CMPS 251 (OOP) QUIZ 4 SPRING 2023, CSE-CENG-QU

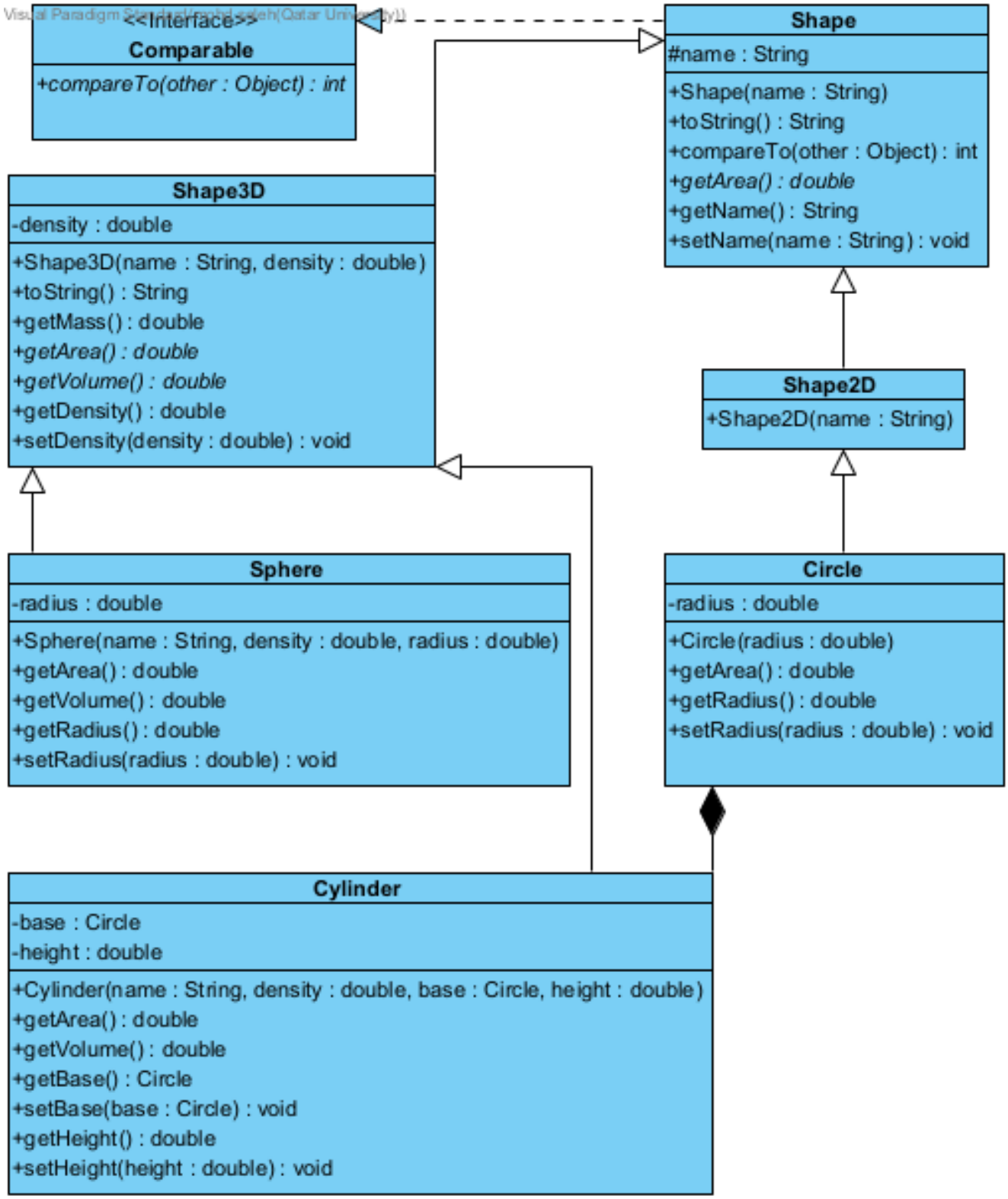
Name		**QUID**	

INSTRUCTIONS

1. Follow university rules for exams during this assessment.
2. You are not allowed to use the textbook, the lecture slides, or any other external sheets. Any other material will be considered cheating.
3. Cheating is an academic violation according to Qatar University rules and regulations, and in some cases, it may result in final dismissal from the University. Students should not under any circumstances commit or participate in any cheating attempt or any act that violates the student code of conduct.
4. You have a total of **25** minutes to complete this assessment. Use your time effectively.
5. All questions are compulsory. Answer all questions on the provided papers. No separate answer sheet or book sheet will be provided.
6. Calculators, mobile phones, any smart devices are NOT allowed.

Question	*Grade*	*Out of*
1		**5**
2		**30**
3		**5**
4		**20**
5		**10**
6		**15**
7		**15**
Total		**100**

Implement the hierarchy in the following UML diagram considering the explanation points that follow.



- ***Shape***, **Shape2D**, and **Shape3D** are **abstract** classes. **Comparable** is an **interface**. **Circle**, **Sphere**, and **Cylinder** are concrete classes.
- The ***compareTo()*** method compares the calling object with the passed object in this manner:
  - It returns -1 if the calling object is of less mass than the passed object, 1 if of more mass, and 0 if equal mass provided that the two objects are of **Shape3D** type.
  - Otherwise, it returns -1 if the calling object is of less area than the passed object, 1 if of more area, and 0 if equal area.

  Note that the method ***compareTo() receives the object ***other*** of type **Object**. Therefore, in the implementation of this method you need to do appropriate down castings as needed.

Shape	Area	Volume
Circle	*PI * Radius²*	-
Sphere	*4 *PI * Radius²*	*4/3 * PI * Radius³*
Cylinder	*2 * PI * Radius * (Height + Radius)*	*2 * PI * Radius² * Height*

- *Mass = Volume * Density*
- The ***toString()*** method of the **Shape** class has this body:

```
return "Shape: " + getName() + " Area: " + getArea();
```

  You need to override this method in the **Shape3D** class to return the name, area, and volume of a 3D shape object. Expected output in each type is as follows:

  Shape: Circle Area: 66.47

  Shape: Sphere Area: 43.68 Volume: 300.81

- Assume that all needed setter and getter methods are already available for you to use. **Do not code them**.

1: Comparable Interface – 5 Points

2: Shape Abstract Class – 30 Points

3: Shape2D abstract Class – 5 Points

4: Shape3D abstract Class – 20 Points

5: Circle Class – 10 Points

6: Sphere Class – 15 Points

7: Cylinder Class – 15 Points