Project Report - Part II

Numerical Analysis

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Overview

The aim of this part is to compare and analyze the behavior of the different numerical methods studied in class: Newton Interpolation and Lagrange interpolation.

Algorithms Analysis

Newton Interpolation

➢ Inputs :
  - X values.
  - Y values.
  - Values to substitute with it at the function.

➢ Outputs :

  The polynomial function obtained from the interpolation and its plot in the data set range.

➢ Pseudo Code:

```
NewtonInterpolation (xValues, yValues, queryPoints){

    n= number of input points

    from j=2 to n-1

       from k=1 to n-j

             calculate coefficient value using

             newton form

             d(k,j) = (yValue(k+1)-yValue(k)) / (xValue(k+1) - xValue(k))

    create vector b to store coefficients from k

    from k=2 to n

       b(k)=d(1,k-1)

    use symbolic function to store the expression of the function

    syms X

    from j=2 to n

       Coefficient = b(j)

       from k=1 to j-1
```

```
            Coefficient   *= (X - Xo(k))

            expand the function to simplify it using expand()

    return the function

    }
```

Lagrange Interpolation

➢ X values must be unique.

➢ Inputs :
  - X values.
  - Y values.
  - Values to substitute with it at the function.

➢ Outputs :

The polynomial function obtained from the interpolation and its plot in the data set range.

➢ Pseudo Code:

```
summ=0

n=length(x_values)

For i=1 to n

      p=1

      For j=1 to n

            If i ≠j

        c = (x-x_values(j))/(x_values(i)-x_values(j))

          p = expand(p*c)

        End If

    Next j

  term =expand(p*y_values(i));

    summ= summ + term;

Next i
```
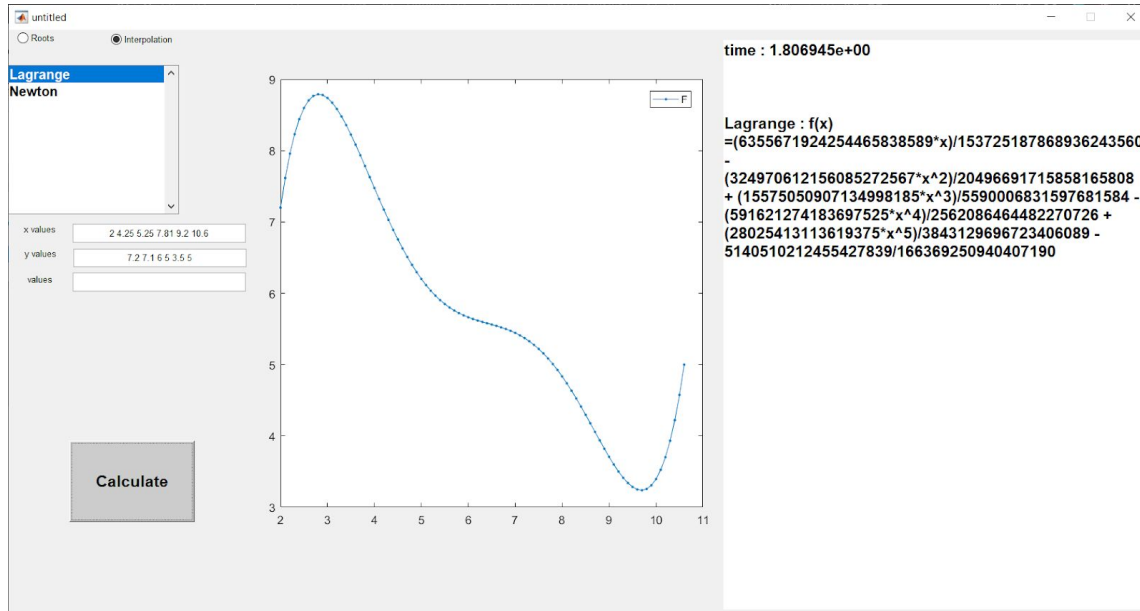
Data Structures Used & Why
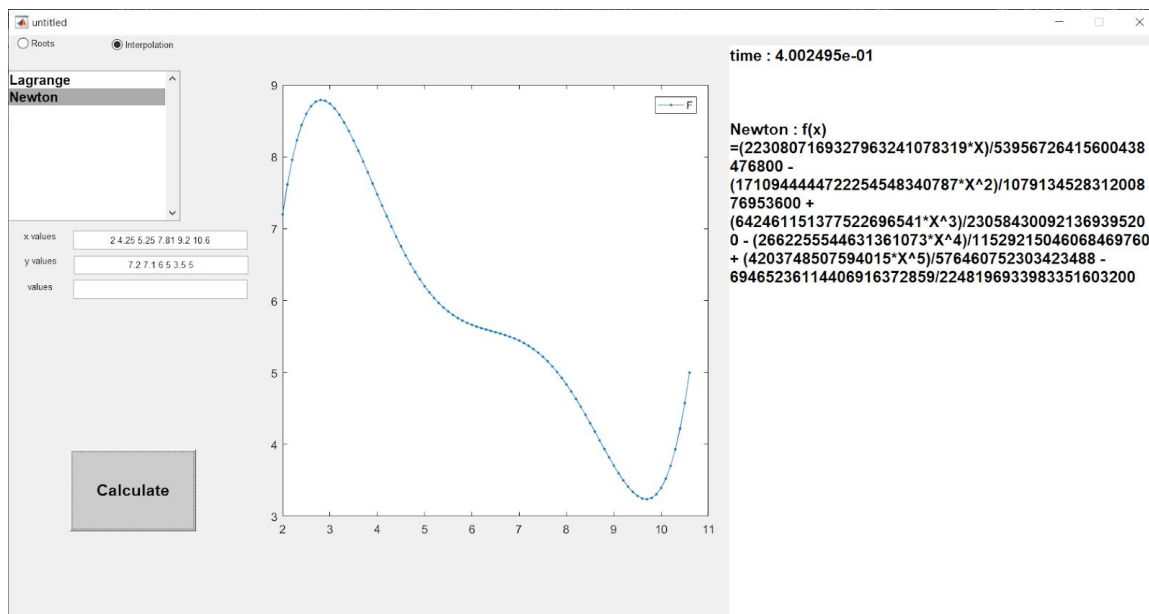
Vectors : because they are fast and reliable.

Different Examples & their Analysis Templates
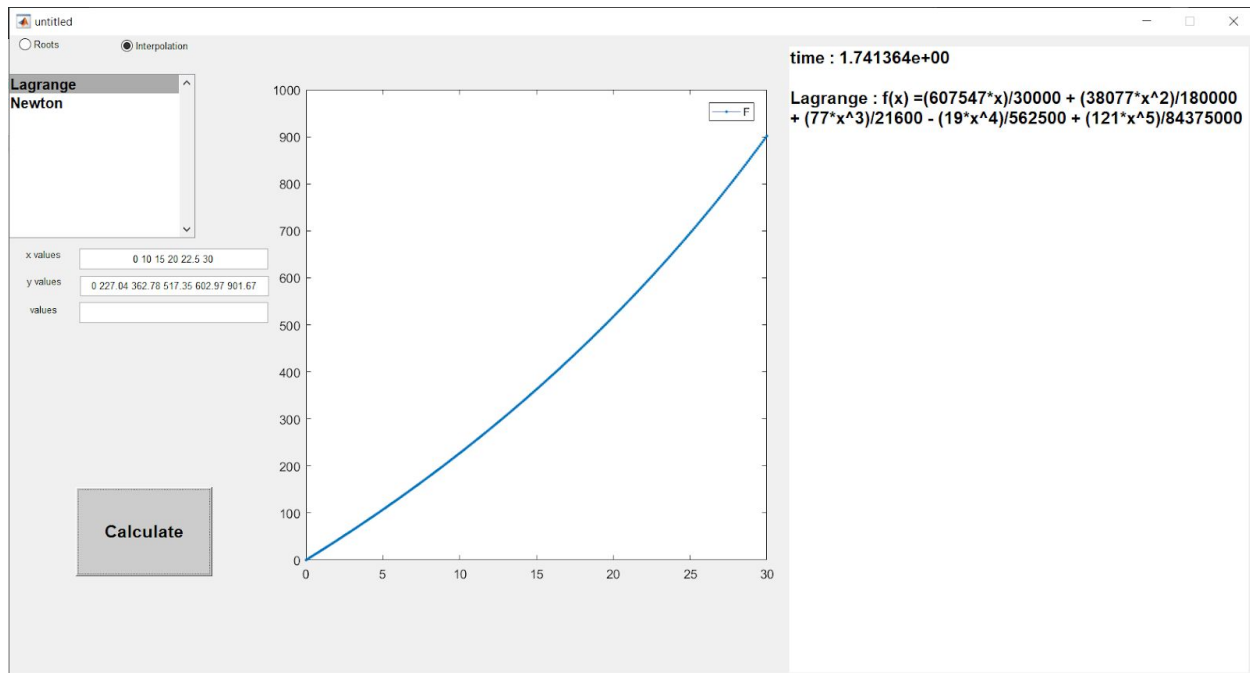
I. Example 1
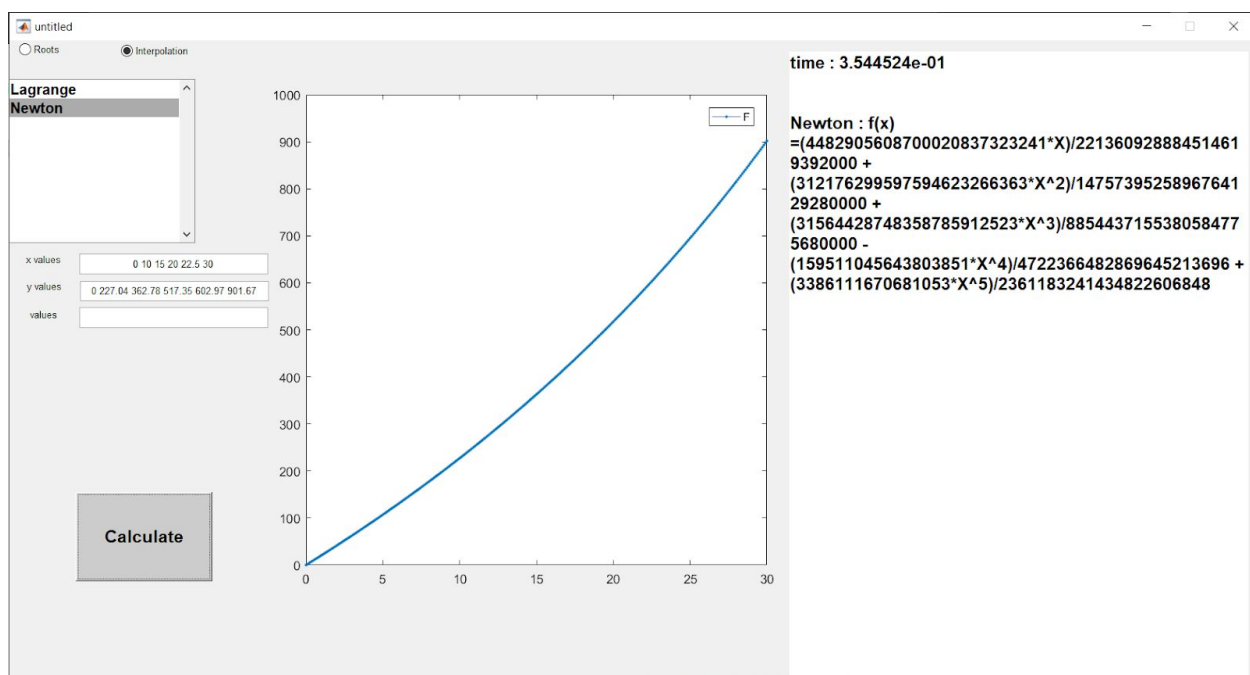
Using Lagrange Interpolation

Using Newton Interpolation

II.   Example 2

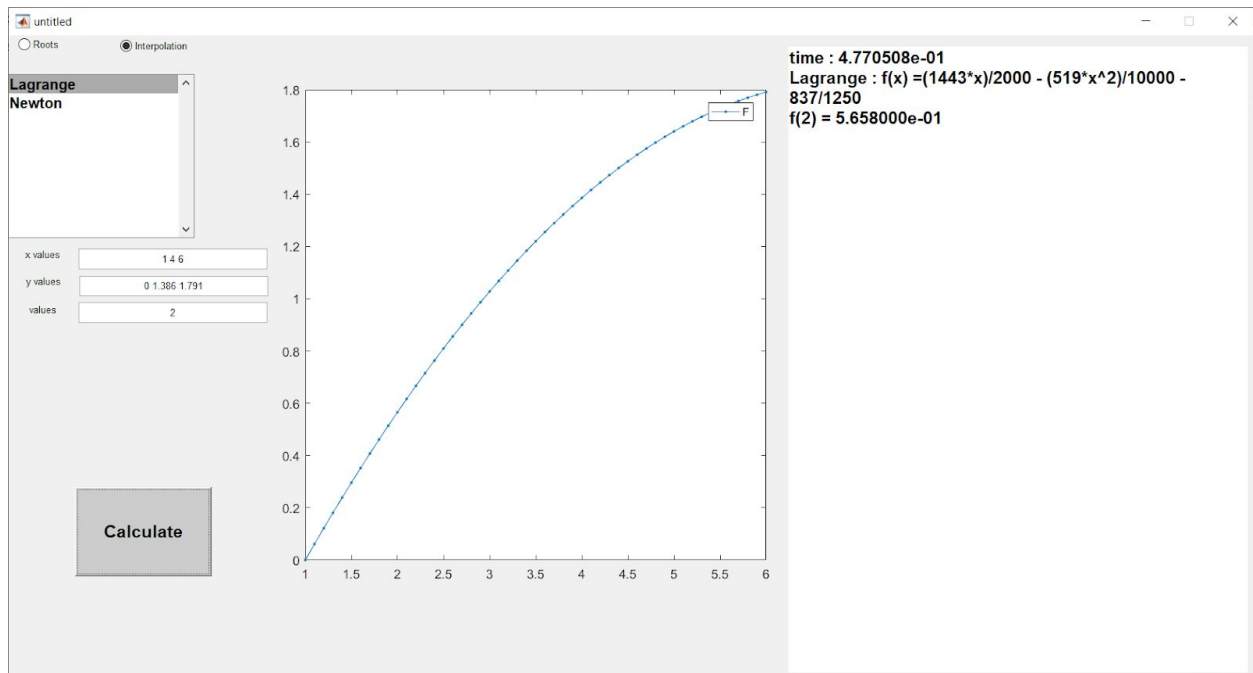### Using Lagrange Interpolation

Using Newton Interpolation

III. Example 3

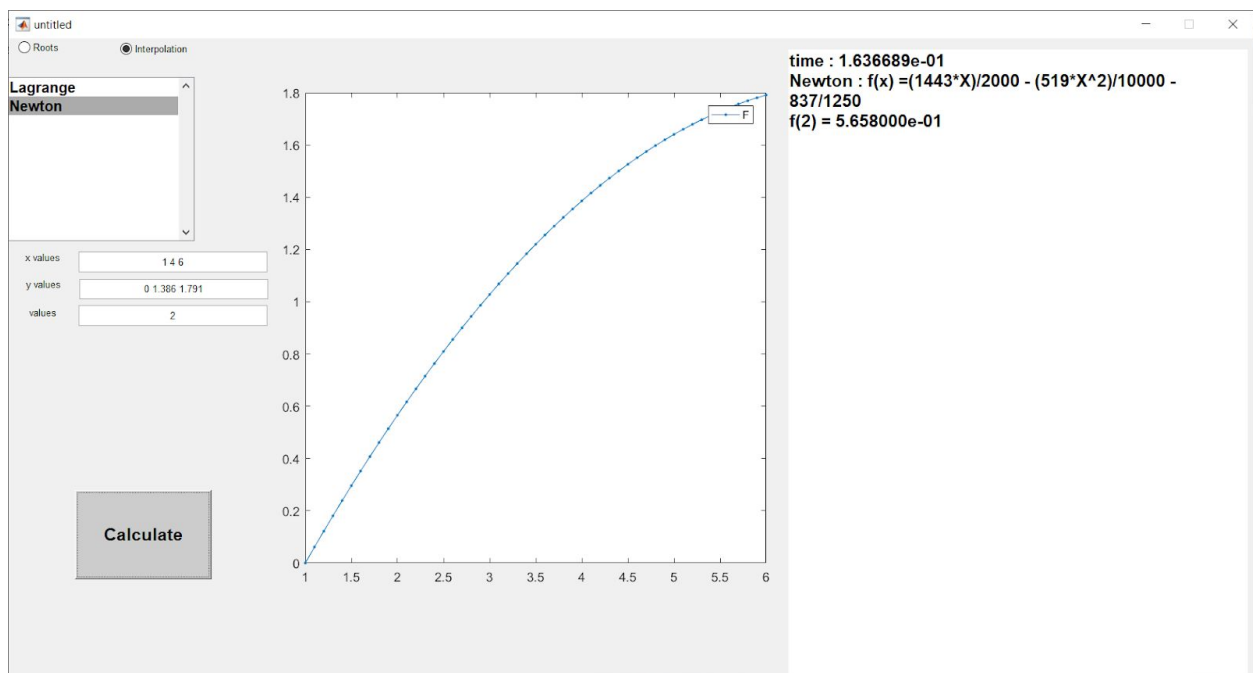### Using Lagrange Interpolation

Using Newton Interpolation

Problematic Functions

None

Sample Runs