



# **SOLID-PRINCIPLES ASSIGNMENT**

**INSTRUCTOR: MUSKAN GUPTA**

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## Question:

Identify how the following code violates the Liskov Substitution Principle? Also, correct the code in order it to be correct as per the Liskov Substitution Principle.

```
class Rectangle {  
    int m_width;  
    int m_height;  
  
    public void setWidth(int width){  
        m_width = width;  
    }  
}
```

```
public void setHeight(int h) {
```

```
    m_height = h;
```

```
}
```

```
public int getWidth() {
```

```
    return m_width;
```

```
}
```

```
public int getHeight() {
```

```
    return m_height;
```

```
}
```

```
public int getArea() {
```

```
    return m_width * m_height;
```

```
}
```

```
}
```

```
class Square extends Rectangle {
```

```
    public void setWidth (int width) {
```

```
        m_width = width;
```

```
        m_height = width;
```

```
    }
```

```
    public void setHeight (int height) {
```

```
        m_width = height;
```

```
        m_height = height;
```

```
    }
```

```
}
```

## Problem in the Code->

The above code violates the Liskov Substitution Principle because a square is a special case of a rectangle, but the Square class does not behave like a Rectangle in terms of its setters. Specifically, the Square class violates the Liskov Substitution Principle because it alters the behavior of the base class (Rectangle) in a way that is incompatible with the expectations of a Rectangle.

The `setWidth` and `setHeight` methods in the Square class override the corresponding methods in the base class, but they change the behavior of a Square object in a way that is incompatible with the behavior of a Rectangle object. Specifically, if we set the width and height of a Rectangle object separately, we can get different values for `getWidth()` and `getHeight()`. But if we set the width or height of a Square object, both properties must always have the same value.

# Output After Fixing Code: 1

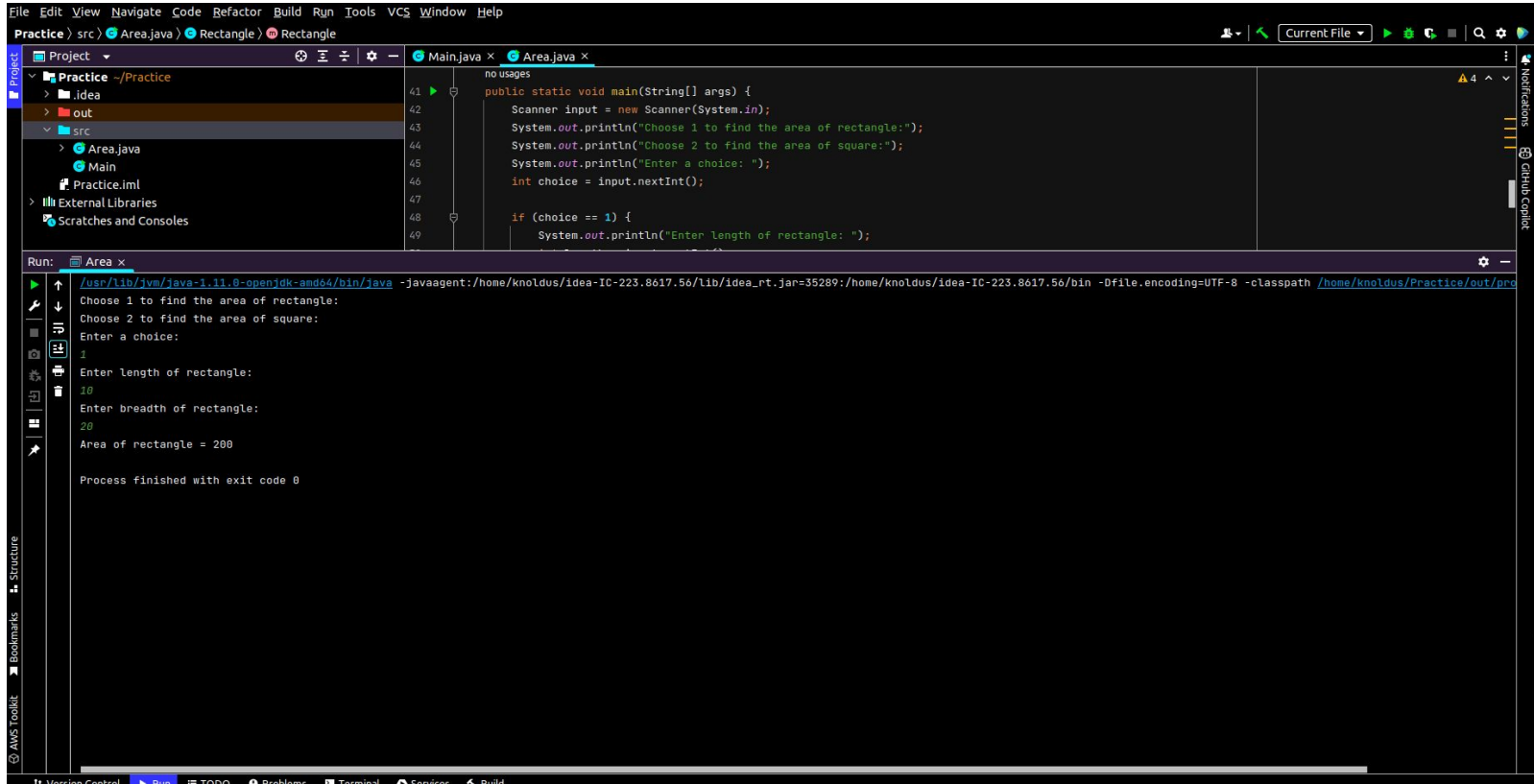
The screenshot shows an IDE with a project named 'Practice'. The 'src' folder contains 'Area.java' and 'Main.java'. The 'out' folder is also visible. The 'Area.java' file is open, showing the following code:

```
52 int breadth = input.nextInt();
53 Rectangle dimensions = new Rectangle(length, breadth);
54 int area = dimensions.getArea();
55 System.out.println("Area of rectangle is: " + area);
56 } else if (choice == 2) {
57     System.out.println("Enter length of side of square: ");
58     int side = input.nextInt();
59     Square squareSide = new Square(side);
60     int area = squareSide.getArea();
61     System.out.println("Area of square is: " + area);
62 } else {
63     System.out.println("Wrong choice!! Only choose 1 or 2.");
64 }
```

The 'Run' window shows the output of the program:

```
Run: Area x
/usr/lib/jvm/java-11.0-openjdk-amd64/bin/java -javaagent:/home/knoldus/idea-IC-223.8617.56/lib/idea_rt.jar=35961:/home/knoldus/idea-IC-223.8617.56/bin -Dfile.encoding=UTF-8 -classpath /home/knoldus/Practice/out/production
Choose 1 to find the area of rectangle:
Choose 2 to find the area of square:
Enter a choice to calculate required area:
2
Enter length of side of square:
10
Area of square is: 100
Process finished with exit code 0
```

# Output After fixing code: 2



The screenshot displays an IDE interface with the following components:

- Project Explorer (Left):** Shows a project named 'Practice' with a source folder 'src' containing 'Area.java' and 'Main'. There is also an 'out' folder.
- Code Editor (Center):** Displays the code for 'Area.java'. The code is as follows:

```
41 // no usages
42 public static void main(String[] args) {
43     Scanner input = new Scanner(System.in);
44     System.out.println("Choose 1 to find the area of rectangle:");
45     System.out.println("Choose 2 to find the area of square:");
46     System.out.println("Enter a choice: ");
47     int choice = input.nextInt();
48     if (choice == 1) {
49         System.out.println("Enter length of rectangle: ");
```
- Run Console (Bottom):** Shows the execution output for 'Area x'. The output is:

```
Choose 1 to find the area of rectangle:
Choose 2 to find the area of square:
Enter a choice:
1
Enter length of rectangle:
10
Enter breadth of rectangle:
20
Area of rectangle = 200
Process finished with exit code 0
```

***THANK YOU!!***