MTP290 Spring 2023
Assignment 2

1 Instructions

1. The assignment can be attempted in teams of 2. Only one team member has to submit it on Moodle/Gradescope (will be announced later). Discussions should only happen within the team. Your code will be checked for plagiarism.
2. Any descriptive answer should be written at the top of the code. Use '%' to comment inside the code.
3. Only .m files accepted, any other type files will not be evaluated. Name them $A2\_Qn\_EntryNo1\_EntryNo2.m$, where n is the question number.
4. **Assignment Deadline: 11.59pm March 9th, 2023**

2 Problems

1. (**2 marks**) Implement the Gauss elimination method with partial pivoting to solve a system of linear equations $Ax = b$, where A is a non-singular matrix. Use the program to find the solution of the linear system $Ax = b$ where

$$A = \begin{bmatrix} 9 & 3 & 2 & 0 & 7 \\ 7 & 6 & 9 & 6 & 4 \\ 2 & 7 & 7 & 8 & 2 \\ 0 & 9 & 7 & 2 & 2 \\ 7 & 3 & 6 & 4 & 3 \end{bmatrix}, b = \begin{bmatrix} 35 \\ 58 \\ 53 \\ 37 \\ 39 \end{bmatrix}.$$

2. (**2.5 marks**) Use MATLAB's rand function to generate A, a random 10×10 matrix, and a random vector $b \in \mathbb{R}^{10}$; solve the system $Ax = b$
   (a) using Doolittle's decomposition.
   (b) using MATLAB's backslash command: $x = A\backslash b$.

3. (**3 marks**)
   (a) Solve the following linear system using Gauss Jacobi method with the initial guess $x_1 = x_2 = x_3 = 0$

$$\begin{aligned} 4x_1 + x_2 - x_3 &= 3 \\ 2x_1 + 7x_2 + x_3 &= 19 \\ x_1 - 3x_2 + 12x_3 &= 31. \end{aligned}$$

   (b) Use Gauss-Jacobi method to attempt solving the linear system

$$\begin{aligned} x_1 + 2x_2 + 3x_3 &= 5 \\ 2x_1 - x_2 + 2x_3 &= 1 \\ 3x_1 + x_2 - 2x_3 &= -1 \end{aligned}$$

4. (**2.5 marks**) The upward velocity of a rocket is given at three different times in the following table

Time (s) (t)	Velocity (m/s) (v)
5	106.8
8	177.2
12	279.2
5	106.8

The velocity data is approximated by a polynomial as

$$v(t) = at^2 + bt + c, t \in [5, 12].$$

Find the values of a, b and c using the Gauss-Seidel method. Assume an initial guess of the solution as $[a, b, c] = [1, 2, 5]$.