CS159 – Advanced Programming **James Madison University**
Sample Examination 3 **Fall 2023**

Name:____________________________

Instructions. Answer all of the following questions. This is a "closed book" exam and you must work entirely on your own. You may not use a computing or communications device of any kind. Your answers need not conform to the course style guide. All questions that involve code or are about code use the Java programming language.

This work complies with the JMU Honor Code.

Signature:__________________________

1. (5 points) Given the attached `Question` and `ExtraCreditQuestion` classes and the following declarations:

```
Question q;
Question r;
Question s;
ExtraCreditQuestion e;
ExtraCreditQuestion f;
```

indicate whether each of the following will compile (**C**) or not compile (**N**).

1.1____ `q = new Question(10.0);`

1.2____ `r = new Question(10.0);`

1.3____ `s = new ExtraCreditQuestion(10.0);`

1.4____ `e = new Question(10.0);`

1.5____ `f = new ExtraCreditQuestion(10.0);`

2. (10 points) Given the attached `Question`, `ExtraCreditQuestion`, and `Summarizer` classes, what would be printed by each of the following fragments?

2.1

```
Question s;
 s = new ExtraCreditQuestion(10.0);
 s.grade(0.5);
 System.out.println(s.toString());
```

____

2.2

```
ExtraCreditQuestion f;
f = new ExtraCreditQuestion(10.0);
f.grade(true);
System.out.println(f.toString());
```

____

2.3

```
ExtraCreditQuestion g;
g = new ExtraCreditQuestion(10);
g.grade(0.5);
System.out.println(g.toString());
```

____

2.4

```
Question s;
 s = new ExtraCreditQuestion(10.0);
 s.grade(0.5);
 Summarizer.display(s);
```

____

2.5

```
ExtraCreditQuestion s;
s = new ExtraCreditQuestion(10.0);
s.grade(0.5);
Summarizer.display(s);
```

____

3. (5 points) Given the following classes and interfaces:

```
    public interface Sortable {
      //Details omitted
    }
```

```
    public interface Animated {
      // Details omitted
    }
```

```
    public class Versatile implements Sortable, Animated {
      // Details omitted
    }
```

```
    public class Utilities {
      public static void add(Animated item) {
        // Details omitted
      }

      public static void add(Sortable item) {
        // Details omitted
      }

      public static void add(Versatile item) {
        // Details omitted
      }
    }
```

indicate whether each of the following fragments will compile (**C**) or not compile (**N**). (Note: A fragment only compiles if all of the statements in it compile.)

3.1____
```
     Versatile v;
    v = new Versatile();
    Utilities.add(v);
```

3.2____
```
     Animated a;
    a = new Versatile();
    Utilities.add(a);
```

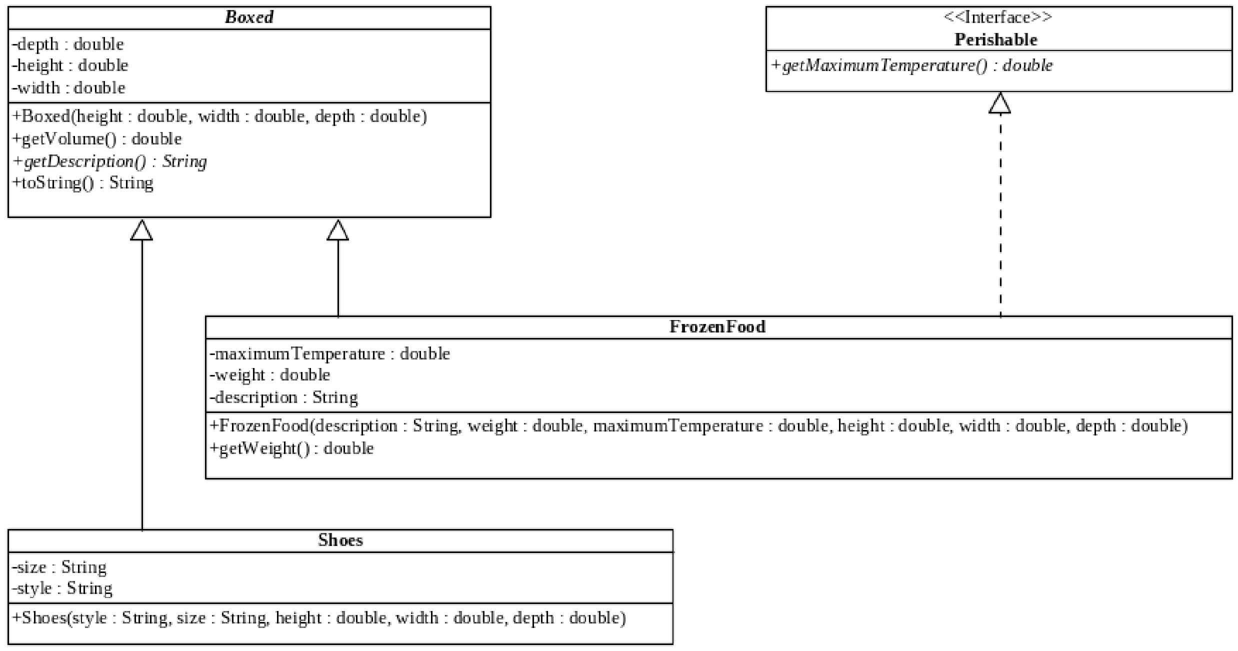
3.3____
```
     Sortable s;
    s = new Versatile();
    Utilities.add(s);
```

3.4____
```
     Animated a;
    a = new Animated();
    Utilities.add(a);
```

3.5____
```
     Animated a;
    a = new Animated();
    Utilities.add(a);
```

4. (5 points) In the space below, create a UML class diagram for the attached `Question` and `ExtraCreditQuestion` classes.

5. (25 Points) The system you must implement is summarized in the following UML class diagram.


Boxed
-depth : double
-height : double
-width : double
+Boxed(height : double, width : double, depth : double)
+getVolume() : double
+*getDescription() : String*
+toString() : String
<<Interface>>
Perishable
+*getMaximumTemperature() : double*
FrozenFood
-maximumTemperature : double
-weight : double
-description : String
+FrozenFood(description : String, weight : double, maximumTemperature : double, height : double, width : double, depth : double)
+getWeight() : double
Shoes
-size : String
-style : String
+Shoes(style : String, size : String, height : double, width : double, depth : double)

You must write all of these classes/interfaces, **all of which must be in the default package**.

Note that `Boxed`, `getDescription()` and `getMaximumTemperature()` are all in italics in this diagram. Also, note that methods in concrete classes that are implied by the specializes/extends and realizes/implements arrows are omitted from the diagram.

In addition to the specifications that are contained in the UML diagram, your answer must comply with the following specifications.

1. The `Boxed` Class
   1.1. The `getVolume()` method must return `depth * height * width`.
   1.2. The `toString()` method must return the result of calling `getDescription()` and `getVolume()`, formatted using a format `String` of `"%s with a volume of %f"`.
2. The `Shoes` Class
   2.1. The `getDescription()` method must return information about the `style` and `size` (in that order), formatted using a format `String` of `"%s in size %s"`.
3. Other Accessors/Getters
   3.1. Any other accessors/getters that are specified in the UML diagram must return the corresponding attributes.

Attachments

```
public class Question {
    private double credit;
    private double points;

    public Question(double points) {
        this.points = points;
        this.credit = 0.0;
    }

    public boolean fullCredit() {
        return credit >= 1.0;
    }

    public void grade(boolean correct) {
        if (correct) {
            credit = 1.0;
        } else {
            credit = 0.0;
        }
    }

    public void grade(double credit) {
        if      (credit > 1.0) {
            this.credit = 1.0;
        } else if (credit < 0.0) {
            this.credit = 0.0;
        } else {
            this.credit = credit;
        }
    }

    public double value() {
        return points * credit;
    }

    public String toString() {
        return String.format("%.1f", value());
    }
}
```

```
public class ExtraCreditQuestion extends Question {

    public ExtraCreditQuestion(double points)
    {
        super(points);
    }

    public double value() {
        if (fullCredit()) {
            return super.value();
        } else {
             return 0.0;
        }
    }
}
```

```java
public class Summarizer {
    public static void display(Question q) {
        System.out.println("Q:" + q.toString());
    }

    public static void display(ExtraCreditQuestion q) {
        System.out.println("E:" + q.toString());
    }
}
```