7) Develop a Java program that prints all real solutions to the quadratic equation $ax^2+bx+c=0$. Read in a, b, c and use the quadratic formula, if the discriminent b^2-4ac is negative, display a message stating that there are no real solutions

Algorithm

Step 1 : Start

Step 2 : Initialize float a, b, c, d and double r_1, r_2;

Step 3 : Print enter the coefficients

Step 4 : Read the values of a, b, c

Step 5 : Calculate d value where $d = b^2-4ac$

Step 6 : if $d > 0$

Calculate r_1 and r_2, print r_1, r_2

Step 7 : else if $d=0$

calculate $r_1 = r_2 = -b/2a$ print r_1, r_2

Step 8 : else

print roots are imaginary;

calculate $r_1 = -b/2a$

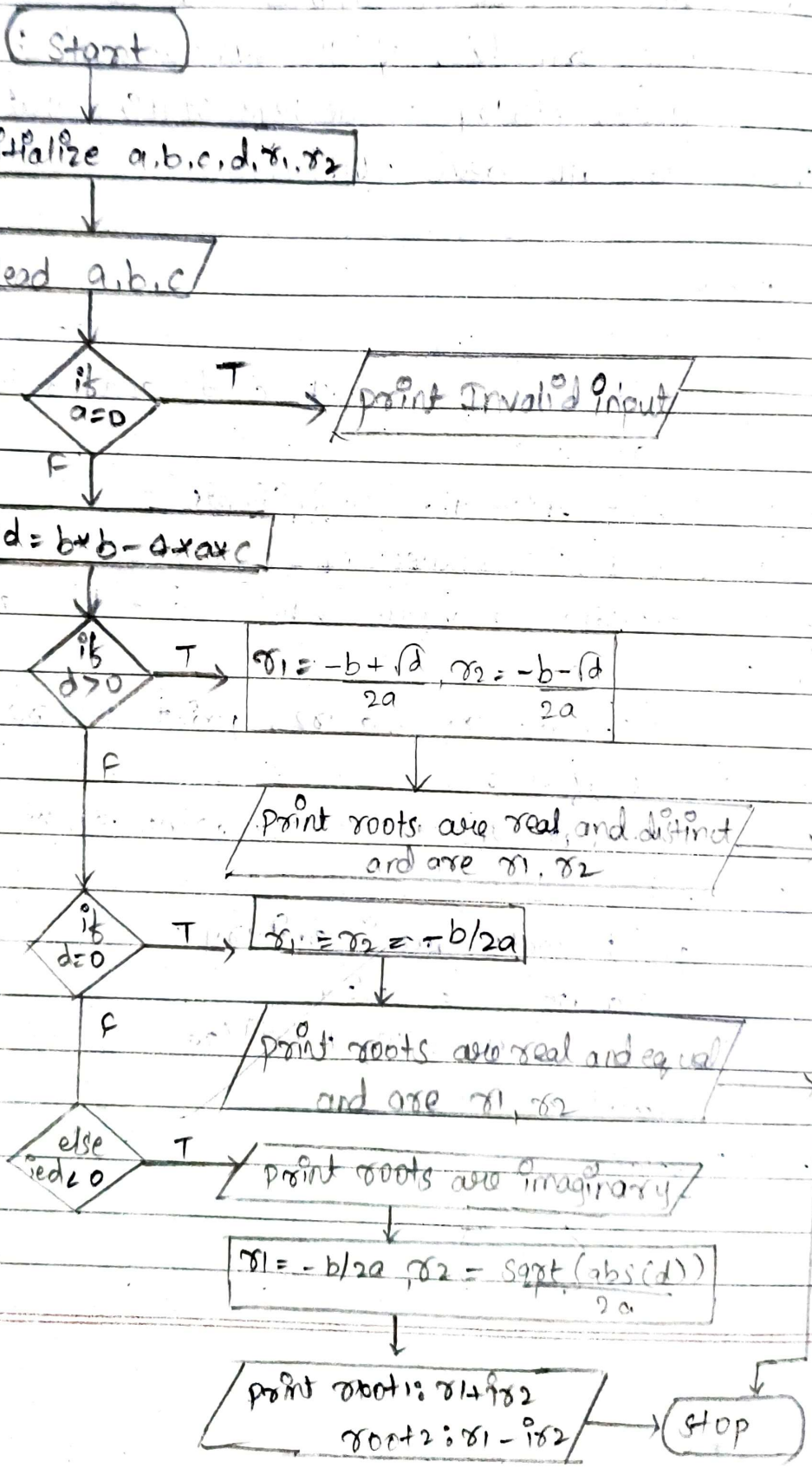
$r_2 = Sqrt(d)/2a$

print r_1 and r_2

Step 9 : Stop

~~Algorithm~~

Flowchart



```
import java.util.Scanner;
import static java.lang.Math.sqrt;
public class QuadraticEquation {
    public static void main (String [ ] args){
        float a, b, c, d;
        double r1, r2;
        Scanner scan = new Scanner (System.in);
        System.out.println ("Enter coefficients");
        a = Scan.nextFloat ( );
        b = Scan.nextFloat ( );
        c = Scan.nextfloat ( );
if (a==0)
System.out.println ("Invalid input");
else {
    d = b*b - 4*a*c;
    if (d>0)
    { System.out.println ("Roots are real & distinct");
      r1 = (-b + Math.Sqrt(d)) / (2*a);
      r2 = (-b - Math.Sqrt(d)) / (2*a);
    System.out.println ("root 1 " + r1 + "root 2 " + r2);}
    else if (d==0)
    { System.out.println ("Roots are real and equal");
      r1=r2 = -b/(2*a);
    System.out.println ("root1: "+r1+" root2: "+r2);}
    else {
    System.out.println ("Roots are imaginary"); }
    r1 = -b/2a;
    r2 = sq(abs) sqrt(d);
                (2a)
    System.out.println ("root1: "+r1+"i "+r2+ "root 2: "
                        +r1+ "-i "+r2); }.
}
```

Output

① enter coefficients

2 1 1

Roots are imaginary

root 1: -0.25 + i0.661437827

root 2: -0.25 - i0.661437827

② enter coefficients

1 2 1

Roots are real and equal

root 1: -1.0

root 2: -1.0

③ enter coefficients

1 3 1

Roots are real and distinct

root 1: -0.381966011125

root 2: -2.618033988

④ enter coefficients

0 1 1

Invalid quadratic equation

22/12/23

```
C:\Users\STUDENT\Desktop\1bm22cs029>javac QE.java

C:\Users\STUDENT\Desktop\1bm22cs029>java QE
Akshara 1BM22CS029
enter coefficients
2
1
1
Roots are imaginary
root1:-0.25+i0.66143782776614 77
root2:-0.25-i0.66143782776614 77

C:\Users\STUDENT\Desktop\1bm22cs029>javac QE.java

C:\Users\STUDENT\Desktop\1bm22cs029>java QE
Akshara 1BM22CS029
enter coefficients
1
2
1
Roots are real and equal
root1:-1.0
root2:-1.0

C:\Users\STUDENT\Desktop\1bm22cs029>javac QE.java

C:\Users\STUDENT\Desktop\1bm22cs029>java QE
Akshara 1BM22CS029
enter coefficients
1
3
1
Roots are real and distinct
root1:-0.3819660112501051
root2:-2.6180339887498 95

C:\Users\STUDENT\Desktop\1bm22cs029>javac QE.java

C:\Users\STUDENT\Desktop\1bm22cs029>java QE
Akshara 1BM22CS029
enter coefficients
0
1
1
Invalid quadratic equation
```