

Department of Computer Science and Engineering

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Course Code : CSE- 4746

Course Title : Numerical Methods Lab

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Question 01: The following values of f (x) are given. x: 1 2 3 4 5 y = f(x):1 8 27 64 125

Write a program to find difference table for the above values.

Solution:

|  |
| --- |
| *#include*<bits/stdc++.h>  *using* *namespace* std; int main()    {  int n; int a[20][20], b[20]; cin*>>*n; *for*(int i*=*0;i*<*n;i*++*)  { cout *<<* "b [" *<<* i *<<* "] = "; cin *>>* b[i]; cout *<<* "a[" *<<* i *<<*"] = "; cin *>>* a[i][0];  } *for*(int i *=* 1; i *<* n; i*++*)  { *for*(int j *=* 0; j *<* n*-*i; j*++*)  { a[j][i] *=* a[j*+*1][i*-*1] *-* a[j][i*-*1];  } } cout *<<* endl *<<* "FORWARD DIFFERENCE TABLE" *<<* endl; *for*(int i *=* 0; i *<* n; i*++*)  { cout *<<* b[i]; *for*(int j *=* 0; j *<* n*-*i ; j*++*)  { |
| cout *<<* "\t" *<<* a[i][j];  } cout *<<* endl;  } *return* 0;    } |

Question 2: The following values of f (x) are given.

X: 1 2 3 4 5 y = f(x): 1 8 27 64 125

Write a program to find the values of y when x = 1.7 by using Newton forward interpolation formula.

Code:

|  |
| --- |
| *#include*<bits/stdc++.h> *using* *namespace* std; float u\_cal(float u, int n)  { float temp *=* u; *for* (int i *=* 1; i *<* n; i*++*) temp *=* temp *\** (u *-* i); *return* temp;  } int fact(int n)  { int f *=* 1; *for* (int i *=* 2; i *<=* n; i*++*) f *\*=* i; *return* f;  }  int main()  { |
| float n *=* 5; float x[] *=* {1,2,3,4,5 }; float y[5][5]; y[0][0] *=* 1; y[1][0] *=* 8; y[2][0] *=* 27; y[3][0] *=* 64; y[4][0] *=* 125;  *for* (int i *=* 1; i *<* n; i*++*) { *for* (int j *=* 0; j *<* n *-* i; j*++*) y[j][i] *=* y[j *+* 1][i *-* 1] *-* y[j][i *-* 1];  } *for* (int i *=* 0; i *<* n; i*++*) { cout *<<* setw(4) *<<* x[i]  *<<* "\t"; *for* (int j *=* 0; j *<* n *-* i; j*++*)  cout *<<* setw(4) *<<* y[i][j] *<<* "\t";  cout *<<* endl;  }  float value *=* 1.7;    float sum *=* y[0][0]; float u *=* (value *-* x[0]) */* (x[1] *-* x[0]); *for* (int i *=* 1; i *<* n; i*++*) {    sum *=* sum *+* (u\_cal(u, i) *\** y[0][i]) */* fact(i);  } cout *<<* "\n Value at " *<<* value *<<* " is "  *<<* sum *<<* endl; *return* 0;  } |

Question 03: The following values of f (x) are given. x 1 2 3 4 5 y = f(x) 1 8 27 64 125

Write a program to find the values of y when x = 4.7 by using Newton backward interpolation formula.

Code:

*#include*<bits/stdc++.h>

*using* *namespace* std;

float calculate(float u, int n)

{

    float temp *=* u;

*for* (int i *=* 2; i *<* n; i*++*)

        temp *=* temp *\** (u *+* i);

*return* temp;

}

int calculateFactorials(int n)

{

    int f *=* 1;

*for* (int i *=* 2; i *<=* n; i*++*)

        f *\*=* i;

*return* f;

}

int main()

{

    int n *=* 5;

    float x[] *=* {1,2,3,4,5};

    float y[5][5];

    y[0][0] *=* 1;

    y[1][0] *=* 8;

    y[2][0] *=* 27;

    y[3][0] *=* 64;

    y[4][0] *=* 125;

*for* (int i *=* 1; i *<* n; i*++*) {

*for* (int j *=* n*-*1; j *>=*i; j*--*)

            y[j][i] *=* y[j][i *-* 1] *-* y[j*-*1][i *-* 1];

    }

*for* (int i *=* 0; i *<* n; i*++*) {

        cout *<<* setw(4) *<<* x[i] *<<* "\t";

*for* (int j *=* 0; j*<=*i; j*++*)

            cout *<<* setw(4) *<<* y[i][j] *<<* "\t";

        cout *<<* endl;

    }

    float value *=* 4.7;

    float sum *=* y[n *-* 1][0];

    float u *=* (value *-* x[n *-* 1]) */* (x[1] *-* x[0]);

*for* (int i *=* 1; i *<* n; i*++*) {

        sum *+=* (calculate(u, i) *\** y[n *-* 1][i]) */* calculateFactorials(i);

    }

    cout *<<* "\n Value at " *<<* value *<<* " is " *<<* sum *<<* endl;

*return* 0;

}