

Variables and Designing a Java Class

Your team has been tasked with designing a simple Circle class. After some back and forth, you agree that Circle objects should be able to do the following:

- create new circle given a center point and a radius
- calculate the area
- calculate the perimeter
- given a point, determine if the point is inside the circle
- shift the circle to have a new center
- scale the radius
- give center
- give radius

You may assume the existence of the Point class below as you work on your Circle class definition.

```
public class Point {  
    private int x;  
    private int y;  
  
    public Point (int x, int y) {  
        this.x = x;  
        this.y = y;  
    }  
  
    public int getX() {  
        return x;  
    }  
  
    public int getY() {  
        return y;  
    }  
  
    public void shift(int xChange, int yChange) {  
        x += xChange;  
        y += yChange;  
    }  
  
    public Point shiftedBy(int xChange, int yChange) {  
        return new Point(x + xChange, y + yChange);  
    }  
  
    public int squaredDistanceFrom(Point p) {  
        int deltax = x - p.x;  
        int deltay = y - p.y;  
        return deltax * deltax + deltay * deltay;  
    }  
}
```

Design Questions

As a team, discuss and come to a consensus on your answers to the questions below.

1. What is the key difference between the methods `shift` and `shiftedBy` of the `Point` class?
2. What data fields does the `Circle` class need to have? There are fundamentally two choices here, discuss the differences between them.
3. What arguments should be passed to the constructor so that it can initialize the fields of a newly created `Circle` object?
4. Can you think of a “no-argument” constructor? What would it produce?
5. Which items in the list of `Circle` functionality given above describe accessors?
6. Decide on names for your accessors, then write the complete definition for each method.
7. The value of π is needed to calculate the area and perimeter of a circle. Of the four possible kinds of Java variables, what should π be?
8. Write the **signatures only** for the methods needed to complete the `Circle` class functionality. Once you are done, compare your method signatures with those of another team. Is there disagreement on any of the following?
 - a. method names
 - b. parameter names
 - c. return values

Together as a class: report out on agreements/disagreements and decide on the final signature for each `Circle` class method.

9. **At the board**, work out the implementation for each `Circle` class method. When you are done discuss the following:
 - *Could* the variables for the circle’s center and radius be declared `final`? *Should* they be declared `final`?
 - The `Circle` constructor can be implemented in two ways:
 1. reuse the provided `Point` object for its center, or
 2. create a new `Point` object of its own based on the provided `Point` object.What are the advantages and disadvantages of each approach?
 - If our implementation uses the `shift` or `shiftedBy` methods, how would it have to change if one of those methods did not exist?
 - Suppose that instead of changing the existing object, the `shift` and `rescale` methods for the `Circle` class are changed so that they return a new `Circle` object.
 - Could the fields for the `Circle` class be changed to *final*?
 - What would be the implications of this change, assuming it is possible?

Together as a class: report out and discuss answers to questions.