Lab 3

Objectives

- Introduction to interfaces
- Introduction to abstract data types

Part I - Interfaces

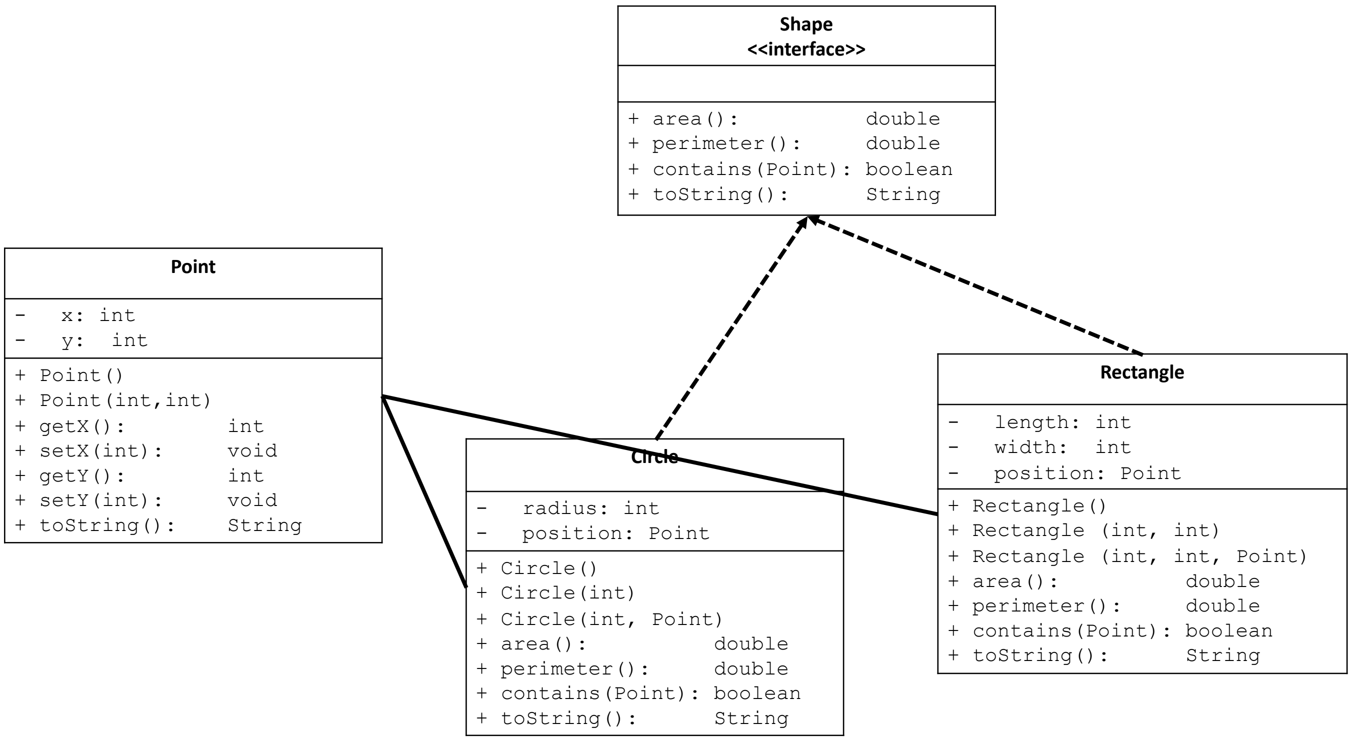
1. Download all of the provided lab files to your Lab3 working directory.

We are going to use an interface to specify what a Shape class should look like. As depicted in the UML below, a Shape should have methods for calculating area, calculating perimeter and determining whether a given Point lies with in a Shape. An interface does not include the implementation of these methods, only their signatures and documentation. The implementation details of these method is dependent on the type of Shape and therefore will be defined in the classes that implement the Shape interface (ie. Circle, Rectangle)

2. Start by opening `Shape.java` to familiarize yourself with the method documentation.

The Circle and Rectangle classes *implement* the Shape interface (depicted by the **dashed arrow** between them in the UML diagram below)
Circle and Rectangle both have an attribute of type Point (depicted by the **solid line with no arrow** between them in the UML diagram below).

3. Open `Circle.java` and you will see a full implementation of the Circle class. Notice, it contains implementations of all methods listed in `Shape.java`



4. Begin the implementation of `Rectangle.java`
    a. Open `Rectangle.java`
    b. Try to compile `Rectangle.java` – You will see compile error something like this:

    ```
    error: Rectangle is not abstract and does not override abstract
    method contains(Point) in Shape
    ```

    Fix this compile error by introducing stubs for each of the methods Rectangle must implement:

    c. Copy the documentation and method signatures
    from Shape.java to Rectangle.java
    d. For each method signature:
        i. remove the "**;**" from the end of the signature
        ii. add an "**{**" and "**}**" to make it a method
        iii. make the method public
        iv. if the method that has a non-void return type, add a dummy return statement

    For example, for the area method the stub would look like this:

    ```
    public double area() {
         return 0;
    }
    ```

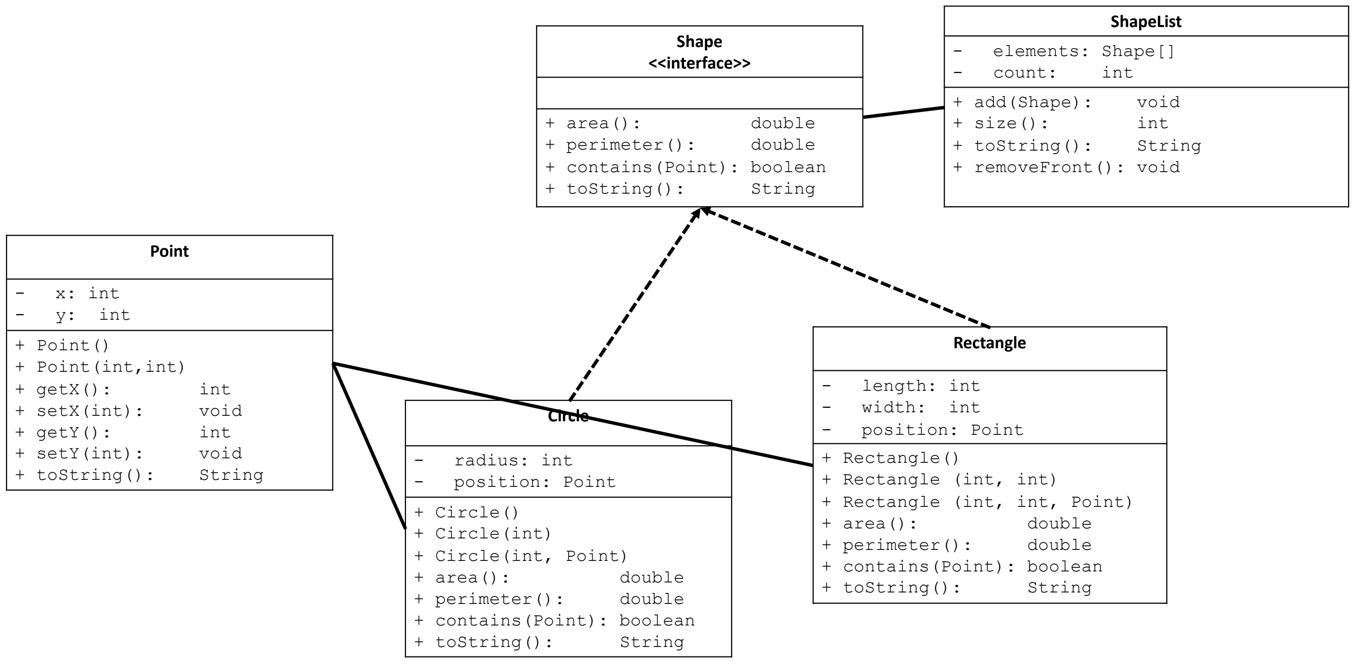
CHECK POINT – get your lab TA to check off after you have completed this. They will want to see you compile `Rectangle.java` and see your stubs.

5. Complete the implementation of `Rectangle.java`
    a. Open `Lab3Tester.java` and compile and run it. You will see tests failing.
    b. Implement one method at a time, recompiling and rerunning the tester after each one

CHECK POINT – get your lab TA to check off after you have completed this. They will want to see you compile and run `Lab3Tester.java` and see your methods implementations.

Part II – Using classes to define a data structure

We are now going to implement a class called `ShapeList` that will hold a collection of Shapes. The addition of this class is depicted in our UML diagram:



1. Start by opening `ShapeList.java` Notice we have added the attributes, a blank constructor and method stubs for you
    a. Uncomment the call to `testShapeList()` in the main of `Lab3Tester.java` and compile/run it
    b. Implement the constructor and each method one at a time.
2. Add tests to `testShapeList()` to ensure your `add` method has the correct behaviour when more than 2 elements are added to the list.

CHECK POINT – get your lab TA to check off after you have completed this. They will want to see you compile and run `Lab3Tester.java` and see the tests in `testShapeList()` pass. They will want to see that you have added tests to ensure the `add` method expands when needed.

Finished early – start your Assignment!