

CBNST LAB PRACTICAL

Date: September 15, 2021

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Newton Raphson Method

Algorithm:

1. Start
2. Define function as $f(x)$
3. Define derivative of function as $g(x)$
4. Input:
 - a. Initial guess x_0
 - b. Tolerable Error e
 - c. Maximum Iteration N
5. Initialize iteration counter $step = 1$
6. Do
 - If $g(x_0) = 0$
 - Print "Mathematical Error"
 - Stop
 - End If
 - $x_1 = x_0 - f(x_0) / g(x_0)$
 - $x_0 = x_1$
 - $step = step + 1$
 - If $step > N$
 - Print "Not Convergent"
 - Stop
 - End If
 - While $abs f(x_1) > e$
7. Print root as x_1
8. Stop

Code:

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```
#include <stdio.h>
#include <math.h>
#include <stdlib.h>

#define phi(x) (pow(2.718282, -1*x)-sin(x))
```

```
double differential(double x0)
{
    const double delta = 1.0e-10;
    double x1= x0-delta;
    double x2= x0+delta;
```

```
    double y1=phi(x1);
    double y2=phi(x2);
```

```
    // printf("gradient= %f\n", grad);
    return (y2-y1)/(x2-x1);
    // return (pow(-2.718282, -1*x)-cos(x));
}
```

```
int main()
{
    int k = 0;
    double x1, x0 ,f0, f1, g0;
    int step = 1, N;
    double allErr;
    printf("Enter the allowed Error: ");
    scanf(" %lf", &allErr);
    int i1, i2;
    printf("Enter the interval lower limit: ");
    scanf(" %d", &i1);
    printf("Enter the interval upper limit: ");
    scanf(" %d", &i2);
```

```
    printf("\nEnter the initial guess x0: ");
    scanf("%lf", &x0);
    printf("Enter maximum iteration:\n");
    scanf("%d", &N);
    {
        if (x0 <= i2 && x0 >= i1)
        {
```

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```
\n");
    printf("\nStep\t\tx0\t\tf(x0)\t\tf'(x0)\t\tx1\t\tf(x1)
\n");
    do
    {
        g0 = differential(x0);
        f0 = phi(x0);
        if (g0 == 0.0)
        {
            printf("Mathematical Error.");
            exit(0);
        }

        x1 = x0 - (f0 / g0);

        printf("%d\t\t%f\t%f\t%f\t%f\t%f\n", step, x0, f0,
g0, x1, f1);
        x0 = x1;

        step = step + 1;

        if (step > N)
        {
            printf("Not Convergent.");
            exit(0);
        }

        f1 = phi(x1);

    } while (fabs(f1) > allErr);

    printf("\nRoot is: %f\n", x1);
}
else
{
    printf("You entered wrong initial guess, needed someth
ing between %d and %d !!!", i1, i2);
}
}
}
```

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```
02_NewtonRaphsonMethod.cpp > differential(double)
1 #include <stdio.h>
2 #include <math.h>
3 #include <stdlib.h>
4
5 #define phi(x) (pow(2.718282, -1*x))-sin(x))
6
7 double differential(double x0)
8 {
```

PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE

Windows PowerShell
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```
PS E:\03 Semester\CBNST\Unit 01> cd "e:\03 Semester\CBNST\Unit 01\" ; if ($?) { g++ 02_NewtonRaphsonMethod.cpp -o 02_NewtonRaphsonMethod.exe ; if ($?) { .\02_NewtonRaphsonMethod.exe } }
```

Enter the allowed Error: 0.0001
Enter the interval lower limit: 0
Enter the interval upper limit: 4

Enter the initial guess x0: 1
Enter maximum iteration: 10

Step	x0	f(x0)	f'(x0)	x1	f(x1)
1	1.000000	-0.473592	-0.908182	0.478528	0.000000
2	0.478528	0.159222	-1.507369	0.584157	0.159222
3	0.584157	0.006079	-1.391753	0.588525	0.006079

Root is: 0.588525
PS E:\03 Semester\CBNST\Unit 01> []

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