

Lab 11

Ch En 263 – Numerical Tools

Due: 27 Feb. 2024

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_Lab11.pdf`
 - Excel portion: submit a workbook named `LastName_FirstName_Lab11.xlsx` where each worksheet tab is named “Problem_1”, “Problem_2”, etc.
 - Python portion: submit a separate file for each problem named `LastName_FirstName_Lab11_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 you will write a Python program to do forward elimination for the system of linear equations:

$$\begin{aligned} -2x_0 + x_1 - 2x_2 &= 1 \\ x_0 + x_1 - x_2 &= -6 \\ x_0 - 2x_1 - x_2 &= -3 \end{aligned}$$

Note that this is one of the systems you solved for the last homework. This can help you debug your code!

- (a) Define numpy array variables `A` and `b` and a variable for the number of rows, `n`.
- (b) Write a loop for $k = 0, 1, \dots, n - 2$ that prints out the diagonal element of each row (except the last one) of the matrix, $a_{k,k}$.
- (c) Write a nested loop for $k = 0, 1, \dots, n - 2$ and $i = k + 1, k + 2, \dots, n - 1$ that prints out the ratio $a_{i,k}/a_{k,k}$ where i are the rows below the k^{th} diagonal.
- (d) Write the full forward elimination algorithm using a triple nested loop where the third loop runs over the columns in row i for $j = k, k + 1, \dots, n - 1$. Print the final upper-triangular matrix and modified RHS (right-hand side) vector `b` to the console.