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CS1300AA Fall 2019

Program 1

Quadratic Equation

10/2/19

Design test your design, and implement (and test again) a C++ program that will take in from the user the coefficient of $x^2 - a$; and the coefficient of $x - b$ and c and outputs the type of roots of the equation. If $b^2 - 4ac \geq 0$, the program should output the roots of the quadratic equation. Use the `cmath` library for the power function.

The roots of the quadratic equation $ax^2 + bx + c = 0$; $a \neq 0$ are given by the following formula:

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

In this formula, the term $b^2 - 4ac$ is called the discriminant. If $b^2 - 4ac = 0$, the equation has a single repeated root. If $b^2 - 4ac > 0$, the equation has two real roots. If $b^2 - 4ac < 0$, the equation has two complex roots.

Output should look like:

Values of a, b, c	Type of roots of equation	Roots of Equation (or NA)
a = 5; b = 6; c = 1	real	x = -0.2 or x = -1

Answers need to be lined up in columns.

Due Date: Wednesday October 2, 2019

Design

inputs → a, b, c

outputs → Type of roots roots of equation
[real, complex, repeated] [output the roots]

Values of vars must be in columns
[a, b, c]

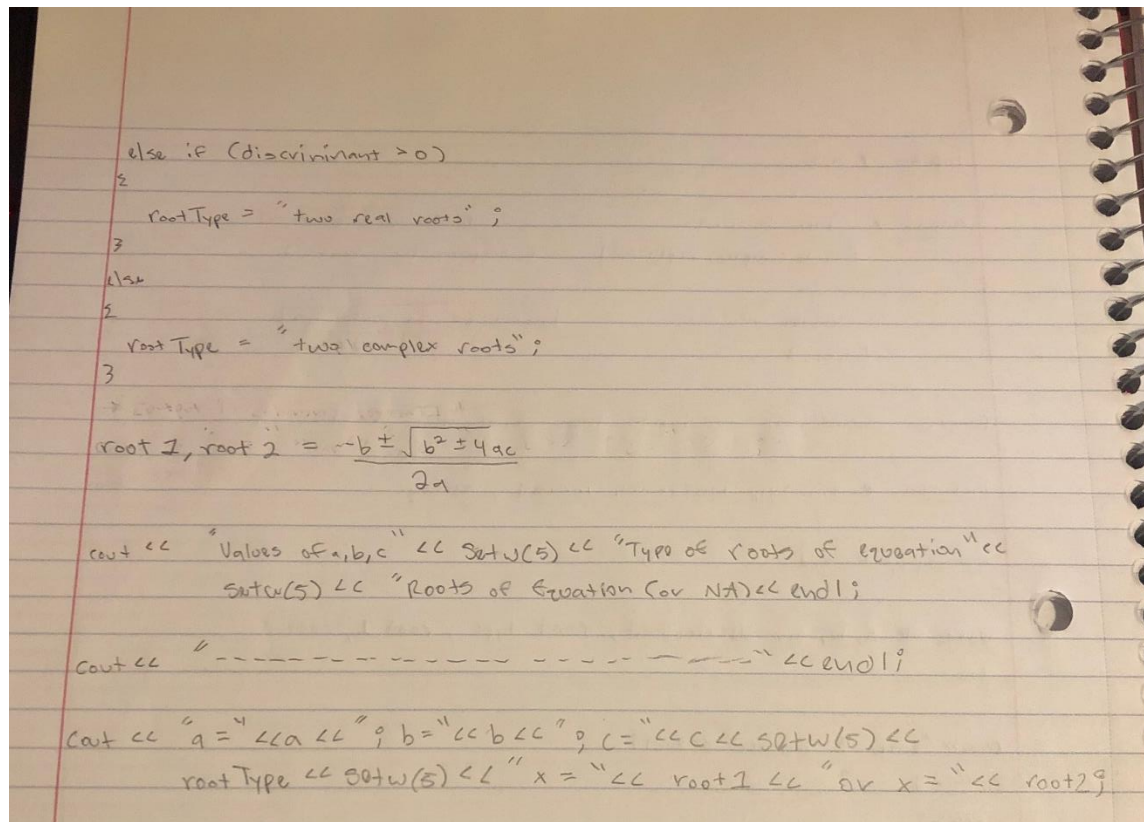
Program should ask for inputs then find the roots

includes → `<math>`, `<iostream>`, `<iomanip>`, `<string>`

namespace → `std`

vars → a, b, c , discriminant, root type, root 1, root 2

```
cout << "Enter 3 numbers" << endl;
cin << a;
cin << b;
cin << c;
discriminant =  $b^2 - 4ac$ ;
if (a == 0)
{
    cout << "a can't be 0" << endl;
    return 0;
}
else if (discriminant == 0)
{
    root type = "single repeated root";
}
↓
```



Source Code

```
#include <iostream>
```

```
#include <cmath>
```

```
#include <iomanip>
```

```
#include <string>
```

```
using namespace std;
```

```
int main()
```

```
{
```

```
    //All my vars are created
```

```
    int a, b, c;
```

```
    double root1, root2, discriminant;
```

```
bool imaginary = false;
```

```
string rootType;
```

```
//Gathers inputs
```

```
cout << "Please enter THREE numbers " << endl;;
```

```
cin >> a;
```

```
cin >> b;
```

```
cin >> c;
```

```
cout << endl;
```

```
//Quick math
```

```
discriminant = pow(b,2) - (4 * a * c);
```

```
//If a = 0 the formula won't work so I checked for that
```

```
if(a == 0)
```

```
{
```

```
    cout << "The first number you enter cannot be a 0, please try again" << endl;
```

```
    return 0;
```

```
}
```

```
else
```

```
//If a doesn't equal 0 then I find the roots of the quadratic
```

```
{
```

```
    root1 = ((-1 * b) + sqrt(discriminant)) / (2 * a);
```

```
    root2 = ((-1 * b) - sqrt(discriminant)) / (2 * a);
```

```
}
```

```

//This will use spaces as the filler between columns

cout << setfill(' ');

cout << fixed << showpoint << setprecision(2);


//Outputs the top row and the divider

cout << "Values of a,b,c" << setw(35) << "Types of roots of equation" << setw(29)
    << "Roots of Equation (or NA)" << endl;

cout << "-----" << endl;


//This section finishes the output based on the discriminant
if(discriminant == 0)
{
    rootType = "Single Repeated Root";
    if(root1 == 0)
    {
        cout << "a = " << a << "; b = " << b << "; c = " << c << setw(25) << rootType
            << setw(15) << "x = " << root2 << endl;
    }
    else
    {
        cout << "a = " << a << "; b = " << b << "; c = " << c << setw(25) << rootType
            << setw(15) << "x = " << root1 << endl;
    }
}

```

```

    }
    else if(discriminant > 0)
    {
        rootType = "Two Real Roots";
        cout << "a = " << a << "; b = " << b << "; c = " << c << setw(19) << rootType
            << setw(21) << "x = " << root1 << " or x = " << root2 << endl;
    }
    else
    {
        rootType = "Two Complex Roots";
        cout << "a = " << a << "; b = " << b << "; c = " << c << setw(22) << rootType
            << setw(18) << "NA" << endl;
    }
    return 0;
}

```

Outputs

Values of a,b,c	Types of roots of equation	Roots of Equation(or NA)
a = 1; b = 1; c = 1	Two Complex Roots	NA

Values of a,b,c	Types of roots of equation	Roots of Equation(or NA)
a = 1; b = 2; c = 1	Single Repeated Root	x = -1.00

Values of a,b,c	Types of roots of equation	Roots of Equation(or NA)
a = 1; b = 9; c = 7	Two Real Roots	x = -0.86 or x = -8.14

Reflection

Project Summary

This project was a quadratic equation calculator; it required 3 inputs and would give outputs based on the results. This project didn't provide any new concepts to me because I went to a vocational school for software development during my junior and senior years of high school. Despite that it was still a good refresher for some of the basics because I haven't coded anything in a couple years.

Challenges

I did run into a couple challenges while programing this project; most of them were my own logic errors. When trying to find the roots I changed the sign in the discriminant instead of the sign outside of the discriminant and that threw off my outputs for quite a while. My other challenge was formatting the output table. At first I set all the output tables to have the same width size, unfortunately depending on the inputs and outputs my table's alignment would get thrown off. To solve this I made an if statement that changes the width of the tables depending on what's going to be outputted.

Solutions

I did take away a couple lesson from this assignment and they are: make sure to double check all formulas when copying them and to always remember to plan your program before coding.