Lab: Polymorphism

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

1. Math Operation

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

You should be able to use the class like this:

Main.java

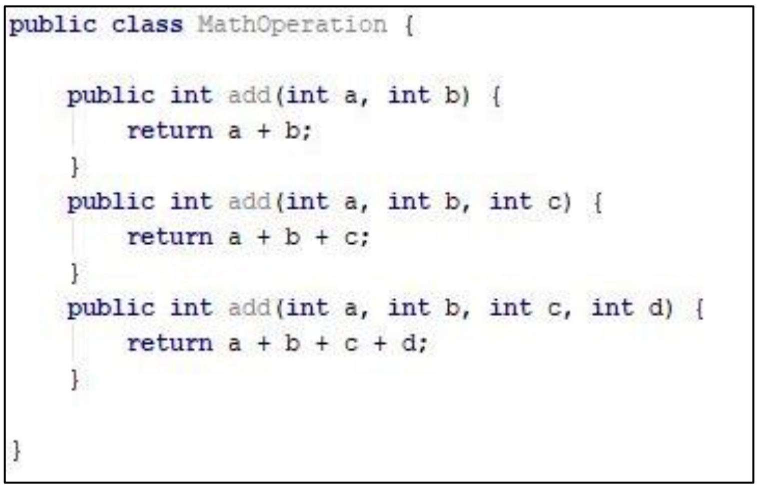
```java
public static void main(String[] args) throws IOException {
    MathOperation math = new MathOperation();
    System.out.println(math.add(2, 2));
    System.out.println(math.add(3, 3, 3));
    System.out.println(math.add(4, 4, 4, 4));
}
```

Examples

Input	Output
	4 9 16

Solution

Class **`MathOperation`** should look like this:



```java
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 these 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 these fields**
- **Public constructor**
- **Concrete methods for calculations (perimeter and area)**

3. Animals

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

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

The **`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

```
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());
}
```

Examples

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

Solution

```java
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());
    }
```

```java
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());
    }
}
```