Iteration in Programming

while loops

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Topics list

1. Repetition in Programming – Intro to looping

2. Use of loops (while loops).

Recap: Boolean conditions

- A boolean condition is an expression that evaluates to either true or false e.g.

$$\boxed{\textcolor{red}{price} >= 0}$$

- Boolean conditions can be used to control:
  - Selection i.e. if statements and
  - Iteration i.e. loops (we will look at these now).

Repetition in Programming

- Computers are very good at repetition.

- Example:
  - calculate pay for 1000 employees.
  - You should use the same calculate pay algorithm 1000 times.
  - You don't write the calculate pay algorithm 1000 times; instead you include it in a loop.

Scenario: Checking Tickets at a Cinema

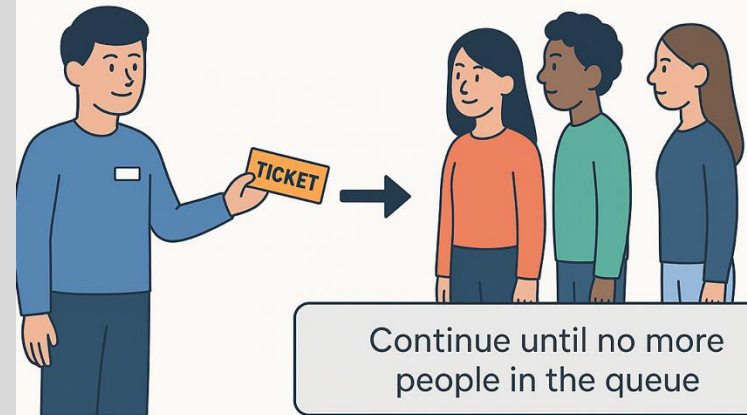Imagine you're working at a cinema. A group of people is coming in for a movie.

Your job is to:

- **Check each person's ticket** as they enter.
- Let them in if they have a valid ticket.
- Keep a **count of how many valid tickets** you check.
- Stop when there are **no more people in the queue (or you have reached a certain number)**.

Form of loop

Real-world action	Programming equivalent
Repeating ticket checks for each person	Loop that repeats for each input
Queue of people	Data to process (e.g., list or unknown number of inputs)
Stop when no more people or reached a certain number	Loop termination condition
Counting valid tickets	Using a counter variable inside the loop

Checking Tickets at a Cinema

A job that involves checking tickets one by one

TICKET

Continue until no more people in the queue

Repetition without loop

- Print "Hello world" to the screen 4 times

```
System.out.println("Hello World");
System.out.println("Hello World");
System.out.println("Hello World");
System.out.println("Hello World");
```

```
NoLoop.main({ });|
Hello World
Hello World
Hello World
Hello World
```

Introducing loop form

- Print "Hello world" to the screen 4 times

  - With a loop:

    - do this 4 times

      System.out.println("Hello World");

```
NoLoop.main({ });|
Hello World
Hello World
Hello World
Hello World
```

Introducing loop form

- Print "Hello world" to the screen 4 times

- Introduce a counter

Set a counter to 1

do this while counter <= 4

System.out.println("Hello World");

increase counter by one

```
NoLoop.main({ });|
Hello World
Hello World
Hello World
Hello World
```

Topics list

1. Repetition in Programming – Intro to looping

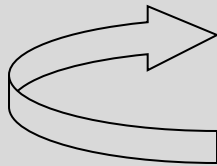2. Use of loops (while loops).

Loops in Programming

- There are three types of loop in (Java) programming:

  - **while** loops
  - **for** loops
  - **do while** loops

while loop pseudo code

General form of a while loop

while keyword

boolean condition

```
while(loop condition) {
    loop body
}
```

Statements to be repeated

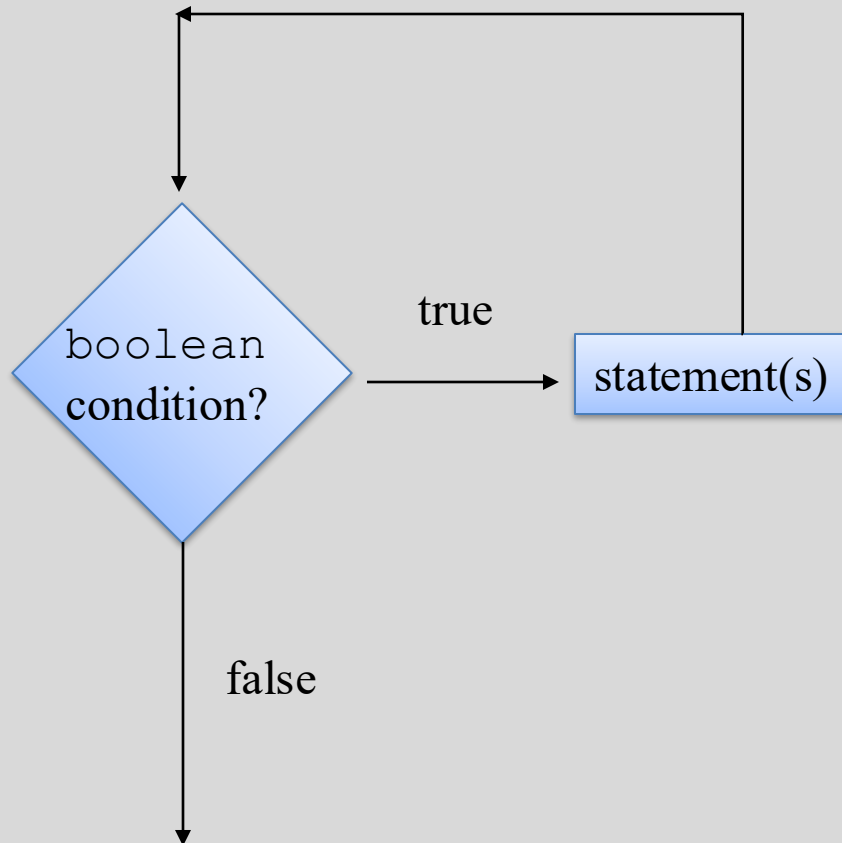Pseudo-code expression of the actions of a while loop

while we wish to continue, do the things in the loop body

Construction of while loop

Declare and initialise loop control variable (LCV)

while(boolean condition based on LCV is true)

{

    "do the job to be repeated"

    "update the LCV"

}

This structure should <u>always</u> be used

while loop Flowchart


```
boolean
condition?
```

true

statement(s)

false

```
int i = 1;
    while (i <= 4)
    {
      System.out.println("Hello World");
      i++;
    }
```

```
NoLoop.main({ });|
Hello World
Hello World
Hello World
Hello World
```

Example 2 - Loop using the counter variable

```java
int i = 1;

while (i <= 6) {
        System.out.println("Num : " +  i);
        i++;
 }
```

```
ForNumberLoop.main({ });
Num : 1
Num : 2
Num : 3
Num : 4
Num : 5
Num : 6
```

Some Study Exercises

Example 1:

1. Change the code so that "Hello World" is printed out 10 times.

Example 2:

1. Change the code so that the numbers from 1 to 10 (inclusive) are printed out, one line at a time.

2. Change the code so that the numbers from 10 to 1 are printed out.

Questions?