JAVA Conditional Instructions

Objectives

- Recap previous session
- Introduction to reading from the standard input
- Introduction to the `boolean` data type
- Boolean operators
- Making decisions
- Homework exercises
- Guidelines

Recap previous session

- What do you understand by calling a method?
- What is a method parameter?
- Can we have two methods with the same name, same number and type of parameters but different type?
- Can we have two methods with the same name but different type and/or numbers of parameters?
- What is `method overloading`?
- Can you give some examples of method overloading from the String class? If not, keep it as an excercise.

Introduction to reading from the standard input

- By standard input, we mean the terminal. And reading from the standard input, simply means that we want to be able to introduce values in the terminal such that the program will be able to use them.
- Before explaining, let's see how this can be done and then we will explain everything line by line:

```java
import java.util.Scanner;

public class App {

    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);

        System.out.println("Enter an integer number:");
        int number = in.nextInt();
        System.out.println("The integer number entered is: " +  number);

        System.out.println("Enter a double number:");
        double number2 = in.nextDouble();
        System.out.println("The double number entered is: " + number2);

        System.out.println("Enter a word:");
        String word = in.next();
        System.out.println("The word entered is: " + word);
        }

    }
```

  - The first line which is very new to you is this: `import java.util.Scanner;`
    - We need this because the functionality that enables us to read from the standard input, resides in a different package, namely the `java.util` package
    - Now if you recall, a package is simply a way to structure you code and classes and JAVA creators decided to put classes with similar functionality in the same package. This means that there are a lot of packages in the JAVA framework but no worry about it, you will see that our IDE can take care of it by itself
    - Now you might wonder, `well, String is also a class and we haven't used any import for it. Also for the Math class`. The answer is that we have a package, called `java.lang` package which contains the classes that most of the JAVA application will use and that's why, it is imported by default.
  - The next interesting line is the one in which we declare a variable of type Scanner and then we initialize it with the keyword `new: `Scanner in = new Scanner(System.in);`
    - Also this way of initializing is fresh for you but it will become a habbit in the next sessions when we will learn about creating our own classes and will also learn about constructors. Until then, just try to use this line exactly as it is whenever you need to read data from the standard input.
  - Now that we have a variable of type `Scanner`, which we can also call it an object, all that we have to do, is to call the method specific to the data type that I want to read from the terminal.
  - For example, if I want to read an integer number, I have to call the `in.nextInt()` method which will read an `int` number and it will return to the caller.
  - You can see in the example, how can we read numbers and text from the standard input, a.k.a terminal.
  - This is pretty much everything that you should know in order to be able to follow the examples and exercises from this session.

Introduction to the `boolean` data type

- For evaluating conditions, JAVA uses the so called `boolean variables`
- The boolean type can only hold two values: `true` or `false`
- We can obtain a boolean variable when evaluating an expression to see if that is `true` or `false`.
- For example, if we want to check if an integer variable has the value 10 we do something like:

```
int number = 9;
boolean isTen = (number == 10);
```

  - One way to make a comparison is to use the double equal sign (`==`).
  - If you remember from our previous lessons, the way in which this expression gets evaluated is as follows:
    - first it checks if the number is equal or not with 10

    - After that, due to the fact that our number is 9 and not 10, the comparison will return the value `false`
    - The boolean variable `isTen` will store the value `false`

Note: Single equal sign means assignment, double equal sign means comparison

Boolean operators

- Boolean operators are pretty much the same with logic operators from math, with slight modifications for some of them:
- `Greater than` operator:

```
    int a = 10;
    int b = 9;
    boolean result = a > b // true because 10 is greater than 9
```

- `Smaller than` operator:

```
    int a = 10;
    int b = 9;
    boolean result = a < b // false because 10 is not smaller than 9
```

- `Smaller or equal` operator:

```
    int a = 10;
    int b = 9;
    boolean result = b <= a // true because 9 is smaller than 10 thus satisfying the requirement of being smaller or equal.
```

- `Greater or equal` operator:

```
        int a = 10;
        int b = 9;
        boolean result = a >= b // true because 10 is greater than 9, thus satisfying the requirement of being greater or equal.
```

- `Equals to` operator:
    - We have already met this operator in the beginning of this section

```
    int a = 10;
    int b = 9;
    boolean result = a == b // false because 10 is not equal to 9
```

- `Not equals to` operator:

  ```
      int a = 10;
      int b = 9;
      boolean result = a != b // true because 10 is not equal to 9. We can
  also read it as "different than"
  ```

- `Logical or` operator:

  - it is denoted by two pipe symbols: `||`
  - It can be read as `OR`

  ```
      int a = 10;
      int b = 9;
      /*
      * It is true because even though a is not smaller than 5, the logical or
  operator requires at least one of the sides of it to evaluate to true
      */
      boolean result = a < 5 || b <= 9;
  ```

  - Also not that logical or is a short circuit operator. This means that if the first side of it (the left handside) evaluates to true, it will not go to evaluate the right handside.
  - This is because, from its definition, the logical or needs at least one side of it to evaluate to true.

- `Logical and` operator:

  - It is denoted by two and symbols `&&`
  - It can be simply read as `and`
  - The difference between this operator and the `or` operator is the fact that it requires both sides to evaluate to true
  - It is also a short circuit operator due to the fact that if the left handside evaluates to false, it will skip evaluating the right handside.

  ```
      int a = 10;
      int b = 9;
      /*
      * It is false because a is not smaller than 5 and even though the right
  handside evaluates to true, the logical and
      * requires bot sides to have expressions that evaluates to true.
      */
      boolean result = a < 5 && b <= 9;
  ```

- Just to understand these two operators, take a look at the table below which summarizes when these operators evaluates to true or false:

a	b	`a && b`	`a || b`
true	true	true	true
true	false	false	true
false	true	false	true
false	false	false	false

- If it is harder for you to understand this table, don't worry, we will have it explained in the class and also, we can come back to it as many times as we need

Making decisions

- The ability of comparing values of expressions is one of the most important features of a programming language.
- By `decision making` we mean the ability of choosing to execute one set of program statements rather than another, based on the date.
- This is pretty similar with the decisions that we take in the real life:

```
if it is raining outside
    then take an umbrella
else
    just wear a T-Shirt and sunglasses
```

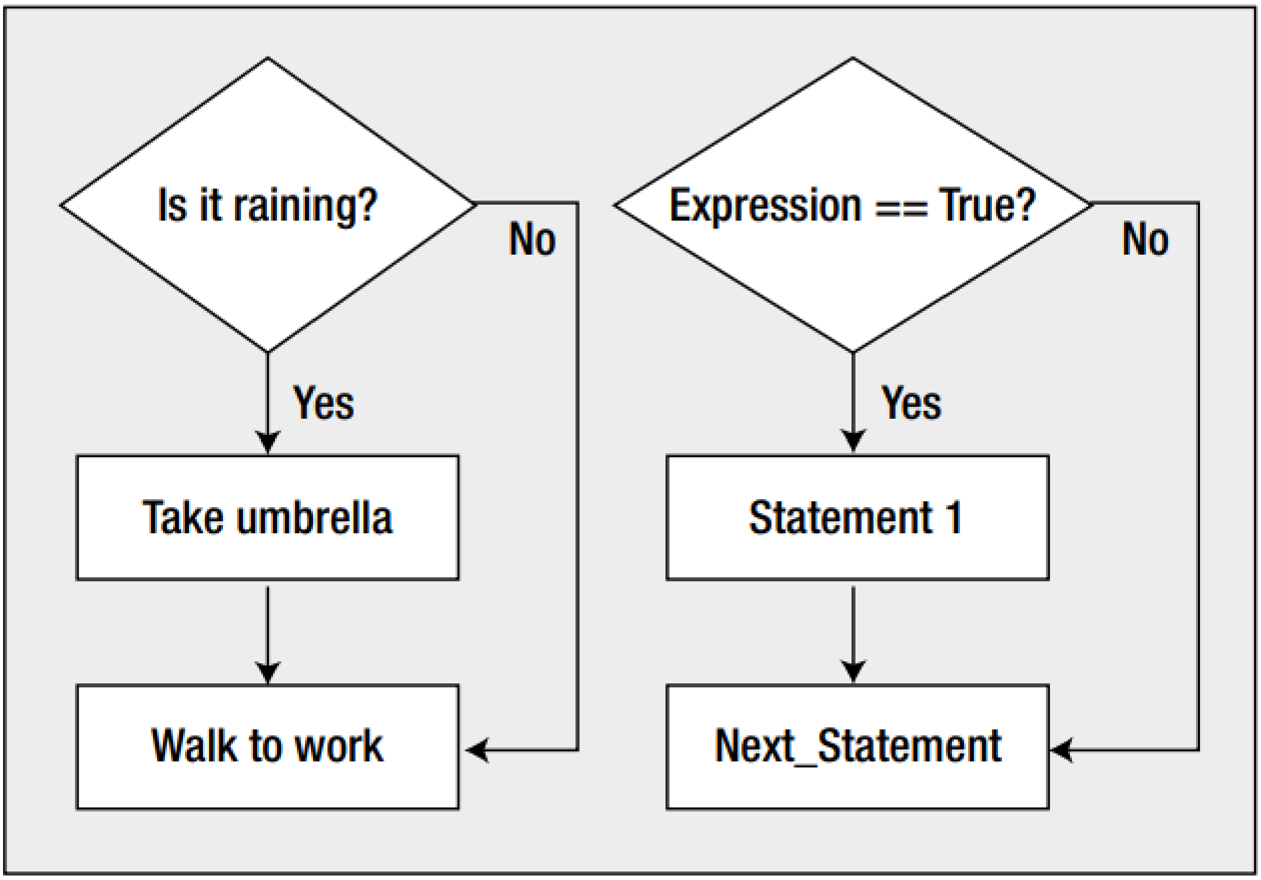
- In JAVA, decisions are made using the `if`, `else`, `else-if` keywords. We will analyse them one by one and you will see how simply it is to use them.

The basic `if` statement

- In JAVA, one of the simplest statements for making decisions is the `if` statement
- The snippet below compares your height with someone else and prints a different sentence depending on the results:

```
public class App {

    public static void main(String[] args) {

        int bogdanHeight = 172;
        int marianHeight = 177;

        if (bogdanHeight > marianHeight) {
            System.out.println("Bogdan is Taller");
        }

        if(marianHeight > bogdanHeight) {
            System.out.println("Marian is Taller");
        }
        if(marianHeight == bogdanHeight) {
            System.out.println("These children have the same height");
        }

    }

}
```

  - There are three `if` statements here
  - The boolean expression for the comparison in each case, appears between the parantheses that immediately follow the keyword `if`
  - If the result of a comparison is `true`, the statement immediately after the `if` will be executed
  - If the result of a comparison is `false`, the statement following the `if` will be skipped
- In the image below, we can see the process of making decisions, illustrated wirth a diagram:



Class Exercises = if statement

1. Create a JAVA program which asks the user to enter a number between 1 and 10 and then output how will the entered number relate to 5 or 6.
   - Sample Input: 5
   - Sample Output: You entered 5 which is smaller than 6
   - Solution:

```
import java.util.Scanner;

public class App {
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        System.out.println("Enter an integer number between 1 and 10:");
        int number = in.nextInt();
        if(number > 5) {
            System.out.println("You entered " + number + " which is greater than 5");
        }

        if(number < 6) {
            System.out.println("You entered " + number + " which is smaller than 6");
        }
    }

}
```

Class exercises - IF-Else statements

1. Create a JAVA program which will solve quadratic equations by reading the values of the equations from the Standard Input:
   - Sample Input:
   - Sample Output:
   - Solution:

```
    import java.util.Scanner;

    public class App {

        public static void main(String[] args) {
            Scanner in = new Scanner(System.in);

            System.out.print("Enter value for a: ");
            double a = in.nextDouble();


            System.out.print("Enter value for b: ");
            double b = in.nextDouble();

            System.out.print("Enter value for c: ");
            double c = in.nextDouble();

            double result = b*b - 4.0 * a * c;
            if(result > 0.0) {
                double r1 = (-b + Math.sqrt(b * b - 4 * a * c))/2 * a;
                double r2 = (-b - Math.sqrt(b * b - 4 * a * c))/2 * a;
                System.out.println("The roots are "+r1+ " and " + r2);
            } else if(result == 0.0) {
                double r1 = -b / (2.0 * a);
                System.out.println("We only have one root: " + r1);
            } else {
                System.out.println("The equation has no real roots");
            }

        }

    }
```

Homework exercises

1. Create a JAVA program which evaluates the following expressions:
    - 10 > 4
    - 123 >= 123
    - 23 < 22 || 21 != 20
    - 23 < 22 && 21 != 20
    - 10 != 10
    - 10 == 10
    - Note: before running the program, try to think what will be the result. Also, for a better visualisation of the results, try to assign each number from the expression to variables and also store the result in a boolean variable. In the end, simply call `System.out.println` and pass the result as parameter.
2. Write a JAVA program which reads a number from the Standard Input and then prints whether it is negative or positive
    - Sample Input: 35
    - Sample Output: The number 35 is positive
3.

Guidelines

- Even though, most of the time, the precedence of the operator matches the one from Math, we should always make a habbit of using paranthesis to avoid subtle bugs.