ECE 270

Justin Newman

Quiz #3
The Quadratic Formula

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1. Statement of the Problem

The purpose of this program is to allow the user to input the coefficient values of a quadratic equation in the form $ax^2 + bx + c$ uses the Quadratic Formula to obtain the x-value(s) that are solutions to the given equation. The program then outputs those solutions to the scree and to a file named quiz3.txt.

2. Description of solution

This program uses the Quadratic Formula solve quadratic equations based on user input of the coefficients a, b, and c.

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

Upon start the user is prompted to input the values of a, b, and c for an equation in the form $ax^2 + bx + c$, the program then computes the discriminant, $(b^2 - 4ac)$, portion of the Quadratic Formula. Having calculated the value of the discriminant, the program then uses an "if" statement to determine which set of operations to perform, depending on whether the discriminant is positive, negative, or 0.

If the discriminant is positive, the solutions will be Real Roots and the program declares a variable for each of the two different solutions, takes the square root of the discriminant, and finishes applying the Quadratic Formula before printing the solutions to the screen and quiz.txt:

```
double answer1, answer2;

discriminant=sqrt(discriminant);

answer1=(-varB+discriminant)/2*varA;
answer2=(-varB-discriminant)/2*varA;

printf("\n\nReal Roots - Answers:\t%.2f & %.2f",answer1,answer2);
fprintf(fp,"\n\nReal Roots - Answers:\t%.2f & %.2f",answer1,answer2);
```

If the discriminant is negative, the solutions will be complex roots and the program declares 2 variables, one to store the real portion of both solutions and one to store the imaginary part. The programs then changes the sign of the discriminant to take the square root, finishes applying the Quadratic Formula, and stores it as the imaginary part of the solutions. Having obtained the real and imaginary parts of the solutions, the

program then outputs them to the scree and quiz3.txt in the form
$$realPart \pm jimaginaryPart:$$

```
double realPart, imagPart;

realPart=-varB/(2*varA);

imagPart=sqrt(-discriminant)/(2*varA);

printf("\n\nComplex Roots - Answers:\t%.2f + j%.2f & %.2f -
j%.2f",realPart,imagPart,realPart,imagPart);
fprintf(fp,"\n\nComplex Roots - Answers:\t%.2f + j%.2f & %.2f -
j%.2f",realPart,imagPart,realPart,imagPart);
```

If the determinant is 0, the program declares a single variable to store the solution, applies the Quadratic Formula, and outputs the result to the screen and quiz3.txt

```
double answer;

answer=-varB/2*varA;

printf("\n\nRepeated Roots - Answer:\t%.2f",answer);
fprintf(fp,"\n\nRepeated Roots - Answer:\t%.2f",answer);
```

3. Output and Testing

To test the program I calculated with 3 data sets to obtain the 3 different conditions of the program, for Real Roots: a=1 b=5 c=6, for Complex Roots: a=3 b=2 c=1, and for Repeated Roots: .

Real Roots:

```
ECE270 Quiz 3, Quadratic Equation Solver
This progam will solve quadratic equations of the type ax^2+bx+c

Please enter the value of a:1.000000

Please enter the value of b:5.000000

Please enter the value of C:6.000000

Real Roots - Answers:    -2.00 & -3.00
```

Complex Roots:

```
ECE270 Quiz 3, Quadratic Equation Solver
This progam will solve quadratic equations of the type ax^2+bx+c

Please enter the value of a:3.000000

Please enter the value of b:2.000000

Please enter the value of C:1.000000

Complex Roots - Answers:      -0.33 + j0.47 & -0.33 -j0.47
```

Repeated Roots:

```
ECE270 Quiz 3, Quadratic Equation Solver
This progam will solve quadratic equations of the type ax^2+bx+c

Please enter the value of a:1.000000

Please enter the value of b:2.000000

Please enter the value of C:1.000000

Repeated Roots - Answer:      -1.00
```

I verified the results by calculator and they are correct.

4. Code

```c
1  /*Justin Newman
2  ECE270 9/19/14
3  Quiz #3:
4  Quadratic Equation Solver*/
5
6  #include<stdio.h>
7  #include<stdlib.h>
8  #include<math.h>
9
10 int main()
11     {
12         double discriminant, varA, varB, varC;
13
14         FILE *fp;
```

```c
15          fp=fopen("quiz3.txt","w");
16
17          //All screen output lines are followed by a matching line that prints
output to quiz3.txt
18          printf("ECE270 Quiz 3, Quadratic Equation Solver");
19          fprintf(fp,"ECE270 Quiz 3, Quadratic Equation Solver");
20
21          printf("\nThis progam will solve quadratic equations of the type
ax^2+bx+c");
22          fprintf(fp,"\nThis progam will solve quadratic equations of the type
ax^2+bx+c");
23
24          printf("\n\nPlease enter the value of a:");
25          scanf("\n%lf",&varA);
26          fprintf(fp,"\n\nPlease enter the value of a:%f",varA);
27
28          printf("\n\nPlease enter the value of b:");
29          scanf("\n%lf",&varB);
30          fprintf(fp,"\n\nPlease enter the value of b:%f",varB);
31
32          printf("\n\nPlease enter the value of c:");
33          scanf("\n%lf",&varC);
34          fprintf(fp,"\n\nPlease enter the value of C:%f",varC);
35
36          discriminant=varB*varB-4*varA*varC;
37
38
39
40          //Based on value of discriminant, determines type of solution and
which operations to perform
41              if(discriminant>0)
42                  {
43                  //If the solutions are real roots:
44                      double answer1, answer2;
45
46                      discriminant=sqrt(discriminant);
47                      answer1=(-varB+discriminant)/(2*varA);
48                      answer2=(-varB-discriminant)/(2*varA);
49                      printf("\n\nReal Roots - Answers:\t%.2f &
%.2f",answer1,answer2);
50                      fprintf(fp,"\n\nReal Roots - Answers:\t%.2f &
%.2f",answer1,answer2);
51
52                  }
53
54              else if(discriminant<0)
55                  {
56                  //If the solutions are complex roots:
57                      double realPart, imagPart;
58
59                      realPart=-varB/(2*varA);
60                      imagPart=sqrt(-discriminant)/(2*varA);
61
62                      printf("\n\nComplex Roots - Answers:\t%.2f + j%.2f & %.2f -
j%.2f",realPart,imagPart,realPart,imagPart);
```

```c
63                         fprintf(fp,"\n\nComplex Roots - Answers:\t%.2f + j%.2f & %.2f
-j%.2f",realPart,imagPart,realPart,imagPart);
64
65                     }
66                 else
67                 {
68                     //If the discriminant is 0, we have a single solution:
69                         double answer;
70
71                         answer=-varB/2*varA;
72
73                         printf("\n\nRepeated Roots - Answer:\t%.2f",answer);
74                         fprintf(fp,"\n\nRepeated Roots - Answer:\t%.2f",answer);
75
76                 }
77
78         fclose(fp);
79         return 0;
80
81     }
82
```