRINT
260 RETURN
```
Line 210 checks in case no-one was born in a particular season.

The main program sets N to the total for A, B, C or D. The loop makes the computer carry out line 230 "N" times.