

LAB NUMBER 4

COURSE: EMBEDDED SYSTEMS DESIGN

SUBJECT: MATHEMATICS FOR EMBEDDED SYSTEM

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POLYNOMIAL INTERPOLATING USING NEWTON FORM

CODE:

```
//
=====
=====
// Name      : newton.cpp
// Author     : shinu & stebin
// Version    :
// Copyright  : Your copyright notice
// Description : Hello World in C++, Ansi-style
//
=====
=====

#include <iostream>
using namespace std;

int main() {
    int n_0 =5;
    double x =3;
    double x_i[n_0] = {-0, 1, -1, 2, -2};
    double f_x[n_0] = {-5, -3, -15, 39, -9};
    double f_o[n_0][n_0];
    cout<<"enter the row size: ";
    cin>>n_0;
    for(int i=0;i<n_0;i++){
        cout<<"enter the x values : ";
        cin>>x_i[i];
    }
    for(int i=0;i<n_0;i++){
        cout<<"enter the f(x) value : ";
        cin>>f_x[i];
    }
    cout<<"for which value x the f(x) need to be calculated : ";
    cin>>x;

    // find the derivatives
    int n=1;
```

```

    for(int i=0;i<n_0;i++){
        f_o[i][0] = f_x[i];
    }
    for(int i=n_0-1;i>=0;i--){
        for(int j=0;j<i;j++){
            //cout<<"\n"<<i<<"--i "<<j<<"--j "<<n<<"--n "<<" \n";
            //cout<<"f_o[j+1][n]-"<<f_o[j+1][n];
            f_o[j][n] = (f_o[j+1][n-1]-f_o[j][n-1])/(x_i[j+1+(n-
1)]]-x_i[j]);
            //cout<<f_o[j][n]<<" \n";

        }
        n++;
    }
    //PRINT THE DERIVATIVES;
    n=0;
    for(int i =0;i<n_0;i++){
        cout<<"\n";
        for(int j=1;j<n_0-i;j++){
            cout<<f_o[i][j];
            cout<<" ";
        }
    }
    //FIND THE F(X) FOR VALUE OF X
    double res=0;
    double ans=1;
    for(int i=0;i<=n_0-1;i++){
        double b=f_o[0][i];
        for(int j=0;j<i;j++){
            ans=ans*(x-x_i[j]);
        }
        res = res+b*ans;
        ans = 1;
    }
    cout<<"\nresult-- "<<res<<endl;
}

```

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Lab 4

Polynomial Interpolating Using Newton Form

Write an application to implement the Polynomial Interpolating Using Newton Form then verify your program for the following example:

i	0	1	2	3	4
x_i	0	1	-1	2	-2
$f(x_i)$	-5	-3	-15	39	-9

eclipse-workspace - newton decomposition/src/newton decomposition.cpp - Eclipse ...

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newton decomposition

Quick Access

Console

```

<terminated> (exit value: 0) newton decomposition [C/C++ Application] /home,
14=
15 enter the x values : 0
16 enter the x values : 1
17 enter the x values : -1
18 enter the x values : 2
19 enter the x values : -2
20 enter the f(x) value : -5
21 enter the f(x) value : -3
22 enter the f(x) value : -15
23 enter the f(x) value : 39
24 enter the f(x) value : -9
25 for which value x the f(x) need to be calculated : 3
26
27 2 -4 8 3
28 6 12 2
29 18 6
30 12
31
32 result-- 241
33
34
35

```

Variables Breakpoint Expressions Modules Disassembly

Register Problem Execution Debug Memory Terminal

Monitors

Activities Eclipse

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newton decomposition

Quick Access

Console

```

<terminated> (exit value: 0) newton decomposition [C/C++ Application] /home,
14=
15 enter the x values : 0
16 enter the x values : 1
17 enter the x values : -1
18 enter the x values : 2
19 enter the x values : -2
20 enter the f(x) value : -5
21 enter the f(x) value : -3
22 enter the f(x) value : -15
23 enter the f(x) value : 39
24 enter the f(x) value : -9
25 for which value x the f(x) need to be calculated : 3
26
27 2 -4 8 3
28 6 12 2
29 18 6
30 12
31
32 result-- 241
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34
35

```

Variables Breakpoint Expressions Modules Disassembly

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atozmath.com/CONM/NumInterPola.aspx?m=1&q1=1%60...

-1 -15

2 39

-2 -9

$x = 3$

Solution:
The value of table for X and Y

X	0	1	-1	2	-2
Y	-5	-3	-15	39	-9

Lagrange's Interpolating Polynomial

The value of x at you want to find $P_n(x): x = 3$

$$Y(x) = \frac{(x-x_1)(x-x_2)(x-x_3)(x-x_4)}{(x_0-x_1)(x_0-x_2)(x_0-x_3)(x_0-x_4)} \times y_0 + \frac{(x-x_0)(x-x_2)(x-x_3)(x-x_4)}{(x_1-x_0)(x_1-x_2)(x_1-x_3)(x_1-x_4)} \times y_1 + \frac{(x-x_0)(x-x_1)(x-x_3)(x-x_4)}{(x_2-x_0)(x_2-x_1)(x_2-x_3)(x_2-x_4)} \times y_2 + \frac{(x-x_0)(x-x_1)(x-x_2)(x-x_4)}{(x_3-x_0)(x_3-x_1)(x_3-x_2)(x_3-x_4)} \times y_3 + \frac{(x-x_0)(x-x_1)(x-x_2)(x-x_3)}{(x_4-x_0)(x_4-x_1)(x_4-x_2)(x_4-x_3)} \times y_4$$

$$Y(3) = \frac{(3-1)(3-1)(3-2)(3-2)}{(0-1)(0-1)(0-2)(0-2)} \times -5 + \frac{(3-0)(3-1)(3-2)(3-2)}{(1-0)(1-1)(1-2)(1-2)} \times -3 + \frac{(3-0)(3-1)(3-2)(3-2)}{(-1-0)(-1-1)(-1-2)(-2)} \times -15 + \frac{(3-0)(3-1)(3-2)(3-2)}{(-1-0)(-1-1)(-1-2)(-2)} \times 39 + \frac{(3-0)(3-1)(3-2)(3-2)}{(2-1)(2-1)(2-3)(2-3)} \times -9$$

$$Y(3) = \frac{40}{4} \times -5 + \frac{60}{-6} \times -3 + \frac{30}{-6} \times -15 + \frac{120}{24} \times 39 + \frac{24}{24} \times -9$$

$$Y(3) = 241$$

Solution of the polynomial at point 3 is $Y(3) = 241$

FOR VALUE OF $X = 3$ $F(X) = 241$