2. Write a C program to generate the roots of a quadratic equation. The various parameters for the quadratic equation are to be received as inputs from the user.

Description:

This program calculates the roots of a quadratic equation of the form:

$ax^2+bx+c=0$

where a, b, and c are coefficients entered by the user. The roots of the equation are found using the quadratic formula:

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

The program follows these steps:

- Reads values of a, b, and c from the user.
- Computes the discriminant (D = b^2 - 4ac).
- Determines the nature of the roots based on the discriminant:
- If D > 0, the equation has two distinct real roots.
- If D = 0, the equation has one real and equal root.
- If D < 0, the equation has complex roots.
- Displays the calculated roots accordingly.

Example:

Case 1: Two Real Roots

Input:

Enter coefficients a, b, c: 1 -3 2

Output:

Roots are 2.00 and 1.00

Case 2: One Repeated Root

Input:

Enter coefficients a, b, c: 1 -2 1

Output:

Root is 1.00

Case 3: Complex Roots

Input:

Enter coefficients a, b, c: 1 2 5

Output:

Roots are -1.00 + 2.00i and -1.00 - 2.00i

Algorithm:

Step 1: Start

Step 2: Declare variables a, b, c (coefficients of the quadratic equation), discriminant, root1, root2, realPart, and imaginaryPart.

Step 3: Prompt the user to enter the values of a, b, and c.

Step 4: Read and store the values of a, b, and c.

Step 5: Compute the discriminant using the formula:

D = b^2 - 4ac

Step 6: Check the value of the discriminant (D):

- If D > 0 (Two distinct real roots):

  Compute root1 and root2 using:

  $$root1 = \frac{-b + \sqrt{D}}{2a}$$

  $$root2 = \frac{-b - \sqrt{D}}{2a}$$

  Display root1 and root2.

- If D == 0 (One repeated real root):

  Compute the single root using:

  $$root1 = root2 = \frac{-b}{2a}$$

  Display root1.

- If D < 0 (Complex roots):

  Compute the real and imaginary parts:

  $$realPart = \frac{-b}{2a}$$

  $$imaginaryPart = \frac{\sqrt{|D|}}{2a}$$

  - **Display the complex roots as:**

  $$realPart + imaginaryPart \times i$$

  $$realPart - imaginaryPart \times i$$

- Step 7: Stop

Source Code:

```
#include<stdio.h>
#include<math.h>

int main()
{
   float
   a,b,c,real,imag;
   float
   root1,root2,d;
   printf("Enter the values of Coefficient a, b, c in a single line
with space in between:\n");
   scanf("%f%f%f",&a,&b,&c);

   d=((b*b)-(4*a*c)); /* Calculate the Determinant ‘d’ */
   if(d==0)
   {
     printf("The roots are real and
     equal\n"); root1=root2=((-
     b)/(2*a)); printf("root1=root2 is
     %.3f\n",root1);
   }
   else if(d>0)
   {
       printf("The roots are real and
       Distinct\n"); root1=(((-
       b)+sqrt(d))/(2*a));
       root2=(((-b)-sqrt(d))/(2*a));
       printf("root1 is %.3f \n root2 is %.3f \n",root1,root2);
   }
   else
   {
   printf("The roots are real and
   imaginary\n"); real=(-b)/(2*a);
   imag=sqrt(fabs(d))/(2*a);
   printf("root1 is %.3f+i%.3f \n",real,imag);
   printf("root2 is %.3f-i%.3f \n",real,imag);
   }
}
```

Sample Output:

```
Enter the values of Coefficient a, b, c in a single line with space in between:
1    6    9
The roots are real and equal
root1=root2 is -3.000

Enter the values of Coefficient a, b, c in a single line with space in between:
1    2    4
The roots are real and imaginary
Root1 = -1 + i1.732
Root2 = -1 – i1.732
```