Polymorphism Using Inheritance

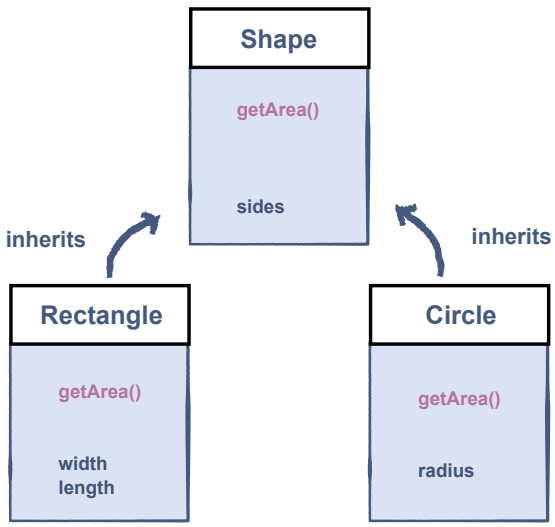
In this lesson, we will be implementing polymorphism using the OOP concepts.

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 derived classes inherit the `getArea()` method, and provide a shape-specific implementation, which calculates its area.



Rectangle and Circle inherit from Shape

Implementation

We will be implementing the **parent class** first, followed by the **child classes**.

Shape Class

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

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

```
class Shape:
    def __init__(self)
    self.sides = 0

    def getArea(self):
        pass
```

Rectangle Class

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

```
# Rectangle IS A Shape with a specific width and height
class Rectangle(Shape):  # derived form Shape class
    # initializer
    def __init__(self, width, height):
        self.width = width
        self.height = height
        self.sides = 4

    # method to calculate Area
    def getArea(self):
        return (self.width * self.height)
```

The `Rectangle` class is extended from the `Shape` class. It inherits the `sides` property from the `Shape` class and defines new properties, `width` and `height`. The *method* `getArea()` returns the area of the rectangle.

Circle Class

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

```
# Circle IS A Shape with a specific radius
class Circle(Shape):  # derived form Shape class
    # initializer
    def __init__(self, radius):
```

```
        self.radius = radius
        self.sides = 0

    # method to calculate Area
    def getArea(self):
        return (self.radius * self.radius * 3.142)
```

The `Circle` class is extended from the `Shape` class. It inherits the `sides` property from the `Shapes` class and defines only one new *property*, `radius`. The method `getArea()` returns the *area* of the circle.

Complete Program

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

```
class Shape:
    def __init__(self):  # initializing sides of all shapes to 0
        self.sides = 0

    def getArea(self):
        pass


class Rectangle(Shape):  # derived form Shape class
    # initializer
    def __init__(self, width=0, height=0):
        self.width = width
        self.height = height
        self.sides = 4

    # method to calculate Area
    def getArea(self):
        return (self.width * self.height)


class Circle(Shape):  # derived form Shape class
    # initializer
    def __init__(self, radius=0):
        self.radius = radius

    # method to calculate Area
    def getArea(self):
        return (self.radius * self.radius * 3.142)


shapes = [Rectangle(6, 10), Circle(7)]
print("Area of rectangle is:", str(shapes[0].getArea()))
print("Area of circle is:", str(shapes[1].getArea()))
```

Explanation

In the main function, we have declared a list that has two objects in it. The first object is a `Rectangle` with `width` 6 and height `10`. The second object is a `Circle` of radius 7.

The `getArea()` method returns the area of the respective shape. This is **Polymorphism**; having specialized implementations of the same methods for each class.

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