

AP COMPUTER SCIENCE A – HOMEWORK #3

The goal of this assignment is to write a program `SolveQuadratic` which solves the quadratic equation

$$ax^2 + bx + c = 0$$

for x by using the Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Recall that the solutions for x can be either a double root, two real roots, or a complex conjugate pair.

You will use the class `ComplexNumber`, listed here

```
public class ComplexNumber {
    /**/
    private double real, imag;
    /**/
    public ComplexNumber ( double real, double imag ) {
        this.real=real;
        this.imag=imag;
    }
    /**/
    public double real () {
        return real;
    }
    /**/
    public double imag () {
        return imag;
    }
    /**/
    public String toString () {
        /**/
        char sign;
        String rS, iS;
        /**/
        rS=String.format("%5.2f",real);
        if ( imag < 0.0 ) sign='-';
        else             sign='+';
        iS=String.format("%4.2f",Math.abs(imag));
        /**/
        return rS + sign + iS + 'i';
    }
}
```

as is. Note that this class is just a container for a complex number with a `toString()` method.

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1) Write a class `QuadraticEquation` which

- a) has a private field `private ComplexNumber [] x` of length 2, which will contain the two solutions x to the quadratic equation.
- b) has a constructor with signature
`public QuadraticEquation (double a, double b, double c)`. The constructor should use the Quadratic Formula to calculate the two solutions x .
- c) has an accessor method `public ComplexNumber [] getX ()` which returns the solutions x to the calling program.

2) Starting with `SolveQuadraticStub.java`, write a class `SolveQuadratic` by adding code to the main method which:

- a) prints a “splash” to the console something like

```
Solve
  2
ax + bx + c = 0 for x.
```

- b) prompts the user for a , b and c . You should use the methods `open`, `readDouble` and `close` provided, similar to what was done in program `ConsoleReaderTest`. When prompting the user for a , you should ensure that $a \neq 0$. Use a `while` loop to accomplish this, and if the user enters `0.0` for a , your program should print `a != 0` to the console, and then re-prompt the user for a .
- c) make a `QuadraticEquation` object, and use the accessor `ComplexNumber [] getX ()` to gain access to the solution x .
- d) print the solution x to the console.

You may test your program with these three test cases:

- i. $50x^2 + 420x + 882 = 0 \Rightarrow x = -4.2$ (twice)
- ii. $50x^2 + 135x - 899 = 0 \Rightarrow x = 3.1 \quad x = -5.8$
- iii. $50x^2 - 470x + 1189 = 0 \Rightarrow x = 4.7 + 1.3i \quad x = 4.7 - 1.3i$

Once your program is working correctly, email the files `QuadraticEquation.java` and `SolveQuadratic.java` to me at sharren@d131.org.