



and 360 degrees as inputs. Experiment by using these commands — try drawing some simple shapes; see what happens if you instruct the turtle to move a greater distance than the screen size permits; try using negative numbers as inputs. To start again with a clear screen, type DRAW.

When trying out commands, you may find that the turtle moves into the text section of the screen, and thus appears to be 'behind' the text so that it can't be seen. These commands may help:

FULLSCREEN — allows the full screen area to be used for graphics;

TEXTSCREEN — removes all graphics and leaves you with text only;

SPLITSCREEN — returns you to splitscreen mode;

PENUP — allows the turtle to move without drawing a line;

PENDOWN — the turtle leaves a 'trail' as it moves.

The commands we have discussed so far are all instructions to make the turtle do your bidding. But you can also use LOGO to get information back from the turtle. The turtle's heading is measured in degrees; a heading of 0 indicates that the turtle is facing straight upwards, and the heading is measured clockwise through 360 degrees. To find the turtle's heading, type:

PRINT HEADING

The turtle's position on the screen is defined in terms of a co-ordinate system, with its origin at the centre of the screen (i.e. the turtle begins at a point with x and y co-ordinates of 0). You can find the turtle's position at any time by typing:

PRINT XCOR PRINT YCOR

Try out these commands by drawing a shape and then ascertaining the turtle's position and the direction in which it is facing. Use this data to return the turtle to its starting point.

You may have found that error messages have appeared in the text area during your experiments with LOGO commands. If not, then make a deliberate mistake to see what happens. For example, type:

FORWARD50

You will see the message:

THERE IS NO PROCEDURE NAMED FORWARD50

The reason for this is that LOGO requires a space between the command FORWARD and the input 50 so as to avoid confusion with a possible command called FORWARD50. You may also get an error message if you have typed a command in lower case.

LOGO is equipped with a line editor that enables you to correct instructions if you notice an error before you press Return. Use the cursor keys to move along the line to the incorrect text. To insert characters, simply type them in — the text to the right of the mistake will move

automatically to accommodate any extra characters. The delete key removes the character to the left of the cursor. Once the line is correct, pressing Return will allow LOGO to accept the new instruction. If you have already pressed Return before noticing a mistake, typing Control-P will retrieve the last line for editing. This feature is equally useful for repeating commands.

Now we can try something a little more mathematical — for example, a square. Remember that a square has four equal sides and that its corners are right angles (90 degrees), so something like this will produce the desired result:

```
FD 50 RT 90
FD 50 RT 90
FD 50 RT 90
FD 50 RT 90
```

Notice that we can abbreviate the commands, and can put more than one command on a single line.

Unfortunately, you may hit a technical problem at this point — your square may look more like a rectangle. This is because of the 'aspect ratio' of your screen — that is, the ratio of the vertical step size to the horizontal step size. There is a LOGO command to deal with this: use .ASPECT followed by a number (the default is 0.8) to change the aspect ratio until your shape really is a square. Now try the following exercises: draw an equilateral triangle; a pentagon; a hexagon; various rectangles; a rhombus; a parallelogram — indeed, anything that takes your fancy!

You may simplify some of the commands and reduce the amount of typing by using REPEAT. To draw the square again, simply type:

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REPEAT 4 [FD 50 RT 90]
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REPEAT is a command with two inputs. The first is a number that indicates the number of times LOGO must do something, and the second is a 'list' of the commands to be obeyed. This list must always be enclosed in square brackets. So our square example tells LOGO that it must repeat the FORWARD 50 RIGHT 90 sequence four times. Now try using REPEAT to simplify construction of the shapes you have already created, and see if you can produce the star shapes shown in some of our illustrations.

Logo Flavours

On the Atari, the turtle looks like a turtle, not a triangle!

All LCSI versions:

Use CLEARSCREEN (abbreviation CS) to begin drawing.

Use Control-Y to recall the last line (except Spectrum, which does not have this feature).

To change the aspect ratio:

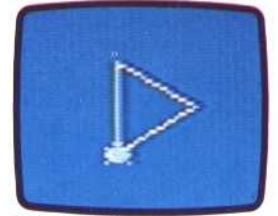
Apple LCSI — SETSCRUNCH followed by new ratio

Atari — .SETSCR followed by new ratio

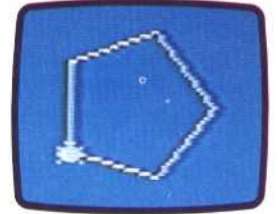
Spectrum — SETSCRUNCH followed by two co-ordinate numbers [x y] (the norm is [100 100])

LOGO Exercises

Can you write procedures to create these shapes? The samples shown were drawn with LCSI LOGO on an Atari 600XL



Equilateral Triangle



Pentagon



Hexagon



Rectangle



Five-Pointed Star



Ten-Pointed Star



Parallelogram