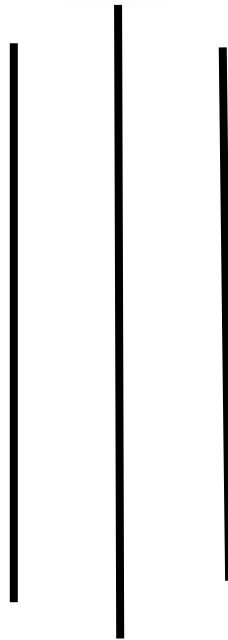


NEPAL ENGINEERING COLLEGE

(AFFILIATED TO POKHARA UNIVERSITY)

Changunarayan, Bhaktapur



REPORT ON:
Lagrange Interpolation

SUBMITTED BY:

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CRN: 020-626

SUBMITTED TO:

Electrical and

Electronics

Experiment no:-5

TITLE:-

Lagrange Interpolation

OBJECTIVE:-

To find the appropriate functional value by Lagrange interpolation using Matlab and C-programming.

THEORY:-

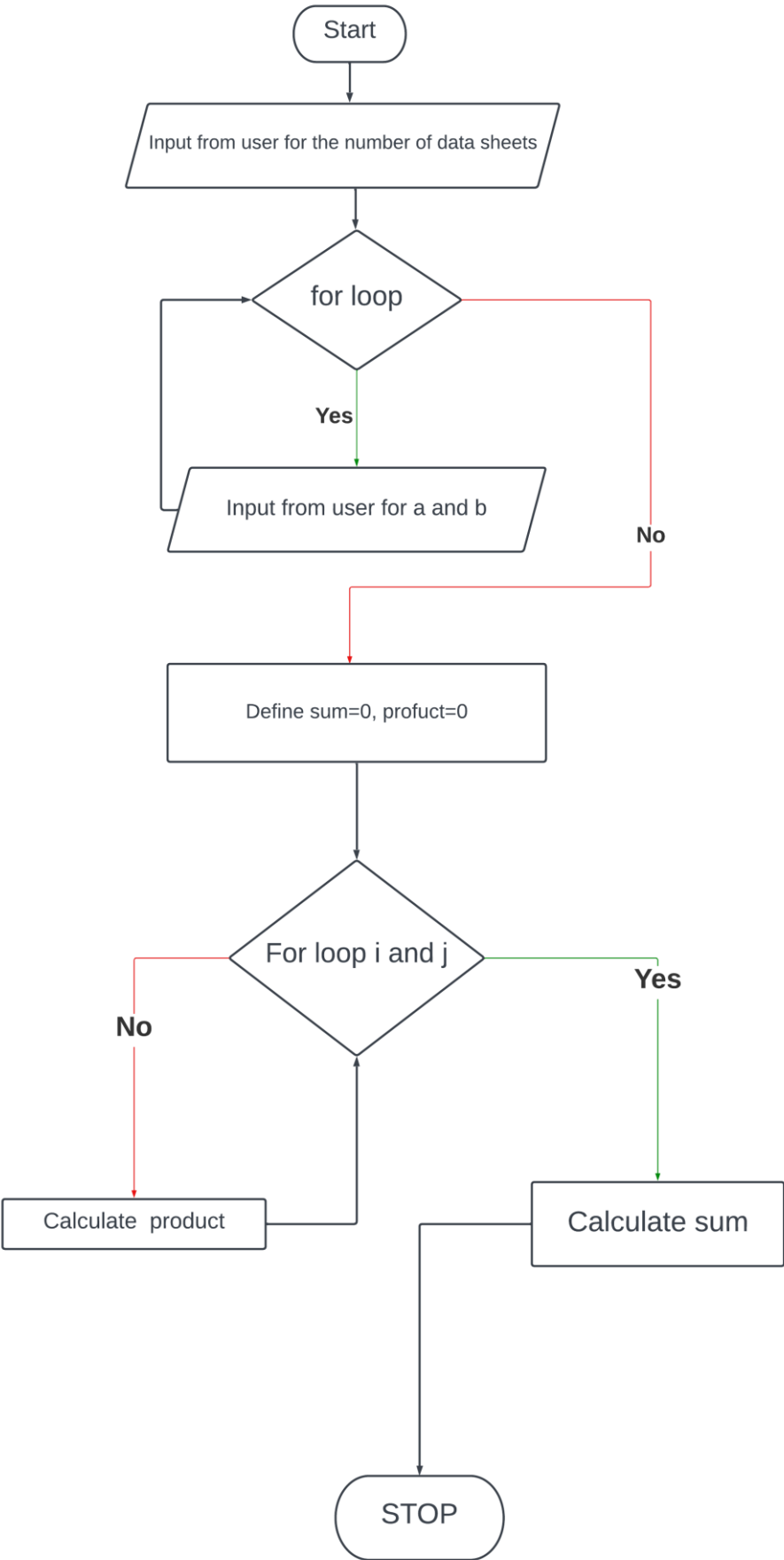
Introduction: Interpolation is the technique to estimate the value of a mathematical function, for any intermediate value of the independent variable. For this we have to generate a polynomial equation which should pass from every given data points. The Lagrange interpolating polynomial is the polynomial $p(x)$ of degree $\leq n - 1$ that passes through the n points (x_1, f_1) , (x_2, f_2) , $(x_3, f_3) \dots \dots \dots (x_n, f_n)$. For the given data sets (x_1, f_1) , (x_2, f_2) , (x_3, f_3) , Lagrange interpolation polynomial is given by:

$$p_n(x) = \frac{(x - x_2)(x - x_3)}{(x_1 - x_2)(x_1 - x_3)} f_1 + \frac{(x - x_1)(x - x_3)}{(x_2 - x_1)(x_2 - x_3)} f_2 + \frac{(x - x_1)(x - x_2)}{(x_3 - x_1)(x_3 - x_2)} f_3$$

Algorithm:

1. Start
2. Read number of data sets (n)
3. Read data x and y for i=1 to n
4. Read value of independent variables say a whose corresponding value of dependent say f is to be determined.
5. Initialize: sum = 0
6. For i = 1 to n
 - Set product = 1
 - For j =1 to n
 - If $i \neq j$ then
$$product = product * (a - x_j) / (x_i - x_j)$$
 - End If
 - Next j
7. Calculate sum = sum + p * f(i)
8. Display value of sum as interpolated value.
9. Stop

Flow chart:-



Question:-

For the given data sets, approximate the functional value for $x = 2.5$ using Lagrange interpolation

x	1	2	3	4	5
y	1	4	9	16	25

Using C-programming

Syntax:-

```
/* Lagrange Interpolation
prepared by:-
Subash khalal
crn: 020-626 */
#include<stdio.h>
#include<conio.h>

int main()
{
    // programmer details
    printf("Lagrange Interpolation by:-\n Subash khalal\n\n");

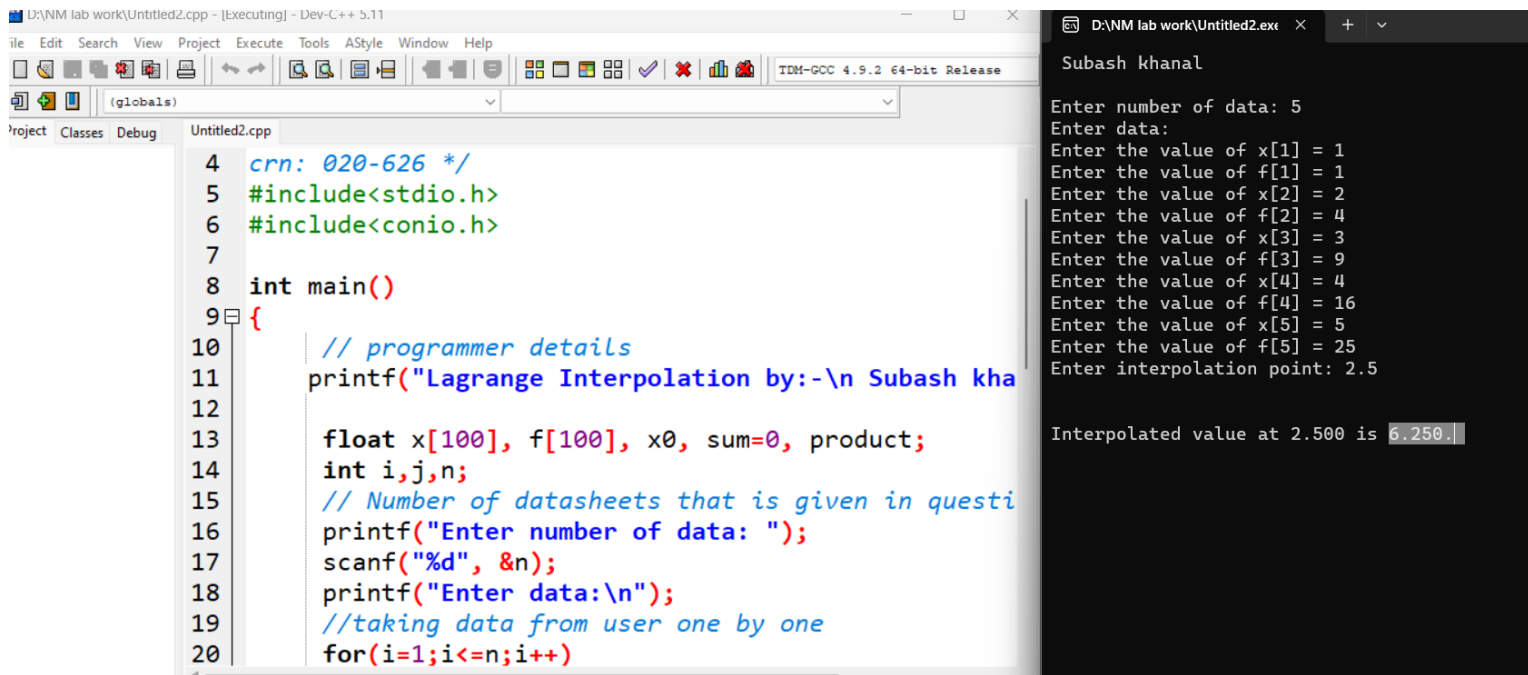
    float x[100], f[100], x0, sum=0, product;
    int i,j,n;
    // Number of datasheets that is given in question
    printf("Enter number of data: ");
    scanf("%d", &n);
    printf("Enter data:\n");
    //taking data from user one by one
```

```

for(i=1;i<=n;i++)
{
    printf("Enter the value of x[%d] = ", i);
    scanf("%f", &x[i]);
    printf("Enter the value of f[%d] = ", i);
    scanf("%f", &f[i]);
}
// asking to user for interpolation point
printf("Enter interpolation point: ");
scanf("%f", &x0);
for(i=1;i<=n;i++)
{
    product=1;
    for(j=1;j<=n;j++)
    {
        if(i!=j) // condition
        {
            product = product* (x0 - x[j])/(x[i] -
x[j]);
        }
    }
    sum = sum + product * f[i];
}
//Result.
printf("\n\nInterpolated value at %.3f is %.3f.", x0,
sum);
getch();
}

```

Output:-



The image shows a screenshot of a C++ IDE with two windows. The left window displays the source code for a program that performs Lagrange interpolation. The right window shows the program's output, which includes user input for data points and the resulting interpolated value.

```
4  crn: 020-626 */
5  #include<stdio.h>
6  #include<conio.h>
7
8  int main()
9  {
10     // programmer details
11     printf("Lagrange Interpolation by:-\n Subash kha
12
13     float x[100], f[100], x0, sum=0, product;
14     int i,j,n;
15     // Number of datasheets that is given in questi
16     printf("Enter number of data: ");
17     scanf("%d", &n);
18     printf("Enter data:\n");
19     //taking data from user one by one
20     for(i=1;i<=n;i++)
```

Subash khana1

Enter number of data: 5
Enter data:
Enter the value of x[1] = 1
Enter the value of f[1] = 1
Enter the value of x[2] = 2
Enter the value of f[2] = 4
Enter the value of x[3] = 3
Enter the value of f[3] = 9
Enter the value of x[4] = 4
Enter the value of f[4] = 16
Enter the value of x[5] = 5
Enter the value of f[5] = 25
Enter interpolation point: 2.5

Interpolated value at 2.500 is 6.250.

The appropriate functional value by Lagrange interpolation using C-programming is 6.250 which was highlighted on output screen.

Using Matlab.

Syntax:-

```
clc,close all;
%programmer details
    fprintf("Lagrange Interpolation by:-\n
Subash khana1\n\n");
n= input('Give the number of datasheets:-
');
x=zeros(1,n); % to intilized x
f=zeros(1,n); % to intilized f
fprintf('x\t\t\t f\n');
%taking data from user one by one
for i=1:n
    x(i)=input('Enter the value of x:-');
    f(i)=input('Enter the value of f:-');
end
%printing the data
for i=1:n
    fprintf('%f\t\t\t\t %f\n',x(i),f(i));
end
% asking to user for interpolation point
x0 = input('Give the value of x0:-');
sum=0;
for i=1:n
    product =1;
    for j=1:n
        if i~=j
            product=product*(x0-
x(j))/(x(i)-x(j));
        end
    end
end
```



```

        sum =sum+product*f(i);
end
%Result.
fprintf('\n\nInterpolated value at %.3f is
%.3f',x0, sum);

```

Output:-

The screenshot shows the MATLAB environment with the Editor window displaying the script 'grap.m' and the Command Window showing the execution results.

Editor - D:\NM lab work\grap.m

```

1-  ose all;
2-  ammer details
3-  rintf("Lagrange Interpolation by:-\n Subas
4-  ut('Give the number of datasheets:-');
5-  s(1,n); % to intilized x
6-  s(1,n); % to intilized f
7-  f('x\t\t\t f\n');
8-  g data from user one by one
9-  1:n
10- i)=input('Enter the value of x:-');
11- i)=input('Enter the value of f:-');
12-
13- ing the data
14- =1:n
15- printf('%f\t\t\t\t %f\n',x(i),f(i));
16-
17- ng to user for interpolation point
18- nput('Give the value of x0:-');

```

Command Window

```

Lagrange Interpolation by:-
Subash khanal
Give the number of datasheets:-5
x          f
Enter the value of x:-1
Enter the value of f:-1
Enter the value of x:-2
Enter the value of f:-4
Enter the value of x:-3
Enter the value of f:-9
Enter the value of x:-4
Enter the value of f:-16
Enter the value of x:-5
Enter the value of f:-25
Give the value of x0:-2.5

fx Interpolated value at 2.500 is 6.250>>

```

The appropriate functional value by Lagrange interpolation using Matlab is **6.250** which was highlighted on output screen.

Description:-

From above program from c-programming and Matlab it was clear that functional value are same using Lagrange interpolation. So, using above program we can find the functional value i.e, 6.250.

Conclusion:-

Hence, from above we can implement and calculate the functional value using the Lagrange interpolation on Matlab and C-programming.