MPP Midterm Exam 4/11/16

Name:____________________________ StudentId:_______________________

There are a total of 35points possible. Note that there are questions on the back of this page. You have until12:00 Noon to complete all the questions.

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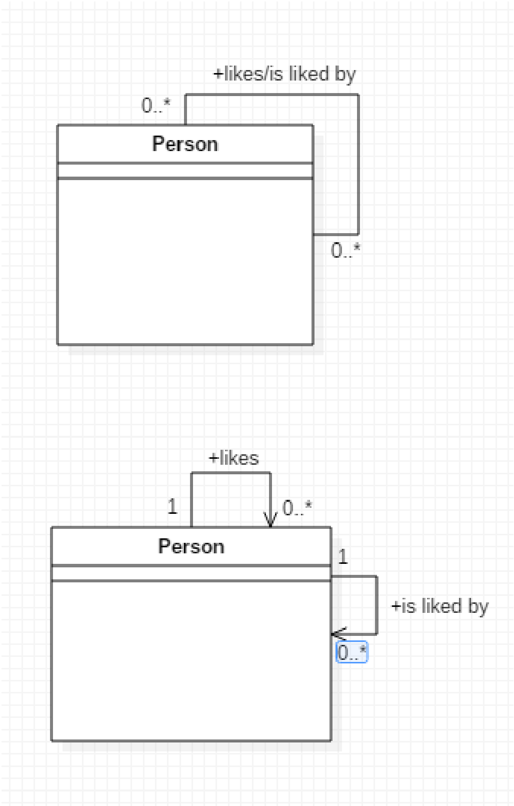
1) (4pts) Name two ways of guaranteeing that no user of your class MyClass can create a subclass of MyClass.

Solution:

a. **Declare MyClass to be final**
b. **Declare the MyClass constructor to be private and provide a factory method to provide instances of the class.**

2) (4pts) A Person may *like* other Persons, and may also be *liked by* other Persons. Draw a class diagram showing these relationships. Use one or more associations; each should have a name and appropriate multiplicities. You must indicate clearly whether associations are 1-way or 2-way.

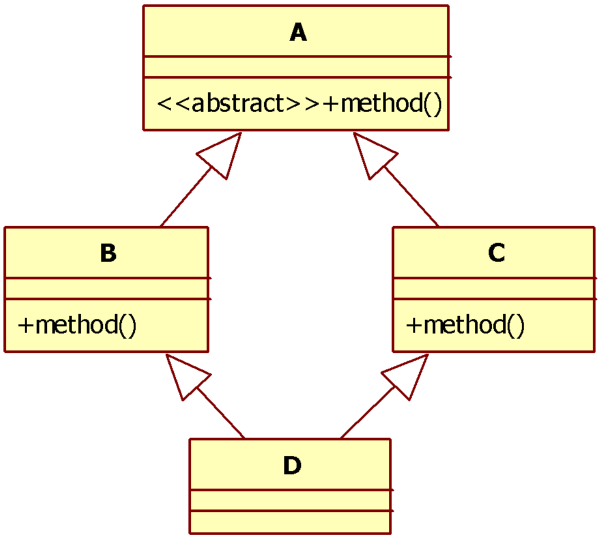
Solution: Both of the following are correct:



3) (2pts) Describe one advantage of using a static method.

You do not have to instantiate the class to use the method.

4) (2pts)What is the “diamond problem?” Draw a diagram showing the problem.



5) (2pts)What is Java's approach to handle the "diamond problem?"

Implementation (a class) can only be 'inherited' / extended once
Types (interfaces) can be 'inherited' / implemented multiple times

6) (4pts) Name two differences between interfaces and abstract classes in Java (restricted to Java SE 7 and earlier).

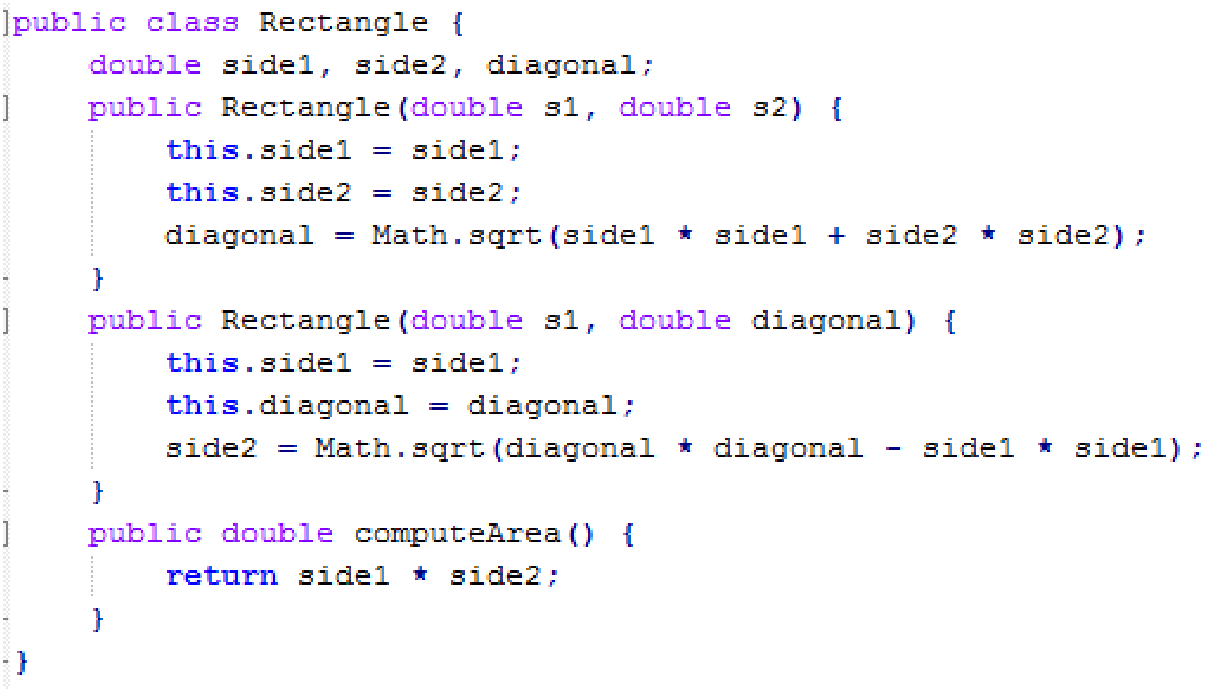
Any 2 of the following are correct:
interfaces cannot have implemented methods – abstract classes can
interfaces cannot have static methods – abstract classes can
interfaces cannot have instance variables – abstract classes can
a class can implement multiple interfaces but extend only one abstract class

7) (2pts)What is the Evolving API Problem?

The Evolving API Problem is the problem that it is not safe to add new methods to an interface in a system that has already been released, because the presence of new methods will break existing implementations.

8) A rectangle can be specified by specifying two sides, but it can also be specified by specifying one side and a diagonal.

A. (2pts) The following code attempts to implement a Rectangle class and provide support for the two ways of constructing a Rectangle. Explain the problem with this code.



```
public class Rectangle {
    double side1, side2, diagonal;
    public Rectangle(double s1, double s2) {
        this.side1 = side1;
        this.side2 = side2;
        diagonal = Math.sqrt(side1 * side1 + side2 * side2);
    }
    public Rectangle(double s1, double diagonal) {
        this.side1 = side1;
        this.diagonal = diagonal;
        side2 = Math.sqrt(diagonal * diagonal - side1 * side1);
    }
    public double computeArea() {
        return side1 * side2;
    }
}
```

Your Explanation:

Solution: The Java compiler does not allow two constructors in a class that have the same signature.

B. (4pts) Write a pseudo-code solution for the rectangle class for the solving this problem.

Your rectangle class will now have a private constructor.

You will have 2 public static methods that return a Rectangle.

For example, -- public static Rectangle createRectangleBySides(double s1, double s2)

And -- public static Rectangle createRectangleBySideAndDiag(double s1, double diagonal)

These static methods will new a Rectangle and set the sides or side and diagonal in the new Rectangle object. A Rectangle factory can call the static methods based on input provided to it.

9) (9pts)For the following use case description show the sequence diagram for a developer estimates the remaining hours of development needed for a feature. Assume the developer for this use case is already logged in. Do not show the login use case.

Business rules are:

i. Remaining development time cannot be a negative number.
ii. A developer may only estimate his/her features
iii. For each time a developer estimates the development time we want a WorkLogRecord which will contain the date/time the estimate was entered and the estimated time remaining. WorkLogRecords will be saved in our DataAccess subsystem.

Your sequence diagram must show how you check the above business rules.

Your answer must show how you check that the development time is non-negative.

It also must show how you make sure developers are updating only the features assigned to them. An example approach is:

- *The developer starts at the developer feature page*
- *The developer requests a list of his/her features*
- *The developer selects one of his/her features*
- *The developer enters in the number of development hours remaining. Show the page validating the entry is non-negative.*

- *The developer clicks submit and a new WorkLogRecord is created with the current date/time and the updated effort time.*
- *The new WorkLogRecord is added to the Feature's list of WorkLogRecords*
- *Save the WorkLogRecord and the Feature to the DataAccess subsystem.*
- *A success page confirms the update*

See diagram solution midtermSequenceDiagramSoln