การทดลองที่ 8

Chapter 13 Abstract Classes and Interfaces

1. Design a new Triangle class that extends the abstract GeometricObject class. Draw the UML diagram for the classes Triangle and GeometricObject and then implement the Triangle class.

   Write a test program that prompts the user to enter three sides of the triangle, a color, and a Boolean value to indicate whether the triangle is filled. The program should create a Triangle object with these sides and set the color and filled properties using the input. The program should display the area, perimeter, color, and true or false to indicate whether it is filled or not.

2. (Sum the areas of geometric objects) Write a method that sums the areas of all the geometric objects in an array. The method signature is:

   ```
   public static double sumArea(GeometricObject[] a)
   ```

   Write a test program that creates an array of four objects (two circles and two rectangles and one triangle) and computes their total area using the sumArea method.

3. (Enable GeometricObject comparable) Modify the GeometricObject class to implement the Comparable interface, and define a static max method in the GeometricObject class for finding the larger of two GeometricObject objects.
   a. (The ComparableCircle class) Define a class named ComparableCircle that extends Circle and implements Comparable. Draw the UML diagram and implement the compareTo method to compare the circles on the basis of area.
   b. (Enable Circle comparable) Rewrite the Circle class to extend GeometricObject and implement the Comparable interface. Override the equals method in the Object class. Two Circle objects are equal if their radii are the same.
   c. (The ComparableRectangle class) Define a class named ComparableRectangle that extends Rectangle and implements Comparable. Draw the UML diagram and implement the compareTo method to compare the rectangles on the basis of area.
   d. (Enable Rectangle comparable) Rewrite the Rectangle class to extend GeometricObject and implement the Comparable and Cloneable interface. Override the equals method in the Object class. Two Rectangle objects are equal if their areas are the same.

   3.1 Write a test program that uses the max method to find the larger of two circles and the larger of two rectangles.

   3.2 Write a test class to find the larger of two instances of comparable objects.

4. (The Colorable interface) Design an interface named Colorable with a void method named howToColor(). Every class of a colorable object must implement the Colorable interface. Design a class named Square that extends GeometricObject and implements Colorable. Implement howToColor to display the message “Color all four sides”.

   Draw a UML diagram that involves Colorable, Square, and GeometricObject. Write a test program that creates an array of five GeometricObjects. For each object in the array, display its area and invoke its howToColor method if it is colorable.

ตัวอย่างผลลัพธ์การทำงานข้อ 3

```
Menu (1=Circle, 2=Rectangle, 3=Triangle, 4=Exit) : 1 <enter>
Circle c1 (radius color weight) : 2.5 RED 120 <enter>
Circle c2 (radius color weight) : 5.5 BLUE 100 <enter>

3.1 Find the larger object using max method : c1 c2 <enter>
Answer : c2

Cloning Circle c3 by using : c2 <enter>
c2 == c3 is : false
c2.equals(c3) is : true

3.2 Find the larger of 2 instances of comparable objects : c1 c3 <enter>
Answer : c3

--------------------------------

Menu (1=Circle, 2=Rectangle, 3=Triangle, 4=Exit) : 2 <enter>
Rectangle r1 (width height color weight) : 4 6 GREEN 200 <enter>
Rectangle r2 (width height color weight) : 6 4 YELLOW 180 <enter>

3.1 Find the larger object using max method : r1 r2 <enter>
Answer : EQUAL

Cloning Rectangle r3 by using : r1 <enter>
r1 == r3 is : false
r1.equals(r3) is : true

3.2 Find the larger of 2 instances of comparable objects : r2 r3 <enter>
Answer : EQUAL

--------------------------------

Menu (1=Circle, 2=Rectangle, 3=Triangle, 4=Exit) : 4 <enter>
End of program.

--------------------------------
```