ASSIGNMENT-3

NAME OF THE EXPERIMENT: Bisection Method Matlab Code(Program) Examples

OBJECTIVE: To find the roots of given equation using Bisection Method

THEORY: Bisection method is very simple but time consuming method. In this method, we first define an interval in which our solution of equation lies. As the name indicates, Bisection method uses the bisecting (divide the range by 2) principle. In this method we minimize the range of solution by dividing it by integer 2.

Following are the steps to find the approximate solution of given equation using Bisection method:

- Let us assume that we have to find out the roots of f(x), whose solution is lies in the range (a,b), which we have to determine. The only condition for bisection method is that f(a) and f(b) should have opposite signs (f(a) negative and f(b) positive). When f(a) and f(b) are of opposite signs at least one real root between 'a' and 'b' should exist.
- For the first approximation we assume that root to be, x0=(a+b)/2
- Then we have to find sign of f(x0).
- If f(x0) is negative the root lies between a and x0.
- If f(x0) is positive the root lies between x0 and b.
- Now we have new minimized range, in which our root lies.
- The next approximation is given by, x1 = (a+x0)/2……if f(x0) is negative. x1 = (x0+b)/2……if f(x0) is positive.
- In this taking midpoint of range of approximate roots, finally both values of range converges to a single value, which we can take as a approximate root.

ALGORITHM:

- Input function and limits.
- x0=(a+b)/2
- If f(x0)<0, a=x else b=x
- Repeat steps 3 and 4, 100 times.
- Display x
- Error = x-(a+b)/2
- Store error values in array
- Repeat steps 7 and 8 10 times.
- Plot error
- STOP.

Q1) Find the root of f(x)=x^3-x-1 by using Bisection Method in the interval[1,2] with a tolerance of 0.001

=>

```
clc
clear all
close all
y = input('Enter the Function');
a = input('Enter the Value of a:');
```

```
b = input('Enter the Value of b:');
e = input('Enter the error:');
i = 1;
fa = feval(y,a);
fb = feval(y,b);
if fa*fb > 0
   disp('No Roots');
else
   c = (a+b)/2;
   fc = feval(y,c);
   fprintf('\n\na\t\t\tb\t\t\tc\t\t\tf(c)\n');
   while abs(fc) > e
      fprintf('%f\t%f\t%f\t%f\n',a,b,c,fc);

      if fa*fc < 0
         b=c;
      else
         a=c;
      end
      c = (a+b)/2;
      fc = feval(y,c);
      d(i) = abs(fc);
      i = i + 1;
   end
   fprintf('Root is: %f\n',c);
   fprintf('Number of Iteration:%f',i);
    Plot(d);
end
```

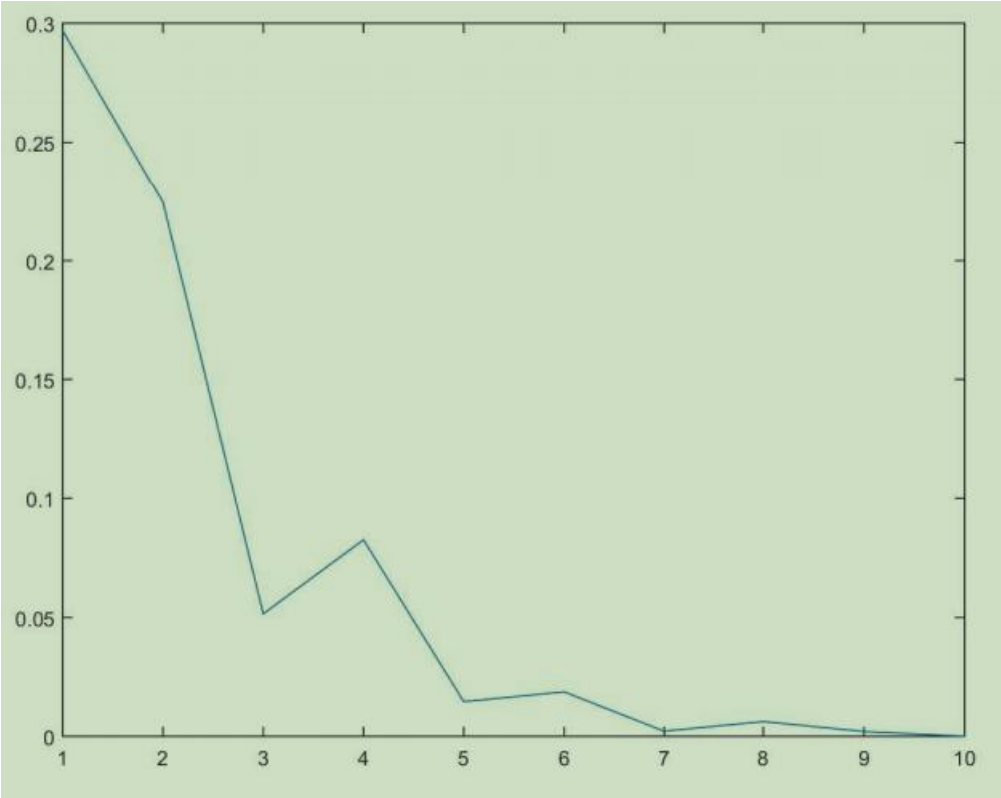
Output:

```
Enter the Function@(x) x^3 - x - 1
Enter the Value of a:1
Enter the Value of b:2
Enter the error:0.001
```

a	b	c	f(c)
1.000000	2.000000	1.500000	0.875000
1.000000	1.500000	1.250000	-0.296875
1.250000	1.500000	1.375000	0.224609
1.250000	1.375000	1.312500	-0.051514
1.312500	1.375000	1.343750	0.082611
1.312500	1.343750	1.328125	0.014576
1.312500	1.328125	1.320313	-0.018711
1.320313	1.328125	1.324219	-0.002128
1.324219	1.328125	1.326172	0.006209
1.324219	1.326172	1.325195	0.002037

```
Root is: 1.324707
Number of Iteration:10
```

FIGURE:



Q2) Find the root of f(x)=x^3-x^2+1 by using Bisection Method in the interval[-200,300] with a tolerance of 0.01

=>Code same as question 1

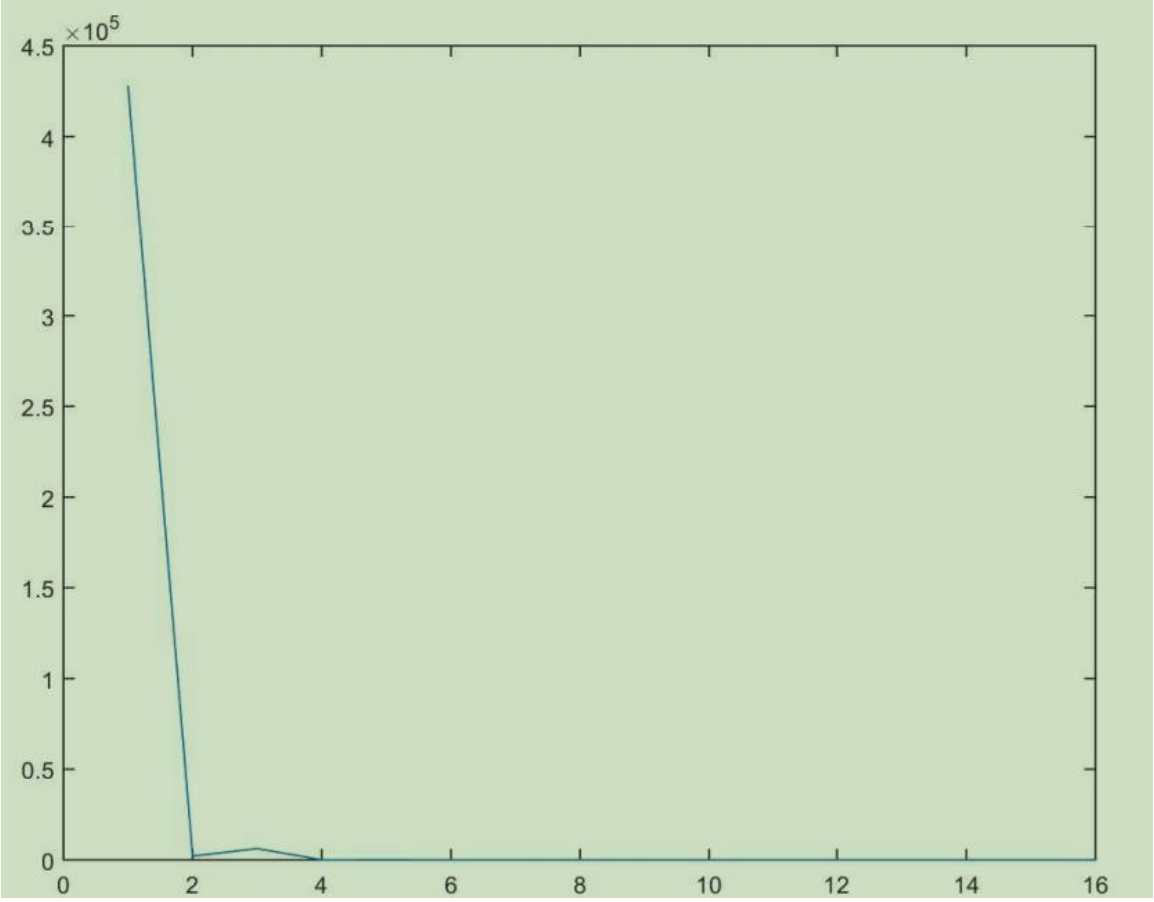
Output:

Enter the Function @(x) x^3 - x^2 +2
Enter the Value of a:-200
Enter the Value of b:300
Enter the error:0.01

a	b	c	f(c)
-200.000000	300.000000	50.000000	122502.000000
-200.000000	50.000000	-75.000000	-427498.000000
-75.000000	50.000000	-12.500000	-2107.375000
-12.500000	50.000000	18.750000	6242.234375
-12.500000	18.750000	3.125000	22.751953
-12.500000	3.125000	-4.687500	-122.969482
-4.687500	3.125000	-0.781250	0.912811
-4.687500	-0.781250	-2.734375	-25.921200
-2.734375	-0.781250	-1.757813	-6.521378
-1.757813	-0.781250	-1.269531	-1.657825
-1.269531	-0.781250	-1.025391	-0.129548
-1.025391	-0.781250	-0.903320	0.446914
-1.025391	-0.903320	-0.964355	0.173186
-1.025391	-0.964355	-0.994873	0.025530
-1.025391	-0.994873	-1.010132	-0.051071

-1.010132 -0.994873 -1.002502 -0.012537
Root is: -0.998688
Number of Iteration:16

FIGURE:



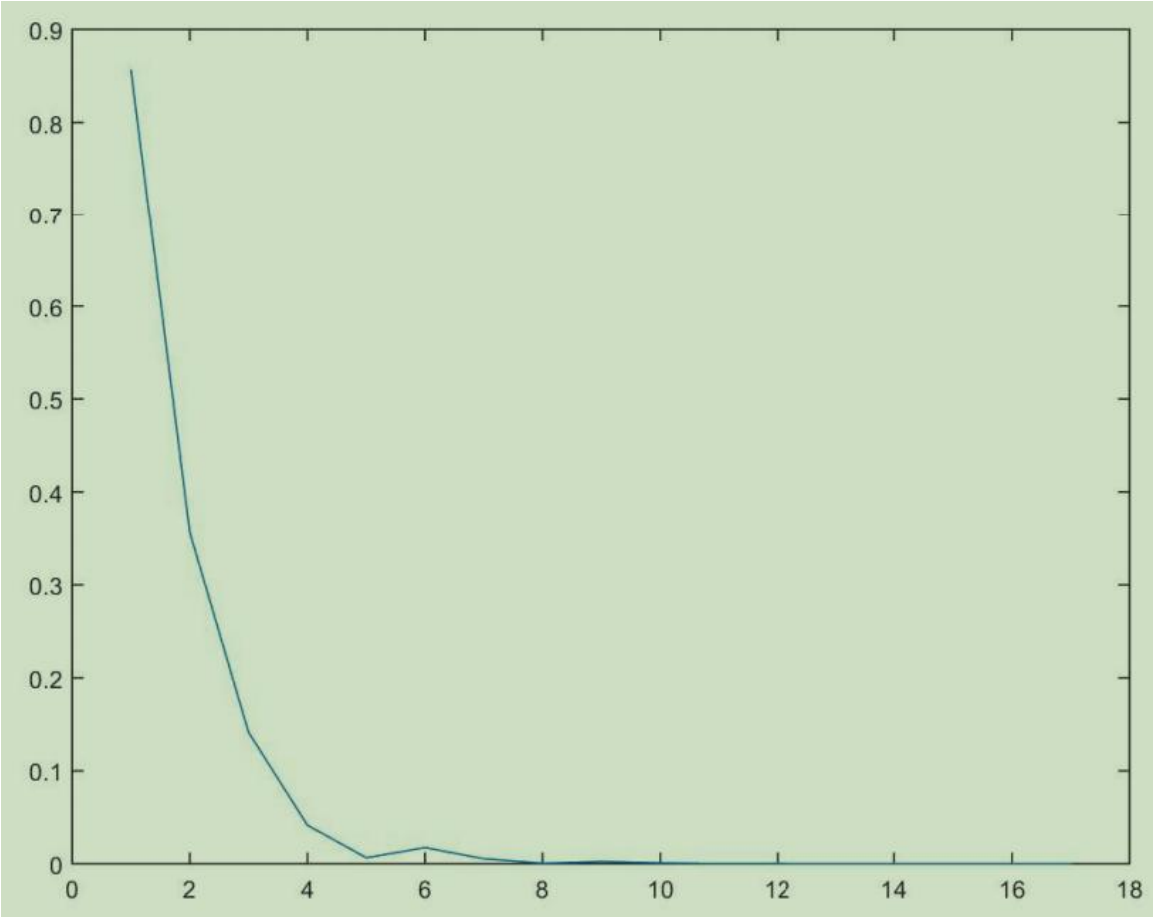
Q3) Find the root of f(x)=x^3-x^2+1 by using Bisection Method in the interval[-200,300] with a tolerance of 0.01
=>Code same as question 1
Output:
Enter the Function @(x) cos(x) - x*exp(x)
Enter the Value of a:0
Enter the Value of b:1
Enter the error:0.00001

a	b	c	f(c)
0.000000	1.000000	0.500000	0.053222
0.500000	1.000000	0.750000	-0.856061
0.500000	0.750000	0.625000	-0.356691
0.500000	0.625000	0.562500	-0.141294
0.500000	0.562500	0.531250	-0.041512
0.500000	0.531250	0.515625	0.006475
0.515625	0.531250	0.523438	-0.017362
0.515625	0.523438	0.519531	-0.005404

0.515625	0.519531	0.517578	0.000545
0.517578	0.519531	0.518555	-0.002427
0.517578	0.518555	0.518066	-0.000940
0.517578	0.518066	0.517822	-0.000197
0.517578	0.517822	0.517700	0.000174
0.517700	0.517822	0.517761	-0.000012
0.517700	0.517761	0.517731	0.000081
0.517731	0.517761	0.517746	0.000035
0.517746	0.517761	0.517754	0.000011

Root is: 0.517757
Number of Iteration:17

FIGURE:



CONCLUSION:

The roots of given equations were found using MATLAB by Bisection Method and the output graphs were plotted.