MATH 307: Individual Homework 20

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Problem 1

See HW instruction.

We will first find U with row reduction.

$$U = \underbrace{\begin{bmatrix} 3 & 2 & 1 \\ 6 & 6 & 3 \\ 3 & 0 & -1 \end{bmatrix}}_{R2-(\mathbf{2})R1} \Rightarrow \underbrace{\begin{bmatrix} 3 & 2 & 1 \\ 0 & 2 & 1 \\ 3 & 0 & -1 \end{bmatrix}}_{R3-(\mathbf{1})R1} \Rightarrow \underbrace{\begin{bmatrix} 3 & 2 & 1 \\ 0 & 2 & 1 \\ 0 & -2 & -2 \end{bmatrix}}_{R3-(-\mathbf{1})R2} \Rightarrow \begin{bmatrix} 3 & 2 & 1 \\ 0 & 2 & 1 \\ 0 & 0 & -1 \end{bmatrix}$$

Then we start L from I and add the above operations (highlighted in bold), we have $L = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 1 & -1 & 1 \end{bmatrix}$.

To verify, we have:

$$LU = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 1 & -1 & 1 \end{bmatrix} \begin{bmatrix} 3 & 2 & 1 \\ 0 & 2 & 1 \\ 0 & 0 & -1 \end{bmatrix} = \begin{bmatrix} 3 & 2 & 1 \\ 6 & 6 & 3 \\ 3 & 0 & -1 \end{bmatrix} = A$$