

ASSIGNMENT:-2

EECE:-212

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Level: 2

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Here are some mathematical problem are solved by MATLAB 2020a according to the questions. The answers are given below:

1. Write a MATLAB programs to find a real root of the following equation $f(x) = x^3 + 10x^2 - 2x - 10$ by the Method of False Position. Use an accuracy level correct to 10 decimal place. Also find the number of iteration to achieve this accuracy.

Solution:

Here is a function $f(x) = x^3 + 10x^2 - 2x - 10$, have to be solved by method of False position and used an accuracy level correct to 10 decimal place. Also find the number of iteration to achieve this accuracy.

The screenshot shows the MATLAB environment with the following components:

- Editor:** Contains the MATLAB script for finding the root of $f(x) = x^3 + 10x^2 - 2x - 10$ using the False Position method. The script includes initialization, a while loop for bracketing the root, and another while loop for refining the root until the accuracy is reached.
- Command Window:** Shows the execution of the script, including the definition of $x1$, $x2$, and the final root value $x3$.
- Workspace:** Displays the variables created during the execution, including acc , ans , $count$, f , x , $x1$, $x2$, $x3$, and y .

```

1 clear all
2 close all
3 clc
4 format long
5 f = @(x) x^3+10*x^2-2*x-10;
6 x = 0;
7 x1 = 0;
8 x2 = 0;
9 while (f(x2) * f(x1) > 0)
10     y = f(x);
11     if y > 0
12         x1 = x;
13     else
14         x2 = x;
15     end
16     x = x+1;
17 end
18 x1
19 x2
20 f(x1)
21 f(x2)
22 count = 0;
23 acc = 10^-10;
24 while (abs(x1-x2) > acc)
25     x3 = x1 - ((f(x1)/(f(x1)-f(x2))))*(x1 - x2);
26     if (f(x3) * f(x2) > 0)
27         x2 = x3;
28     else
29         x1 = x3;
30     end
31     count = count + 1;
32 end
33 x1;
34 x2;
35 x3
36 count
  
```

Command Window Output:

```

x1 =
    0

x2 =
    0

1

ans =
    -1

ans =
    34

x3 =
    1.046287968394019

count =
    34

fx >>
  
```

Workspace Variables:

Name	Value
acc	1.0000e-10
ans	-1
count	34
f	@(x)x^3+10*x^2-2*x...
x	3
x1	1.0463
x2	1.0463
x3	1.0463
y	34

Here the solution is: **1.046287968394019**

Number of iterations: **34**

2. Plot the values of x calculated in each iteration from the False Position Method's equation. (For this problem, you should store the calculated value of x in an array, then use that array to plot the curve)

Solution:

Here have to Plot the values of x calculated in each iteration from the False Position Method's equation.

The image shows a MATLAB Editor window with the following code:

```

1 clear all
2 close all
3 clc
4 format long
5 f = @(x) x^3+10*x^2-2*x-10;
6 x = 0;
7 x1 = 0;
8 x2 = 0;
9 while (f(x2) * f(x1) > 0)
10     y = f(x);
11     if y > 0
12         x1 = x;
13     else
14         x2 = x;
15     end
16     x = x+1;
17 end
18 x1;
19 x2;
20 count = 0;
21 acc = 10^-10;
22 while (abs(x1-x2) > acc)
23     x3 = x1 - (f(x1)/(f(x1)-f(x2))) * (x1 - x2);
24     if (f(x3) * f(x2) > 0)
25         x2 = x3;
26     else
27         x1 = x3;
28     end
29     count = count + 1;
30     graph(count) = x3;
31 end
32 x1;
33 x2;
34 x3;
35 count;
36 graph;
37 plot(graph)

```

The Command Window shows the output of the code, displaying the values of x1, x2, x3, and the count for each iteration. The output is as follows:

```

graph =
Columns 1 through 4
1.028571428571428 1.039570170179403 1.043749801661508 1.045330280942723
Columns 5 through 8
1.045926804185185 1.046151792081000 1.046236627107945 1.046268612200073
Columns 9 through 12
1.046280670985132 1.046285217234967 1.046286931195051 1.046287577365699
Columns 13 through 16
1.046287820974749 1.046287912816358 1.046287947441017 1.046287960494653
Columns 17 through 20
1.046287965415926 1.046287967271266 1.046287967970737 1.046287968234440
Columns 21 through 24
1.046287968333857 1.046287968371338 1.046287968385468 1.046287968390795
Columns 25 through 28
1.046287968392804 1.046287968393561 1.046287968393846 1.046287968393954
Columns 29 through 32
1.046287968393995 1.046287968394010 1.046287968394016 1.046287968394018
Columns 33 through 34
1.046287968394019 1.046287968394019
fx >>

```

The Workspace window shows the following variables:

Name	Value
acc	1.0000e-10
count	34
f	@(x)x^3+10*x^2-2*x-10...
graph	1x34 double
x	3
x1	1.0463
x2	1.0463
x3	1.0463
y	34

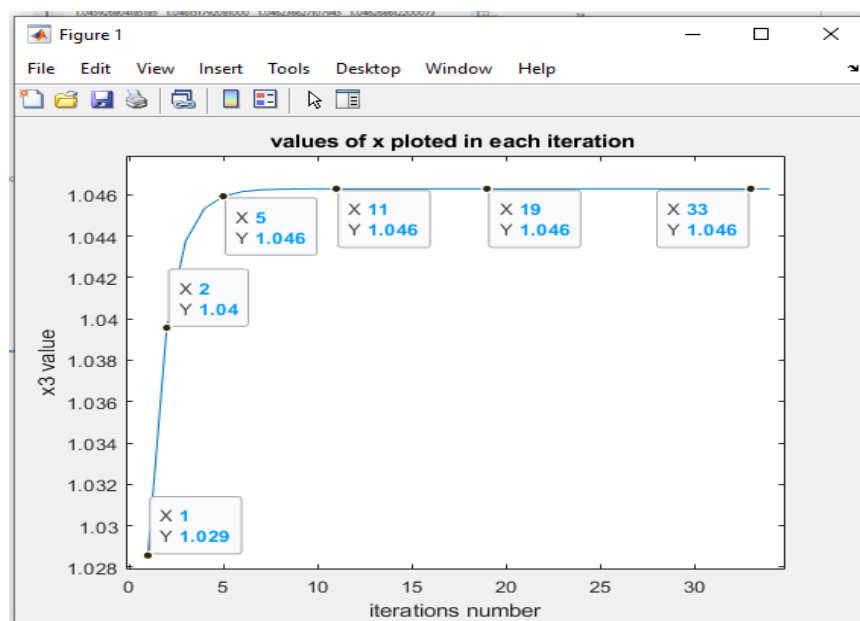


Figure 1: the values of x vs Number of iterations

3. Find a real root of the above function using False Position Method by hand Calculation. Show the first three iteration.

Solution:

Here we have to find out the real roots of the function using false position method by hand calculations. The first three iterations are shown:

The function is:

$$x^3 + 10x^2 - 2x - 10$$

From the previous program we have got that,

The upper value is, $x_1 = 2$,

For which the function gets the positive value.

Which is **$f(x_1) = 34$**

The lower value is, $x_2 = 1$,

Which is **$f(x_2) = -1$**

For which the function gets the negative value.

The false position method programming is:

```
while (abs(x1-x2)>acc)
    x3 = x1 - ((f(x1)/(f(x1)-f(x2)))*(x1 - x2))
    if (f(x3) * f(x2) > 0)
        x2 = x3;
    else
        x1 = x3;
    end
    count = count + 1;
end
```

According to **false position method:**

1st iteration:

$$x_3 = x_1 - \frac{f(x_1)}{f(x_1) - f(x_2)} * (x_1 - x_2)$$

Or,

$$\begin{aligned} x_3 &= 2 - \frac{34}{34 - (-1)} * (2 - 1) \\ &= 1.028571428571428 \end{aligned}$$

Now in the loop:

$f(x_3) = -0.3893644315$, $f(x_2) = -1$

$f(x_3) * f(x_2) > 0$

so according to loop

x2=x3;

that means **x2 = 1.028571428571428**

and so now **f(x2)= -0.3893644315**

now in the

2nd iteration :

$$x3 = x1 - \frac{f(x1)}{f(x1) - f(x2)} * (x1 - x2)$$

Or,

$$\begin{aligned} x3 &= 2 - \frac{34}{34 - (-0.3893644315)} * (2 - 1.028571428571428) \\ &= 1.039570170179403 \end{aligned}$$

Now in the loop:

f(x3)= -0.1486090885, f(x2)= -0.3893644315

f(x3)*f(x2)>0

so according to loop

x2=x3;

that means **x2 = 1.039570170179403**

and so now **f(x2)= -0.1486090885**

now in the 3rd iteration :

$$x3 = x1 - \frac{f(x1)}{f(x1) - f(x2)} * (x1 - x2)$$

Or,

$$\begin{aligned} x3 &= 2 - \frac{34}{34 - (-0.1486090885)} * (2 - 1.039570170179403) \\ &= 1.043749801661508 \end{aligned}$$

So, finally the 3 iterations are:

- 1. 1.028571428571428**
- 2. 1.039570170179403**
- 3. 1.043749801661508**

