Experiment No. 1

Aim :- Find out the Roots of a Quadratic Equation and Generate its Boundary Value Test Cases.

Input :- A quadratic equation $a(x^2)+bx+c=0$ with input as three positive integers a, b, c having values ranging from an interval [0, 100].

Theory :- Consider a program for the determination of the nature of roots of a quadratic equations. Its input is a triple of positive integers and values may be from 0, 100. The program output may have one of the following words.

Quadratic Equation will be Type:

$ax2+bx+c=0$

Roots are real if $(b2-4ac)>0$

Roots are imaginary if $(b2-4ac)<0$

Roots are equal if $(b^2-4ac)=0$

Equation is not quadratic if $a=0$.

Program :

```
#include<iostream>
#include<conio.h>
using namespace std;
int main()
{
    int a,b,c,d;
    cout<<"The equation is a(x2)+bx+c=0\n";
    cout<<"Enter value of a:";
    cin>>a;
    cout<<"Enter value of b:"<<cin>>b;
    cout<<"Enter value of c:"<<cin>>c;
    d = (b*b)-4*a*c;
    if((a<0)||(b<0)||(c<0)||(a>100)||(b>100)||
                                (c>100))
        cout<<"Invalid input"<<endl;
    elseif (a==0)
        cout<<"Not a quadratic equation";
    elseif (d==0)
        cout<<"Roots are equal";
    elseif (d<0)
        cout<<"Imaginary roots";
    else
        cout<<"Real roots";
    getch();
}
```

Boundary Value Analysis:

Total number of Test Cases = 4n+1

where n → number of inputs = 4(3)+1

= 13 test cases

Boundary values test cases are given as: 0 (minimum), 1 (just above minimum), 50 (Nominal), 99 (just below Maximum), & 100 (Maximum).

Test Case ID	a	b	c	Expected Output
1	50	50	0	Real Roots
2	50	50	1	Real Roots
3	50	50	50	Imaginary Roots
4	50	50	99	Imaginary Roots
5	50	50	100	Imaginary Roots
6	50	0	50	Imaginary Roots
7	50	1	50	Imaginary Roots
8	50	99	50	Imaginary Roots
9	50	100	50	Equal Roots
10	0	50	50	Not a Quadratic Eqn
11	1	50	50	Real Roots
12	99	50	50	Imaginary Roots
13	100	50	50	Imaginary Roots.

Boundary Value Analysis focuses on the input variables of the function. For the purpose of this report I will define two variable X1 and X2. Where X1 lies bet^n A & B or X2 lies bet^n C & D. [A ≤ X1 ≤ B C ≤ X2 ≤ D]

In the general application of Boundary value Analysis can be done in a uniform manner. The basic form of implementation is to maintain all but one of the variable at their nominal values and allowing the remaining variable to take on its extreme values. The value used to test the extremities are:

- Min ---------- Minimal
- Min+ ---------- Just above Minimal
- Nom ---------- Average
- Max- ---------- Just below Maximum
- Max ---------- Maximum

Some Important Example:

The NextDate problem

$1 \leq Day \leq 31$

$1 \leq Month \leq 12$

$1812 \leq Year \leq 2012$

(Here the year has been restricted so that test cases are not too large).

Conclusion: Thus we have studied and executed program to find out the Roots of a Quadratic Equation and executed its Boundary Value Test Cases.

```
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:50
Enter the value of b:50
Enter the value of c:0
Real roots
```

```
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:50
Enter the value of b:50
Enter the value of c:1
Real roots
```

```
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:50
Enter the value of b:50
Enter the value of c:50
Imaginary roots
```

```
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:50
Enter the value of b:50
Enter the value of c:99
Imaginary roots
```

```
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:50
Enter the value of b:50
Enter the value of c:100
Imaginary roots
```

```
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:50
Enter the value of b:0
Enter the value of c:50
Imaginary roots
```

```
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:50
Enter the value of b:1
Enter the value of c:50
Imaginary roots
```

```
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:50
Enter the value of b:99
Enter the value of c:50
Imaginary roots
```

```
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:50
Enter the value of b:100
Enter the value of c:50
Roots are equal
```

```
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:0
Enter the value of b:50
Enter the value of c:50
Not a quadratic equation
```

```
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:1
Enter the value of b:50
Enter the value of c:50
Real roots
```

```
F:\#BLACKHEART\#PROGRAMS\exp1.exe
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:99
Enter the value of b:50
Enter the value of c:50
Imaginary roots
```

```
F:\#BLACKHEART\#PROGRAMS\exp1.exe
The quadratic equation is of the type a(x2)+bX+c=0
Enter the value of a:100
Enter the value of b:50
Enter the value of c:50
Imaginary roots
```