Matrix theory Assignment 1

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***Abstract*—This documnet contains the solution to a variable *k* in a set of linear equations**

Download all python codes from

https://github.com/saipranavkr/EE5609/codes

and latex-tikz codes from

https://github.com/saipranavkr/EE5609

1 Problem

For which value of k will the following pair of linear equations have no solution

$$(3\ 1)\mathbf{x} = 1$$
$$(2k\text{-}1\ \ k\text{-}1)\mathbf{x} = 2k{+}1$$

2 Solution

Constructing the augmented matrix

$$\begin{pmatrix} 3 & 1 & 1 \\ 2k-1 & k-1 & 2k+1 \end{pmatrix}$$

Transforming the matrix into row-echelon form

$$\begin{pmatrix} 3 & 1 & 1 \\ 2k-1 & k-1 & 2k+1 \end{pmatrix} \xleftrightarrow{R2 \leftarrow R1 * \frac{2k-1}{3} - R2} \begin{pmatrix} 3 & 1 & 1 \\ 0 & \frac{2k-1}{3} - (k-1) & \frac{2k-1}{3} - (2k+1) \end{pmatrix} \tag{2.0.1}$$

For the linear equations to have no solution, Rank(Coefficient matrix) ≠ Rank(Augmented matrix)

$$\implies \frac{2k-1}{3} - (k-1) = 0 \tag{2.0.2}$$

and

$$\frac{2k-1}{3} - (2k+1) \neq 0 \tag{2.0.3}$$

Solving the above equations,

$$\implies k = 2 \quad \cap \quad k \neq -1 \tag{2.0.4}$$

From equation (2.0.4), it is clear that k = 2
Hence, for k = 2, the given set of linear equations will have no solution.