

# Iteration in Programming

while loops and loop control variable

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# Topics list

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

# What Is Iteration?

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**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

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- 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?

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Write 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

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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

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

# Loops in Programming

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- There are three types of loop in (Java) programming:
  - **while** loops
  - **for** loops
  - **do while** loops

# The while Loop

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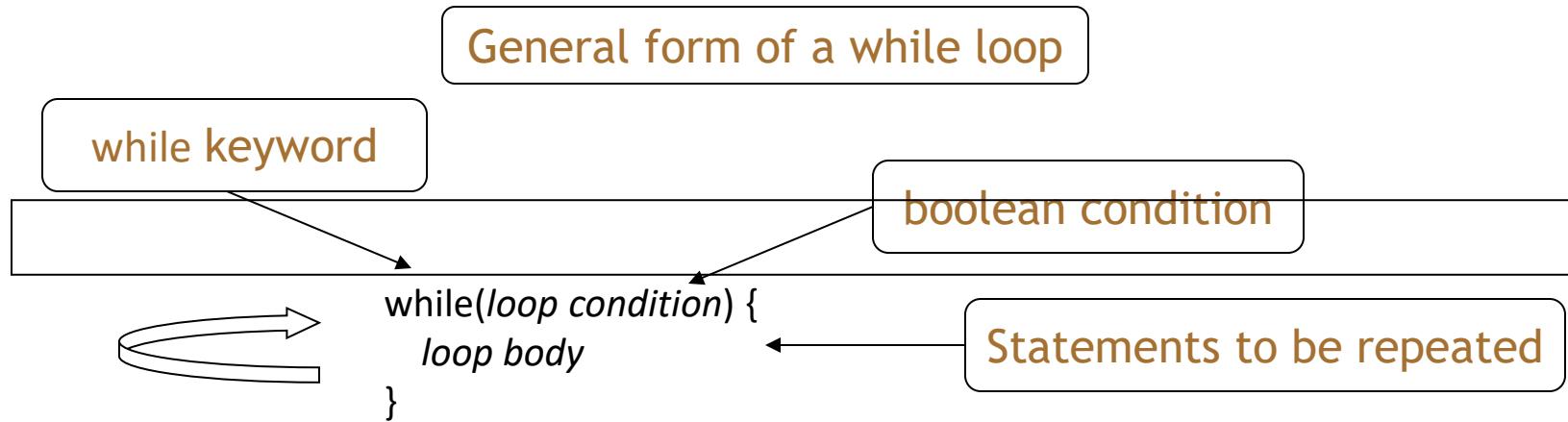
A while loop means:

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

If the condition becomes false, the loop stops.

# while loop pseudo code

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Pseudo-code expression of the actions of  
a while loop

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

# Loop Control Variable (LCV)

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**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

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

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

{

“do the job to be repeated”

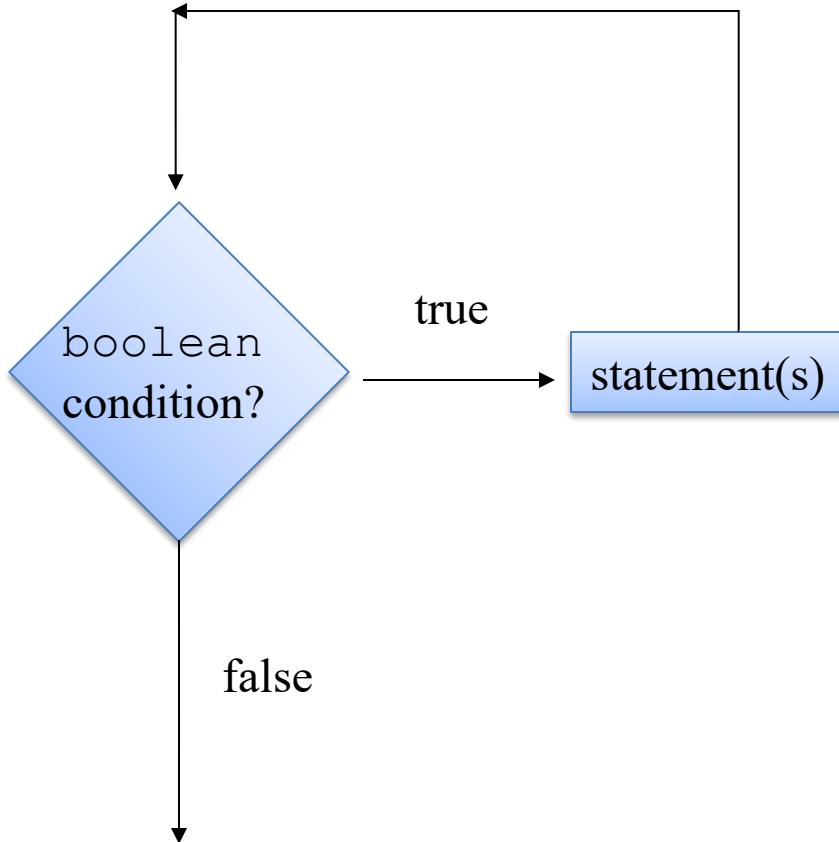
“update the **LCV**”

}

This structure should always be used

# while loop Flowchart

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

# Example - while

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```
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)

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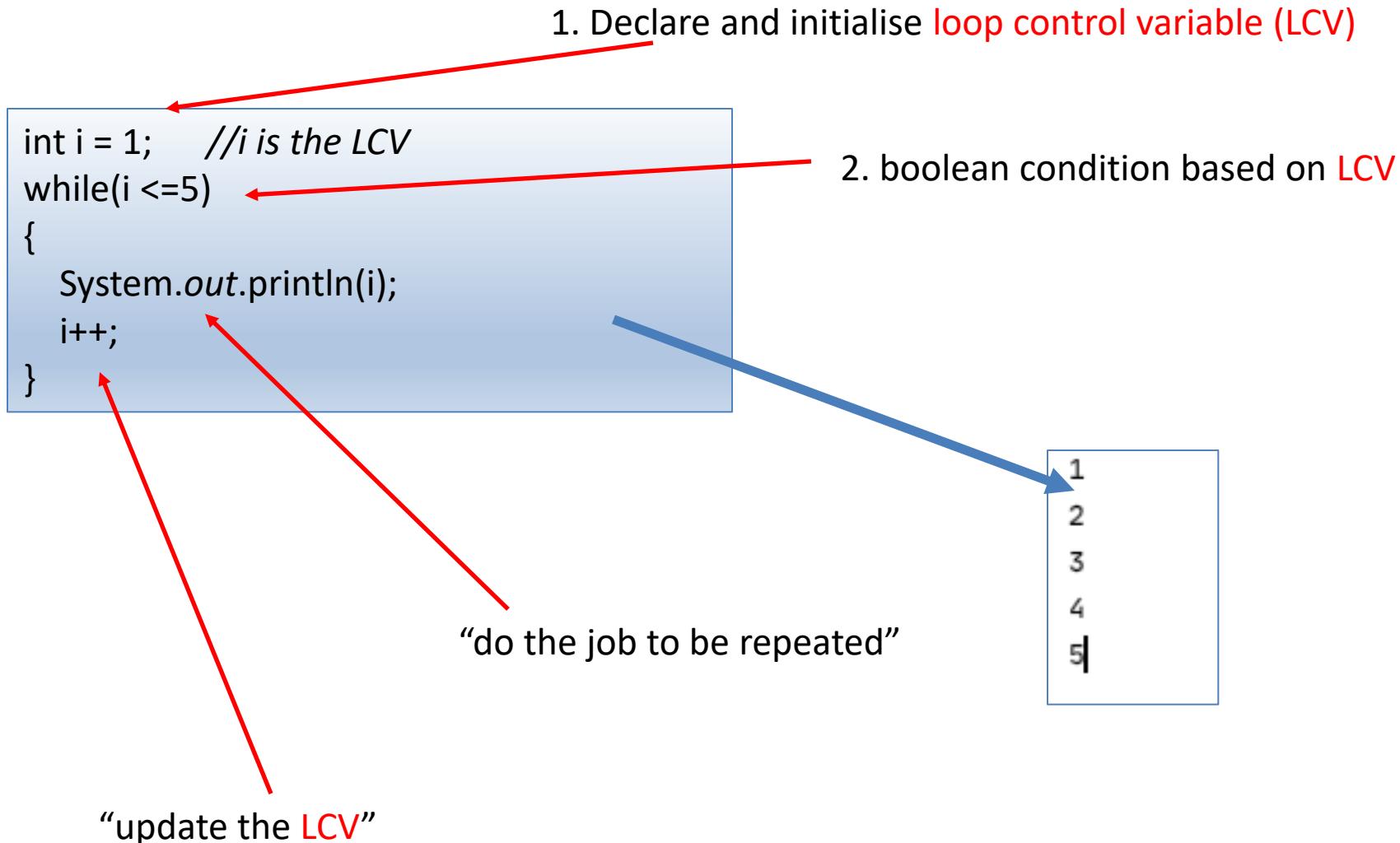
“update the **LCV**”

}

```
1  
2  
3  
4  
5
```

# Example – while

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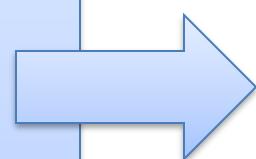


# Some Study Exercises

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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

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- Write 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

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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

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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?

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