ALGONQUIN COLLEGE

Computer Engineering Technology – Computing Science

Course: Numerical Computing – CST8233
Term: Fall 2021

Lab #9

• Objectives

The main objective of this lab is to use R program to implement Maclaurin Series.

• Earning

This lab worth 1.5 % 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. Maclaurin Series

Maclaurin series is used to expand a function around zero. This series is infinite series and is given as follows:

$$f(x) = \sum_{n=0}^{\infty} \frac{f^n(0)}{n!}(x)^n$$

where $f^n(0)$ is the n^{th} derivative of $f(x)$ evaluated at $x = 0$.

Step 2. Exercise

A. Find the first four non-zero terms of Maclaurin Series of:

$$f(x) = 10 + e^x \cos x$$

Note: ignore all terms of fifth order and higher.

B. Write R program that takes the value of x as an input from the user and then, it computes the value of $f(x)$ using the terms found in part A.

C. Plot the function $f(x)$ for values of $-5 \leq x \leq +5$.

D. On the same plot, use the four terms obtained in Part A to find the approximate value of the function. Use a step of 0.1 for x.

E. Based on the graph, comment on the convergence interval. Fine the Absolute and Relative errors using the approximated function and fill the table shown below.

x	Absolute error	Relative error
-3.5		
-3.0		
-2.5		
-2.0		
-1.5		
-1.0		
-0.5		
0		
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		

You need to demo this to your lab professor.