CMPT-439 Numerical Computation
Project 7

1. Do the following.

a) (5**0 points**) Design a function (in any high-level language or Matlab) implementing the Lagrange interpolation. Follow the algorithm from the class notes (Lecture 8) or from the textbook (p. 154 of [1]). The input arguments of this function should be a value where the function shall be interpolated, a vector of values where the function is defined, and a vector of the corresponding function values. Your function shall be robust, which means shat it should not depend on the number of points where it is defined.

b) (**10 points**) Ask a generative AI tool (ChatGPT or any other) to create a function utilizing Lagrange interpolation using the same programming language, which you used, meeting the same requirements as your function had to meet. Evaluate distinctions between your code and generative AI code. **Is AI-generated code correct? Does it meet requirements?**

c) (**25 extra credit points, but must be combined with task f)**) Design a function (in any high level language or Matlab) implementing the Newton interpolation method using divided differences. Follow the algorithm from the class notes (Lecture 8). The input arguments of this function should be a value where the function shall be interpolated, a vector of values where the function is defined, and a vector of the corresponding function values.
Ask a generative AI tool (ChatGPT or any other) to create a function utilizing Lagrange interpolation using the same programming language, which you used, meeting the same requirements as your function had to meet. Evaluate distinctions between your code and generative AI code. **Is AI-generated code correct? Does it meet requirements?**

d) (**20 points**) Using the Lagrange method and a function, which you designed, interpolate the following function

($f(x) = xe^x$ **) at** x**=0.6**

x	$f(x)$
0.3	0.404958
0.5	0.824361
0.7	1.40963
0.9	2.21364
1.1	3.30458

(1) Using only the first 3 data points
(2) Using only the first 4 data points
(3) Using only the last 4 data points
(4) Using all the given data points

e) (**10 points**) Using the Lagrange method and a function, which was designed by generative AI, interpolated the function from Task d). Consider the same four cases.

f) (**required for extra credit in conjunction with b)**)
Using the Newton's method interpolate the function from Task d) using all the given data points and compare your result to the one obtained in d)

g) (**10 points**) Compare all results (which you got with your function(s) and AI-designed function(s) to the exact correct value, which is $f(0.6) = 0.6e^{0.6} = 1.09327$. Which one of your results is closer to the exact correct value? Why? Write a brief report with your results and conclusions.

2. Turn in your source code and your report

Reference

[1] Gerald, C.F. and Wheatley, P.O., Applied Numerical Analysis, 7th Edition, Pearson, 2004