

Assignment 9

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Abstract—This document contains a solution to find explicitly all 2x2 row-reduced echelon matrices.

Download all latex-tikz codes from

https://github.com/Matish007/Matrix-Theory-EE5609-/tree/master/Assignment_9

1 PROBLEM

Describe explicitly all 2x2 row-reduced echelon matrices.

2 SOLUTION

A matrix is said to be in row-reduced echelon form if the following conditions hold:

- 1) the first non-zero entry in each non-zero row is 1.
- 2) each column that contains the leading non-zero entry of some row has all its other entries equal to 0.
- 3) every row that has all its entries zero must be below every row that has a non-zero entry.

From (1) and (2) it can be concluded that the entries of a row-reduced echelon matrix would be either 1 or 0. In a 2x2 matrix total 4 entries are there and in each entry we can have 1 or 0. So total 2x2 matrices possible are 16. Let's take each and check how many of them satisfies our conditions.

$$\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix} \quad (2.0.1)$$

It satisfies all conditions. So it is a row-reduced echelon matrix.

$$\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \quad (2.0.2)$$

It satisfies all conditions. So it is a row-reduced echelon matrix.

$$\begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix} \quad (2.0.3)$$

It satisfies all conditions. So it is a row-reduced echelon matrix.

$$\begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix} \quad (2.0.4)$$

It doesnot satisfy (3). So it is not a row-reduced echelon matrix.

$$\begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix} \quad (2.0.5)$$

It doesnot satisfy (3). So it is not a row-reduced echelon matrix.

$$\begin{pmatrix} 1 & 1 \\ 0 & 0 \end{pmatrix} \quad (2.0.6)$$

It satisfies all the conditions. So it is a row-reduced echelon matrix.

$$\begin{pmatrix} 1 & 0 \\ 1 & 0 \end{pmatrix} \quad (2.0.7)$$

It doesnot satisfy (2). So it is not a row-reduced echelon matrix.

$$\begin{pmatrix} 0 & 0 \\ 1 & 1 \end{pmatrix} \quad (2.0.8)$$

It doesnot satisfy (3). So it is not a row-reduced echelon matrix.

$$\begin{pmatrix} 0 & 1 \\ 0 & 1 \end{pmatrix} \quad (2.0.9)$$

It doesnot satisfy (2). So it is not a row-reduced echelon matrix.

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad (2.0.10)$$

It satisfies all the conditions. So it is a row-reduced echelon matrix.

$$\begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix} \quad (2.0.11)$$

It doesnot satisfy (2).So it is not a row-reduced echelon matrix.

$$\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix} \quad (2.0.12)$$

It doesnot satisfy (2).So it is not a row-reduced echelon matrix.

$$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \quad (2.0.13)$$

It is not even in a echelon form,So not a row-reduced echelon matrix.

$$\begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix} \quad (2.0.14)$$

It doesnot satisfy (2).So it is not a row-reduced echelon matrix.

$$\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix} \quad (2.0.15)$$

It doesnot satisfy (2).So it is not a row-reduced echelon matrix.

$$\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix} \quad (2.0.16)$$

It doesnot satisfy (2).So it is not a row-reduced echelon matrix.

So,2x2 matrices which are row-reduced echelon matrix are:- $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 1 & 1 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$