Experiment No. 06
Experiment Name: Experiment with OOP Features

Course title: Programming Language II(Java) Lab
Course code:
Spring 2025

Date of Submission:

Submitted to-

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Hw 1: Create a Student class with private fields:

name,

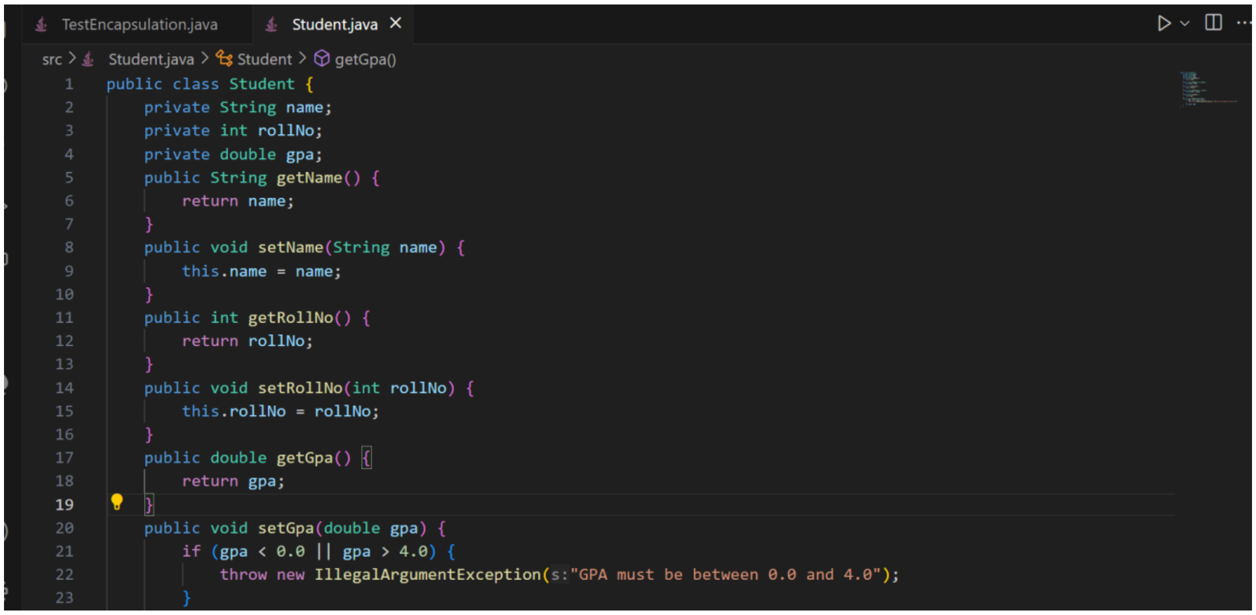
rollNo,

gpa

Provide public getters and setters.

Validate that gpa cannot be negative or over 4.0.

Student.java



```
public class Student {
    private String name;
    private int rollNo;
    private double gpa;
    public String getName() {
        return name;
    }
    public void setName(String name) {
        this.name = name;
    }
    public int getRollNo() {
        return rollNo;
    }
    public void setRollNo(int rollNo) {
        this.rollNo = rollNo;
    }
    public double getGpa() {
        return gpa;
    }
    public void setGpa(double gpa) {
        if (gpa < 0.0 || gpa > 4.0) {
            throw new IllegalArgumentException(s:"GPA must be between 0.0 and 4.0");
        }
```

```
public class Student {
    private String name;
    private int rollNo;
    private double gpa;
    public String getName() {
        return name;
    }
    public void setName(String name) {
        this.name = name;
    }
    public int getRollNo() {
        return rollNo;
    }
    public void setRollNo(int rollNo) {
        this.rollNo = rollNo;
    }
    public double getGpa() {
        return gpa;
    }
    public void setGpa(double gpa) {
        if (gpa < 0.0 || gpa > 4.0) {
            throw new IllegalArgumentException("GPA must be between 0.0 and
4.0");
        }
        this.gpa = gpa;
    }
}
```

TestEncapsulation.java

```
public class TestEncapsulation {
    public static void main(String[] args) {
        Student obj = new Student();
        obj.setName("Arafat");
        obj.setRollNo(51);
        try {
            obj.setGpa(3.5);
        } catch (IllegalArgumentException e) {
            System.out.println(  e.getMessage());
        }
        System.out.println("Student's name: " + obj.getName());
        System.out.println("Student's rollNo: " + obj.getRollNo());
        System.out.println("Student's gpa: " + obj.getGpa());
    }
}
```

Hw 2:

Create a base class Shape with method getArea().

Derive classes

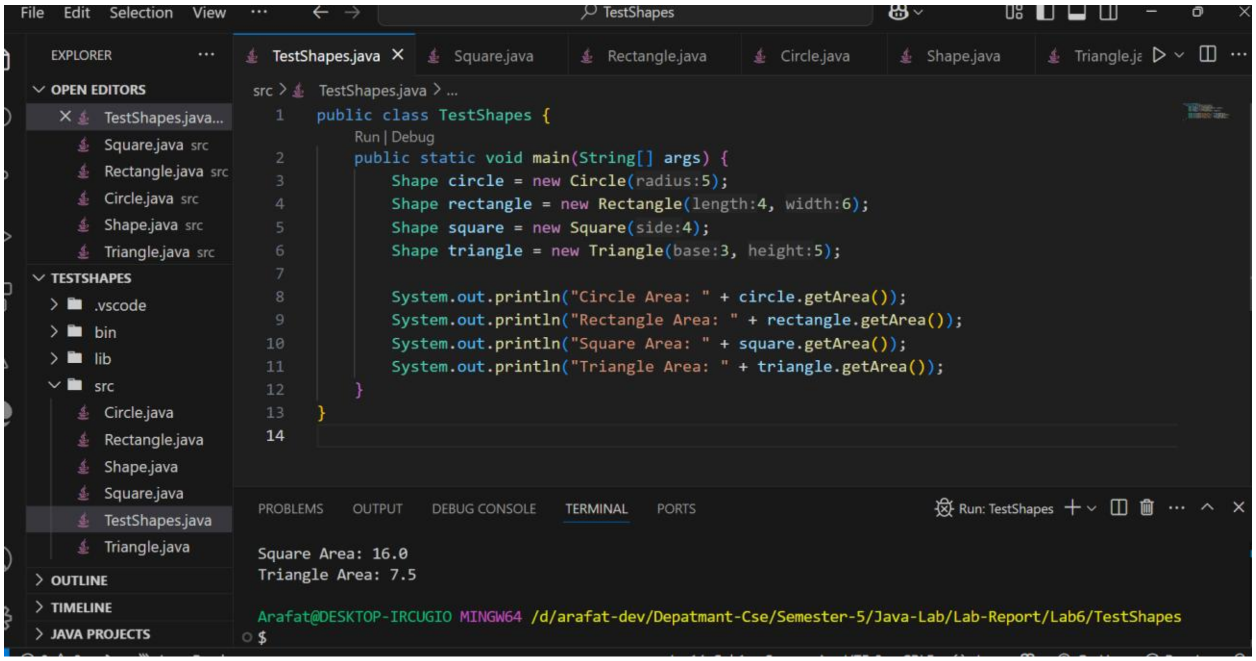
Circle,

Rectangle,

Square, and

Triangle.

Override getArea() appropriately in each subclass.



```
public class TestShapes {
    public static void main(String[] args) {
        Shape circle = new Circle(radius:5);
        Shape rectangle = new Rectangle(length:4, width:6);
        Shape square = new Square(side:4);
        Shape triangle = new Triangle(base:3, height:5);

        System.out.println("Circle Area: " + circle.getArea());
        System.out.println("Rectangle Area: " + rectangle.getArea());
        System.out.println("Square Area: " + square.getArea());
        System.out.println("Triangle Area: " + triangle.getArea());
    }
}
```

```
Square Area: 16.0
Triangle Area: 7.5

Arafat@DESKTOP-IRCUGIO MINGW64 /d/arafat-dev/Depatmant-Cse/Semester-5/Java-Lab/Lab-Report/Lab6/TestShapes
$
```

Shape.java

```java
public class Shape {
    public double getArea() {
        return 0.0;
    }
}
```

Circle.java

```java
public class Circle extends Shape {

    private double radius;

    public Circle(double radius) {
        this.radius = radius;
    }

    @Override
    public double getArea() {
        return Math.PI * radius * radius;
    }
}
```

Rectangle.java

```java
public class Rectangle extends Shape {
    private double length;
    private double width;

    public Rectangle(double length, double width) {
        this.length = length;
        this.width = width;
    }

    @Override
    public double getArea() {
        return length * width;
    }
}
```

Square.java

```java
public class Square extends Shape {
    private double side;

    public Square(double side) {
        this.side = side;
    }

    @Override
    public double getArea() {
        return side * side;
    }
}
```

Triangle.java

```java
public class Triangle extends Shape {
    private double base;
    private double height;

    public Triangle(double base, double height) {
        this.base = base;
        this.height = height;
    }

    @Override
    public double getArea() {
        return 0.5 * base * height;
    }
}
```

TestShapes.java

```java
public class TestShapes {
    public static void main(String[] args) {
        Shape circle = new Circle(5);
        Shape rectangle = new Rectangle(4, 6);
        Shape square = new Square(4);
        Shape triangle = new Triangle(3, 5);

        System.out.println("Circle Area: " + circle.getArea());
        System.out.println("Rectangle Area: " + rectangle.getArea());
        System.out.println("Square Area: " + square.getArea());
        System.out.println("Triangle Area: " + triangle.getArea());
    }
}
```

Hw 3: Create a class Animal with a method makeSound().

Create subclasses

Dog,

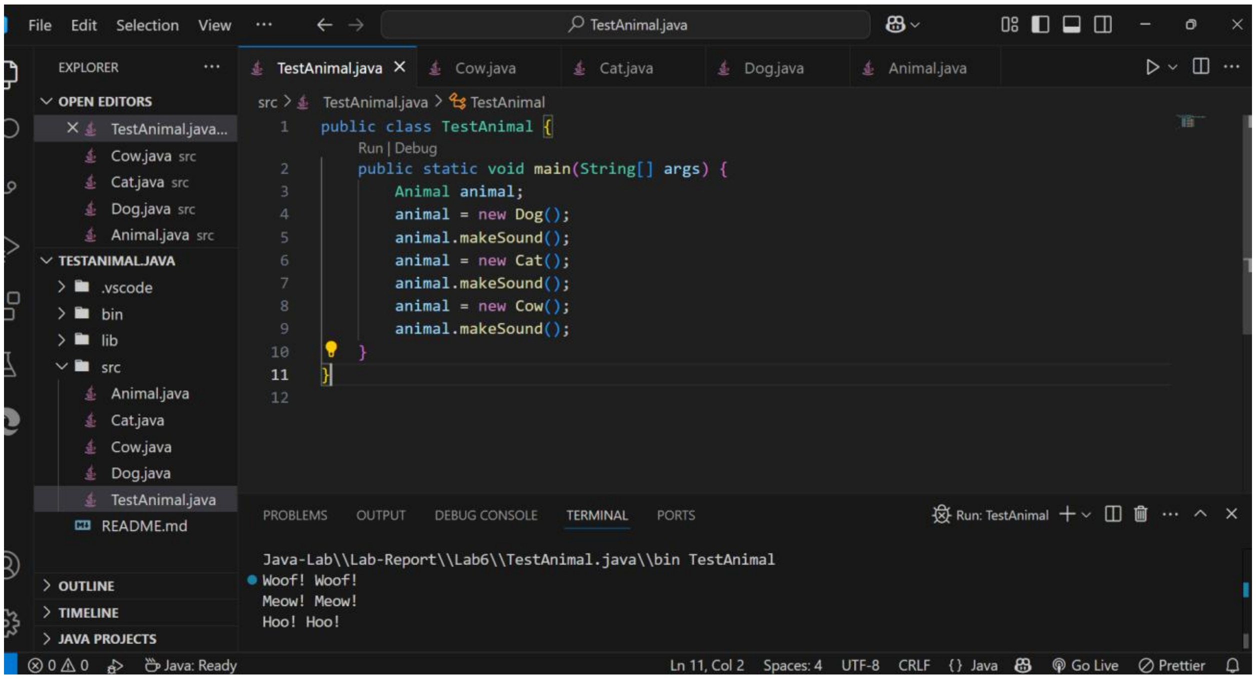
Cat, and

Cow,

override makeSound() to print unique sounds.

Use dynamic method dispatch to demonstrate

polymorphism.



```java
public class TestAnimal {
    public static void main(String[] args) {
        Animal animal;
        animal = new Dog();
        animal.makeSound();
        animal = new Cat();
        animal.makeSound();
        animal = new Cow();
        animal.makeSound();
    }
}
```

```
Java-Lab\\Lab-Report\\Lab6\\TestAnimal.java\\bin TestAnimal
Woof! Woof!
Meow! Meow!
Hoo! Hoo!
```

Animal.java

```java
public class Animal {
    public void makeSound() {
        System.out.println("Some generic animal sound");
    }
}
```

Dog.java

```java
public class Dog extends Animal {
    @Override
    public void makeSound() {
        System.out.println("Woof! Woof!");
    }
}
```

Cat.java

```java
public class Cat extends Animal {
    @Override
    public void makeSound() {
        System.out.println("Meow! Meow!");
    }
}
```

Cow.java

```java
public class Cow extends Animal {
    @Override
    public void makeSound() {
        System.out.println("Hoo! Hoo!");
    }
}
```

TestAnimal.java

```java
public class TestAnimal {
    public static void main(String[] args) {
        Animal animal;
        animal = new Dog();
        animal.makeSound();
        animal = new Cat();
        animal.makeSound();
        animal = new Cow();
        animal.makeSound();
    }
}
```