Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam – 603 110

(An Autonomous Institution, Affiliated to Anna University, Chennai) Department of Computer Science & Engineering UCS1313 – Object Oriented Programming Using Java Lab Exercise – 4 – Abstract class and Interfaces

Objective:

- To test the following Inheritance type: multiple inheritance.
- To test the Polymorphism through Interface / abstract classes by method overriding.

Sample Learning Outcome:

- Need of interface and it's implementation in Java
- Need of abstract class and it's implementation in Java
- Multiple inheritance
- Accessing the derived class objects through base class/interface reference –
 Dynamic method dispatch/Dynamic binding

Best Practices:

- Class Diagram usage
- Naming convention for file names, variables
- Comment usage at proper places
- Prompt messages during reading input and displaying output
- Incremental program development
- Modularity
- All possible test cases in output
- 1. Design a class called **Person** as described below:

Person	
-name:String	
-address:String	
+Person(name,address)	
+getName():String	
+getAddress():String	
+setAddress(address):void	1

A sub-class Employee of class Person is designed as shown below:

Employee
-empid:String
-dept:String
-basic:int
+Employee(name,address,empid,dept,basic)
+getEmpid():int
+getDept():String
+setDept(dept):void
+setBasic(basic):void
+getBasic():int +calSalary():float

A sub-class Faculty of class Employee is designed as shown below:

Faculty
-designation:String
-course:String
+Faculty(name,address,empid,dept,basic,desig,course)
+getDesig():String
+setDesig(desig):void
+setCourse(course):void
+getCourse():float
+calSalary():float

< <student>></student>
+getMarks():float []
+calcGPA():float

Design a sub-class TeachingAssitant of class Employee, implements << Student>>

TeachingAssitant
-project:String
-course:String
-marks:float []
+TeachingAssitant(name,address,empid,dept,basic,project,course,marks)
+getProject():String
+getCourse():String
+setCourse(course):void
+getMarks():float []
+calcGPA():float
+calSalary():float

Write a TestDriver function to get input for Faculty and TeachingAssistant and display their details. Find the class that can be kept as abstract.

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Shape
#color:String="red"

3

+Shape()
+Shape(color)
+getColor():String
+setColor(color):void

abs getArea():float

abs getPerimeter():float

II) Create a class hierarchy for the following using Interface /

Abstract class: Design **Shape** as described below:

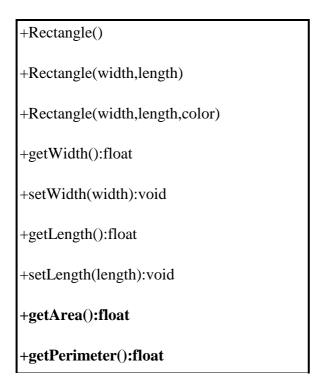
Where abs – abstract method

A sub-class **Circle** of class *Shape* is designed as shown below:

Circle
#radius:float=1.0
+Circle()
+Circle(radius)
+Circle(radius,color)
+getRadius():float
+setRadius(radius):void
+getArea():float
+getPerimeter():float

A sub-class **Rectangle** of class *Shape* is designed as shown below:

Rectangle	
#width:float=1.0	
#length:float=1.0	4



A sub-class **Square** of class *rectangle* designed as shown below (Square is one where the length and width of rectangle are same):

Square
+Square()
- Compagaida
+Square(side)
+Square(side,color)
is quare (side, eoror)
+getSide():float
+setSide(side):void
+getArea():float
+getPerimeter():float

Note the following:

- Shape contains the abstract methods.
- Those abstract methods are to be implemented by the defining classes.

EXERCISE:

- Draw the class diagram of the above class hierarchy.
- Implement the above class hierarchy by using Interface and Abstract class.

Hint:

To write an Interface:

- Only abstract methods can be declared inside the Interface.
- Identify the common behavior of the set of objects and declare that as abstract methods inside the Interface.
- The classes that implements the Interface will provide the actual implementation of those abstract methods.

To write an Abstract class:

- An abstract class can have constructor(s), abstract or non-abstract method(s).
- Define the constructors and non-abstract method in the Abstract class Shape. Declare the common behavior as the abstract method.
- Let the classes Rectangle, Circle, Square define its own constructors, member variable and methods.
- Write a *test driver* called TestInterface | TestAbstract. Use an array of objects of type Shape to display the area, perimeter of all the shapes (Circle, Rectangle, Square).
- Note down the differences while implementing the Inheritance through Interface and Abstract class.
- Note the run-time polymorphism in resolving the method call exhibited by Java through method overriding.