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 Geometric objects comparable) Modify the Geometric class, Circle class, Rectangle class, and Triangle class to find the larger of two objects, however if both are equal, display a message “EQUAL”. You should implement the Comparable interfaces and define a static max method in the related classes to find the larger of two objects and override the equals method to test the equality.

   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.

      Override the equals method in the Object class. Two Circle objects are equal if their radii are the same.

   b. (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.

      Override the equals method in the Object class. Two Rectangle objects are equal if their areas are the same.

   c. (The ComparableTriangle class) Define a class named ComparableTriangle. Implement the compareTo and override the equals method by yourself.

   3.1 Write a test program that test whether two objects are equal or not and uses the max method to find the larger of two objects.

   3.2 Program should display messages and results as shown in the example.

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.

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Menu (1=Circle, 2=Rectangle, 3=Triangle, 4=Exit)
Your choice : 1 <enter>

Circle c1 (name radius color) : c1 2.5 RED <enter>
Circle c2 (name radius color) : c2 5.5 BLUE <enter>

Equal Circles, if their radii are the same : false
The larger object using max method : [Circle] name = c2 radius = 5.5  color = BLUE
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Menu (1=Circle, 2=Rectangle, 3=Triangle, 4=Exit)
Your choice : 2 <enter>

Rectangle r1 (name width height color) : r1 4 6 GREEN <enter>
Rectangle r2 (name width height color) : r2 6 4 YELLOW <enter>

Equal rectangles, if their areas are the same : true
Find the larger object using max method : EQUAL
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Menu (1=Circle, 2=Rectangle, 3=Triangle, 4=Exit)
Your choice : 3 <enter>

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