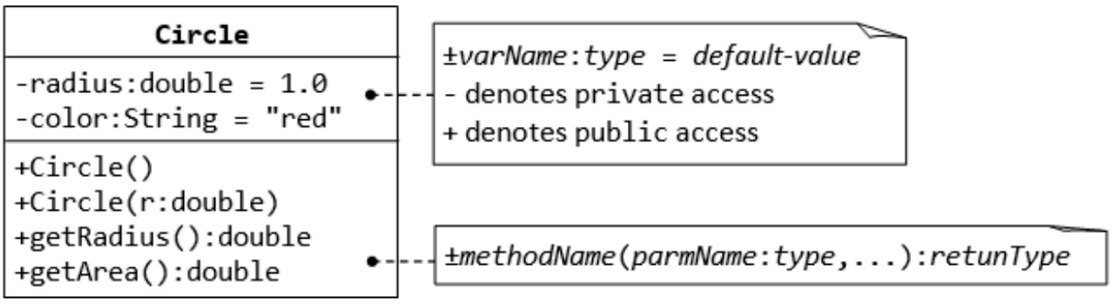
Inheritance Exercise - Reading Class Diagrams

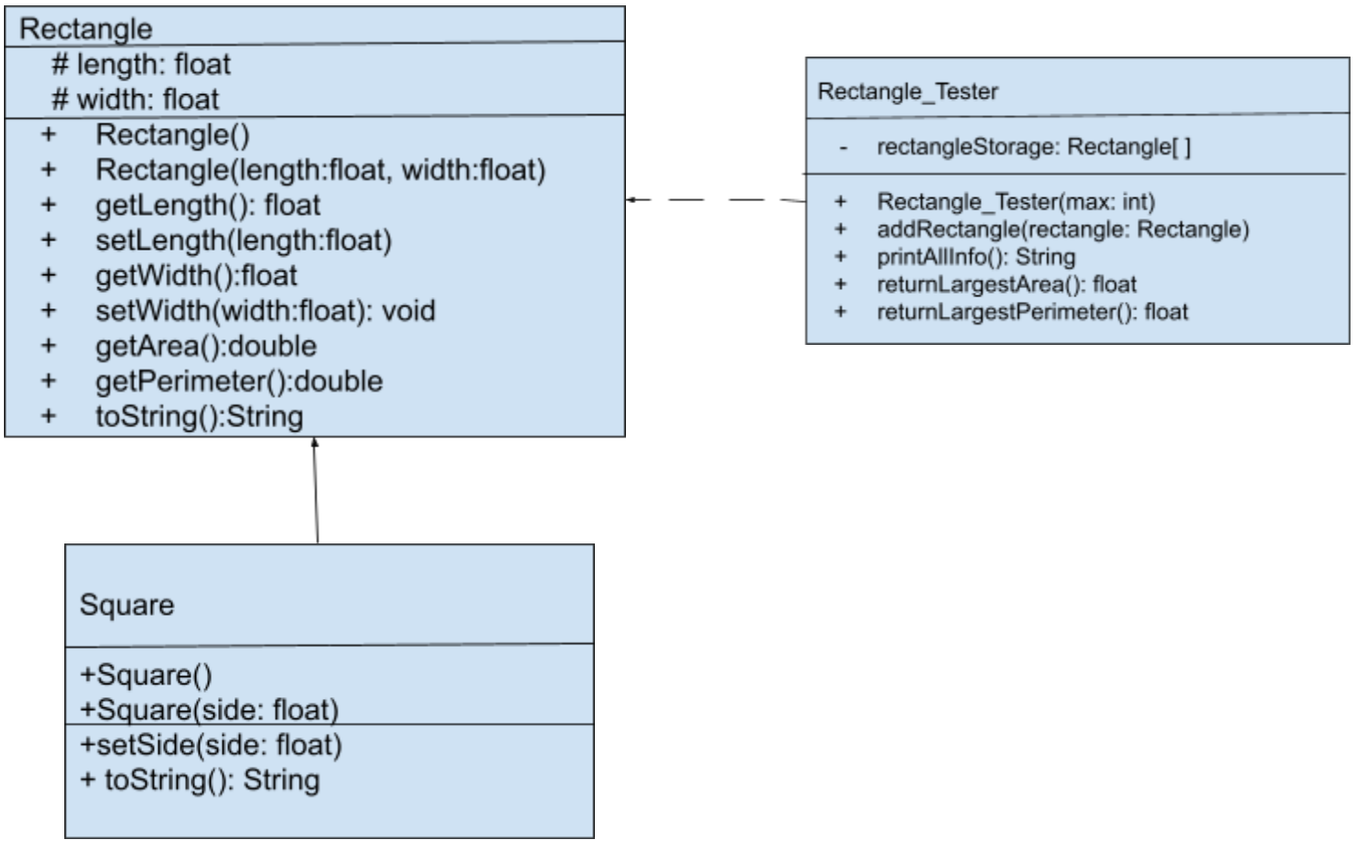
Class Diagrams Note:



The rectangle on the left is the class diagram. The other two rectangles demonstrate how to read a class diagram.

A class diagram consists of 3 sections:

1. **The top is the name of the class (required)**
2. **Middle section instance variables (optional, only if there are no variables necessary to the class)**
   - **A + before the variable name indicates public access (i.e. anyone can directly access the variable). This is generally regarded as bad practice.**
   - **A - before the variable name indicates private access (i.e. only the class can directly access the variable). This is considered better practice.**
   - **A # before the variable name indicates protected access.**
3. **The last section is for methods (optional, only if there are no methods necessary to the class)**



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toString() is supposed to print out all of the details of a rectangle or square object.

Example:

This rectangle has a length of ____ and width of _____. It has a perimeter of _____ and an area of _____.

This square has a length and width of _____. Its perimeter is _____ and its area is _____.

Notes:

Use the super keyboard where necessary.

If the default rectangle or square constructor is called, randomize a length and width between 1 and 100 (inclusive).

The Rectangle_Tester class will use an array to store Rectangle objects. When its constructor is called you are initializing the array to a maximum size. Do not add a rectangle to be added unless there is room.

Write a client class to test out all features of the three classes identified on page 1.

Rectangle Class Code:

```
public class Rectangle {
	protected float length;
	protected float width;

	Rectangle () {
		width = (float) (1 + Math.random() * 100);
		length = (float) (1 +Math.random() * 100);
	}

	Rectangle (float length, float width){
		this.length = length;
		this.width = width;
	}

	public float getLength () {
		return length;
	}

	public void setLength (float length) {
		this.length = length;
	}

	public float getWidth () {
		return width;
	}

	public void setWidth (float width) {
		this.width = width;
	}

	public double getArea () {
		double area;
		area = length * width;
```

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```
            return area;
      }

      public double getPerimeter () {
            double perimeter;
            perimeter = (2 * length) + (2 * width);
            return perimeter;
      }

      public String toString () {
            String string;
            string = "This rectangle has a length of " + this.length
+ " and width of " + this.width + ". It has a perimeter of " +
this.getPerimeter() + " and an area of " + this.getArea();
            return string;
      }

}
```

Square Class Code:

```
public class Square extends Rectangle {
      public Square () {
            float side = (float) (1 + Math.random() * 100);
            super.setWidth(side);
            super.setLength(side);
      }

      public Square (float side) {
            super(side,side);
      }

      public void setSide (float side) {
            super.setLength(side);
            super.setWidth(side);
      }

      public String toString () {
            String string;
            string = "This square has a length and width of " +
super.getWidth() + ". Its perimeter is " + super.getPerimeter() + "
and its area is " + super.getArea() + ".";
            return string;
      }

}
```

Rectangle_Tester Class Code:

```
import java.util.*;
public class Rectangle_Tester {

      private Rectangle [] rectangleStorage;

      public Rectangle_Tester (int max) {
            rectangleStorage = new Rectangle [max];
            for (int x = 0; x < rectangleStorage.length; x++) {
                  rectangleStorage[x] = new Rectangle ();
            }
      }

      public void addRectangle () {
            Scanner input = new Scanner (System.in);
            for (int x = 0; x < rectangleStorage.length; x++) {
                  System.out.println("\t *Rectangle " + (x+1) + "*");
```

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```
                System.out.println("Enter the width of rectangle "
+ (x+1));
                float width = input.nextFloat();
                System.out.println("Enter the length of rectangle "
+ (x+1));
                float length = input.nextFloat();
                rectangleStorage[x].setWidth(width);
                rectangleStorage[x].setLength(length);
          }
     }

     public void printAllInfo () {
          for (int x = 0; x < rectangleStorage.length; x++) {
                System.out.print("Rectanle " + x + " - ");
                System.out.print("•Length: " +
rectangleStorage[x].length + " ");
                System.out.print("•Width: " +
rectangleStorage[x].width + " ");
                System.out.print("•Area: " +
rectangleStorage[x].getArea() + " ");
                System.out.print("•Perimeter: " +
rectangleStorage[x].getPerimeter() + "\n");
          }
     }

     public float returnLargestArea () {
          float largest = 0;
          for (int x = 0; x < rectangleStorage.length; x++) {
                if (rectangleStorage[x].getArea()> largest) {
                     largest = (float)
rectangleStorage[x].getArea();
                }
          }
          return largest;
     }

     public float returnLargestPerimeter () {
          float largest = 0;
          for (int x = 0; x < rectangleStorage.length; x++) {
                if (rectangleStorage[x].getPerimeter()> largest) {
                     largest = (float)
rectangleStorage[x].getPerimeter();
                }
          }
          return largest;
     }

}
```

Client Class Code: used to test all three classes. (use at least 10 Rectangle / Square objects)

```
import java.util.*;
public class Client {

     public static void main(String[] args) {
          // TODO Auto-generated method stub
          //This code tests the Rectangle_Tester class
          Scanner input = new Scanner (System.in);

          float largestArea;

          float largestPerimeter;

          System.out.println("Enter the number of rectangles");
```

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```
            int max = input.nextInt();

            Rectangle_Tester rectangle_tester = new
Rectangle_Tester(max);
            rectangle_tester.addRectangle();

            rectangle_tester.printAllInfo();

            largestArea = rectangle_tester.returnLargestArea();

            largestPerimeter =
rectangle_tester.returnLargestPerimeter();
            System.out.println("The largest area is " + largestArea);

            System.out.println("The largest perimeter is " +
largestPerimeter);
      }
}
```

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