Practical No. 01

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Aim : Write a program in C/C++ to find the roots of a quadratic equation and perform Boundary Value Analysis (BVA).

Theory :

- What is Boundary Value Analysis (BVA)?

→ - Boundary testing is the process of testing between extreme ends or boundaries between partitions of the input values.
- The various extreme ends such as start-end, lower-upper, maximum-minimum, Just Inside-Just-outside, etc., Such values are called boundary values and the testing is called as boundary testing.
- The basic idea in boundary testing is to select input variable values at their :
  - Minimum
  - Just above the minimum
  - A nominal value
  - Just below the maximum
  - Maximum

- Why boundary analysis testing?

→ - This testing is used to reduce a very large number of test cases to manageable chunks.
- This testing is appropriate for calculation-intensive applications with a large number of variables/inputs.

```cpp
#include<bits/stdc++.h>
using namespace std;

int main(){

    int a,b,c,d;
   cout << "The equation is a(x^2)+b(x)+c = 0 \n";
   cout << "Enter value of a : ";
   cin  >> a;
   cout << "Enter value of b : ";
   cin  >> b;
   cout << "Enter value of c : ";
   cin  >> c;

   if(a < 0 || b < 0 || c < 0 || a > 100 || b > 100 || c > 100){
             cout<<"Invalid Input\n";
   }else{
             d = b*b - 4*a*c;
             if(a == 0){
                       cout << "Not a quadratic equation\n";
             }else if(d == 0){
                       cout << "Roots are equal\n";
             }else if(d < 0){
                       cout << "Imaginary Roots\n";
             }else{
                       cout << "Roots are real\n";
             }
             system("pause");
   }
   system("cls");

   return 0;
}
```

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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].

Boundary Value Analysis :

Total Number of Test cases = $4n + 1$,
where, $n \rightarrow$ number of inputs $= 4(3) + 1$
$= 12 + 1 = 13$.

Boundary value test cases are given as :

Minimum : 0
just above minimum : 1
Nominal : 50
just below maximum : 99
maximum : 100

Test case Id	a	b	c	expected output	Actual output
1	50	50	0	Real Roots	Real Roots
2	50	50	1	Real Roots	Real Roots
3	50	50	50	Imaginary Roots	Imaginary Roots
4	50	50	99	Imaginary Roots	Imaginary Roots
5	50	50	100	Imaginary Roots	Imaginary Roots
6	50	0	50	Imaginary Roots	Imaginary Roots
7	50	1	50	Imaginary Roots	Imaginary Roots

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Test case Id	a	b	c	expected output	Actual Output
8	50	99	50	Imaginary Roots	Imaginary Roots
9	50	100	50	Equal Roots	Equal Roots
10	0	50	50	Not a quadratic Equn	Not a quadratic Equation
11	1	50	50	Real Roots	Real Roots
12	99	50	50	Imaginary Roots	Imaginary Roots.
13	100	50	50	Imaginary Roots	Imaginary Roots

The Boundary Value Analysis focuses on the input variables of the function for the purpose of this report. I will define two variable such as x and y. where 'x' lies between 'a' and 'b' or y lies between 'c' and 'd'.

$[a \leq x \leq b \ , \ c \leq y \leq d]$

In general, the 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 at their nominal values and allowing the remaining variable to take on its extreme value. The value used to test the extermibies are :

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

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Some important Example :

The next date problem

$1 <= Day <= 31$

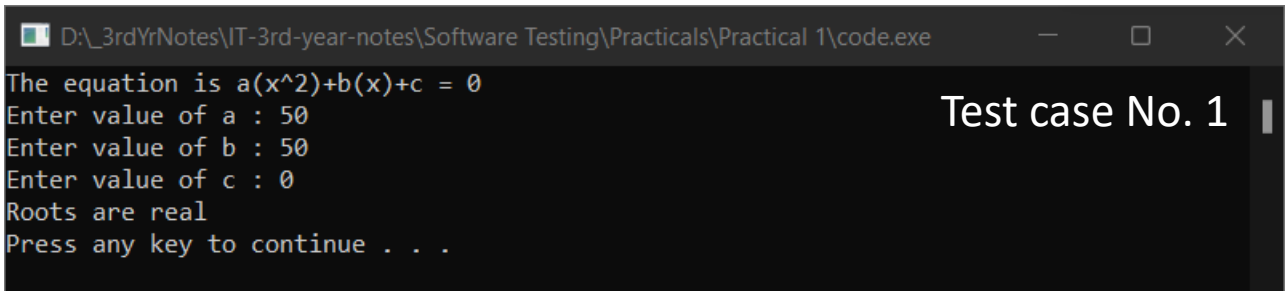
$1 <= Month <= 12$

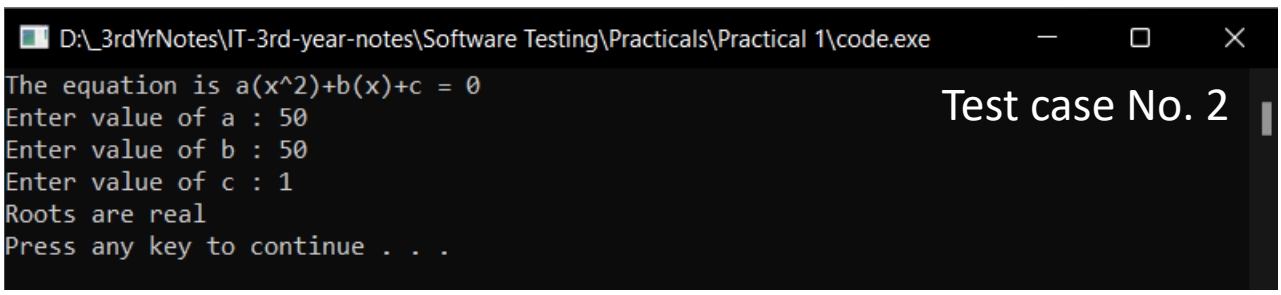
$1812 <= Year <= 2012$

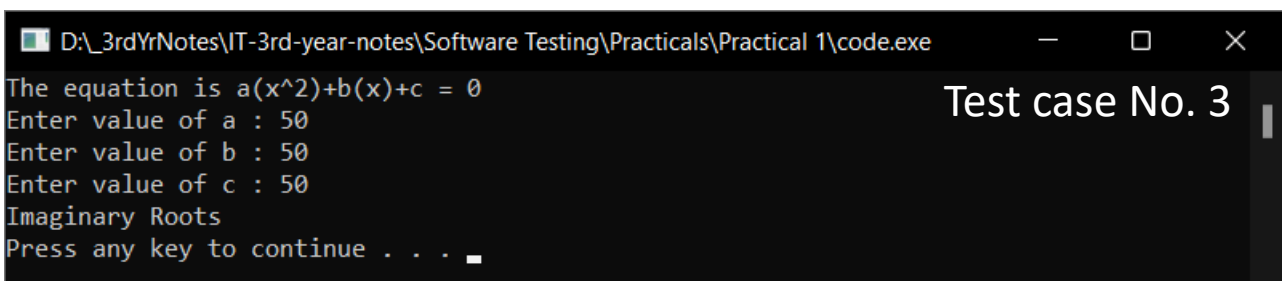
(Here the year has been restricted so that test ~~es~~ cases are not too large).

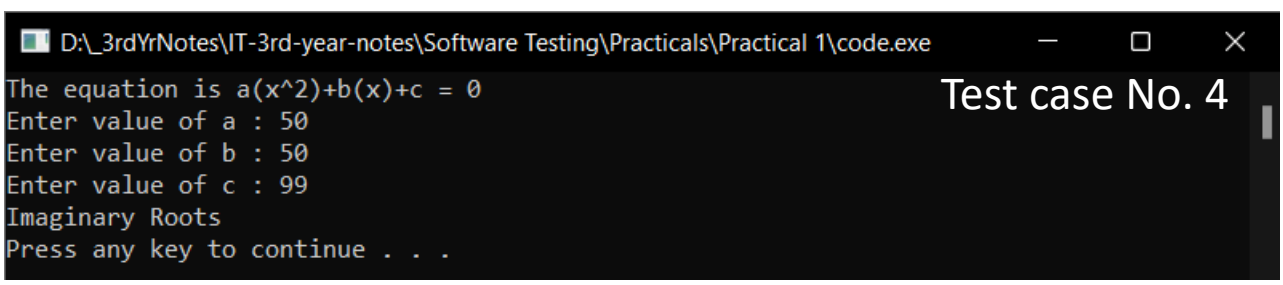
Conclusion :

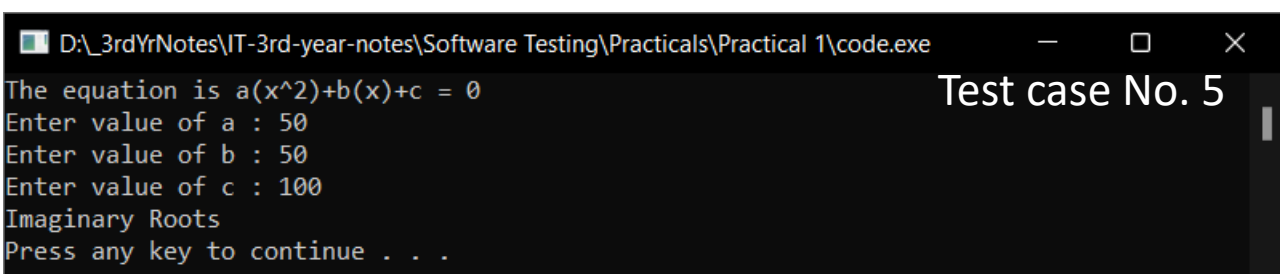
Thus, we have studient and executed program to find out the roots of a quadratic equation and executed its boundary values test cases.

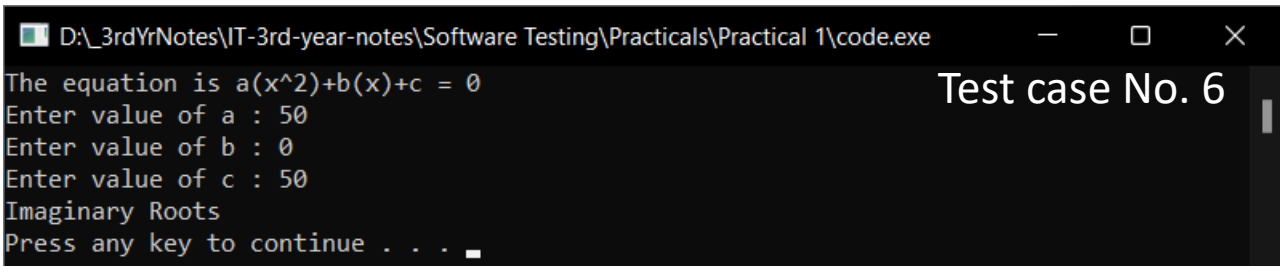

D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 50
Enter value of b : 50
Enter value of c : 0
Roots are real
Press any key to continue . . .
Test case No. 1

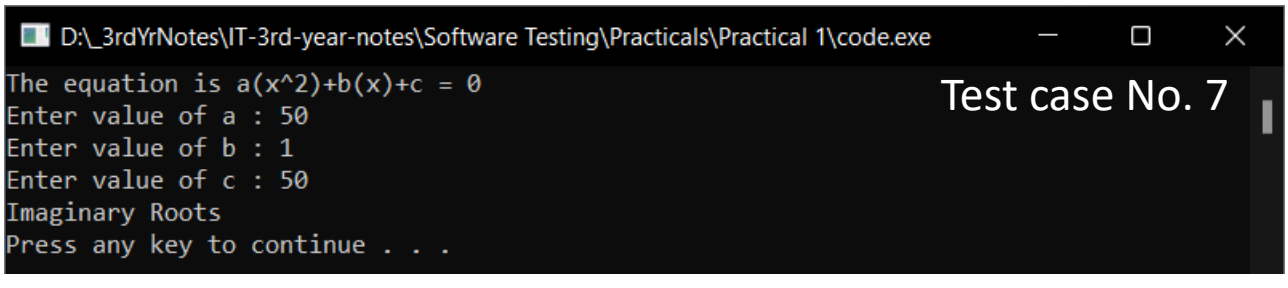

D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 50
Enter value of b : 50
Enter value of c : 1
Roots are real
Press any key to continue . . .
Test case No. 2

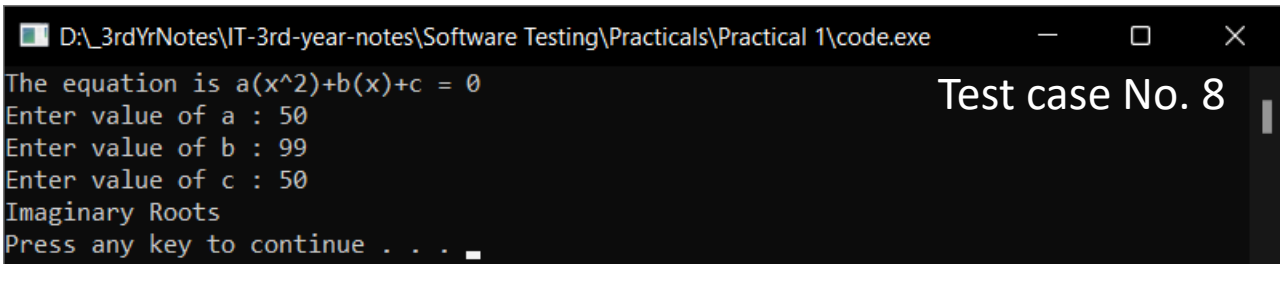

D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 50
Enter value of b : 50
Enter value of c : 50
Imaginary Roots
Press any key to continue . . .
Test case No. 3

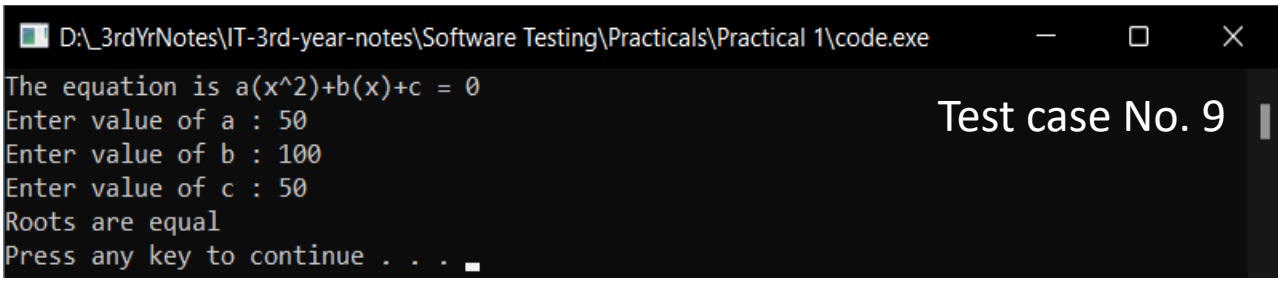

D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 50
Enter value of b : 50
Enter value of c : 99
Imaginary Roots
Press any key to continue . . .
Test case No. 4

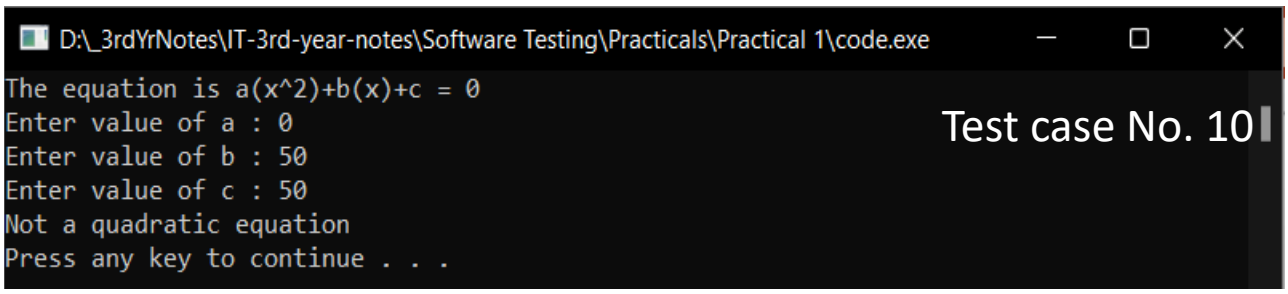

D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 50
Enter value of b : 50
Enter value of c : 100
Imaginary Roots
Press any key to continue . . .
Test case No. 5

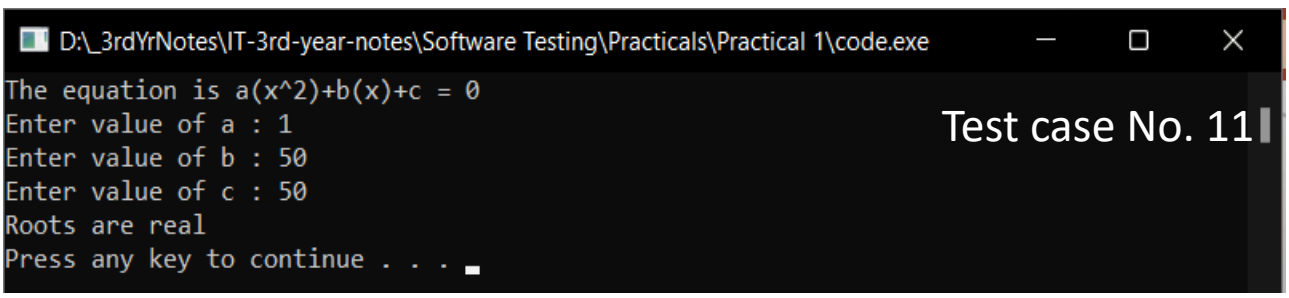

D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 50
Enter value of b : 0
Enter value of c : 50
Imaginary Roots
Press any key to continue . . .
Test case No. 6

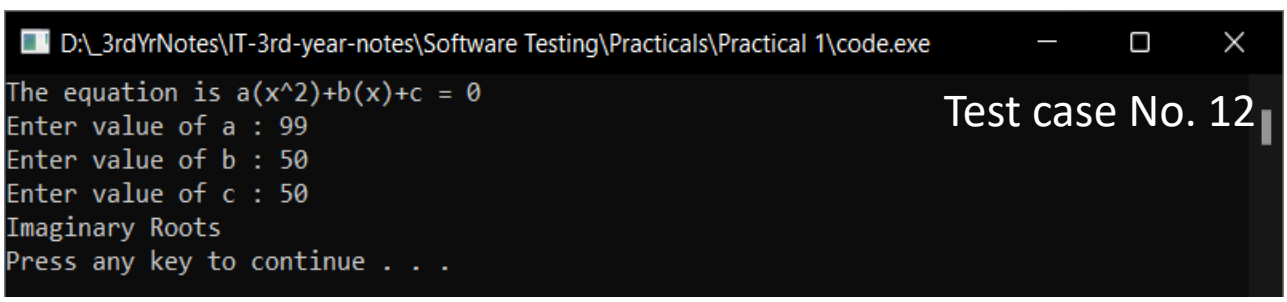

D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 50
Enter value of b : 1
Enter value of c : 50
Imaginary Roots
Press any key to continue . . .
Test case No. 7

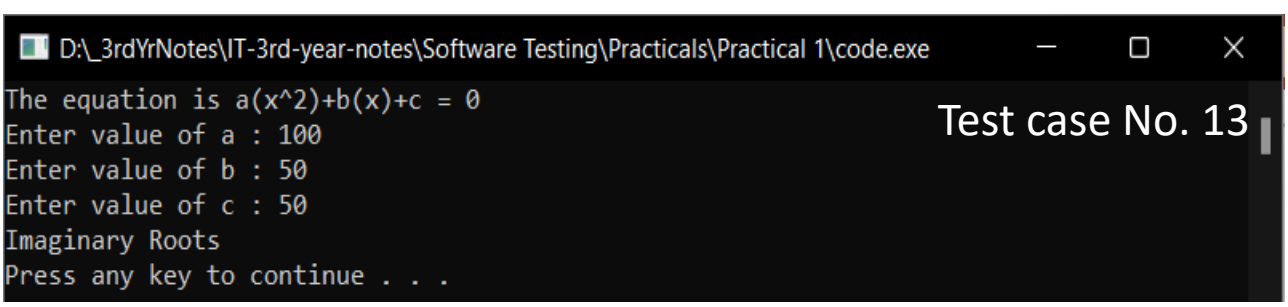

D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 50
Enter value of b : 99
Enter value of c : 50
Imaginary Roots
Press any key to continue . . .
Test case No. 8


D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 50
Enter value of b : 100
Enter value of c : 50
Roots are equal
Press any key to continue . . .
Test case No. 9


D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 0
Enter value of b : 50
Enter value of c : 50
Not a quadratic equation
Press any key to continue . . .
Test case No. 10


D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 1
Enter value of b : 50
Enter value of c : 50
Roots are real
Press any key to continue . . .
Test case No. 11


D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 99
Enter value of b : 50
Enter value of c : 50
Imaginary Roots
Press any key to continue . . .
Test case No. 12


D:_3rdYrNotes\IT-3rd-year-notes\Software Testing\Practicals\Practical 1\code.exe
The equation is a(x^2)+b(x)+c = 0
Enter value of a : 100
Enter value of b : 50
Enter value of c : 50
Imaginary Roots
Press any key to continue . . .
Test case No. 13