NEPAL ENGINEERING COLLEGE

(AFFILIATED TO POKHARA UNIVERSITY)

Changunarayan, Bhaktapur

REPORT ON:

Lagrange Interpolation

SUBMITTED BY:

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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($x1$, $f1$), ($x2$, $f2$), ($x3$, $f3$) … … … … . (xn, fn). For the given data sets($x1$, $f1$), ($x2$, $f2$), ($x3$, $f3$), 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 ≠ j then

    $product = product * (a - xj)/(xi - xj)$

    End If

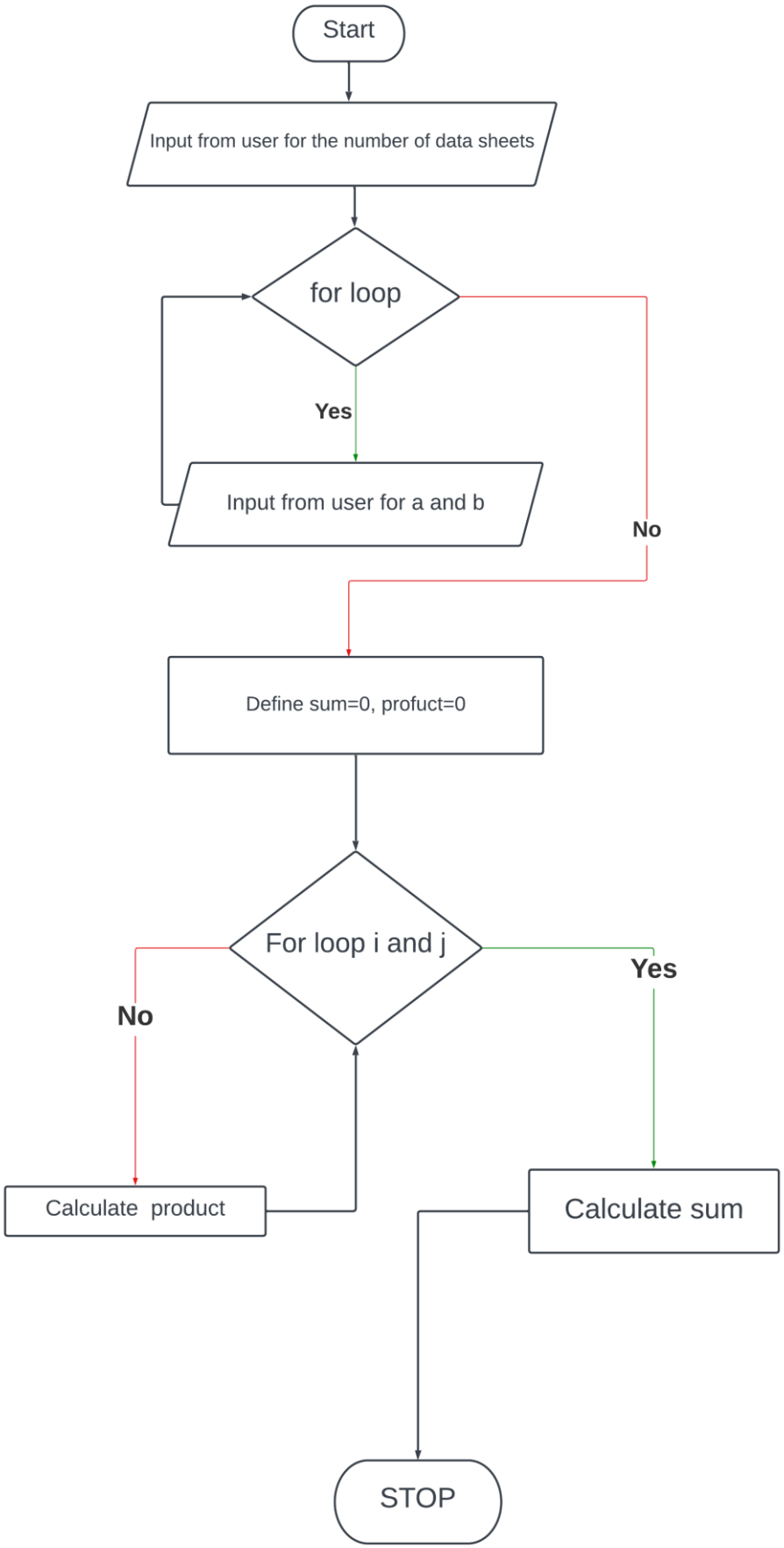
    Next j

7. Calculate sum = sum + p * f(i)

8. Display value of sum as interpolated value.

9. Stop

Flow chart:-


Start
Input from user for the number of data sheets
for loop
Yes
Input from user for a and b
No
Define sum=0, profuct=0
For loop i and j
No
Yes
Calculate product
Calculate sum
STOP

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:-

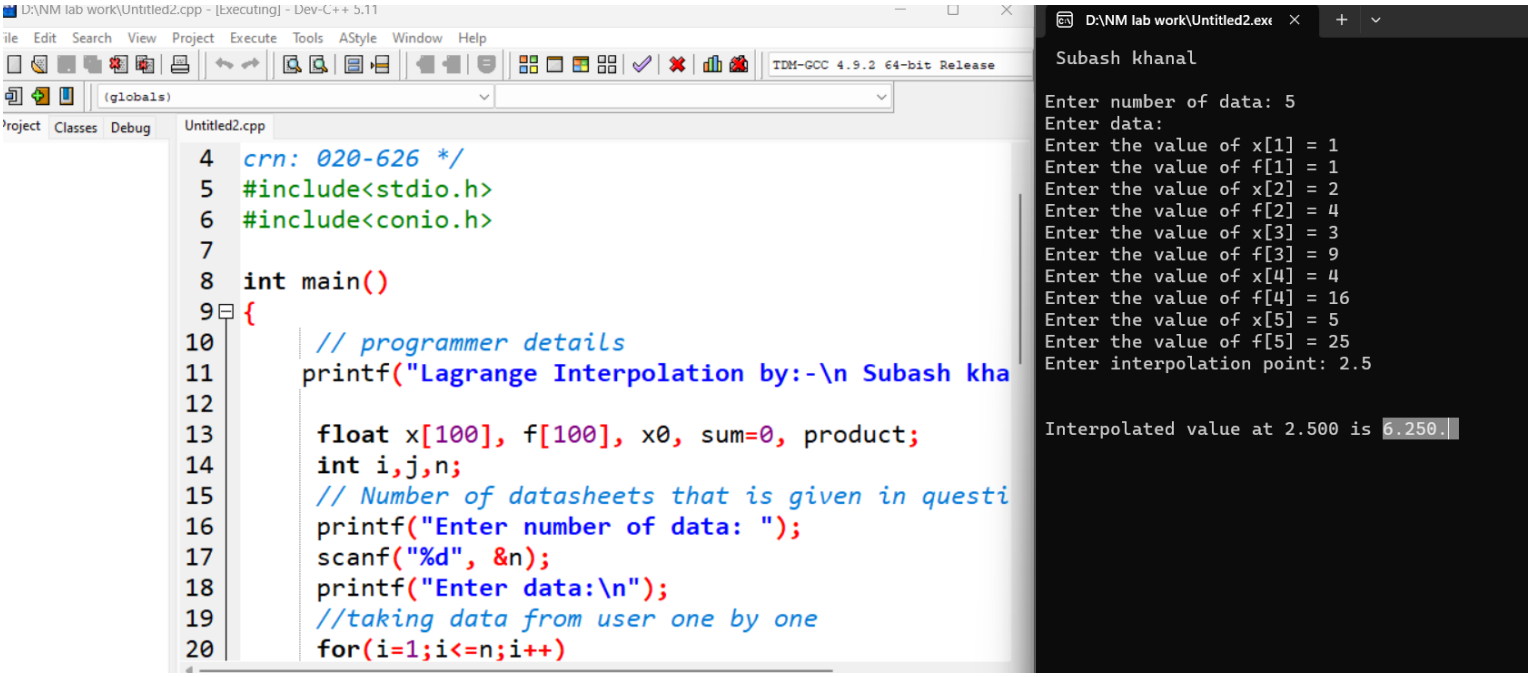
```c
/* Lagrange Interpolation
prepared by:-
Subash khanal
crn: 020-626 */
#include<stdio.h>
#include<conio.h>

int main()
{
     // programmer details
    printf("Lagrange Interpolation by:-\n Subash khanal\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 appropriate functional value by Lagrange interpolation using C-programming is 6.250 which was highlighted on output screen.

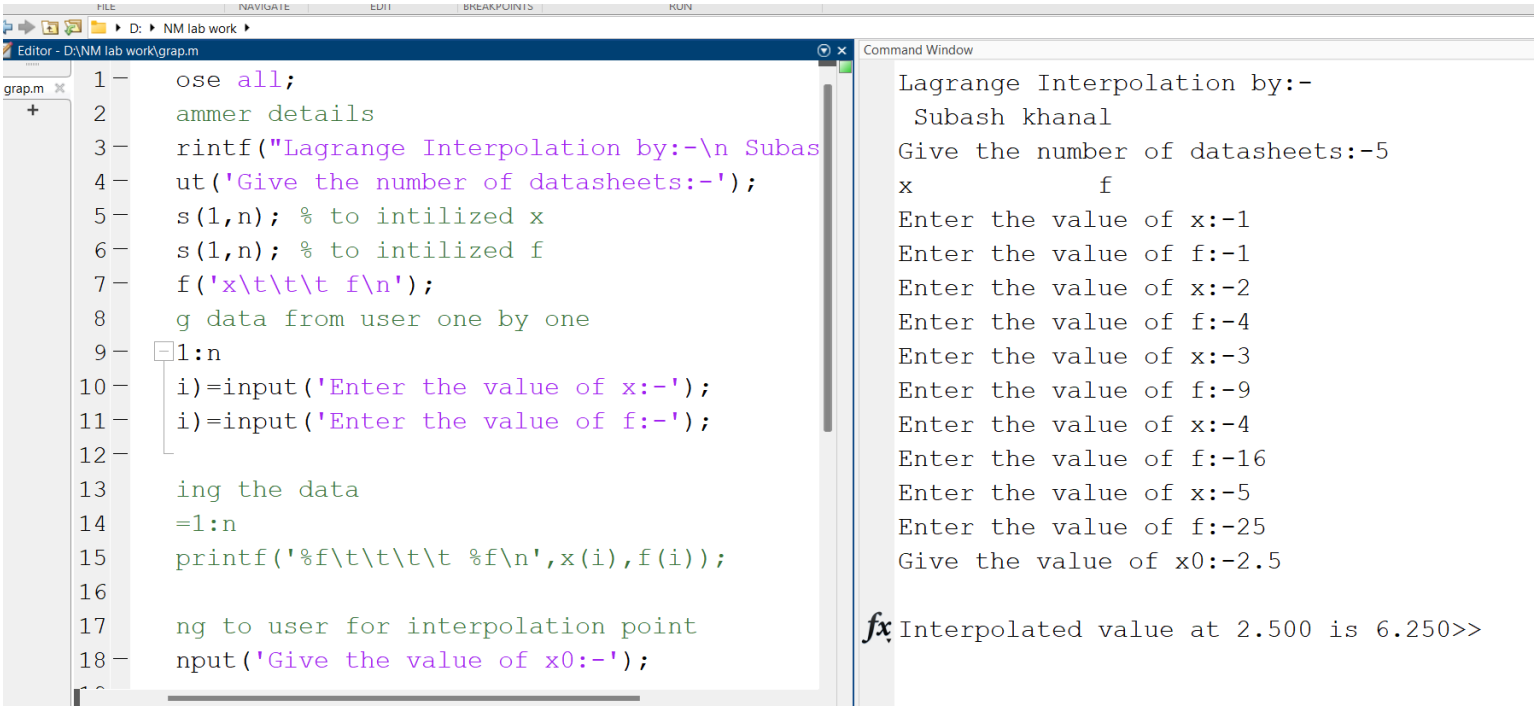
Using Matlab.

Syntax:-

```
clc,close all;
%programmer details
    fprintf("Lagrange Interpolation by:-\n
Subash khanal\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
```

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

Output:-



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.