

NM Lab assignment-2

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```
/*  
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.  
*/
```

```
#include<bits/stdc++.h>  
using namespace std;
```

```
int main()  
{  
    int n;  
    cout<<"n =";  
    cin>>n;  
  
    double x[n],y[n],table[n][n];  
    cout<<"Value of x : ";  
    for(int i=0;i<n;i++){  
        cin>>x[i];  
    }  
  
    cout<<"Value of y : ";  
    for(int i=0;i<n;i++){  
        cin>>y[i];  
    }  
}
```

```

for(int i=0;i<n;i++){
    table[i][0]=y[i];
}

for(int i=1;i<n;i++){
    for(int j=0;j<n-i;j++){
        table[j][i]=table[j+1][i-1]-table[j][i-1];
    }
}

cout<<"Difference Table : "<<endl;
cout<<fixed<<setprecision(2);

for(int i=0;i<n;i++){
    cout<<"x="<<x[i]<<"\ty="<<table[i][0];
    for(int j=1;j<n-i;j++){
        cout<<"\t"<<table[i][j];
    }
    cout<<endl;
}

}

```

/*

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's forward interpolation formula.

*/

```

#include<bits/stdc++.h>
using namespace std;

int main()
{
    int n;
    cout << "n = ";
    cin>>n;

    double x[n],y[n],table[n][n];
    cout << "Value of x : ";
    for(int i=0;i<n;i++){
        cin>>x[i];
    }

    cout << "Value of y : ";
    for(int i=0;i<n;i++){
        cin>>y[i];
    }

    for(int i=0;i<n;i++){
        table[i][0]=y[i];
    }

    for(int i=1;i<n;i++)
    {
        for(int j=0;j<n-i;j++)
        {
            table[j][i]=table[j+1][i-1]-table[j][i-1];
        }
    }

    // cout << "Difference Table : " << endl;
    // cout << fixed << setprecision(2);

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

```

```

//  cout << "x=" << x[i] << "\ty=" << table[i][0];
//  for(int j=1;j<n-i;j++){
//      cout << "\t" << table[i][j];
//  }
//  cout << endl;
// }

double X;
cout << "Enter x : ";
cin >> X;
double h = x[1] - x[0];
double u = (X - x[0]) / h;
double y_answer = y[0];
double u_term = u;
double fact = 1;

for(int i=1;i<n;i++){
    fact *= i;
    y_answer += (u_term * table[0][i]) / fact;
    u_term *= (u - i);
}
cout << "Ans = " << y_answer << endl;

}

```

/*

3. 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's backw

ard interpolation

formula.

*/

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

```
using namespace std;
```

```
int main()
```

```
{
```

```
    int n;
```

```
    cout << "n = ";
```

```
    cin>>n;
```

```
    double x[n],y[n],table[n][n];
```

```
    cout << "Value of x : ";
```

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

```
        cin>>x[i];
```

```
    }
```

```
    cout << "Value of y : ";
```

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

```
        cin>>y[i];
```

```
    }
```

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

```
        table[i][0]=y[i];
```

```
    }
```

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

```
    {
```

```
        for(int j=0;j<n-i;j++){
```

```
        {
```

```
            table[j][i]=table[j+1][i-1]-table[j][i-1];
```

```
        }
```

```
    }
```

```

double X;
cout << "Enter x : ";
cin >> X;
double h = x[1] - x[0];
double u = (X - x[n-1]) / h;
double y_answer = y[n-1];
double u_term = u;
double fact = 1;

for(int i=1; i<n; i++){
    fact *= i;
    y_answer += (u_term * table[n-1][i]) / fact;
    u_term *= (u + i);
}
cout << "y = " << y_answer << endl;

}

```

/*

4. 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 x for which $f(x) = 85$ by using Lagrange

◆s inverse

interpolation formula.

*/

#include<bits/stdc++.h>

```

using namespace std;

int main()
{
    int n;
    cout << "n = ";
    cin>>n;

    double x[n],y[n],table[n][n];
    cout << "Value of x : ";
    for(int i=0;i<n;i++){
        cin>>x[i];
    }

    cout << "Value of y : ";
    for(int i=0;i<n;i++){
        cin>>y[i];
    }

    double fx,ans=0;
    cout << "f(x) = ";
    cin >> fx;

    for(int i=0;i<n;i++){
        double t1=1.0,t2=1.0;
        for(int j=0;j<n;j++){
            if(j==i) continue;
            t1 *= (fx - y[j]);
            t2 *= (y[i] - y[j]);
        }
        ans += ((double)((t1/t2)*x[i]));
    }
    cout << "X = " << ans << endl;

}

```

```
/*
```

5.The following values of $f(x)$ are given. Prepare the divided difference table for the following data

| | | | | | |
|----------|---|----|----|-----|-----|
| x | 1 | 3 | 4 | 6 | 10 |
| y = f(x) | 0 | 18 | 58 | 190 | 920 |

Write a program to find the values of y when $x = 2.7$ by using Newton's divided difference formula.

```
*/
```

```
#include <bits/stdc++.h>
using namespace std;
```

```
int main()
```

```
{
```

```
    int n;
```

```
    cout << "n = ";
```

```
    cin >> n;
```

```
    double x[10], y[10], table[10][10];
```

```
    cout << "Enter x values:\n";
```

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

```
        cout << "x" << i << ": ";
```

```
        cin >> x[i];
```

```
    }
```

```
    cout << "Enter y values:\n";
```

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

```
        cout << "y" << i << ": ";
```

```
        cin >> y[i];
```

```
    }
```

```
    double X;
```



```

cout << "Enter X to find f(x): ";
cin >> X;

for (int i = 0; i < n; i++) {
    table[i][0] = y[i];
}

for (int j = 1; j < n; j++) {
    for (int i = 0; i < n - j; i++) {
        table[i][j] = (table[i + 1][j - 1] - table[i][j - 1]) / (x[i + j] - x[i]);
    }
}

double ans = table[0][0];
double term = 1.0;
for (int i = 1; i < n; i++) {
    term *= (X - x[i - 1]);
    ans += table[0][i] * term;
}

cout << fixed << setprecision(5);
cout << "f(" << X << ") = " << ans << endl;
return 0;

}

/*
Input 1:
5
5 7 11 13 21
150 392 1452 2366 9702
Output:
f(6) is : 252
Input 2:
5
1   3   4   6   10
0  18  58 190 920

```

2.7

Output:

f(2.7) is : 9.35463

*/