Department of Computer Science and Engineering

.

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;
}
```