Numerical Computation
Assignment 4

1. Considering following linear systems

$$3.03x_1 - 12.1x_2 + 14x_3 = -119$$

$$-3.03x_1 + 12.1x_2 - 7x_3 = 120$$

$$6.11x_1 - 14.2x_2 + 21x_3 = -139$$

the actual solution is $[0, 10, \frac{1}{7}]$.

a. Use Gaussian elimination and three-digit **chopping** arithmetic to find the solution.

b. Use Gaussian elimination with partial pivoting and three-digit **chopping** arithmetic to find the solution.

c. Use Gaussian elimination with scale partial pivoting and three-digit **rounding** arithmetic to find the solution.

2. Please modify the Matlab function **gauss_no_pivot** shown in lecture so we could see the result of each step of the row reduction. (Show the m-file and highlight the modification(addition) parts.)

3. Please add partial pivoting into the Matlab function you found in Question 2. (Show the m-file and highlight the modification(addition) parts.)

4. Please add scaled partial pivoting into the Matlab function you found in Question 2. (Show the m-file and highlight the modification(addition) parts.)

5. Find the solutions of following system using the function you found in Q2, Q3 and Q4 respectively. (Show the solution and each step of the row reduction.)

$$\begin{bmatrix} 3 & 9 & 4 & 8 & 11 \\ -2 & 0.1 & 10 & -0.3 & 2 \\ 10 & 100 & 0.3 & -1 & 17 \\ 6 & 5 & 11 & 0.1 & 0 \\ 0.01 & -0.6 & 1 & 0 & 55 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} 0.6 \\ 12 \\ 102 \\ 33 \\ 1 \end{bmatrix}$$

6. Find the solutions of following system using the function you found in Q2 and Q3 respectively. Are the solutions the same? Explain the reason.

$$\begin{bmatrix} 10^{-26} & 1 & 3 \\ 100 & 26 & 11 \\ 3 & 11 & -13 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 10 \\ 2 \\ 4 \end{bmatrix}$$