

Review Assignment (Total: 100 pts)

Suppose you want to design classes to model BoundedShape objects, such as circles, and rectangles. MyBoundedShape objects share many common properties and behaviors. A MyBoundedShape object can be drawn in a certain color, filled or unfilled, and display the object's creation date. Therefore, a general class, MyBoundedShape, can be used to model all MyCircle and MyRectangles objects. MyCircle object is-a MyBoundedShape object and MyRectangle object is-a MyBoundedShape object.

Requirements:

- Create **four** Java classes as per the provided information below.
- Meticulously follow the specific instructions, ensuring the incorporation of attributes and methods for each class.
- Ensure that **each class** file is accompanied by comprehensive code documentation. Remember, the quality of your code documentation contributes 10% to your assignment grade. For detailed information about code documentation requirements, please refer to the Course Information section.
- Create a compressed (zipped) file named 'xxRA.zip' for the Review Assignment, where 'xx' should be replaced with your initials.
- Ensure that all four essential files are included within this zip: MyBoundedShape.java, MyRectangle.java, MyCircle.java, and TestBoundedShapes.java.
- Please adhere to the Programming Assignment policy, which prohibits the use of ChatGPT tools, as specified under the 'Course Information' button

1. **MyBoundedShape** class: (Save the filename as: **MyBoundedShape.java** file)

MyBoundedShape class features the following characteristics:

- Three data fields are declared:
 - **color**, initialized with the value "white" and of type *String*.
 - **filled**, initialized with the value false and of type *boolean*.
 - **dateCreated**, of type *java.util.Date*, representing the creation date and time.
- Two constructors:
 - It includes a no-argument constructor: **MyBoundedShape()** that initializes the **dateCreated** instance variable by generating a new object of the *java.util.Date* class with the current date and time.
 - Another constructor: **MyBoundedShape(String color, boolean filled)** is present, accepting **color** and **filled** as arguments. It initializes all three data fields, including initializing the **dateCreated** instance variable by generating a new object of the *java.util.Date* class with the current date and time.
- Accessor (getter) and mutator (setter) methods are provided for the three data fields, allowing controlled interaction with these properties.
 - **getColor():String**
 - **setColor(color:String): void**
 - **isFilled():Boolean**
 - **setFilled(filled: Boolean):void**
 - **getDateCreated():java.util.Date**

- The `toString()` method is implemented, returning a *string* representation of the object, including the object's creation date, color and whether filled or not.

For example,

```
created on Thu Aug 17 17:58:48 EDT 2023
color: white and filled: false
```

2. **MyCircle** class: (Save the filename as: **MyCircle.java** file)

Since a circle is a special type of boundedshape object, it shares common properties and methods with **MyBoundedShape** objects. Thus, it makes sense to define the **MyCircle** class that extends the **MyBoundedShape** class.

- **MyCircle** class inherits all accessible data fields and methods from the **MyBoundedShape** class.
- A data field named **radius** is declared, of type *double*, to store the radius value of the circle.
- Three constructors are defined:
 - A default constructor: `MyCircle()` that sets the value of radius to **1.0**.
 - Second constructors: `MyCircle(double radius)`, accepting **radius** as an argument with the default values for color and filled from the superclass's constructor.
 - Third constructor: `MyCircle(double radius, String color, boolean filled)`, accepting radius, color, and filled as arguments.
- Accessor (getter) and mutator (setter) methods are provided for the radius data field.
 - `getRadius(): double`
 - `setRadius(double radius): void`
- The class also defines methods to calculate and retrieve specific attributes of the circle:
 - `getArea(): double` Returns the area of the circle, calculated as $\text{radius} * \text{radius} * \pi$.
 - `getPerimeter(): double` Returns the perimeter of the circle, calculated as $2 * \text{radius} * \pi$.
 - `getDiameter(): double` Returns the diameter of the circle, calculated as $2 * \text{radius}$.
- The `printCircle(): void` method is implemented to print information about the circle object. Display the current date and time as well as the radius value with one decimal place. For instance, it might output:

```
"The circle is created Fri Jan 19 01:39:25 EST 2024, and the radius is 1.0."
```

3. **MyRectangle** class (Save the filename as: **MyRectangle.java** file)

Likewise, **MyRectangle** can also be defined as a special type of **MyBoundedShape**.

- **MyRectangle** class inherits all accessible data fields and methods from the **MyBoundedShape** class.
- Two data fields named **width** and **height** are declared, both of type *double*, intended to store the dimensions of the rectangle.
- Three constructors are defined:
 - A default constructor `MyRectangle()` that sets the value of width to **1.0** and height to **2.0**.
 - Second constructor: `MyRectangle(double width, double height)` with two parameters for setting up the values of width and height

- A third constructor: `MyRectangle(double width, double height, String color, boolean filled)` with four parameters as needed.
- Accessor (getter) and mutator (setter) methods are provided for all data fields, namely width and height.
 - `getWidth(): double`
 - `setWidth(double width):void`
 - `getHeight(): double`
 - `setHeight(double height):void`
- The class also defines methods to calculate and retrieve specific attributes of the rectangle:
 - `getArea():double` Returns the area of the rectangle, calculated as `width * height`.
 - `getPerimeter():double` Returns the perimeter of the rectangle, calculated as `2 * (width + height)`.

4. Create a **TestMyBoundedShapes** class (save the file as **TestMyBoundedShapes.java**)

- a. Create three instances of `MyCircle` objects, each invoking a different constructor, and three instances of `MyRectangle` objects, each invoking a different constructor, as illustrated in the examples below from the previously created `MyCircle` and `MyRectangle` classes.

For example:

```
//Create subclass MyCircle objects
MyCircle oval = new MyCircle(8);//with the radius argument
MyCircle oval1 = new MyCircle();//default constructor
MyCircle oval2 = new MyCircle(16.7, "red", true);//with three arguments

//Create subclass Rectangle objects
MyRectangle rectangle = new MyRectangle();//default constructor
MyRectangle rectangle1 = new MyRectangle(12, 4);
MyRectangle rectangle2 = new MyRectangle(10.4, 20.5, "blue", true);
```

- b. Utilize an **array** of **MyBoundedShapes** objects or an **ArrayList** of **MyBoundedShapes** objects to add these six objects, as both `MyCircle` and `MyRectangle` objects are instances of **MyBoundedShapes**.
- c. Invoke the appropriate class's `toString` method (Note: The `toString` method can also be invoked implicitly here) to display "created on Fri Jan 19 01:44:00 EST 2024 color: white and filled: false".
- d. If the object is a 'MyCircle' object, it will also invoke the `printCircle()` method to display "The circle is created on Fri Jan 19 01:44:00 EST 2024, and the radius is 5.0"
- e. Invoke the methods as needed to display each object's area and perimeter information with two decimal places, and their attributes with one decimal place for double type values.
- f. The results of this execution will be depicted in the figures presented below:

```
run:
created on Fri Jan 19 02:52:31 EST 2024
color: white and filled: false

The circle is created Fri Jan 19 02:52:31 EST 2024, and the radius is 8.0

This is a circle object:

The radius is 8.0
The diameter is 16.0
The area is 201.06
The perimeter is 50.27
-----
created on Fri Jan 19 02:52:31 EST 2024
color: white and filled: false

The circle is created Fri Jan 19 02:52:31 EST 2024, and the radius is 1.0

This is a circle object:

The radius is 1.0
The diameter is 2.0
The area is 3.14
The perimeter is 6.28
-----
created on Fri Jan 19 02:52:31 EST 2024
color: red and filled: true

The circle is created Fri Jan 19 02:52:31 EST 2024, and the radius is 16.7

This is a circle object:

The radius is 16.7
The diameter is 33.4
The area is 876.16
The perimeter is 104.93
-----
created on Fri Jan 19 02:52:31 EST 2024
color: white and filled: false

This is a rectangle object:
The width is 1.0
The height is 2.0
The area is 2.00
The perimeter is 6.00
-----
created on Fri Jan 19 02:52:31 EST 2024
color: white and filled: false

This is a rectangle object:
The width is 12.0
The height is 4.0
The area is 48.00
The perimeter is 32.00
-----
created on Fri Jan 19 02:52:31 EST 2024
color: blue and filled: true

This is a rectangle object:
The width is 10.4
The height is 20.5
The area is 213.20
The perimeter is 61.80
-----
BoundedShape object 1 is a MyCircle
BoundedShape object 2 is a MyCircle
BoundedShape object 3 is a MyCircle
BoundedShape object 4 is a MyRectangle
BoundedShape object 5 is a MyRectangle
BoundedShape object 6 is a MyRectangle
BUILD SUCCESSFUL (total time: 0 seconds)
```