Algorithms

Iteration and count-controlled loops

Learn

You have previously learnt that when a series of actions are repeated, it is called a loop. You also learnt that loops are used in programming to repeat a set of instructions.

An ▅▅▅▅ is a single pass through a set of instructions within an algorithm or program. Therefore, when a loop is repeated several times, we say that there are several iterations.

Count-controlled loop

A ▅▅▅▅ can be used to keep track of the number of times a loop occurs. A loop in which a counter is used like this is known as a ▅▅▅▅. A count-controlled loop is an example of iteration.

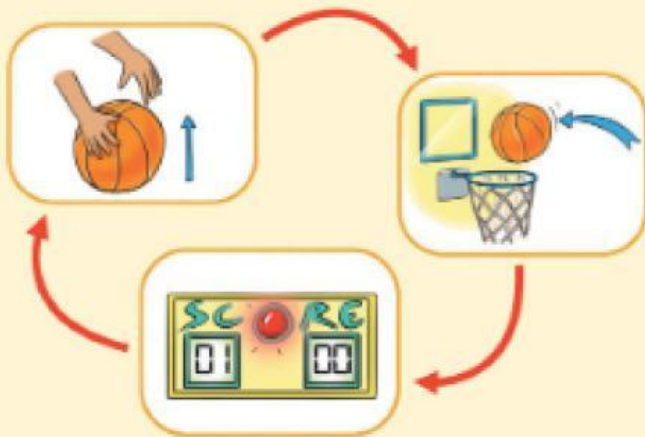These instructions to draw a square can contain a count-controlled loop:

1 Place pen on paper.

2 Draw a 5 cm line.

3 Turn a quarter turn right.

4 Repeat steps 2 and 3 three more times.

5 Remove pen from paper.

In an arcade basketball game, a player is allowed five attempts to shoot a basketball through the hoop.

1 Start the game.

2 Pick up the basketball.

3 Shoot the basketball at the basketball hoop.

4 Award one point if the basketball goes through the hoop.

5 Repeat steps 2, 3 and 4 four more times.

6 End game.

The algorithm will repeat steps 2, 3 and 4 a total of five times. This means that there are five iterations of these steps.

On a racetrack, cars race each other for a number of laps.

This algorithm is for a four-lap race. The following instructions are repeated:

| Drive past the crowd |
| Finish the lap |

These instructions are repeated 4 times.

Algorithm name: Car Race	
Step	**Instruction**
①	Start the race
②	
③	Finish the lap
④	Drive past the crowd
⑤	Finish the lap
⑥	
⑦	Finish the lap
⑧	Drive past the crowd
⑨	Finish the lap
⑩	End the race
⑪	Stop car

Did you know?

Iterations occur everywhere. For example, when singing a song, we repeat the chorus several times. This is an example of iteration.

Keywords

iteration: a single pass through a set of instructions

counter: keeps track of the number of times a loop has run

count-controlled loop: a type of loop where instructions are repeated a set number of times

Practise

1 State whether the following statements are true or false:

a When instructions are repeated, it is called a loop.

b A count-controlled loop tells us how many times a loop is repeated.

c A set of instructions repeated once is known as an iteration.

d In a count-controlled loop, you cannot tell how many times an instruction is to be repeated.

e You cannot have a set of instructions do more than one iteration.

2 You have been asked to fill an empty jug with water using a glass. The algorithm below has been written to perform this task. Once the algorithm is complete, the jug is full of water.

Step	Instruction
1	Start
2	Fill glass with water
3	Pour water from glass into jug
4	Fill glass with water
5	Pour water from glass into jug
6	Fill glass with water
7	Pour water from glass into jug
8	Stop

Answer the following questions:

a State which instruction or instructions are repeated.

b Can you state how many times the instructions are repeated? That is, how many iterations of the instructions are needed to fill the jug?

c What would happen if there were more iterations?

d What would happen if there were fewer iterations?