Matrix Theory (EE5609) Assignment 1

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***Abstract*—This document contains the solution to find the inverse of matrix,if it exists**

Download all python codes from

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https://github.com/utkarshsurwade/
    Matrix_Theory_EE5609/tree/master/codes
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and latex-tikz codes from

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https://github.com/utkarshsurwade/
    Matrix_Theory_EE5609/tree/master/
    Assignment2
```

1 Problem

Using elementary transformations, find the inverse of the matrix,if it exists

$$\begin{pmatrix} 1 & 3 & -2 \\ -3 & 0 & -5 \\ 2 & 5 & 0 \end{pmatrix} \tag{1.0.1}$$

2 Solution

$$Let\ \mathbf{A} = \begin{pmatrix} 1 & 3 & -2 \\ -3 & 0 & -5 \\ 2 & 5 & 0 \end{pmatrix} \tag{2.0.1}$$

Therefore the augmented matrix can be represented as follows :

$$\left(\begin{array}{ccc|ccc} 1 & 3 & -2 & 1 & 0 & 0 \\ -3 & 0 & -5 & 0 & 1 & 0 \\ 2 & 5 & 0 & 0 & 0 & 1 \end{array}\right) \tag{2.0.2}$$

Applying elementary transformations on $\mathbf{A}$ as follows:

$$\xleftrightarrow[R_3 \leftarrow R_3 - 2R_1]{R_2 \leftarrow R_2 + 3R_1} \left(\begin{array}{ccc|ccc} 1 & 3 & -2 & 1 & 0 & 0 \\ 0 & 9 & -11 & 3 & 1 & 0 \\ 0 & -1 & 4 & -2 & 0 & 1 \end{array}\right) \tag{2.0.3}$$

$$\xleftrightarrow[R_1 \leftarrow R_1 - 3R_2]{R_2 \leftrightarrow -R_3} \left(\begin{array}{ccc|ccc} 1 & 0 & 10 & -5 & 0 & 3 \\ 0 & 1 & -4 & 2 & 0 & -1 \\ 0 & 9 & -11 & 3 & 1 & 0 \end{array}\right) \tag{2.0.4}$$

$$\xleftrightarrow[R_3 \leftarrow \frac{R_3}{25}]{R_3 \leftarrow R_3 - 4R_2} \left(\begin{array}{ccc|ccc} 1 & 0 & 10 & -5 & 0 & 3 \\ 0 & 1 & -4 & 2 & 0 & -1 \\ 0 & 0 & 1 & \frac{-3}{5} & \frac{1}{25} & \frac{9}{25} \end{array}\right) \tag{2.0.5}$$

$$\xleftrightarrow[R_2 \leftarrow R_2 + 4R_3]{R_1 \leftarrow R_1 - 10R_3} \left(\begin{array}{ccc|ccc} 1 & 0 & 0 & 1 & \frac{-2}{5} & \frac{-3}{5} \\ 0 & 1 & 0 & \frac{-2}{5} & \frac{4}{25} & \frac{11}{25} \\ 0 & 0 & 1 & \frac{-3}{5} & \frac{1}{25} & \frac{9}{25} \end{array}\right) \tag{2.0.6}$$

Therefore $\mathbf{A^{-1}}$ is as follows:

$$\begin{pmatrix} 1 & \frac{-2}{5} & \frac{-3}{5} \\ \frac{-2}{5} & \frac{4}{25} & \frac{11}{25} \\ \frac{-3}{5} & \frac{1}{25} & \frac{9}{25} \end{pmatrix} \tag{2.0.7}$$