Polymorphism in OOP

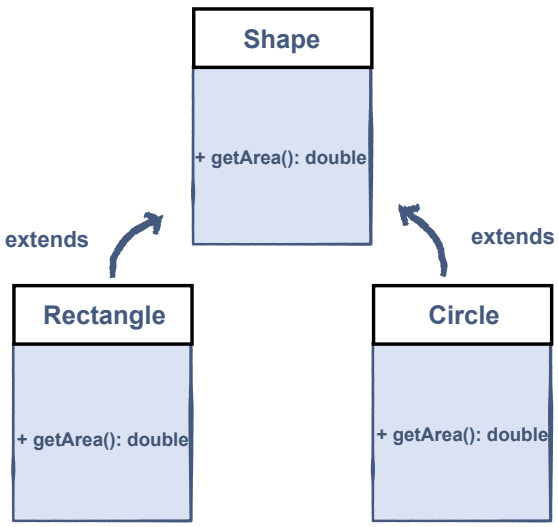
In this lesson, we will be implementing polymorphism using the OOP concepts.

WE'LL COVER THE FOLLOWING

So far, we have learned that we can add new data and methods to a class through inheritance. But what if we want our derived class to inherit a method from the base class and have a different implementation for it? That is when polymorphism, a fundamental concept in the OOP paradigm, comes into play.

Example

Here we consider the example of a **Shape** class, which is the base class while many shapes like *Rectangle and Circle* extending from the base class are derived classes. These classes contain the **getArea()** method which calculates the area for the respective shape.



Implementation

We will be implementing the **Base** class and the **Derived** classes respectively.

Shape Class

The **Shape** class has only one public method called `getArea()`.

Let's look at the implementation of the **Shape** class:

```
// A simple Shape which provides a method to get the Shape's area
class Shape {

  public double getArea(){}

}
```

Rectangle Class

Now, consider the **Rectangle** class which is extended from the *Shape* class. It has two data members, i.e., `width` and `height` and it returns the *Area* of the rectangle by using the **getArea()** method.

Let's look at the implementation of the **Rectangle** class:

```
// A Rectangle is a Shape with a specific width and height
class Rectangle extends Shape {   // derived form Shape class

  // Private data members
  private double width;
  private double height;

  // Constructor
  public Rectangle(double width, double height) {
    this.width = width;
    this.height = height;
  }

  // Public method to calculate Area
  public double getArea() {
    return width * height;
  }

}
```

Circle Class

Now, consider the **Circle** class which is extended from the *Shape* class. It has only one data member, i.e., *radius* and it returns the *Area* of the circle by using the **getArea()** method.

Let's look at the implementation of the **Circle** class:

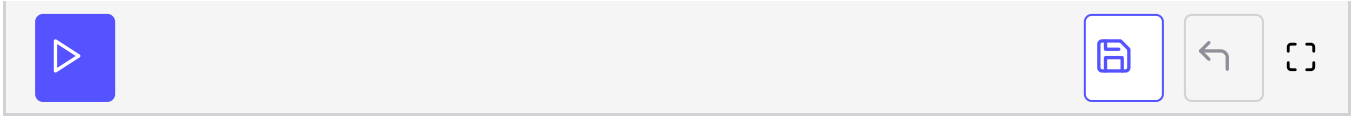
```
// A Circle is a Shape with a specific radius
class Circle extends Shape {

  // Private data member
  private double radius;

  // Constructor
  public Circle(double radius) {
    radius = radius;
  }

  // Public method to calculate Area
  public double getArea() {
    return 3.14 * radius * radius;
  }

}
```

Complete Program

Now, by merging all the classes and calling the **getArea()** method, see what happens:

```
// A sample class Shape which provides a method to get the Shape's area

class Shape {

  public double getArea() {
    return 0;
  }

}

// A Rectangle is a Shape with a specific width and height
class Rectangle extends Shape {   // extended form the Shape class

  private double width;
  private double height;

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

  public double getArea() {
    return width * height;
  }
```

```
}

// A Circle is a Shape with a specific radius

class Circle extends Shape {
  private double radius;

  public Circle(double radius) {
    this.radius = radius;
  }
  public double getArea() {
    return 3.14 * radius * radius;
  }

}


class driver {

  public static void main(String args[]) {
    Shape[] shape = new Shape[2]; // Creating shape array of size 2

    shape[0] = new Circle(2); // creating circle object at index 0
    shape[1] = new Rectangle(2, 2); // creating rectangle object at index 1

    System.out.println("Area of the Circle: " + shape[0].getArea());
    System.out.println("Area of the Rectangle: " + shape[1].getArea());
  }

}
```



Program Execution

In the main function, we have declared a **Shape** class array of size **2** and declared the **Rectangle** and the **Circle** class objects at index **0** and **1** respectively. Now the `getArea()` method returns the area of the respective shape. This is **Polymorphism.**

In the next lesson, we'll be learning about the process of **method overriding**.