Laboratory Activity No. 7	
Polymorphism	
Course Code: CPE103	**Program:** BSCPE
Course Title: Object-Oriented Programming	**Date Performed:** 02 - 22 - 25
Section: 1 - A	**Date Submitted:** 02 - 22 - 25
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1. Objective(s):

This activity aims to familiarize students with the concepts of Polymorphism in Object-Oriented Programming

2. Intended Learning Outcomes (ILOs):

The students should be able to:
2.1 Identify the use of Polymorphism in Object-Oriented Programming
2.2 Implement an Object-Oriented Program that applies Polymorphism

3. Discussion:

Polymorphism is a core principle of Object-Oriented that is also called “method overriding”. Simply stated the principles says that a method can be redefined to have a different behavior in different derived classees.

For an example, consider a base file reader/writer class then three derived classes Text file reader/writer, CSV file reader/ writer, and JSON file reader/writer. The base file reader/writer class has the methods: read(filepath=””) , write(filepath=””). The three derived classes (classes that would inherit from the base class) should have behave differently when their read, write methods are invoked.

Operator Overloading:
Operator overloading is an important concept in object oriented programming. It is a type of polymorphism in which a user defined meaning can be given to an operator in addition to the predefined meaning for the operator.

Operator overloading allow us to redefine the way operator works for user-defined types such as objects. It cannot be used for built-in types such as int, float, char etc., For example, '+' operator can be overloaded to perform addition of two objects of distance class.

Python provides some special function or magic function that is automatically invoked when it is associated with that particular operator. For example, when we use + operator on objects, the magic method __add__() is automatically invoked in which the meaning/operation for + operator is defined for user defined objects.

4. Materials and Equipment:

Windows Operating System
Google Colab

5. Procedure:

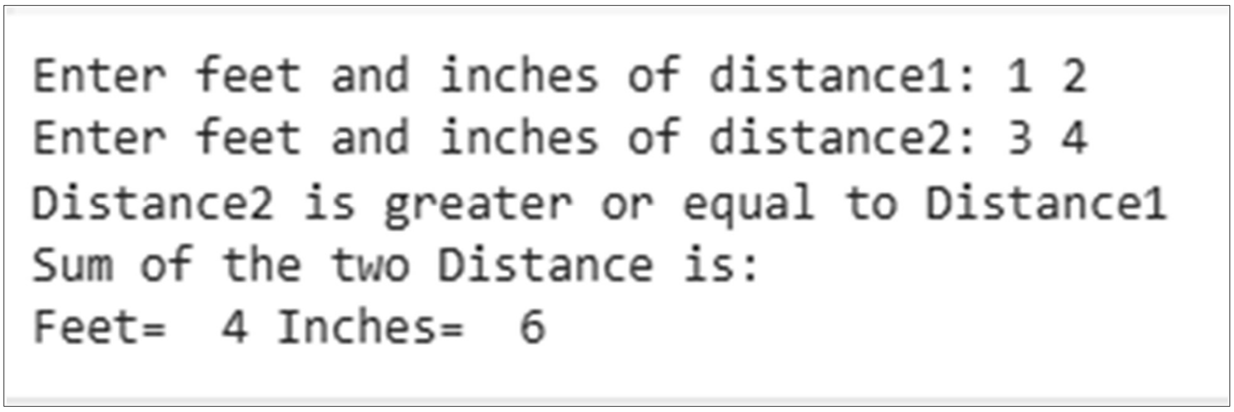
Creating the Classes

1. Create a folder named oopfa1<lastname>_lab8
2. Open your IDE in that folder.
3. Create the base polymorphism_a.ipynb file and Class using the code below:

Coding:

```
# distance is a class. Distance is measured in terms of feet and inches
class distance:
 def __init__(self, f,i):
 self.feet=f
 self.inches=i

# overloading of binary operator > to compare two distances
 def __gt__(self,d):
 if(self.feet>d.feet):
 return(True)
 elif((self.feet==d.feet) and (self.inches>d.inches)):
 return(True)
 else:
 return(False)

# overloading of binary operator + to add two distances
 def __add__(self, d):
 i=self.inches + d.inches
 f=self.feet + d.feet
 if(i>=12):
 i=i-12
 f=f+1
 return distance(f,i)

# displaying the distance
 def show(self):
 print("Feet= ", self.feet, "Inches= ",self.inches)

a,b= (input("Enter feet and inches of distance1: ")).split()
a,b =[int(a),int(b)]
c,d= (input("Enter feet and inches of distance2: ")).split()
c,d =[int(c),int(d)]
d1 = distance(a,b)
d2 = distance(c,d)

if(d1>d2):
 print("Distance1 is greater than Distance2")
else:
 print("Distance2 is greater or equal to Distance1")
d3=d1+d2
print("Sum of the two Distance is:")
d3.show()
```

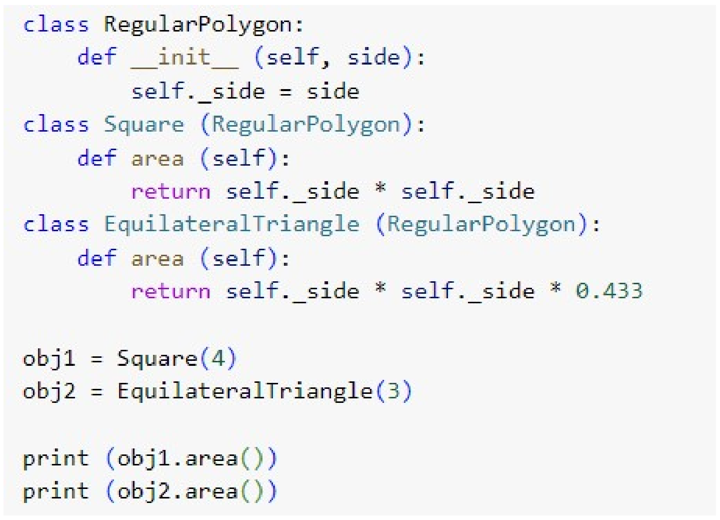
4. Screenshot of the program output:



```
Enter feet and inches of distance1: 1 2
Enter feet and inches of distance2: 3 4
Distance2 is greater or equal to Distance1
Sum of the two Distance is:
Feet=  4 Inches=  6
```

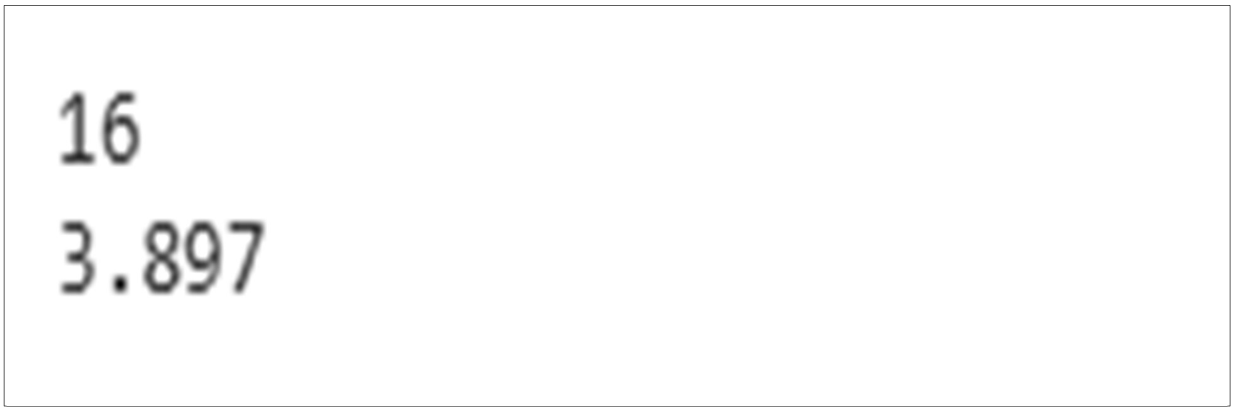
Testing and Observing Polymorphism

1. Create a code that displays the program below:



```
class RegularPolygon:
    def __init__ (self, side):
        self._side = side
class Square (RegularPolygon):
    def area (self):
        return self._side * self._side
class EquilateralTriangle (RegularPolygon):
    def area (self):
        return self._side * self._side * 0.433

obj1 = Square(4)
obj2 = EquilateralTriangle(3)

print (obj1.area())
print (obj2.area())
```

2. Save the prog ram as polymorphism_b.ipynb and paste the screenshot below:

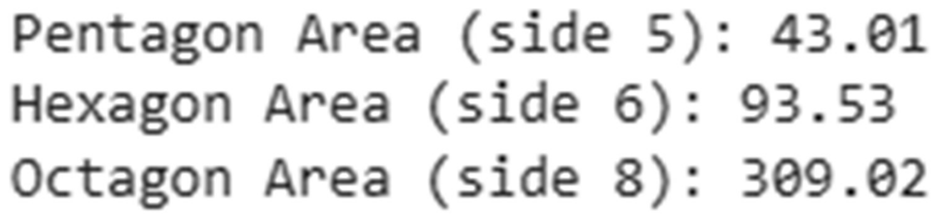


```
16
3.897
```

1. Run the program and observe the output.
2. Observation:
    - This code defines a RegularPolygon class with subclasses for Square and EquilateralTriangle. Each subclass has an area method to compute the area of the respective shape

6. Supplementary Activity:

In the above program of a Regular polygon, add three more shapes and solve for their area using each proper formula. Take a screenshot of each output and describe each by typing your proper labeling.



```
Pentagon Area (side 5): 43.01
Hexagon Area (side 6): 93.53
Octagon Area (side 8): 309.02
```

Pentagon: The Pentagon class, which inherits from RegularPolygon, calculates the area of a regular pentagon, and an object is created with a side length of 5.

Hexagon: The Hexagon class extends RegularPolygon to compute the area of a regular hexagon, with an instance initialized using a side length of 6.

Octagon: The Octagon class, derived from RegularPolygon, includes a method for calculating the area of a regular octagon, and an object is instantiated with a side length of 8.

Questions

1. Why is Polymorphism important?
   Polymorphism allows flexibility and reusability in code by enabling a single interface to represent different types, making the system more scalable and maintainable.

2. Explain the advantages and disadvantages of using applying Polymorphism in an Object-Oriented Program.
   Advantages: code reusability, flexibility and extensibility, cleaner code
   Disadvantages: performance overhead, increased complexity, debugging challenges

3. What maybe the advantage and disadvantage of the program we wrote to read and write csv and json files?
   Advantages: simple to use, supports common formats for data exchange, human-readable
   Disadvantages: limited to simple data structures, performance issues with large files, error handling challenges

4. What maybe considered if Polymorphism is to be implemented in an Object-Oriented Program?
   When implementing polymorphism, it's important to ensure consistent interfaces across classes, decide between method overloading or overriding, use design patterns for flexibility, and maintain code readability and scalability.

5. How do you think Polymorphism is used in an actual programs that we use today?
   Polymorphism is used in GUI frameworks, game development, database management, and network protocols to allow different objects to use the same method while behaving differently.

7. Conclusion:

In conclusion, polymorphism improves flexibility, reusability, and maintainability in object-oriented programming. While it simplifies development, it requires careful design to avoid complexity. It’s widely used in real-world applications, making systems more adaptable and scalable.

8. Assessment Rubric: