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Subject :- LINEAR ALGEBRA

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QNo 1 :-

$$\begin{pmatrix} 1 & ID3 & 3 & 0 & 5 \\ 0 & 1 & -ID\,last & 0 & 7 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & ID3 \end{pmatrix}$$

Sol:- let Suppose

ID = 7449
ID3 = 4
IDLast = 9

Inverse of ID last is = -9
putting values.

$$\begin{pmatrix} 1 & 4 & 3 & 0 & 5 \\ 0 & 1 & -9 & 0 & 7 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & 4 \end{pmatrix}$$

$$\underset{\sim}{R} \begin{pmatrix} 1 & 4 & 0 & 0 & 23 \\ 0 & 1 & 0 & 0 & -23 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & 4 \end{pmatrix} \begin{matrix} R_1-3R_3 \\ R_2+5R_3 \end{matrix}$$

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$$R \left[\begin{array}{ccccc} 1 & 0 & 0 & 0 & 92 \\ 0 & 1 & 0 & 0 & -23 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & 4 \end{array}\right] R_1 - 3R_2$$

$x_1 = 92$

$x_2 = -23$

$x_3 = -6$

$x_4 = 4$

QNo 2:-

Part a):-

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 2 & -5 & -1 \end{bmatrix},$$

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 0 & 3 & -5 \end{bmatrix}$$

Sol:-

we know that the first two Rows in both matrix are same. Therefore only the third Row are different of both matrix.

So,

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 2 & -5 & -1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 0 & -5 & -5 \end{bmatrix} R_3-2R_2$$

And,

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 0 & 3 & -5 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 2 & -5 & -1 \end{bmatrix} R_3 + 2R_2$$

In first Row we multiply 2 with Row second and then subtract it from third Row which Give the Same result like Matrix (B).

In Second (B) Matrix we also multiply 2 with Second Row but here we add second Row with third Row and Give the Same Result like (A).

Part B):-

a):- $\begin{bmatrix} e & 0 & 0 & 0 \\ 0 & \pi & 0 & 0 \\ 0 & 0 & -\pi & 0 \\ 0 & 0 & 0 & e \end{bmatrix}$ is in echelon form

Yes, it is an echelon form because in echelon form the number of zero increase Row by Row.

B):- $\begin{bmatrix} 1 & 0 & \pi \\ 0 & 1 & e \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ is in echelon form

No, it is not in echelon form.
It is in Reduce echelon form.

c) :-
$$\begin{bmatrix} 5 & 0 & 0 & 7 \\ 0 & 1 & 0 & 5 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$
is in reduced row echelon form.

It is an echelon form not Reduced echelon form.

D) :-
$$\begin{bmatrix} 1 & 0 & 0 & 7 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$
is in reduced Row echelon form.

It is also echelon form.

QNo 3:-

Part A):-

Difference b/w echelon and Reduced Row echelon form:-

The echelon form of a Matrix isn't unique which means there are infinite answers are possible when you perform Row - reduction.
Reduced Row echelon form is at the other end of the spectum, it is unique, which mean Row - reduction on a matrix will produce the same answer no matter how you perform the same Row operation.

Practical uses:- The reduce row echelon form is used to solved the system of linear equation.

e.g:-

$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 3 \end{array}\right]$$

Part B:-

$$\begin{bmatrix} 1 & ID2 & 8 \\ 2 & 8 & -1 \\ -ID3 & 0 & 0 \\ 1 & -4 & ID\_first\_last \end{bmatrix}$$

Sol:-

Note:- Full ID is 7449.

ID2 = 4

ID3 = 4

1st, last = 49

putting values:-

$$\begin{bmatrix} 1 & 4 & 8 \\ 2 & 8 & -1 \\ -4 & 0 & 0 \\ 1 & -4 & 49 \end{bmatrix}$$

$$R \sim \begin{bmatrix} 1 & 4 & 8 \\ 0 & 0 & -17 \\ 0 & 16 & 32 \\ 0 & -8 & 41 \end{bmatrix} \begin{array}{l} R_2-2R_1 \\ R_3+4R_1 \\ R_4-R_1 \end{array}$$

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R/

$$\begin{pmatrix} 1 & 4 & 8 \\ 0 & 0 & -17/4 \\ 0 & 16 & 32 \\ 0 & -8 & 41 \end{pmatrix} \quad 1/4\, R2$$

$$\begin{pmatrix} 1 & 4 & 8 \\ 0 & 0 & -17/4 \\ 0 & 0 & 0 \\ 0 & 0 & 57 \end{pmatrix} \quad \begin{matrix} R4 + 2R1 \\ R3 - 4R1 \end{matrix}$$

$$\begin{pmatrix} 1 & 4 & 8 \\ 0 & 0 & -17/4 \\ 0 & 0 & 0 \\ 0 & 0 & 57 \end{pmatrix}$$

it is an echelon form.