Problem Name:

Performing intra and extra polation using Lagrange Interpolation Method.

Apparatus:

- Computing Device (e.g.; Computer)
- Programming Environment (MATLAB R2016b)

Method:

The Lagrange interpolation method based on two points is straightforward to implement due to its simplicity. With only two points, the calculation involves basic arithmetic operations, making it computationally efficient.

Algorithm:

1. Start

2. Read number of data (n)

3. Read data Xi and Yi for i=1 to n

4. Read value of independent variables say xp

   whose corresponding value of dependent say yp is to be determined.

5. Initialize: yp = 0

6. For i = 1 to n

   Set p = 1

For j =1 to n

If i ≠ j then

Calculate p = p * (xp - Xj)/(Xi - Xj)

End If

Next j

Calculate yp = yp + p * Yi

Next i

6. Display value of yp as interpolated value.

7. Stop

Code:

```
function y0= LagrangeInterpolation_1039(x, y, x0)
x= input('Enter x values: ');
y= input('Enter y values: ');
x0= input('Enter new x: ');

%x is the vector of abscissa
%y is the matching vector of ordinates
%x0 represents target to be interpolated
%y0 represents the solution from Lagrange Interpolation

y0=0;
```

```
n= length(x);
for j=1:n
   t=1;
   for i=1:n
      if i~=j
         t=t*(x0-x(i))/(x(j)-x(i));
      end
   end
   y0=y0+t*y(j);
end
end
```

Input:

Enter x values: [1; 2; 3; 4; 5; 6]

Enter y values: [3; 0; -1; 0; 3; 8]

Enter new x: 8

Output:

Editor - C:\Rim(1039)\LagrangeInterpolation_1039.m

LagrangeInterpolation_1039.m

```
function y0= LagrangeInterpolation_1039(~, ~, ~)
x= input('Enter x values: ');
y= input('Enter y values: ');
x0= input('Enter new x: ');

%x is the vector of abscissa
%y is the matching vector of ordinates
%x0 represents target to be interpolated
%y0 represents the solution from Lagrange Interpolation

y0=0;
n= length(x);
for j=1:n
    t=1;
    for i=1:n
        if i~=j
            t=t*(x0-x(i))/(x(j)-x(i));
        end
    end
    y0=y0+t*y(j);
end
end
```

Command Window

```
>> LagrangeInterpolation_1039
Enter x values: [1;2;3;4;5;6]
Enter y values: [3;0;-1;0;3;8]
Enter new x: 8

ans =

   24.0000

fx >>
```

Discussion:

Lagrange interpolation is a powerful technique for approximating a function based on a set of data points. By constructing an interpolation polynomial through Lagrange basis polynomials, it provides a flexible approach to data interpolation. However, careful consideration is required to balance accuracy with computational complexity and numerical stability issues.