Department of Computer Science

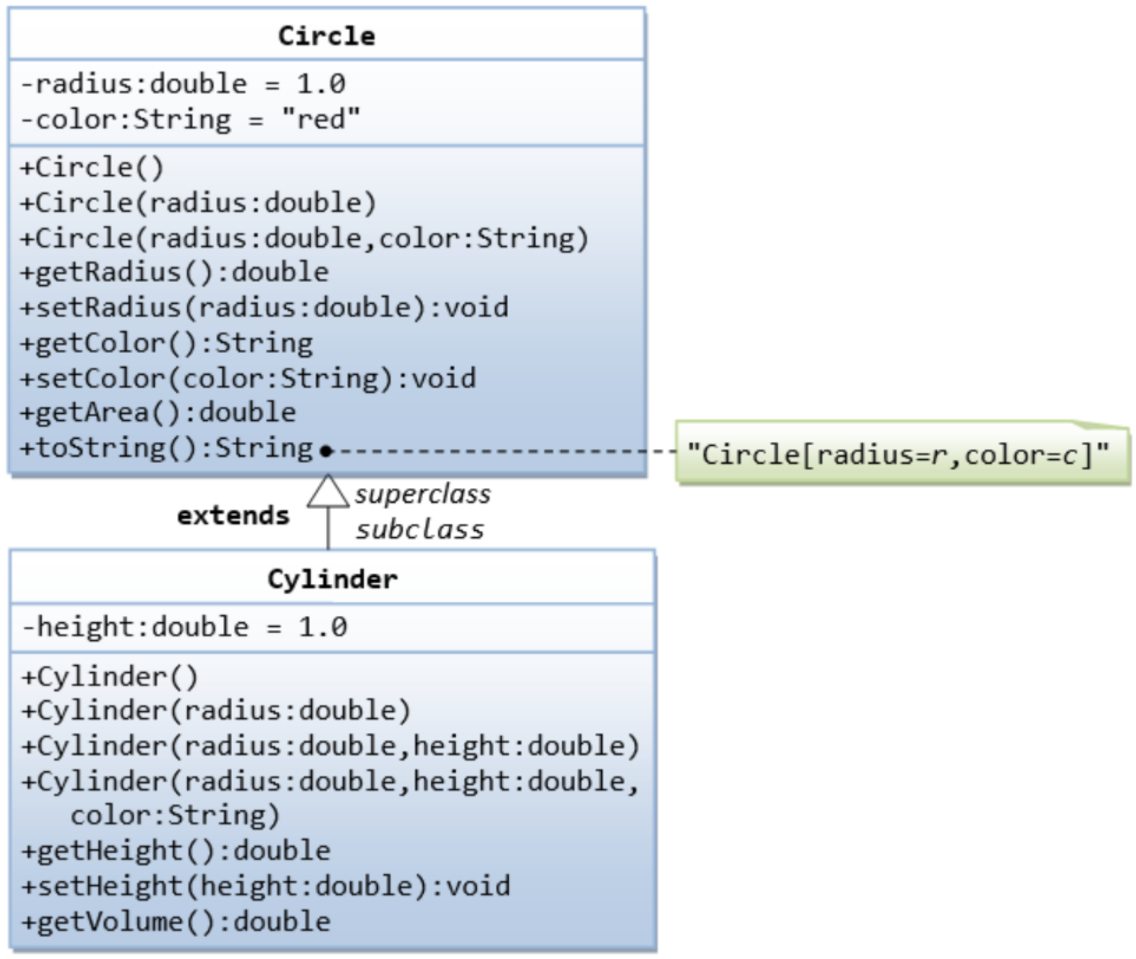
University of Engineering and Technology, Lahore

An Introduction to OOP Inheritance and Dynamic Polymorphism

These exercises shall guide you through the important concepts in inheritance and Dynamic Polymorphism.

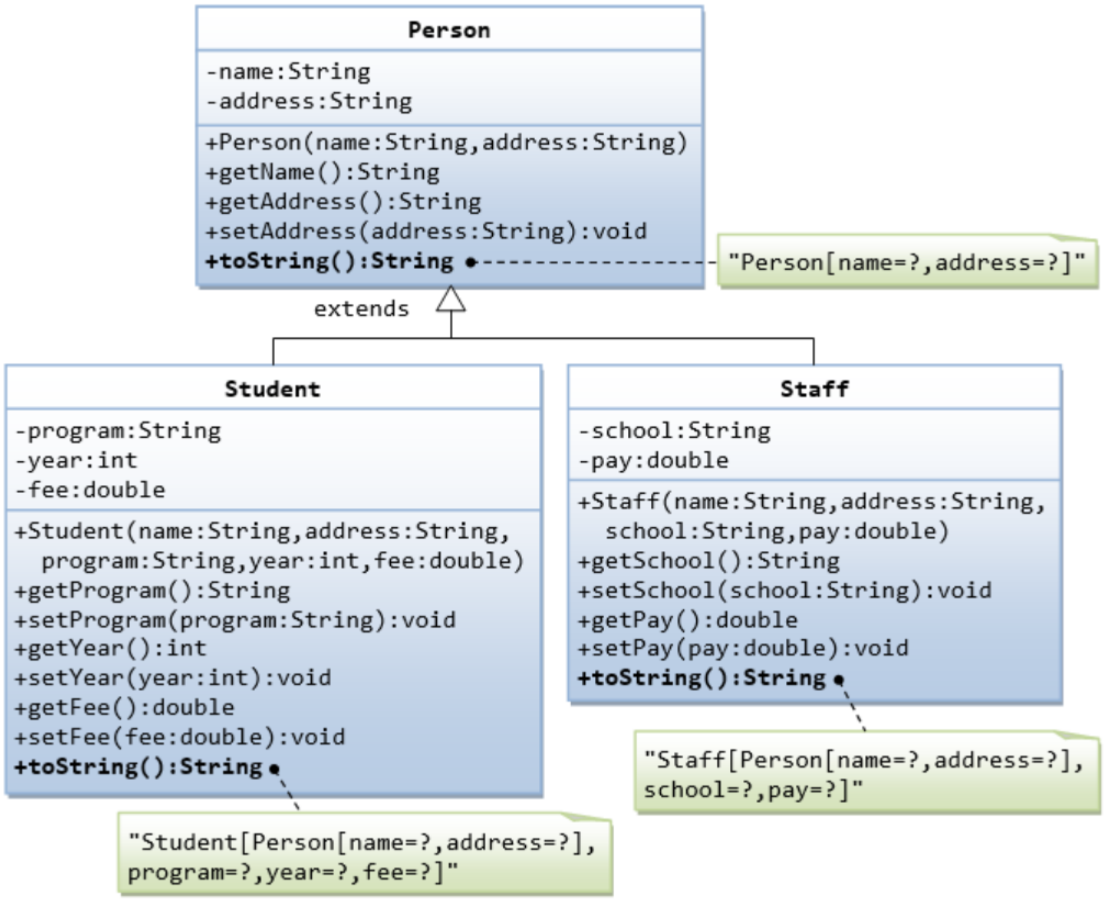
Problem # 1:

In this exercise, a subclass called Cylinder is derived from the superclass Circle as shown in the class diagram (where an arrow pointing up from the subclass to its superclass). Study how the subclass Cylinder invokes the superclass' constructors and inherits the variables and methods from the superclass Circle. The attributes in the Circle class are protected.



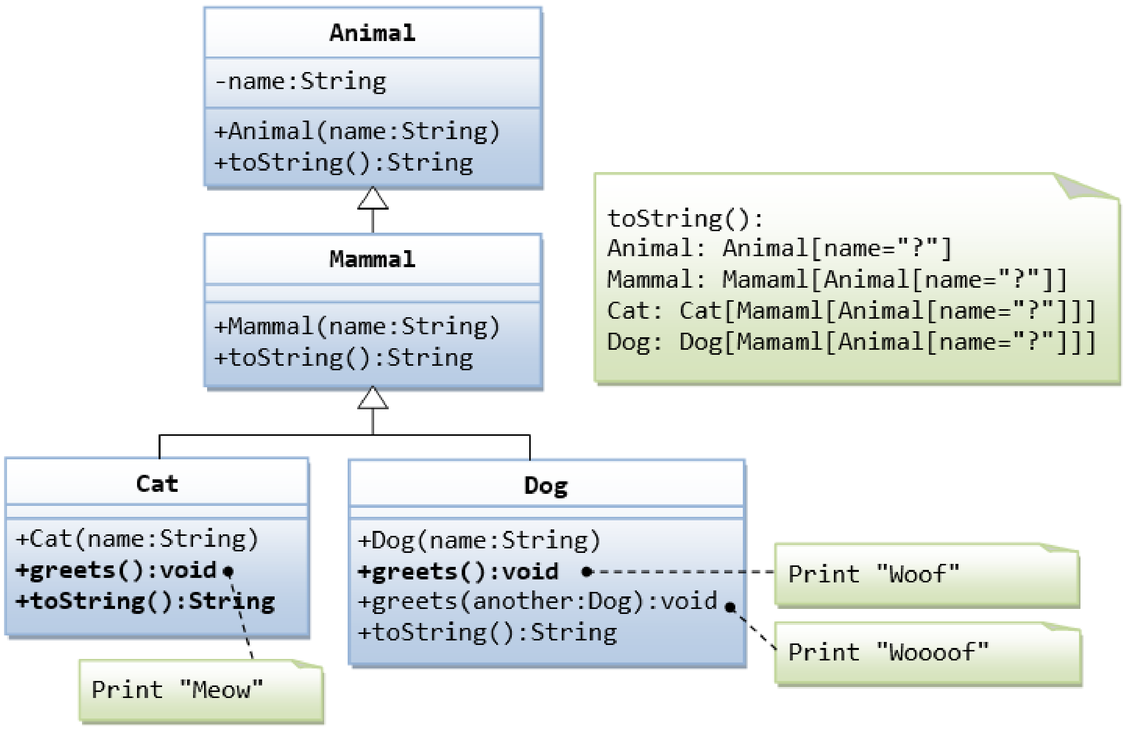
Make a driver program that creates 3 Cylinder objects (1 by using default constructor and 2 by using parameterized constructors), then set the height and then get the volume.

Problem # 2:
Write the classes as shown in the following class diagram. Mark all the overridden methods with override keyword. The attributes in the person class are protected.


Person
-name:String
-address:String
+Person(name:String,address:String)
+getName():String
+getAddress():String
+setAddress(address:String):void
+toString():String
"Person[name=?,address=?]"
extends
Student
-program:String
-year:int
-fee:double
+Student(name:String,address:String, program:String,year:int,fee:double)
+getProgram():String
+setProgram(program:String):void
+getYear():int
+setYear(year:int):void
+getFee():double
+setFee(fee:double):void
+toString():String
"Student[Person[name=?,address=?], program=?,year=?,fee=?]"
Staff
-school:String
-pay:double
+Staff(name:String,address:String, school:String,pay:double)
+getSchool():String
+setSchool(school:String):void
+getPay():double
+setPay(pay:double):void
+toString():String
"Staff[Person[name=?,address=?], school=?,pay=?]"

Make a driver program that creates 2 students and 2 staff and print their information using the **toString** method.

Problem # 3:
Write the classes as shown in the following class diagram. Mark all the overridden methods with the override keyword. The attributes in the animal class are protected.



Make a driver program that creates 2 Cats and 2 Dogs and without using the IF statement call the respective greets() and toString() method.

Problem # 4:
We want to develop a system such that it allows us to create three types of shapes.

Rectangle: to represent a rectangle, width and height are required. Formula to find the area is wxh.

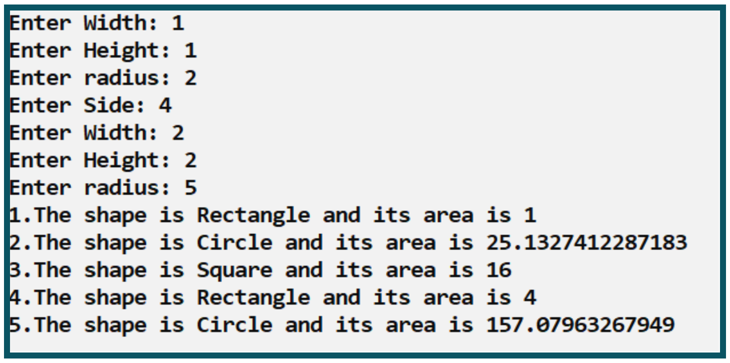
Square: to represent a square, a single side (s) is sufficient. Formula to find the area of square is sxs=s2

Circle: to represent a radius (r) is enough. Formula to find the area of Circle is 2πr2

Problem Scenario:

- System is required to save information of these three shapes.
- In main method any type and any number of shape objects could be created.
- All these objects should be created through the respective UI Class and should be added in to a SINGLE COMMON LIST. We do NOT want to create separate DLs for each type of shape.
- When a program runs it shows all objects, object type (type of shape) and the area of the shape.

Sample Output:



```
Enter Width: 1
Enter Height: 1
Enter radius: 2
Enter Side: 4
Enter Width: 2
Enter Height: 2
Enter radius: 5
1.The shape is Rectangle and its area is 1
2.The shape is Circle and its area is 25.1327412287183
3.The shape is Square and its area is 16
4.The shape is Rectangle and its area is 4
5.The shape is Circle and its area is 157.07963267949
```