

Iteration in Programming

while loops and loop control variable

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Topics list

1. Repetition in Programming – Intro to looping
2. Use of loops (while loops).

What Is Iteration?

Iteration means repeating a set of instructions.
Computers are very good at repetition.

Example:

- Calculate pay for 1,000 employees
- Same algorithm, repeated many times
- We use **loops** instead of rewriting code.

Recap: Boolean conditions

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

`x < 50`

`i <= 10`

`name.equals("John")`

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

Why We Need Loops?

Write the all the numbers between 1 and 5 inclusive

– Without loop:

```
System.out.println(1);  
System.out.println(2);  
System.out.println(3);  
System.out.println(4);  
System.out.println(5);
```

This is inefficient and not scalable.

Thinking in Loops

Instead, we want to say:

“Do this 5 times, changing a value each time.”

We will use:

- A variable that changes
- A condition that controls repetition

```
System.out.println(i);
```

With the value of i going from 1 to 5

This leads us to **loops**.

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

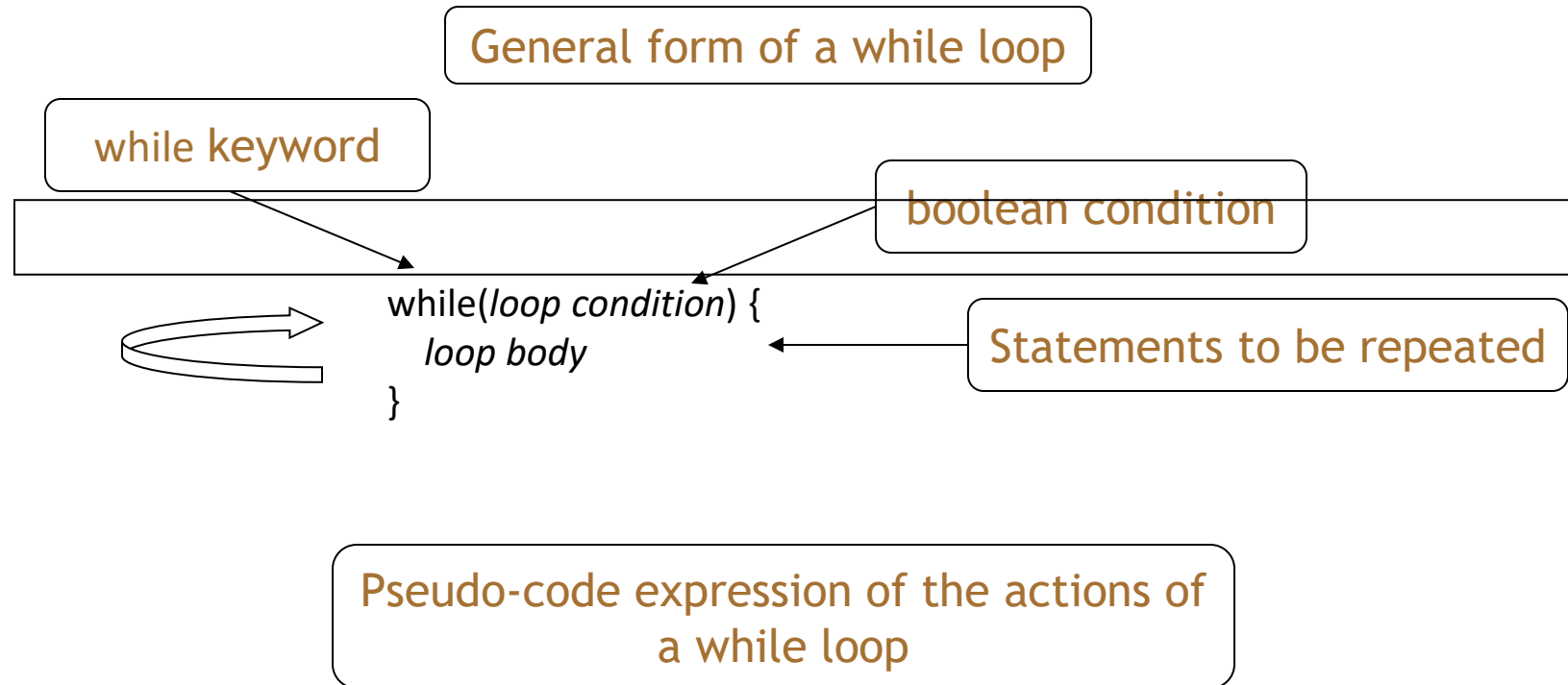
The while Loop

A while loop means:

“While this condition is true, keep repeating these statements.”

If the condition becomes false, the loop stops.

while loop pseudo code



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

Loop Control Variable (LCV)

A loop control variable (LCV):

- Controls how many times the loop runs
- Is checked in the loop condition
- Is updated inside the loop

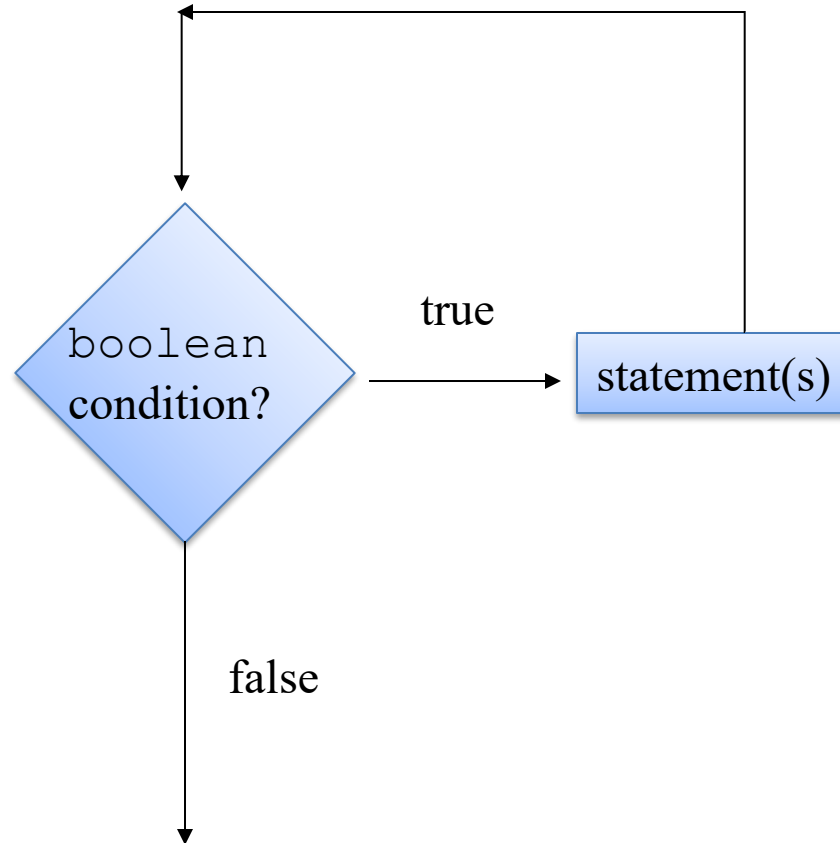
Without an LCV, loops often run forever.

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 always be used

while loop Flowchart



```
int i = 1;      //i is the LCV
while(i <=5)
{
    System.out.println(i);
    i++;
}
```

Example - while

```
int i = 1; //i is the LCV  
while(i <=5)  
{  
    System.out.println(i);  
    i++;  
}
```

Declare and initialise **loop control variable (LCV)**

while(boolean condition based on **LCV** is true)

{

“do the job to be repeated”

“update the **LCV**”

}



1
2
3
4
5

Example – while

1. Declare and initialise **loop control variable (LCV)**

```
int i = 1;  //i is the LCV
while(i <=5)
{
    System.out.println(i);
    i++;
}
```

2. boolean condition based on **LCV**

“do the job to be repeated”

“update the **LCV**”

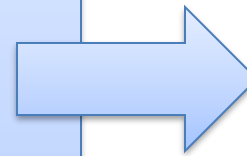
1
2
3
4
5

Some Study Exercises

This basic while loop,
produces this output.

```
int i = 1;

while (i <=5)
{
    System.out.println("Hello World");
    i++;
}
```



```
Hello World
Hello World
Hello World
Hello World
Hello World
```


Form of loop - revisited

- Write the all the numbers between 1 and 5 inclusive
 - With a loop:
 - do this 5 times

`System.out.println(i);`

With the value of i going from 1 to 5

Solution – Whats the difference?

```
public class Driver {  
  
    public static void main(String args[]){  
  
        for(int i = 1; i<=5; i++){  
            System.out.println(i);  
        }  
  
        int i = 0;  
        while(i < 5){  
            System.out.println(i+1);  
            i++;  
        }  
  
        i=1;  
        do{  
            System.out.println(i);  
            i++;  
        }while(i<6);  
    }  
}
```

Common Mistakes

Common errors with while loops:

- Forgetting to update the LCV
- Incorrect loop condition
- Off-by-one errors

These can cause **infinite loops** or incorrect output.

Some Study Exercises

1. Change the code so that “Hello World” is printed out 10 times.
2. Change the code so that the numbers from 1 to 10 (inclusive) are printed out, one line at a time.
3. Change the code so that the numbers from 10 to 1 are printed out.

Questions?

