Day: Muneeb Lone 23i-2623 DS-B Date: / /

Homework #1

Muneeb

Q1: $A = \begin{bmatrix} 2 & 0 & -1 \\ 1 & 1 & 0 \\ -1 & 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 1 & -1 \\ 3 & 5 & 1 \\ 2 & 2 & 0 \end{bmatrix}$

$$\sim \begin{bmatrix} 2 & 0 & -1 \\ -1 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix} \text{ Swap R2 R3}$$

$$\sim \begin{bmatrix} \cancel{3} & \cancel{1} & \cancel{-1} \\ \cancel{-1} & \cancel{1} & \cancel{1} \\ \cancel{1} & \cancel{1} & \cancel{0} \end{bmatrix} \cancel{\text{R1 + R3}} \qquad \begin{bmatrix} 3 & 1 & -1 \\ -1 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix} \text{ R1+R3}$$

$$\begin{bmatrix} 3 & 1 & -1 \\ -1 & 1 & 1 \\ 2 & 2 & 0 \end{bmatrix} \text{ 2R3}$$

$$\begin{bmatrix} 3 & 1 & -1 \\ 3 & 5 & 1 \\ 2 & 2 & 0 \end{bmatrix} \text{ 2R3+R2} \leftarrow \text{Ans}$$

Q2:
$$A = \begin{array}{c} \begin{array}{ccc} x & y & z \end{array} \\ \left[\begin{array}{ccc|c} 1 & 3 & -1 & a \\ 1 & 1 & 2 & b \\ 0 & 2 & -3 & c \end{array}\right] \end{array}$$

$$\sim \left[\begin{array}{ccc|c} 1 & 3 & -1 & a \\ 0 & -2 & 3 & b-a \\ 0 & 2 & -3 & c \end{array}\right] \text{ R2 - R1}$$

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$$\sim \left[\begin{array}{ccc|c} 1 & 3 & -1 & a \\ 0 & -2 & 3 & b-a \\ 0 & 0 & 0 & (b-a)+c \end{array}\right] \quad R3+R2$$

For this system to be consistent, $(b-a)+c$ must be equal to 0. For any non-zero value, the system will be inconsistent because it will satisfy the form

$[\,0 \quad 0 \quad 0 \mid b\,]$ where $b \neq 0$

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Q3: $A = \cancel{\left[\begin{array}{cccc|c} \frac{1}{2} & 1 & -1 & -6 & 2 \\ \frac{1}{6} & \frac{1}{2} & -3 & +1 & -1 \\ \frac{1}{3} & -2 & -0 & -4 & 8 \end{array}\right]}$

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$$A = \begin{array}{c} \begin{array}{ccccc} x_1 & x_2 & x_3 & x_4 & x_5 \end{array} \\ \left[\begin{array}{ccccc|c} \frac{1}{2} & 1 & -1 & -6 & 0 & 2 \\ \frac{1}{6} & \frac{1}{2} & 0 & -3 & 1 & -1 \\ \frac{1}{3} & 0 & -2 & 0 & -4 & 8 \end{array}\right] \end{array}$$

$$A = \left[\begin{array}{ccccc|c} 1 & 2 & -2 & -12 & 0 & 4 \\ 1 & 3 & 0 & -18 & 6 & -6 \\ 1 & 0 & -6 & 0 & -12 & 24 \end{array}\right] \begin{array}{l} 2R_1 \\ 6R_2 \\ 3R_3 \end{array}$$

$$\sim \left[\begin{array}{ccccc|c} 1 & 2 & -2 & -12 & 0 & 4 \\ 0 & 1 & +2 & -6 & 6 & -10 \\ 1 & 0 & -6 & 0 & -12 & 24 \end{array}\right] \begin{array}{l} \\ R_2 - R_1 \\ \\ \end{array}$$

$$\sim \left[\begin{array}{ccccc|c} 1 & 2 & -2 & -12 & 0 & 4 \\ 0 & 1 & +2 & -6 & 6 & -10 \\ 0 & -2 & -4 & 12 & -12 & 20 \end{array}\right] \begin{array}{l} \\ \\ R_3 - R_1 \end{array}$$

$$\sim \begin{array}{c} \left[\begin{array}{ccccc|c} 1 & 2 & -2 & -12 & 0 & 4 \\ 0 & 1 & +2 & -6 & 6 & -10 \\ 0 & 0 & -6 & 0 & -12 & 24 \end{array}\right] \\ \begin{array}{ccccc} x_1 & x_2 & x_3 & x_4 & x_5 \end{array} \end{array} \begin{array}{l} \\ \\ R_3 + R_1 \end{array}$$

$$-6x_3 - 12x_5 = 24$$

As the system ~~last~~ row does not have a row satisfying the form $[\,0 \;\; 0 \; \dots \; 0 \,|\, b\,]$ where $b \neq 0$, a solution exists.