Nested Loops & Control statements

Camille Duquesne
1ère IB

Any questions/difficulties you would like to share about last session’s content ?

B2 Programming

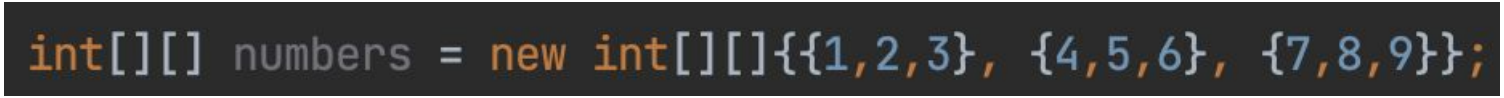
B2.2.2 Construct programs that apply arrays and Lists.

B2.3.3 Construct programs that utilize looping structures to perform repeated actions.

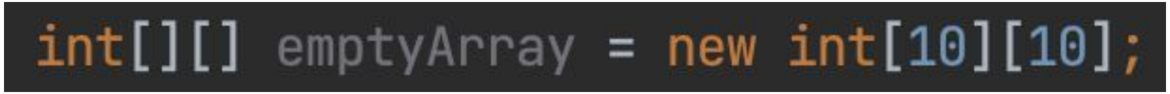
- Types of loops, including counted loops and conditional loops, and appropriate use of each type
- Conditional statements within loops, using Boolean and/or relational operators to govern the loop's execution

Nested arrays

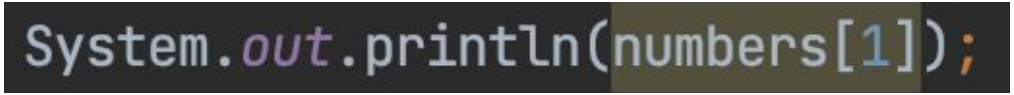
We saw previously how define simple arrays but java also allow us to define double arrays ! Their behavior is the same as one dimensional Arrays. We also call them matrices



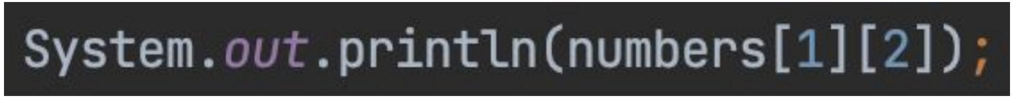
```java
int[][] numbers = new int[][]{{1,2,3}, {4,5,6}, {7,8,9}};
```



```java
int[][] emptyArray = new int[10][10];
```

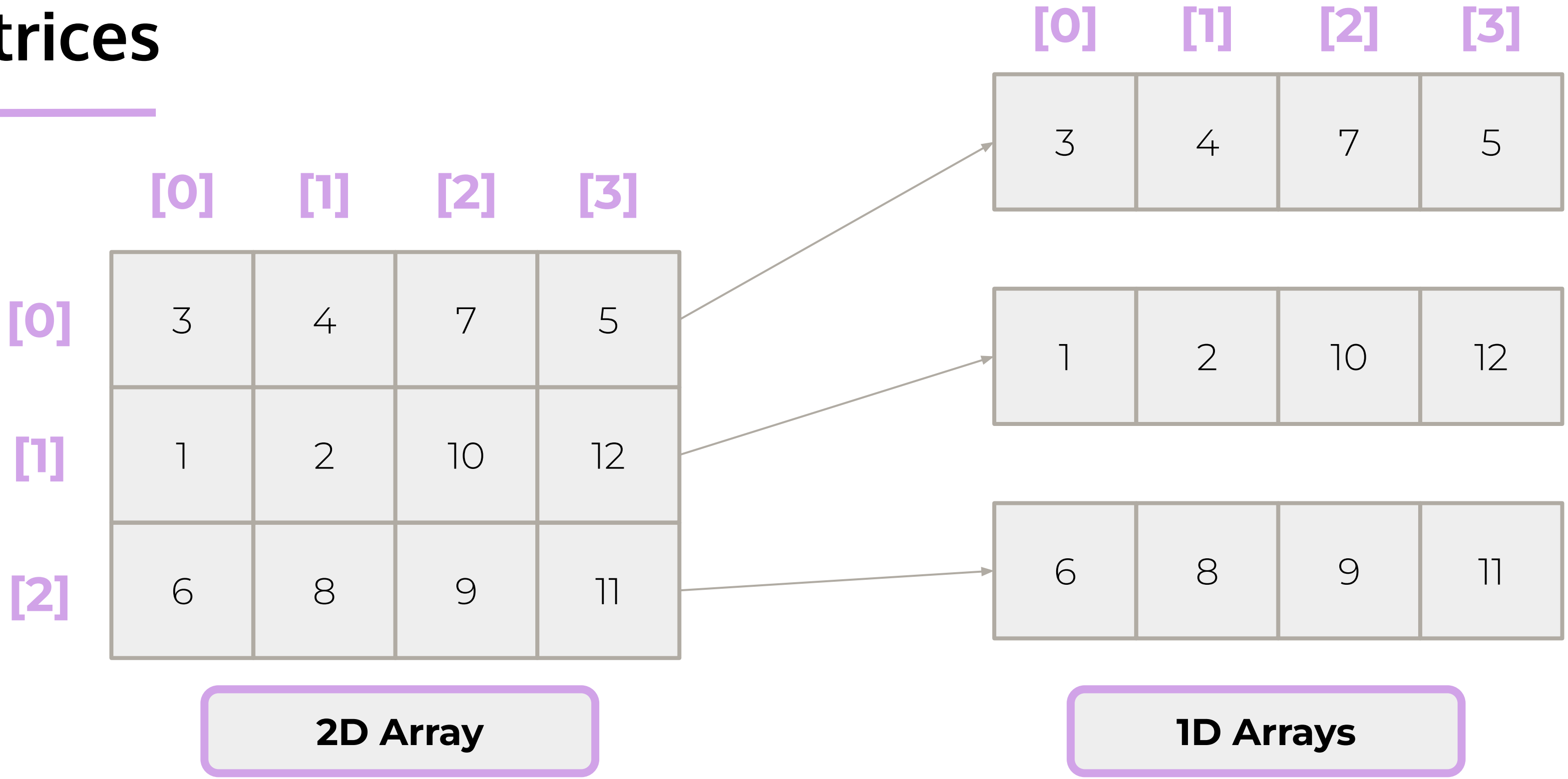


```java
System.out.println(numbers[1]);
```



```java
System.out.println(numbers[1][2]);
```

Matrices



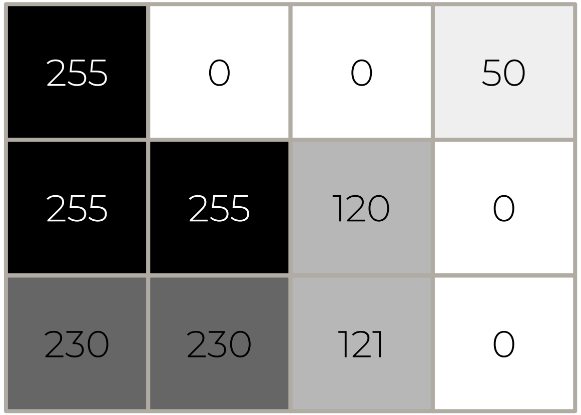
	[0]	[1]	[2]	[3]
[0]	3	4	7	5
[1]	1	2	10	12
[2]	6	8	9	11

2D Array

[0]	[1]	[2]	[3]
3	4	7	5
1	2	10	12
6	8	9	11

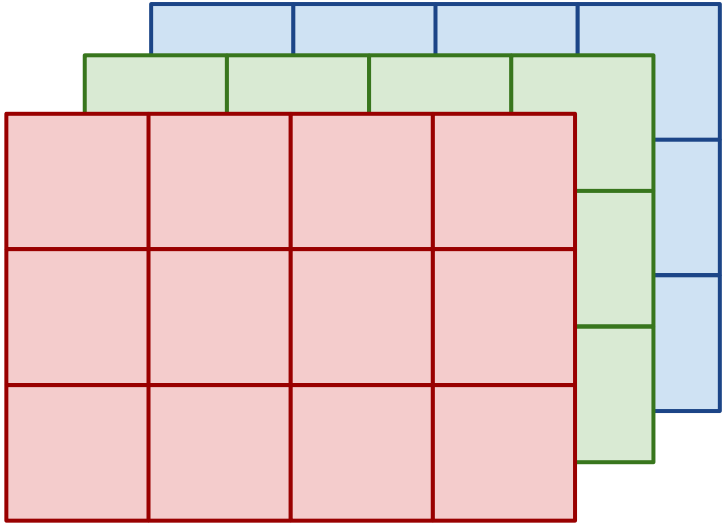
1D Arrays

Examples



255	0	0	50
255	255	120	0
230	230	121	0

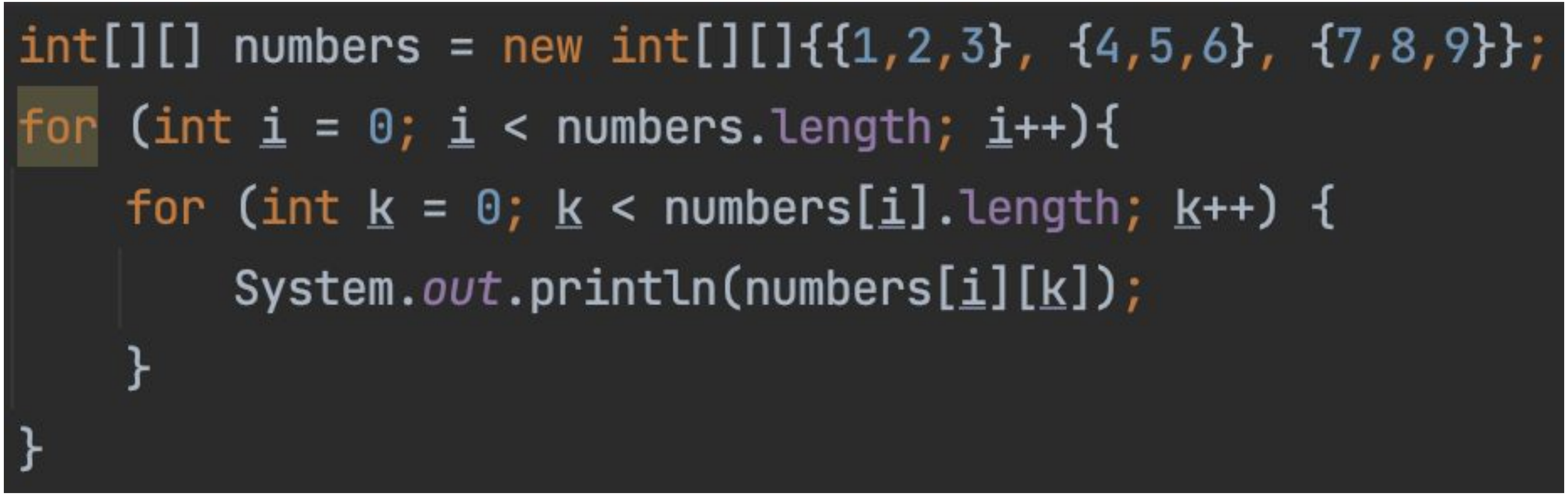
Grey scale images



Color images

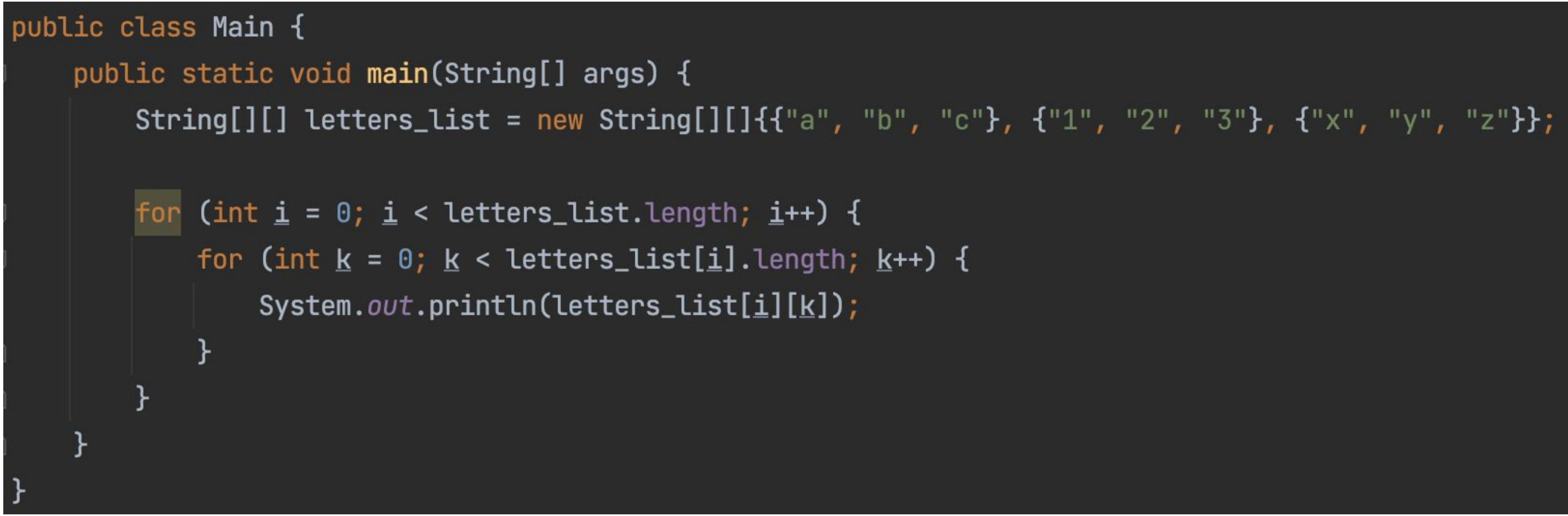
Nested loops

To iterate on our values of our nested arrays we can write … nested loops !



```
int[][] numbers = new int[][]{{1,2,3}, {4,5,6}, {7,8,9}};
for (int i = 0; i < numbers.length; i++){
    for (int k = 0; k < numbers[i].length; k++) {
        System.out.println(numbers[i][k]);
    }
}
```

What does this code output ?



```
public class Main {
    public static void main(String[] args) {
        String[][] letters_list = new String[][]{{"a", "b", "c"}, {"1", "2", "3"}, {"x", "y", "z"}};

        for (int i = 0; i < letters_list.length; i++) {
            for (int k = 0; k < letters_list[i].length; k++) {
                System.out.println(letters_list[i][k]);
            }
        }
    }
}
```

Control statements

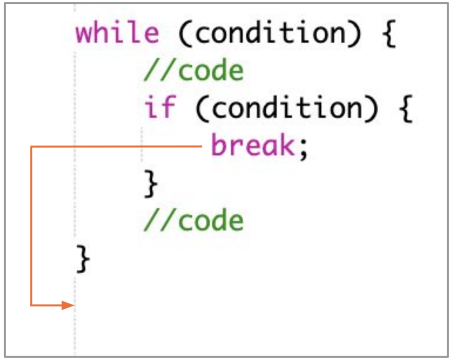
Sometimes it is desirable to skip some statements in a loop or break out of a loop.
In such cases we use the :

- Break statement
- Continue statement

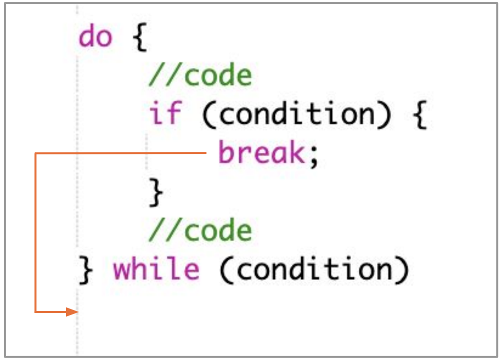
Break statements

The break statement terminates the loop immediately, and the control of the program moves to the next statement following the loop.

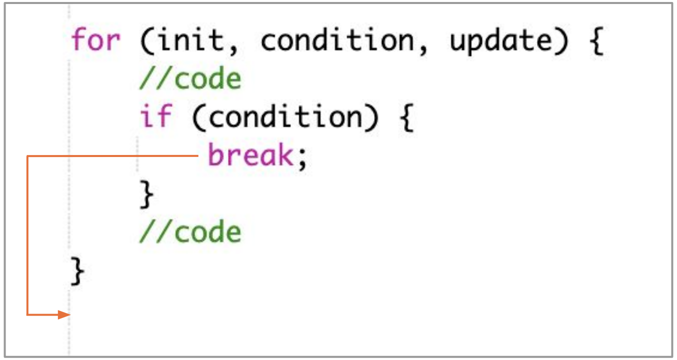
In the case of nested loops, the break statement terminates the innermost loop.



```
while (condition) {
    //code
    if (condition) {
        break;
    }
    //code
}
```

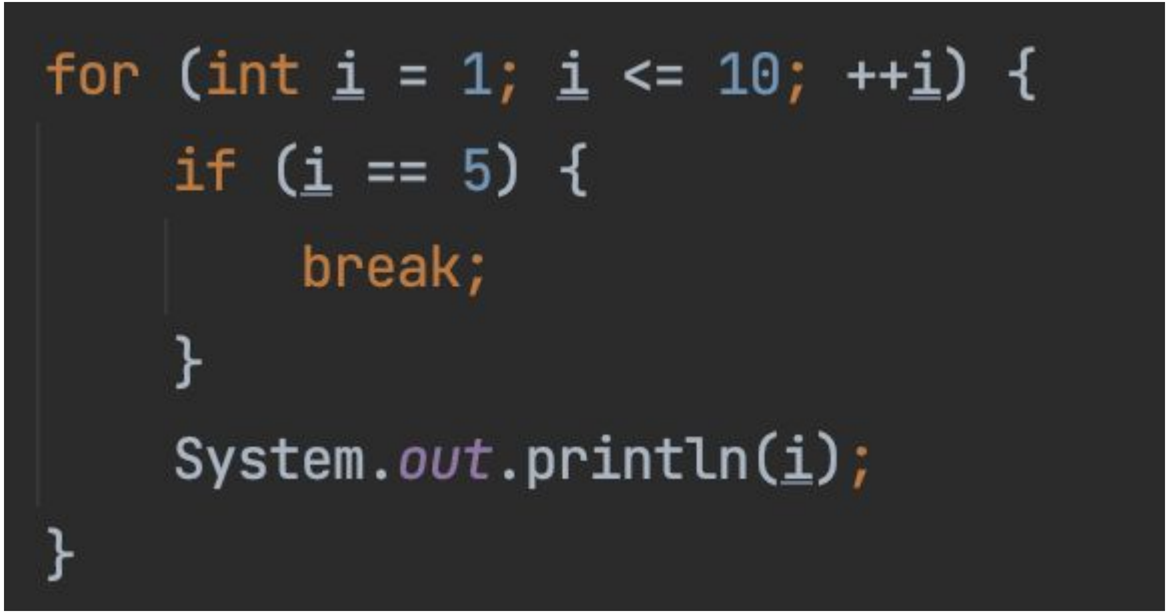


```
do {
    //code
    if (condition) {
        break;
    }
    //code
} while (condition)
```

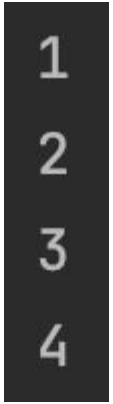


```
for (init, condition, update) {
    //code
    if (condition) {
        break;
    }
    //code
}
```

Break statement example



```
for (int i = 1; i <= 10; ++i) {
    if (i == 5) {
        break;
    }
    System.out.println(i);
}
```

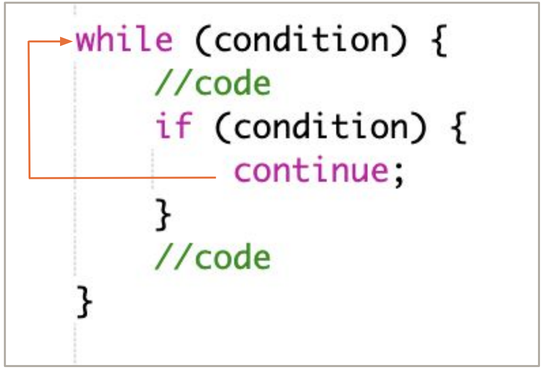


```
1
2
3
4
```

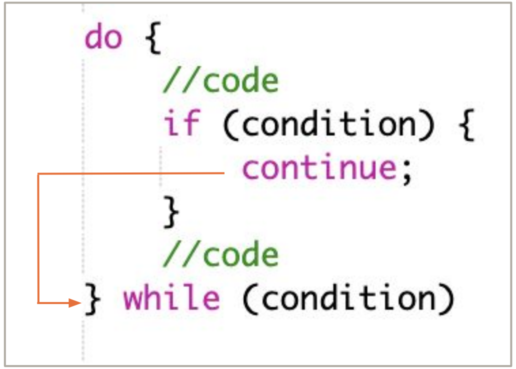
Continue statement

The continue statement skips the current iteration of a loop

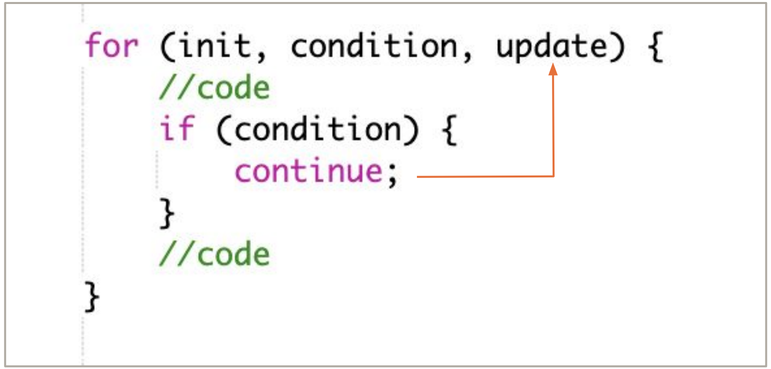
In the case of nested loops, the continue statement skips the current iteration of the innermost loop.



```
while (condition) {
    //code
    if (condition) {
        continue;
    }
    //code
}
```

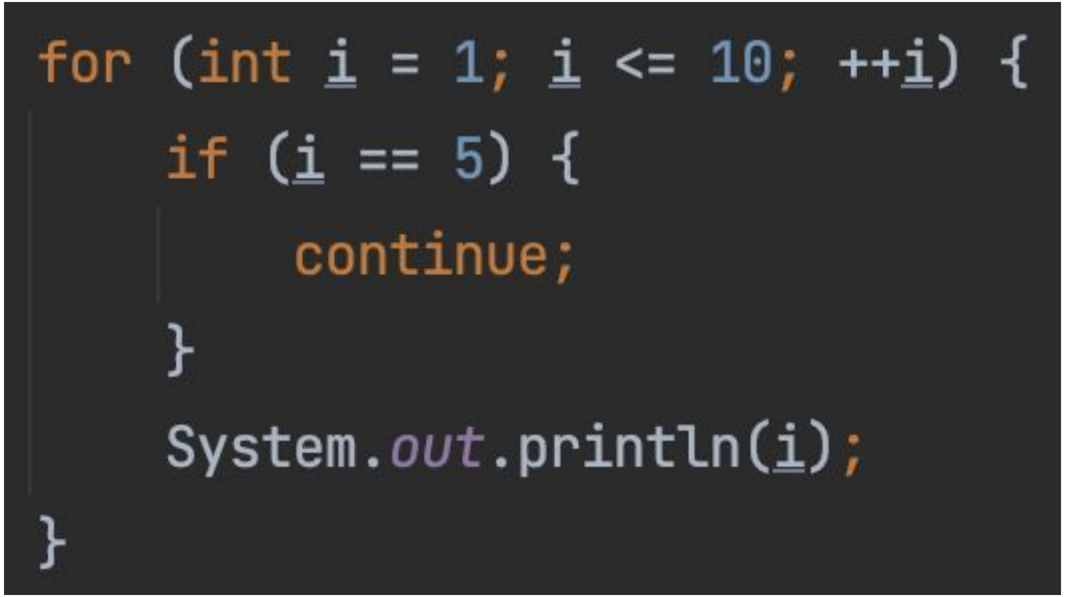


```
do {
    //code
    if (condition) {
        continue;
    }
    //code
} while (condition)
```

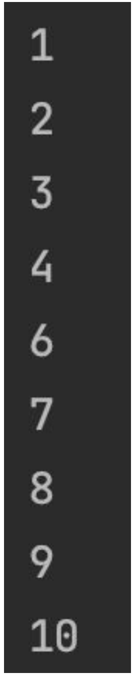


```
for (init, condition, update) {
    //code
    if (condition) {
        continue;
    }
    //code
}
```

Continue Example

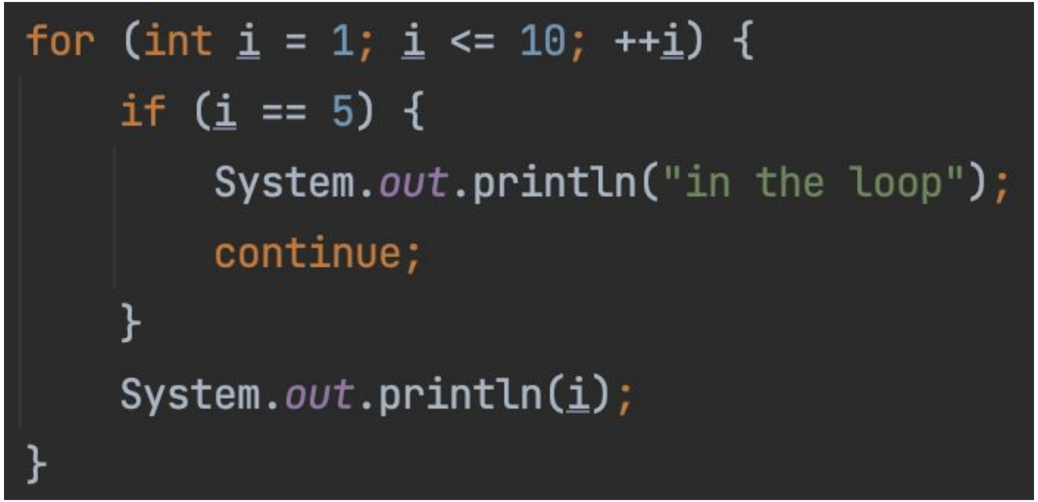


```java
for (int i = 1; i <= 10; ++i) {
    if (i == 5) {
        continue;
    }
    System.out.println(i);
}
```



```
1
2
3
4
6
7
8
9
10
```

What does this code output ?



```
for (int i = 1; i <= 10; ++i) {
    if (i == 5) {
        System.out.println("in the loop");
        continue;
    }
    System.out.println(i);
}
```

Pause & Recall

Created by Victoruler
from Noun Project

Close your eyes and try to recall as many things as possible that were covered during this lesson.

Alternatively, you can keep your eyes open and write down as many things you remember on a piece of paper.

This will help strengthen your memory of key concepts 💪

Exercise 1 *(GenAI 🟠 Orange)*

Write a program that prints all numbers from 0 to 20 except for 17, using a control flow statement

Exercise 2 *(GenAI 🟠 Orange)*

With a double loop, create a script that prints out the 10x10 multiplication table

Exercise 3 *(GenAI 🟠 Orange)*

Using a double loop create and print a matrix (=double array) with 0s everywhere except on the diagonal, on which there should be 1s.

Exercise 4 *(GenAI 🟠 Orange)*

Write a Java program that calculates and displays the sum of all elements in a 2D array. Create a nested loop to iterate through the array's rows and columns and accumulate the sum.

Exercise 5 *(GenAI 🟠 Orange)*

Given a 2D array (matrix), write a Java program that transposes it, switching rows and columns. Display the transposed matrix as output.

Exercise 6 *(GenAI 🟠 Orange)*

Write a Java program that finds and displays the maximum value in a 2D array. You can start by assuming the first element is the maximum and then compare it to all other elements in the array.

Exercise 7 *(GenAI 🟠 Orange)*

Create a Java program that searches for a specific value in a 2D array. Prompt the user to enter a value to search for, and then iterate through the array to find and display the coordinates (row and column) where the value is located.

Exercice 8 *(GenAI 🟠 Orange)*

Write a Java program that performs the sum of two 2D matrices of the same size.

Exercice 9 *(GenAI 🟠 Orange)*

Given a square 2D array (matrix), write a Java program to rotate it 90 degrees clockwise. Display the rotated matrix as output.

Exercice 10 *(GenAI 🟠 Orange)*

Write a Java program that checks if a given square 2D array is symmetric. A matrix is symmetric if it is equal to its transpose. Display whether the matrix is symmetric or not.

Exercice 11 *(GenAI 🟠 Orange)*

Generate and display Pascal's Triangle as a 2D array in Java. Each element in the triangle is the sum of the two elements directly above it.

Exercise 12 *(GenAI 🟠 Orange)*

Solve as many exercises on paper only. You can check your solution against your running code solution when you are done.

Write down any mistakes you have made so you can have a checklist of common mistakes to lookout for ! (for example, take particular care to indentation and loop conditions)

Bonus - Exercice 13 *(GenAI 🟠 Orange)*

Write a Java program to print a given matrix in a spiral order, starting from the top-left corner and moving clockwise.

Homework

Finish all the exercises

Create flashcards for the following terms:

2D array

Nested loops

Break

Continue

Coding mistakes that you made and that you should watch out for