

MATH 4513 : HOMEWORK 5

1. Solve the following linear systems twice. First use Gaussian elimination and give the factorization $\mathbf{A} = \mathbf{L}\mathbf{U}$. Second, use Gaussian elimination with scaled pivoting and determine the factorization of the form $\mathbf{P}\mathbf{A} = \mathbf{L}\mathbf{U}$.

(a)

$$\begin{pmatrix} -1 & 1 & -4 \\ 2 & 2 & 0 \\ 3 & 3 & 2 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \\ \frac{1}{2} \end{pmatrix}$$

(b)

$$\begin{pmatrix} 1 & 6 & 0 \\ 2 & 1 & 0 \\ 0 & 2 & 1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \\ 1 \end{pmatrix}$$

2. Show how Gaussian elimination with scaled row pivoting works on these examples (LU factorization phase only).

(a)

$$\mathbf{A} = \begin{pmatrix} 2 & -2 & 4 \\ 1 & 1 & -1 \\ 3 & 7 & 5 \end{pmatrix}$$

(b)

$$\mathbf{A} = \begin{pmatrix} 3 & 7 & 3 \\ 1 & \frac{7}{3} & 4 \\ 4 & \frac{4}{3} & 0 \end{pmatrix}$$