Lab 19

Ch En 263 – Numerical Tools

Due: 20 Nov. 2025

Instructions

- Complete the exercise(s) below, and submit the following files to Learning Suite:
  - Handwritten portion: scan each page (or take a picture) and combine them into a single pdf named: `LastName_FirstName_Lab19.pdf`
  - Excel portion: submit a workbook named `LastName_FirstName_Lab19.xlsx` where each worksheet tab is named "Problem_1", "Problem_2", etc.
  - Python portion: submit a separate file for each problem named `LastName_FirstName_Lab19_ProblemXX.py` where XX is the problem number.
- Warning: the LS assignment will close promptly at 11:59 pm and late assignments will only receive 50% credit.

Lab Exercises

1. In this problem we are going to compute the integral

$$I = \int_0^3 1 - \exp(-x)\, dx$$

using a couple different methods.

   (a) Do the integral by hand and find the exact value, I_{exact}.

   (b) Write a function that uses the composite trapezoidal rule to find I for an arbitrary number of trapezoids n. Use this function to compute the integral with an increasing number of trapezoids. Specifically, create an array $I_{\text{trap},n}$ for $n \in [2, 40]$.

   (c) Create a plot of $I_{\text{trap},n}$ versus n using your array. Include the I_{exact} as lines (dashed/-dotted/colored so you can see them both) on the plot for reference.

2. Numerically evaluate the integral

$$I = \int_0^{2\pi} e^{-x} \sin(3x) dx$$

using the composite trapezoidal rule with $N = 101$ points in Excel.