Assignment 8

Priya Bhatia

Abstract—**This document finds the solutions of given matrix by row reduction.**

Download python codes from

Download latex-tikz codes from

1 PROBLEM

If

$$A = \begin{pmatrix} 3 & -1 & 2 \\ 2 & 1 & 1 \\ 1 & -3 & 0 \end{pmatrix} \quad (1.0.1)$$

Find all solutions of $AX = 0$ by row reducing A.

2 SOLUTION

For the given equation $AX = 0$ can be defined as follows:

$$\begin{pmatrix} 3 & -1 & 2 \\ 2 & 1 & 1 \\ 1 & -3 & 0 \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} \quad (2.0.1)$$

Now, we can apply Row Reduction Methodology of matrix A :

$$\begin{pmatrix} 3 & -1 & 2 & 0 \\ 2 & 1 & 1 & 0 \\ 1 & -3 & 0 & 0 \end{pmatrix} \xleftarrow{R_1=R_1+R_2} \begin{pmatrix} 5 & 0 & 3 & 0 \\ 2 & 1 & 1 & 0 \\ 1 & -3 & 0 & 0 \end{pmatrix} \quad (2.0.2)$$

$$\xleftarrow{R_2=R_2-2R_3} \begin{pmatrix} 5 & 0 & 3 & 0 \\ 0 & 7 & 1 & 0 \\ 1 & -3 & 0 & 0 \end{pmatrix} \quad (2.0.3)$$

$$\xleftarrow{R_3=R_3-\frac{1}{5}R_1} \begin{pmatrix} 5 & 0 & 3 & 0 \\ 0 & 7 & 1 & 0 \\ 0 & -3 & -\frac{3}{5} & 0 \end{pmatrix} \quad (2.0.4)$$

$$\xleftarrow{R_1=\frac{1}{5}R_1} \begin{pmatrix} 1 & 0 & \frac{3}{5} & 0 \\ 0 & 7 & 1 & 0 \\ 0 & -3 & -\frac{3}{5} & 0 \end{pmatrix} \quad (2.0.5)$$

$$\xleftarrow{R_2=\frac{1}{7}R_2} \begin{pmatrix} 1 & 0 & \frac{3}{5} & 0 \\ 0 & 1 & \frac{1}{7} & 0 \\ 0 & -3 & -\frac{3}{5} & 0 \end{pmatrix} \quad (2.0.6)$$

$$\xleftarrow{R_3=R_3+3R_2} \begin{pmatrix} 1 & 0 & \frac{3}{5} & 0 \\ 0 & 1 & \frac{1}{7} & 0 \\ 0 & 0 & -\frac{6}{35} & 0 \end{pmatrix} \quad (2.0.7)$$

$$\xleftarrow{R_3=-\frac{35}{6}R_3} \begin{pmatrix} 1 & 0 & \frac{3}{5} & 0 \\ 0 & 1 & \frac{1}{7} & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix} \quad (2.0.8)$$

$$\xleftarrow{R_2=R_2-\frac{1}{7}R_3} \begin{pmatrix} 1 & 0 & \frac{3}{5} & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix} \quad (2.0.9)$$

$$\xleftarrow{R_1=R_1-\frac{3}{5}R_3} \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix} \quad (2.0.10)$$

So, as we can see the only solution we got after row reducing of matrix A is zero vector. Thus, the solution is :

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} \quad (2.0.11)$$