Rajshahi University of Engineering & Technology

CSE 2104: Sessional Based on CSE 2103

Lab Report 04

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Problem#01: Determining a functional value using Newton’s interpolation method

**THEORY:** Here, two tables, forward difference table and backward difference table is created first and then the root is determined using the respective formula of this method.

#include <iostream>

using namespace std;

int main()

{

int x[4], y[4], d[4], dd[4], ddd[4], bd[4], bdd[4], bddd[4];

d[4] = dd[4] = dd[3] = ddd[4] = ddd[3] = ddd[2] = bd[0] = bdd[0] = bdd[1] = bddd[0] = bddd[1] = bddd[2] = 0;

cout << "Enter the value of x: ";

for(int i = 0; i < 4; i++){

cin >> x[i];

}

cout << "Enter the value of y: ";

for(int i = 0; i < 4; i++){

cin >> y[i];

}

double xx;

cout << "Enter the value of x to find corresponding output: ";

cin >> xx;

double p = (double) (xx - x[0]) / (x[1] - x[0]);

cout << "\nP = " << p << endl;

for(int i = 0; i < 3; i++)

d[i] = y[i + 1] - y[i];

for(int i = 0; i < 2; i++)

dd[i] = d[i + 1] - d[i];

for(int i = 0; i < 1; i++)

ddd[i] = dd[i + 1] - dd[i];

for(int i = 1; i < 4; i++)

bd[i] = y[i] - y[i - 1];

for(int i = 2; i < 4; i++)

bdd[i] = bd[i] - bd[i - 1];

for(int i = 3; i < 4; i++)

bddd[i] = bdd[i] - bdd[i - 1];

cout << "FORWARD DIFFERENCE TABLE\nx\ty\tD1\tD2\tD3\n";

for(int i = 0; i < 4; i++)

{

ddd[3] = 0;

cout << x[i] << "\t" << y[i] << "\t" << d[i] << "\t" << dd[i] << "\t" << ddd[i] << endl;

}

cout << "BACKWARD DIFFERENCE TABLE\nx\ty\tBD1\tBD2\tBD3\n";

for(int i = 0; i < 4; i++)

{

cout << x[i] << "\t" << y[i] << "\t" << bd[i] << "\t" << bdd[i] << "\t" << bddd[i] << endl;

}

double fy = x[0] + p\*d[0] + p\*(p-1)\*dd[0]/2 + p\*(p-1)\*(p-2)\*ddd[0]/6;

cout << fy << endl;

cout << "(Using forward difference table) Output for the value, x = " << x << ": " << fy << endl;

cout << "(Using backward difference table) Output for the value, x = " << x << ": " << by << endl;

}

OUTPUT:

Enter the value of x: 1 3 5 7

Enter the value of y: 24 120 336 720

Enter the value of x to find corresponding output: 8

P = 3.5

FORWARD DIFFERENCE TABLE

x y D1 D2 D3

1 24 96 120 48

3 120 216 168 0

5 336 384 0 0

7 720 0 0 0

BACKWARD DIFFERENCE TABLE

x y BD1 BD2 BD3

1 24 0 0 0

3 120 96 0 0

5 336 216 120 0

7 720 384 168 48

(Using forward difference table) Output for the value, x = 8: 990

(Using backward difference table) Output for the value, x = 8: 990

**DISCUSSION**:The value of the corresponding function was determined by two tables, though they are the same.