Q1. Write a Java class called Color that has the following features:

- A color is stored as three double values: a red, a green and a blue value. Each of these values ranges between 0 and 1. For example, the color red would be stored with a red value of 1.0, a green value of 0.0 and a blue value of 0.0. A mid-gray color would be stored as 0.5, 0.5, 0.5 for the red, green and blue values respectively.
- A class constructor which takes red, green and blue double values to create a new color.
- A second constructor which takes a string that represents the color in hex format. For example, the color red would be represented as "#FF0000", the color blue as "#0000FF".
- An overridden toString() method with returns a hex string representing the color.

To test your code:

```
public static void main(String args[]) {
   Color pink = new Color(1.0,0.0,0.5);
   System.out.println(pink);
   Color orange = new Color("#FFA500");
   System.out.println(orange);
}
```

should result in the printout:

```
#ff007f
#ffa500
```

[20 marks]

Q2. Write an abstract class in Java called Shape. A Shape has:

- A color, stored as a Color object, using your Color class from Q1
- A parameterless constructor, which sets a shape's color to the default color black (0.0, 0.0, 0.0)
- A constructor which takes a Color reference as a parameter to set a shape's color when it is created
- An abstract area() method, which is intended to return the area of shape
- An abstract getType() method, which is intended to return the type of a shape as a string (e.g. "Circle", or "Triangle", etc.)
- A toString() method which returns the Shape data as a string. The shape data returned should include the shape's type, color and area.

[15 marks]

Q3. Add a public static inner class called Point, as a member of your Shape class. A Point has:

- x and y coordinates, as double values
- A constructor, that takes x and y values as parameters
- Methods x() and y() that return the x and y values of a Point respectively
- A toString() method that returns a string representation of a Point, for example as "(0.5,1.0)"

Submit your complete Shape class code.

[10 marks]

Q4. Write a Java class called Circle, which inherits from your Shape class. A Circle has:

- A center point, stored as a Shape.Point object
- A radius value, stored as a double value
- A constructor which takes a center point (as a Shape.Point reference) and a radius value
- Another constructor which takes a center point, a radius value and a Color, to set the Shape's color
- An implementation of Shape's abstract methods: getType() and area()
- An overridden toString() method which returns a string representation of all Circle information

The following main() method:

```
public static void main(String args[]) {
   Shape s1 = new Circle(new Shape.Point(1,1), 2.5, new Color(0.5,0.5,0));
   System.out.println(s1);
}
```

should give a printout similar to:

```
Shape Type: Circle - Color: #7f7f00 - Area: 19.634954084936208 - Center: (1.0,1.0) - Radius: 2.5
```

[15 marks]

Q5. Write a Java class called Triangle, which inherits from your Shape class. A Triangle has:

- Three Shape.Point objects to store its three vertices
- A constructor which constructs a triangle from three given points (Shape.Point objects)
- Another constructor which takes three points and a Color to initialize the Shape's color
- An implementation of the inherited abstract methods: getType() and area()
- An overridden toString() method which returns a string representation of all Triangle data

[15 marks]

Q6. Write a main() method which creates an array of four shapes, two Circles and two Triangles. Add a for loop to your code, to iterate through the array, printing each shape's data.

[10 marks]

Q7. Write a static method in Java with the following form:

```
String[] getWordsContainingSubstring(String text, String subString)
```

The method takes a string containing text and returns an array of words that contain the given substring.

For example, given the text "This is some text for testing. Search for words containing the given substring." When searched for the substring "ing", the method should return an array with the three elements: "testing", "containing" and "substring". Note that any punctuation ("." "," etc.) should be excluded from the words in the array.

[15 marks]