Matrix theory Assignment 1

K R Sai Pranav

***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

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

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.