เรื่องที่ 7 Overloading Method และ Overriding Method

ENGCE174 การเขียนโปรแกรมเชิงวัตถุ (Object-oriented programming)

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Java Methods

A method is a block of code which only runs when it is called.

You can pass data, known as parameters, into a method.

Methods are used to perform certain actions, and they are also known as functions.

Why use methods? To reuse code: define the code once, and use it many times.

Create a Method

A method must be declared within a class. It is defined with the name of the method, followed by parentheses (). Java provides some pre-defined methods, such as `System.out.println()`, but you can also create your own methods to perform certain actions:

- `myMethod()` is the name of the method
- `static` means that the method belongs to the Main class and not an object of the Main class. You will learn more about objects and how to access methods through objects later in this tutorial.
- `void` means that this method does not have a return value. You will learn more about return values later in this chapter

```
public class Main {
  static void myMethod() {
    // code to be executed
  }
}
```

Call a Method

To call a method in Java, write the method's name followed by two parentheses () and a semicolon;

In the following example, `myMethod()` is used to print a text (the action), when it is called:

Inside `main`, call the `myMethod()` method:

```
public class Main {
  static void myMethod() {
    System.out.println("I just got executed!");
  }

  public static void main(String[] args) {
    myMethod();
  }
}

// Outputs "I just got executed!"
```

Call a Method

A method can also be called multiple times:

In the next chapter, Method Parameters, you will learn how to pass data (parameters) into a method.

```
public class Main {
  static void myMethod() {
    System.out.println("I just got executed!");
  }

  public static void main(String[] args) {
    myMethod();
    myMethod();
    myMethod();
  }
}

// I just got executed!
// I just got executed!
// I just got executed!
```

Test Yourself With Exercises

Insert the missing part to call `myMethod` from `main`.

```
static void myMethod() {
  System.out.println("I just got executed!");
}

public static void main(String[] args) {
  ;
}
```

Parameters and Arguments

Information can be passed to methods as parameter. Parameters act as variables inside the method.

Parameters are specified after the method name, inside the parentheses. You can add as many parameters as you want, just separate them with a comma.

The following example has a method that takes a `String` called fname as parameter. When the method is called, we pass along a first name, which is used inside the method to print the full name:

When a parameter is passed to the method, it is called an argument. So, from the example above: `fname` is a parameter, while `Liam`, `Jenny` and `Anja` are arguments.

```
public class Main {
  static void myMethod(String fname) {
    System.out.println(fname + " Refsnes");
  }

  public static void main(String[] args) {
    myMethod("Liam");
    myMethod("Jenny");
    myMethod("Anja");
  }
}
// Liam Refsnes
// Jenny Refsnes
// Anja Refsnes
```

Multiple Parameters

You can have as many parameters as you like:

Note that when you are working with multiple parameters, the method call must have the same number of arguments as there are parameters, and the arguments must be passed in the same order.

```
public class Main {
  static void myMethod(String fname, int age) {
    System.out.println(fname + " is " + age);
  }

  public static void main(String[] args) {
    myMethod("Liam", 5);
    myMethod("Jenny", 8);
    myMethod("Anja", 31);
  }
}

// Liam is 5
// Jenny is 8
// Anja is 31
```

Return Values

The `void` keyword, used in the examples above, indicates that the method should not return a value. If you want the method to return a value, you can use a primitive data type (such as `int`, `char`, etc.) instead of `void`, and use the `return` keyword inside the method:

```
public class Main {
  static int myMethod(int x) {
    return 5 + x;
  }

  public static void main(String[] args) {
    System.out.println(myMethod(3));
  }
}
// Outputs 8 (5 + 3)
```

Return Values

This example returns the sum of a method's two parameters:

```
public class Main {
  static int myMethod(int x, int y) {
    return x + y;
  }

  public static void main(String[] args) {
    System.out.println(myMethod(5, 3));
  }
}
// Outputs 8 (5 + 3)
```

Return Values

You can also store the result in a variable (recommended, as it is easier to read and maintain):

```
public class Main {
  static int myMethod(int x, int y) {
    return x + y;
  }

  public static void main(String[] args) {
    int z = myMethod(5, 3);
    System.out.println(z);
  }
}
// Outputs 8 (5 + 3)
```

A Method with If...Else

It is common to use `if...else` statements inside methods:

```
public class Main {

  // Create a checkAge() method with an integer variable called age
  static void checkAge(int age) {

    // If age is less than 18, print "access denied"
    if (age < 18) {
      System.out.println("Access denied - You are not old enough!");

    // If age is greater than, or equal to, 18, print "access granted"
    } else {
      System.out.println("Access granted - You are old enough!");
    }

  }

  public static void main(String[] args) {
    checkAge(20); // Call the checkAge method and pass along an age of 20
  }
}

// Outputs "Access granted - You are old enough!"
```

Test Yourself With Exercises

Add a `fname` parameter of type `String` to `myMethod`, and output "John Doe":

```
static void myMethod(          ) {
  System.out.println(      + " Doe");
}

public static void main(String[] args) {
  myMethod("John");
}
```

Method Overloading

With method overloading, multiple methods can have the same name with different parameters:

```
int myMethod(int x)
float myMethod(float x)
double myMethod(double x, double y)
```

Method Overloading

Consider the following example, which has two methods that add numbers of different type:

```
static int plusMethodInt(int x, int y) {
  return x + y;
}

static double plusMethodDouble(double x, double y) {
  return x + y;
}

public static void main(String[] args) {
  int myNum1 = plusMethodInt(8, 5);
  double myNum2 = plusMethodDouble(4.3, 6.26);
  System.out.println("int: " + myNum1);
  System.out.println("double: " + myNum2);
}
```

Method Overloading

Instead of defining two methods that should do the same thing, it is better to overload one.

In the example below, we overload the `plusMethod` method to work for both `int` and `double`:

Note: Multiple methods can have the same name as long as the number and/or type of parameters are different.

```
static int plusMethod(int x, int y) {
  return x + y;
}

static double plusMethod(double x, double y) {
  return x + y;
}

public static void main(String[] args) {
  int myNum1 = plusMethod(8, 5);
  double myNum2 = plusMethod(4.3, 6.26);
  System.out.println("int: " + myNum1);
  System.out.println("double: " + myNum2);
}
```

Java Polymorphism

Polymorphism means "many forms", and it occurs when we have many classes that are related to each other by inheritance.

Like we specified in the previous chapter; Inheritance lets us inherit attributes and methods from another class. Polymorphism uses those methods to perform different tasks. This allows us to perform a single action in different ways.

For example, think of a superclass called `Animal` that has a method called `animalSound()`. Subclasses of Animals could be Pigs, Cats, Dogs, Birds - And they also have their own implementation of an animal sound (the pig oinks, and the cat meows, etc.):

Java Polymorphism

```
class Animal {
  public void animalSound() {
    System.out.println("The animal makes a sound");
  }
}

class Pig extends Animal {
  public void animalSound() {
    System.out.println("The pig says: wee wee");
  }
}

class Dog extends Animal {
  public void animalSound() {
    System.out.println("The dog says: bow wow");
  }
}
```

Remember from the Inheritance chapter that we use the `extends` keyword to inherit from a class.

Java Polymorphism

Now we can create `Pig` and `Dog` objects and call the `animalSound()` method on both of them:

Why And When To Use "Inheritance" and "Polymorphism"?

- It is useful for code reusability: reuse attributes and methods of an existing class when you create a new class.

```
class Animal {
  public void animalSound() {
    System.out.println("The animal makes a sound");
  }
}

class Pig extends Animal {
  public void animalSound() {
    System.out.println("The pig says: wee wee");
  }
}

class Dog extends Animal {
  public void animalSound() {
    System.out.println("The dog says: bow wow");
  }
}

class Main {
  public static void main(String[] args) {
    Animal myAnimal = new Animal();  // Create a Animal object
    Animal myPig = new Pig();  // Create a Pig object
    Animal myDog = new Dog();  // Create a Dog object
    myAnimal.animalSound();
    myPig.animalSound();
    myDog.animalSound();
  }
}
```