Selections

CMPT220L
Due on Feb 18, 2022 by 11:59PM
Points: 100

Problems

1. *(Algebra: solve quadratic equations)* The two roots of a quadratic equation $ax^2 + bx + c = 0$ can be obtained using the following formula:

   $$r_1 = \frac{-b+\sqrt{b^2-4ac}}{2a} \text{ and } r_2 = \frac{-b-\sqrt{b^2-4ac}}{2a}$$

   $b^2 - 4ac$ is called the discriminant of the quadratic equton. If it is positive, the equatiojn has two real roots. If it is zero, the equation has one root. If it is negative, the equation has no real roots.

   Write a program that prompts the user to enter values for a, b, and c and displays the result based on the discriminant. If the discriminant is positive, display two roots. If the discriminant is `0`, display one root. Otherwise, display "The equation has no real roots."

   Note you can use `Math.pow(x, 0.5)` to compute $\sqrt{x}$. Here are sample runs:

   ```
   Enter a, b, c: 1.0 3 1
   The equation has two roots -0.381966 and -2.61803

   Enter a, b, c: 1 2.0 1
   The equation has one root -1.0

   Enter a, b, c: 1 2 3
   The equation has no real roots
   ```

2. *(Reduce fractions)* Write a program that prompts the user to enter the numerator and denominator of a fraction. The program determines whether the number is a proper fraction or an improper fraction. If it is a proper fraction, display the number. If not, reduce it to a mixed fraction or to an integer.

   Here are sample runs:

   ```
   Enter a numerator: 45
   Enter a denominator: 46
   45 / 46 is a proper fraction

   Enter a numerator: 45
   Enter a denominator: 15
   45 / 15 is an improper fraction and it can be reduced to 3

   Enter a numerator: 45
   Enter a denominator: 25
   45 / 25 is an improper fraction and its mixed fraction is 1 + 20 / 25
   ```

3. *(Slope-intercept form)* Write a program that prompts the user to enter the coordinates of two points (x_1, y_1) and (x_2, y_2), and displays the line equation in the slope- intercept form, i.e., $y = mx + b$. For a

review of line equations, see `http://www.purplemath.com/modules/strtlneq.htm`. m and b can be computed using the following formulas:
$m = y_2 - y_1/x_2 - x_1 \qquad b = y_1 - mx_1$
Don't display m if it is 1 and don't display b if it is 0.

Here are sample runs:

```
Enter the coordinates for two points: 1 1 0 0
The line equation for two points (1, 1) and (0, 0) is y = x

Enter the coordinates for two points: 4.5 -5.5 6.6 -6.5
The line equation for two points (4.5, -5.5) and (6.6, -6.5) is
 y = -0.47619x - 3.35714
```

4. *(Random point)* Write a program that generates a random point inside a circle. The circle is centered at (0, 0) with a radius 5. Display the point and its distance to the center.

   Here are sample runs:

```
The point is (-3.3878721143708708, 3.1409080280010944)
and its distance to the center is 4.619846393950072

The point is (-0.14972878708817536, 4.986535034124079)
and its distance to the center is 4.9887824522852995
```

Submission

Make sure you create one Java file per project. Place your `.java` files under the corresponding folder in your local copy of the GitHub repository, commit and push it to the remote repository. Make sure that the professor has access to the repository (`jfac65-marist`).

```
cmpt220lastname\
   hw03\
      Problem1.java
      Problem2.java
      Problem3.java
      Problem4.java
```