EE5609 Assignment 8

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Abstract—**This document solves problem based on solution of system of linear equations.**

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1 PROBLEM

Find all solutions of

$$x_1 - 2x_2 + x_3 + 2x_4 = 1$$
$$x_1 + x_2 - x_3 + x_4 + x_5 = 2$$
$$x_1 + 7x_2 - 5x_3 - x_4 = 3$$

2 SOLUTION

The given equations can be written as,

$$\mathbf{Ax} = B \tag{2.0.1}$$

$$\begin{pmatrix} 1 & -2 & 1 & 2 \\ 1 & 1 & -1 & 1 \\ 1 & 7 & -5 & -1 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \tag{2.0.2}$$

Now, we form the augmented matrix and perform Row reduction,

$$\begin{pmatrix} 1 & -2 & 1 & 2 & \bigm| & 1 \\ 1 & 1 & -1 & 1 & \bigm| & 2 \\ 1 & 7 & -5 & -1 & \bigm| & 3 \end{pmatrix} \tag{2.0.3}$$

$$\xleftarrow{R_2=R_2-R_1, R_3=R_3-R_1} \begin{pmatrix} 1 & -2 & 1 & 2 & \bigm| & 1 \\ 0 & 3 & -2 & -1 & \bigm| & 1 \\ 0 & 9 & -6 & -3 & \bigm| & 2 \end{pmatrix} \tag{2.0.4}$$

$$\xleftarrow{R_2=\frac{1}{3}R_2} \begin{pmatrix} 1 & -2 & 1 & 2 & \bigm| & 1 \\ 0 & 1 & \frac{-2}{3} & \frac{-1}{3} & \bigm| & \frac{1}{3} \\ 0 & 9 & -6 & -3 & \bigm| & 2 \end{pmatrix} \tag{2.0.5}$$

$$\xleftarrow{R_3=R_3-9R_1} \begin{pmatrix} 1 & -2 & 1 & 2 & \bigm| & 1 \\ 0 & 1 & \frac{-2}{3} & \frac{-1}{3} & \bigm| & \frac{1}{3} \\ 0 & 0 & 0 & 0 & \bigm| & -1 \end{pmatrix} \tag{2.0.6}$$

Rank of **A** is less than rank of the augmented matrix. Hence, the given system has no solution.