

Introduction

A polynomial is an expression consisting of variables and coefficients, that involves only the operations of addition, subtraction, multiplication, and non-negative integer exponents of variables.

A polynomial function is a function that can be defined by evaluating a polynomial.

The root-finding problem is one amongst the foremost important computational problems. It arises in an exceedingly big variety of practical applications in physics, chemistry, biosciences, engineering, etc. during this code we'll use the numerical analysis bisection method.

The importance of root finding in computer fields is it's used in solving optimization problems and in automatic control designs. This topic is crucial in case in machine learning.

The root finding algorithm in this program is the bisection method

Case study

In this topic we are going to solve ten equations using the program in order to show the program's efficiency

Case:1

$$f(x) = -0.6x^2 + 2.4x + 5.5$$

This function has two real roots between $[-2, 6]$ which are

$$x_1 = -1.62859$$

$$x_2 = 5.62859$$

Microsoft Visual Studio Debug Console

```
Enter the polynomial Equation
In the form  $anx^n + a(n-1)x^{(n-1)} + \dots + a_0$ 
Enter all the coefficients even if they are 1 or 0

-0.6x^2+2.4x^1+5.5

Enter the range you want to find the roots in
Strat : -2
End : 6

The root number 1 is -1.62859
The root number 2 is 5.62859
```

Case:2

$$f(x) = 4x^3 - 6x^2 + 7x - 2.3$$

This function has only one root between $[-5, 10]$ which is

$$x_1 = 0.450127$$

```
Microsoft Visual Studio Debug Console

Enter the polynomial Equation
In the form  $anx^n + a(n-1)x^{(n-1)} + \dots + a_0$ 
Enter all the coefficients even if they are 1 or 0

4x^3-6x^2+7x^1-2.3

Enter the range you want to find the roots in
Strat : -5
End : 10

The root number 1 is 0.450127
```

Case:3

$$f(x) = -3x^3 + 19x^2 - 20x - 13$$

This function has three real roots between $[-2, 5]$ which are

$$x_1 = -0.446892$$

$$x_2 = 2.04989$$

$$x_3 = 4.73032$$

```
Microsoft Visual Studio Debug Console

Enter the polynomial Equation
In the form  $anx^n + a(n-1)x^{(n-1)} + \dots + a_0$ 
Enter all the coefficients even if they are 1 or 0

-3x^3+19x^2-20x^1-13

Enter the range you want to find the roots in
Strat : -2
End : 5

The root number 1 is -0.446892
The root number 2 is 2.04989
The root number 3 is 4.73032
```

Case:4

$$f(x) = x^4 - 8x^3 - 35x^2 + 450x - 1001$$

This function has only one real root between $[0, 10]$ which is

$$x_1 = 5.60979$$

```
Microsoft Visual Studio Debug Console

Enter the polynomial Equation
In the form  $anx^n + a(n-1)x^{(n-1)} + \dots + a_0$ 
Enter all the coefficients even if they are 1 or 0

1x^4-8x^3-35x^2+450x^1-1001

Enter the range you want to find the roots in
Strat : 0
End : 10

The root number 1 is 5.60979
```

Case:5

$$f(x) = 2x^3 - 11.7x^2 + 17.7x - 5$$

This function has three real roots between $[-5, 10]$ which are

$$x_1 = 0.365105$$

$$x_2 = 1.92175$$

$$x_3 = 3.56316$$

```
Microsoft Visual Studio Debug Console

Enter the polynomial Equation
In the form  $ax^n + a(n-1)x^{(n-1)} + \dots + a_0$ 
Enter all the coefficients even if they are 1 or 0

2x^3-11.7x^2+17.7x^1-5

Enter the range you want to find the roots in
Strat : -5
End : 10

The root number 1 is 0.365105
The root number 2 is 1.92175
The root number 3 is 3.56316
```

Case:6

$$f(x) = 2x^4 + 6x - 5$$

This function has one real root between $[0, 6]$ which is

$$x_1 = 0.735687$$

```
Microsoft Visual Studio Debug Console

Enter the polynomial Equation
In the form  $ax^n + a(n-1)x^{(n-1)} + \dots + a_0$ 
Enter all the coefficients even if they are 1 or 0

2x^4+0x^3+0x^2+6x^1-5

Enter the range you want to find the roots in
Strat : 0
End : 6

The root number 1 is 0.735687
```

Case:7

$$f(x) = -x^6 - 7x^5 + 10x^4 - 9x^3 + 15x^2 + 100x - 30$$

This function has four real roots between $[-10, 5]$ which are

$$x_1 = -8.33393 \quad x_2 = -1.57809$$

$$x_3 = 0.289085$$

$$x_4 = 2.07072$$

```
Microsoft Visual Studio Debug Console

Enter the polynomial Equation
In the form  $ax^n + a(n-1)x^{(n-1)} + \dots + a_0$ 
Enter all the coefficients even if they are 1 or 0

-1x^6-7x^5+10x^4-9x^3+15x^2+100x^1-30

Enter the range you want to find the roots in
Strat : -10
End : 5

The root number 1 is -8.33393
The root number 2 is -1.57809
The root number 3 is 0.289085
The root number 4 is 2.07072
```

Case:8

$$f(x) = 4x^3 + 2x^2 - 7$$

This function has only one real root between $[-5, 5]$

$$x_1 = 1.05936$$

```
Microsoft Visual Studio Debug Console

Enter the polynomial Equation
In the form  $anx^n + a(n-1)x^{(n-1)} + \dots + a_0$ 
Enter all the coefficients even if they are 1 or 0

4x^3+2x^2+0x^1-7

Enter the range you want to find the roots in
Start : -5
End : 5

The root number 1 is 1.05936
```

Case:9

$$f(x) = 3x^3 - x^2 - 7x + 2$$

This function has three real roots between $[-5, 5]$ which are

$$x_1 = -1.78078$$

$$x_2 = 0.280777$$

$$x_3 = 1.55697$$

```
Microsoft Visual Studio Debug Console

Enter the polynomial Equation
In the form  $anx^n + a(n-1)x^{(n-1)} + \dots + a_0$ 
Enter all the coefficients even if they are 1 or 0

3x^3-1x^2-7x^1+2

Enter the range you want to find the roots in
Start : -5
End : 5

The root number 1 is -1.50764
The root number 2 is 0.284004
The root number 3 is 1.55697
```

Case:10

$$f(x) = -x^5 + 10x^4 + 55x^3 - 30x^2 + 10x - 100$$

This function has two real roots between $[-5, 10]$ which are

$$x_1 = -4.40694$$

$$x_2 = 1.27117$$

```
Microsoft Visual Studio Debug Console

Enter the polynomial Equation
In the form  $anx^n + a(n-1)x^{(n-1)} + \dots + a_0$ 
Enter all the coefficients even if they are 1 or 0

-1x^5+10x^4+55x^3-30x^2+10x^1-100

Enter the range you want to find the roots in
Start : -5
End : 10

The root number 1 is -4.40694
The root number 2 is 1.27117
```