Tutorial Sheet - Topic 05

Programming Fundamentals 1

Loops, while loops, for loops, nested loops.

Part A: Understanding While Loops

1. Writing simple while loops

Write Java code for each of the following:

1. Print the message **"Hello World"** five times using a `while` loop.
2. Print the numbers from **1 to 10** (inclusive) on separate lines.
3. Print the numbers from **10 down to 1** (inclusive) on the same line, separated by spaces.
4. Print the numbers from **5 to 12** (inclusive) on separate lines.
5. Print the numbers from **20 down to 10** (inclusive) on the same line, separated by spaces.
6. Print the numbers from **2 to 17** (inclusive) in steps of 3 on separate lines

2. Predicting output

Without running the code, write down exactly what is printed by the following program:

```java
int i = 2;
while (i <= 8) {
    System.out.println("Value of i: " + i);
    i = i + 2;
}
```

a. How many times does the loop run?
b. What is the last value of `i` printed?

3. Correcting logic

The following loop is supposed to print the numbers 1–5, but it doesn't work.
Explain what's wrong and correct the code:

```java
int i = 1;
while (i <= 5) {
    System.out.println(i);
}
```

4. Designing your own

Write a `while` loop that prints the **square of each number** from 1 to 5:

```
1
4
9
16
25
```

Part B: For Loops

5. Rewriting while as for

Rewrite each of the following `while` loops using a `for` loop.

(a)

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

(b)

```java
int n = 10;
while (n >= 1) {
    System.out.println(n);
    n--;
}
```

6. Writing simple for loops (rewriting the while loops from Part A)

Write Java code for each of the following:

1. Print the message **"Hello World"** five times using a `for` loop.
2. Print the numbers from **1 to 10** (inclusive) on separate lines.
3. Print the numbers from **10 down to 1** (inclusive) on the same line, separated by spaces.
4. Print the numbers from **5 to 12** (inclusive) on separate lines.
5. Print the numbers from **20 down to 10** (inclusive) on the same line, separated by spaces.
6. Print the numbers from **2 to 17** (inclusive) in steps of 3 on separate lines

7. Tracing nested loops

What will this code print?

```java
for (int i = 0; i < 2; i++) {
    for (int j = 0; j < 3; j++) {
        System.out.println("i = " + i + ", j = " + j);
    }
}
```

a. How many total lines are printed?
b. What is printed on the 5th line?

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8. Writing a counting pattern

Using for loop/s, write code that prints:

```
Counting up: 1 2 3 4 5
Counting down: 5 4 3 2 1
```

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9. Thinking challenge

Why might a **while loop** be useful for **input validation** (for example, asking a user for a positive number)?
Write an example snippet to demonstrate your reasoning. Use the Loop Control Variable concept.

- What would your Loop Control Variable be?
- How would you initialise it?
- How would you update it?
- How would you test it?