ALGONQUIN COLLEGE

Computer Engineering Technology – Computing Science

Course: Numerical Computing – CST8233
Term: Fall 2021

Lab #5

• Objectives

The main objective of this lab is to practice using decision making and loops structures in developing mathematical algorithms/formulae.

• Earning

This lab worth 1% of your final course mark. Each student should complete this lab and demo the codes of the exercises to the lab professor during the lab session.

• Steps

Step 1. Lagrange Polynomials Interpolation

Interpolation is a method of constructing new data points within the range of a discrete set of known data points. In the lecture, we covered the direct method of interpolation. Mainly, the linear, quadratic, and cubic interpolation which require solving two equations, three equations, or four equations, respectively.

Another way to construct a new data point uses Lagrange Polynomials. In this method, we write the function as a polynomial if order "n-1" where n is the number of the given data points. This function is given as:

$$f_N(x) = \sum_{i=1}^{N} L_i(x) \times f(x_i)$$

where

$$L_i(x) \prod_{\substack{i=1 \\ i \neq j}}^{N} \frac{x - x_j}{x_i - x_j}$$

Once the function is found, a new data point can be constructed.

Step 2. Exercises

- Write an R function called "**lagInter()**" that asks the user to enter two vectors: xVec and yVec, each of which of length N. Then, the function asks the user to enter a value of x_k. The function will calculate the value of y_k using Lagrange Polynomials Interpolation explained above.

- The function should validate that the value of x_k falls between the minimum and maximum values of xVec.

- You can use the following values to test your function:

x	$f(x)$
1	0.144
1.3	-0.6878
1.6	-0.9962
1.9	-0.5507
2.2	0.3115

  Find $f(1.5)$. The answer should be "-0.9773".

<u>You need to demo this to your lab professor.</u>

> **"Testing leads to failure, and failure leads to understanding."** - *Burt Rutan*