

Lab: Polymorphism

This document defines the lab for ["Java OOP" course @ Software University](#). Please submit your solutions (source code) of all below described problems in [Judge](#).

1. Math Operation

Create a class **MathOperation**, which should have method **add()**. Method **add()** have to be invoked with **two**, **three** or **four** **Integers**.

You should be able to use the class like this:

Main.java
<pre>public static void main(String[] args) throws IOException { MathOperation math = new MathOperation(); System.out.println(math.add(2, 2)); System.out.println(math.add(3, 3, 3)); System.out.println(math.add(4, 4, 4, 4)); }</pre>

Examples

Input	Output
	4
	9
	16

Solution

Class **MathOperation** should look like this:

```
public class MathOperation {

    public int add(int a, int b) {
        return a + b;
    }

    public int add(int a, int b, int c) {
        return a + b + c;
    }

    public int add(int a, int b, int c, int d) {
        return a + b + c + d;
    }

}
```

2. Shapes

Create class hierarchy, starting with abstract class **Shape**:

- **Fields:**
 - **perimeter : Double**
 - **area : Double**
- **Encapsulation for this fields**

- **Abstract methods:**
 - `calculatePerimeter()`
 - `calculateArea()`

Extend Shape class with two children:

- **Rectangle**
- **Circle**

Each of them needs to have:

- **Fields:**
 - For Rectangle**
 - **height : Double**
 - **width : Double**
 - For Circle**
 - **radius : Double**
- **Encapsulation for this fields**
- **Public constructor**
- **Concrete methods for calculations (perimeter and area)**

3. Animals

Create a class **Animal**, which holds two fields:

- **name: String**
- **favouriteFood: String**

Animal has one abstract method **explainSelf(): String**.

You should add two new classes - **Cat** and **Dog**. **Override** the **explainSelf()** method by adding concrete animal sound on a new line. (Look at examples below)

You should be able to use the class like this:

Main	
<pre>public static void main(String[] args) { Animal cat = new Cat("Oscar", "Whiskas"); Animal dog = new Dog("Rocky", "Meat"); System.out.println(cat.explainSelf()); System.out.println(dog.explainSelf()); }</pre>	

Examples

Input	Output
	I am Oscar and my favourite food is Whiskas MEEOW I am Rocky and my favourite food is Meat DJAAF

Solution

```
public abstract class Animal {  
    private String name;  
    private String favouriteFood;  
  
    protected Animal(String name, String favouriteFood) {  
        this.setName(name);  
        this.setFavouriteFood(favouriteFood);  
    }  
  
    public String explainSelf() {  
        return String.format("I am %s and my favourite food is %s",  
            this.getName(),  
            this.getFavouriteFood());  
    }  
}
```

```
public class Cat extends Animal {  
    public Cat(String name, String favouriteFood) {  
        super(name, favouriteFood);  
    }  
  
    @Override  
    public String explainSelf() {  
        return String.format("%s%nMEEOW", super.explainSelf());  
    }  
}
```