Assignment04

20 Points

Objectives

- `math` and `math` Library operation
- Translating formulas
- Selection

Background

- Write a Python program to find the roots of a quadratic equation $aX^2 + bX + c = 0$. Roots of a quadratic equation are values for x where the curve intersects the X axis (in other words, when you plug in x in the formula $aX^2 + bX + c$ results in 0). A quadratic equation may have no root, one root or 2 roots. The formula is:

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

where the symbol "±" indicates that the equation may have 2 roots:

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

- **Discriminant**: The expression under the square root, $b^2 - 4ac$ is called the discriminant, referred to as D hereafter. D has to be greater than or equal to 0 for square root √ to have real answers. When D is less than 0, √ has no real answer, thus the equation has no roots. When D is equal to zero, $\sqrt{D}$ is equal to 0, so the equation has only one root: **–b / 2a**. When D is greater than zero, the equation has 2 distinct roots that are computed according to above formulas.

Instructions & Requirements

1) Create a new `.py` file and start writing code.

2) ***Introductory Comments:*** At the beginning of the program, include "Introductory Comments" as below. All your submissions should include a segment of introductory comments.

```
#============================================================
# Your Name & Lab Section: (ex: Purdue Pete, Friday 1:30pm)
# Your Purdue Email:
# Program Description: In your own words, provide a brief, meaningful
description of the program in 1-2 sentences (just "Assignment04" is not
meaningful).
# Academic Honesty:
# I attest that this is my original work.
# I have not used unauthorized source code, either modified or unmodified.
# I have not given other fellow student(s) access to my program.
#============================================================
```

3) ***Inline Comments:*** Add **at least 7** InLine comments to provide explanatory information about your code and get the grade.

```
EX.  #Calculate the area of the rectangle
     #Print a message to get input from the user
```

4) Import `math` library
5) Define the `main()` function and write code as follows inside the `main()`:
*6) ** Declare necessary variables (at least 4 variables). All inputs from the user should be assigned to variables with meaningful names and proper data types (choosing wrong data types can produce results that are different from the desired outputs).*
7) Prompt the user to enter the coefficient a.
8) Prompt the user to enter the coefficient b.
9) Prompt the user to enter the coefficient c.
10) Print the Quadratic Equation with the entered user's inputs (coefficients) **with single decimal place** as **Desired Outputs**.
11) Compute the discriminant $D = b^2 - 4ac$ and store it in a variable.
12) Display the discriminant to the screen **with three decimal places.**
13) Using a cascading *if* statement (`if – else if`), check the value of D. Depending on the value, print the results accordingly as **Desired Outputs**. When computing the roots of this equation, print the results **with three decimal places.**
14) Determine the minimum of the three coefficients a, b, c and display the minimum to the screen **with two decimal places**.
15) Call `main()`

Submission

- **Submit the `.py` file on Brightspace.**
- BEFORE submission, test your program by comparing the outputs with **Desired Outputs** below.
- AFTER submission, download your submission and test whether your program runs without any issue (For Windows users, don't double-click the source code. Run it using an IDE).
- NO late submission will be accepted.
- There will be penalties for wrong file submission and any errors in the program.
- Only the last submission will be graded, although you can turn in as many as you want.

Desired Outputs

BEFORE submission, test your program by comparing the outputs with the figure(s) below. Your program **MUST** produce the same outputs as below when given the same inputs.

** For this assignment, test all three cases below and make sure no error occurs. **

1) Figure 1: When the equation has 2 roots.

```
****************************************
*              Vijay                   *
*           xyz@purdue.edu             *
*          CNIT155 Assignment 4        *
****************************************

This program will find the roots based on the discriminant of the quadratic equation: aX^2 + bX + c = 0

        Enter the coefficient a: 3.5
        Enter the coefficient b: 7
        Enter the coefficient c: 2.1

        Quadratic Equation is: 3.5X^2 + 7.0X + 2.1 = 0

        The Discriminant is: 19.600

        The equation has two real roots: -0.368 and -1.632

        The smallest coefficient is: 2.10
```

2) Figure 2: When the equation has only one root.

```
****************************************
*              Vijay                   *
*           xyz@purdue.edu             *
*          CNIT155 Assignment 4        *
****************************************

This program will find the roots based on the discriminant of the quadratic equation: aX^2 + bX + c = 0

        Enter the coefficient a: 2
        Enter the coefficient b: 8
        Enter the coefficient c: 8

        Quadratic Equation is: 2.0X^2 + 8.0X + 8.0 = 0

        The Discriminant is: 0.000

        The equation has one real root: -2.000
        The smallest coefficient is: 2.00
```

3) Figure 3: When the equation has NO real roots.

```
****************************************
*              Vijay                   *
*           xyz@purdue.edu             *
*          CNIT155 Assignment 4        *
****************************************

This program will find the roots based on the discriminant of the quadratic equation: aX^2 + bX + c = 0

        Enter the coefficient a: 3
        Enter the coefficient b: 2.5
        Enter the coefficient c: 6

        Quadratic Equation is: 3.0X^2 + 2.5X + 6.0 = 0

        The Discriminant is: -65.750

        The equation has no real roots.
        The smallest coefficient is: 2.50
```