

Homework 6

Ch En 263 – Numerical Tools

Due: 26 Feb. 2024

Instructions

- Complete the problems 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_HW6.pdf`
 - Excel portion: submit a workbook named `LastName_FirstName_HW6.xlsx` where each worksheet tab is named “Problem_1”, “Problem_2”, etc.
 - Python portion: submit a separate file for each problem named `LastName_FirstName_HW6_ProblemXX.py` where XX is the problem number.

Problems

1. Do the following by hand. Use the first step of the Gauss Elimination algorithm (forward elimination) to reduce the linear system

$$\begin{aligned}4x_0 - 3x_2 - 4x_3 &= 4 \\x_0 - 4x_1 + 4x_2 + 2x_3 &= -21 \\x_0 - 5x_1 - 3x_2 + 4x_3 &= 5 \\-4x_0 - 3x_1 + x_2 + 2x_3 &= 6\end{aligned}$$

to an upper triangular matrix and a modified right-hand-side (RHS) vector. Your answer should consist of the upper triangular matrix and RHS vector that results from the procedure described in class and in the notes. Other versions will not get full credit; the point of this problem is to become familiar with the forward elimination algorithm to help you program it on the next homework. You *do not* need to report the solution, \mathbf{x} .

2. Using the residual function that you developed in Lab 10, decide which is the correct solution to the linear system from problem 3. You should turn in a Python code that uses the `residual` function to test each of the potential answers (a-d). Your code should print something to the console that identifies the correct solution.

a)

$$x = \begin{bmatrix} -3 \\ 0 \\ -4 \\ -1 \end{bmatrix}$$

b)

$$x = \begin{bmatrix} 5 \\ -1 \\ 4 \\ 7 \end{bmatrix}$$

c)

$$x = \begin{bmatrix} 3 \\ 0 \\ 5 \\ -1 \end{bmatrix}$$

d)

$$x = \begin{bmatrix} 2 \\ -1 \\ -4 \\ 7 \end{bmatrix}$$