BLG 202E - Assignment 2

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Q-1)

$$\left.\begin{aligned} x_1 - x_2 + 3x_3 &= 2 \\ x_1 + x_2 &= 4 \\ 3x_1 - 2x_2 + x_3 &= 1 \end{aligned}\right\} \Longrightarrow \begin{bmatrix} 1 & -1 & 3 \\ 1 & 1 & 0 \\ 3 & -2 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 4 \\ 1 \end{bmatrix}$$

$$\left[\begin{array}{ccc|c} 1 & -1 & 3 & 2 \\ 1 & 1 & 0 & 4 \\ 3 & -2 & 1 & 1 \end{array}\right] \xrightarrow[R_3 - 3R_1 \to R_3]{R_2 - R_1 \to R_2} \left[\begin{array}{ccc|c} 1 & -1 & 3 & 2 \\ 0 & 2 & -3 & 2 \\ 0 & 1 & -8 & -5 \end{array}\right] \xrightarrow{\frac{R_2}{2} \to R_2} \left[\begin{array}{ccc|c} 1 & -1 & 3 & 2 \\ 0 & 1 & -\frac{3}{2} & 1 \\ 0 & 1 & -8 & -5 \end{array}\right]$$

$$\xrightarrow{R_3 - R_2 \to R_3} \left[\begin{array}{ccc|c} 1 & -1 & 3 & 2 \\ 0 & 1 & -\frac{3}{2} & 1 \\ 0 & 0 & -\frac{13}{2} & -6 \end{array}\right] \xrightarrow{R_3 \cdot \frac{-2}{13} \to R_3} \left[\begin{array}{ccc|c} 1 & -1 & 3 & 2 \\ 0 & 1 & -\frac{3}{2} & 1 \\ 0 & 0 & 1 & \frac{12}{13} \end{array}\right]$$

Resulting Upper Triangle Matrix

Backward substitution:

$\rightarrow x_3 = \frac{12}{13}$

$\rightarrow x_2 - \frac{3x_3}{2} = 1 \qquad x_2 = 1 + \frac{3}{2} \cdot \frac{12}{13} = \frac{31}{13}$

$\rightarrow x_1 - x_2 + 3x_3 = 2 \qquad x_1 = 2 + \frac{31}{13} - 3 \cdot \frac{12}{13} = \frac{21}{13}$

$$X = \begin{bmatrix} \frac{21}{13} \\ \frac{31}{13} \\ \frac{12}{13} \end{bmatrix}$$