Project 1: Solid Shapes
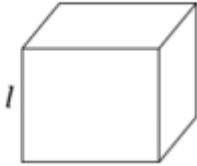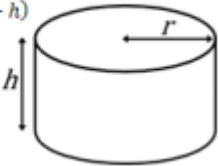
Miami Dade College
COP2805: Java 2 Programming

Due: Nov 18, 2020
Total Points (10 pts)

Problem Description:

Solid Name	Description
CUBE $A = 6l^2$ $V = l^3$ l	A cube is a three-dimensional object bounded by 6 equal square sides. The surface area of a cube, where the length of a side is l, is: $$A = 6l^2$$ The volume of a cube is: $$V = l^3$$
CYLINDER $A = 2\pi r(r + h)$ $V = \pi r^2 h$ h r	The cylinder, also known as the right circular cylinder, is formed by rotating a line, of length h, around a fixed axis parallel to that line. A cylinder has two ends that are equally sized circles parallel to one another and the circular side is at a right angle to these circular ends. The surface area of cylinder is: $$A = 2\pi r(r + h)$$ The volume of a cylinder is: $$V = \pi r^2 h$$
SPHERE $S = 4\pi r^2$ $V = \dfrac{4\pi r^3}{3}$ r	The sphere is a 3-dimensional object, whose surface is continuous, and all points of the surface are an equal distance from a fixed point, the center. The surface area of a sphere, where r is the radius, is: $$S = 4\pi r^2$$

	The volume of a sphere is: $$V = \frac{4\pi r^3}{3}$$

Instructions:

1. Design a superclass named **SolidShape** to represent any solid shape. The class must contain:
    a. A String data field named **color** that specify the color of the solid shape.
    b. A no-arg constructor that creates a default solid shape.
    c. A constructor that creates a solid shape with the specified **color**.
    d. The setter and getter methods for the data field.
    e. A abstract method named **getArea()** that returns the area of the shapes.
    f. A abstract method named **getVolume()** that returns the volume of the shapes.

2. Design a class named **Cube** that extends **SolidShape**. The class must contain:
    a. One **double** data field named *side* with a default value **1.0** to denote one side of the cube.
    b. A no-arg constructor that creates a default cube.
    c. A constructor that creates a cube with the specified **side**.
    d. The setter and getter methods for the data field.
    e. A method named **getArea()** that returns the area of this triangle.
    f. A method named **getVolume()** that returns the volume of this cube.
    g. A method named **toString()** that returns a string description for the cube.

    Review the formulas to compute the area and the volume of the Cube on the problem description section.

3. Design a class named **Cylinder** that extends **SolidShape**. The class must contain:
    a. Two **double** data fields named **length** and **radius** with a default value **1.0** for both length and radius of the cylinder.
    b. A no-arg constructor that creates a default cylinder.
    c. A constructor that creates a cylinder with the specified data fields.
    d. The setter and getter methods for the data fields.
    e. A method named **getArea()** that returns the area of this cylinder.
    f. A method named **getVolume()** that returns the volume of this cylinder.
    g. A method named **toString()** that returns a string description for the cylinder.

    Review the formulas to compute the area and the volume of the Cylinder on the problem description section.

4. Design a class named **Sphere** that extends **SolidShape**. The class must contain:
   a. One **double** data field named **radius** with a default value **1.0** for the radius of the sphere.
   b. A no-arg constructor that creates a default sphere.
   c. A constructor that creates a sphere with the specified data field.
   d. The setter and getter methods for the data field.
   e. A method named **getArea()** that returns the area of this sphere.
   f. A method named **getVolume()** that returns the volume of this sphere.
   g. A method named **toString()** that returns a string description for the sphere.

   Review the formulas to compute the area and the volume of the Sphere on the problem description section.

5. Modify the **SolidShape** class to implement the **Comparable** interface and define a static **max** method in the **SolidShape** class for finding the larger of three **SolidShape** objects.
6. Design an interface named **Colorable** with a **void** method named **howToColor()**. Modify the class named **Cube** that extends **SolidShape** and implements **Colorable**. Implement **howToColor** to display the message "**Color all six sides**".
7. Write a test program **TestSolidShape** that creates three **SolidShapes**, for each object consider the below:
   a. Prompts the user to enter one side of the cube, and a color. The program should create a **Cube** object with this side and set the **color** property using the input. The program should display the area, volume, color and the message "**Color all six sides**".
   b. Prompts the user to enter length, radius, and a color of the cylinder. The program should create a **Cylinder** object with this length and radius and set the **color** property using the input. The program should display the area, volume, and color.
   c. Prompts the user to enter radius of the sphere, and a color. The program should create a **Sphere** object with this radius and set the **color** property using the input. The program should display the surface area, volume, and color.
   d. Uses the **max** method to find the larger of the three solid shapes, display the name and area of the solid shape.

Hint: Consider using the following data to verify the results of your formulas.

```
SPHERE_____
Description: The sphere is a 3 dimensional object, whose surface is continuous
        created by rotating a right triangle about the vertical side.

Radius: 4

The area and volume of a sphere with a radius of 4.00 is:
Area: 201.06
Volume: 268.08


CUBE_____
Description: A cube is a three dimensional object bounded by 6 equal square sides.

Length : 4

The area and volume of a cube with a length of 4.00 is:
Area: 96.00
Volume: 64.00


CYLINDER_____
Description: The cylinder is formed by rotating a line, of length h,
        around a fixed axis parallel to that line.

Radius: 2
Length: 3

The results for Cylinder, with a radius of 2.00, and a length of 3.00 is:
Area: 62.83
Volume: 37.70
```

Evaluation Rubric:

1. (5 pt.) The name of the project file must be: Project1
2. (5 pt.) Include a documentation block at the beginning of the program with the following information: Example:
   - Student Name: Olga Canedo
   - Date: 11/18/2020
   - Program Name: Project1
   - Description: Program to calculate area and volume of the solid shapes.
3. (10 pt.) Consider the below to format the output code:
   - Use descriptive variable names such as matrix instead of A
   - Use indentation in the code lines that allow a fluent reading of the code
   - Add documentation the lines of code to help understand the logic of the programmer
4. (35 pt.) Verify that your code has no syntax errors
5. (40 pt.) Verify that your code generates the expected results (not logic errors)
6. (5 pt.) Submit for review only the java files in the corresponding Blackboard link.

SolidShape.java
Cube.java
Cylinder.java
Sphere.java
Colorable.java