ID 7 # 2
ID-L # 6

Q# 01: Ali Bachaa. ID # 16236

$$\left[\begin{array}{cccc|c} 1 & ID-3 & 3 & 0 & 5 \\ 0 & 1 & -ID\text{-}last & 0 & 7 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & ID\text{-}3 \end{array}\right]$$

$$\sim \left[\begin{array}{cccc|c} 1 & 2 & 3 & 0 & 5 \\ 0 & 1 & -6 & 0 & 7 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & 2 \end{array}\right]$$

As we can see that the given matrix is already in Echelon form.

$\therefore \quad 6R_3 + R_2$

$$\sim \left[\begin{array}{cccc|c} 1 & 2 & 3 & 0 & 5 \\ 0 & 1 & 0 & 0 & 7 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & 2 \end{array}\right]$$

$-2R_2 + R_1$

$$\sim \left[\begin{array}{cccc|c} 1 & 0 & 3 & 0 & 5 \\ 0 & 1 & 0 & 0 & 7 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & 2 \end{array}\right]$$

$-3R_3 + R_1$

$$\sim \left[\begin{array}{cccc|c} 1 & 0 & 0 & 0 & 5 \\ 0 & 1 & 0 & 0 & 7 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & 2 \end{array}\right]$$

$\therefore \quad 1x_1 + 0x_2 + 0x_3 + 0x_4 = 5$

$0x_1 + 1x_2 + 0x_3 + 0x_4 = 7$

$0x_1 + 0x_2 + 1x_3 + 0x_4 = -6$

$0x_1 + 0x_2 + 0x_3 + 1x_4 = 2$

$$\Rightarrow \boxed{\begin{aligned} 1x_1 &= 5 \\ x_2 &= 7 \\ x_3 &= -6 \\ x_4 &= 2 \end{aligned}}$$

Result.

Ans 2 PartA

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

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

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

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

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

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Ans No 2 Part No B 4 parts

Part No 1 A

$$\begin{bmatrix} e & 0 & 0 & 0 \\ 0 & \pi & 0 & 0 \\ 0 & 0 & -\pi & 0 \\ 0 & 0 & 0 & e \end{bmatrix}$$

Sol:-

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

yes in echelon form becauses no of zero increases as we goes down row by row before 1st non-zero.

Q2(b) $\begin{bmatrix} 1 & 0 & \Pi \\ 0 & 1 & e \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ is in echelon form

yes in echelon form because number of zero increase row by row before 1st non-zero.

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

No because the 1st element in R_1 lie C_1 is not 1 so not in reduce echelon form.

$$C = \begin{bmatrix} 5 & 0 & 0 & 7 \\ 0 & 1 & 0 & 5 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$

Solution

$$\begin{bmatrix} 5 & 0 & 0 & 7 \\ 0 & 1 & 0 & 5 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 0 & 0 & 7 \\ 0 & 1 & 0 & 5 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$

is in echelon form because it satisfies the 4th condition that is in a column that contains the leading ~~column~~ entry of row all the other element are zero

$$d = \begin{bmatrix} 1 & 0 & 0 & 7 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$

Solution:-

$$\begin{bmatrix} 1 & 0 & 0 & 7 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & 0 & 7 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$

in echelon form because satisfies the 4th condition. It is in a column that contains the leading entry row all the other elements are zero

Q3 Part A

Reduce Row Echelon form

- A Matrix is said to be in reduced row echelon form when it satisfies following conditions
- The Matrix satisfies condition for a row echelon form.
- The leading entry in each row is the only non-zero entry in its row

For example

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Q3 Part A

Row Echelon form:- A matrix is said to be in row (column) echelon for when it satisfies the following condition.

(i) The first non-zero element in each row leading entry is 1

(2) Each leading entry is in a row to the right of the leading entry in the previous row

(3) Rows with all zero elements if any are below (after) the row. a non-zero element

For example

$$\begin{bmatrix} 1 & 4 & 6 \\ 0 & 0 & 2 \\ 0 & 0 & 4 \end{bmatrix}$$

↳ Q#3(B) Echelon Form by using Row Operations:-

$$\begin{bmatrix} 1 & 10-2 & 8 \\ 2 & 8 & -1 \\ -10+3 & 0 & 0 \\ 1 & -4 & 10-9-1 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 5 & 8 \\ 2 & 8 & -1 \\ -7 & 0 & 0 \\ 1 & -4 & 15 \end{bmatrix}$$

$-2R_1 + R_2$

$$\sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & -2 & -17 \\ -7 & 0 & 0 \\ 1 & -4 & 15 \end{bmatrix}$$

$-2(1)+2 = 0$

$-2(5)+8 = -2$

$-2(8)-1 = -17$

$7R_1 + R_3$

$$\sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & -2 & -17 \\ 0 & 35 & 56 \\ 1 & -4 & 15 \end{bmatrix}$$

$7(1)+(-7) = 0$

$7(5)+(0) = 35$

$7(8)+(0) = 56$

$-1R_1 + R_4$

$$\sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & -2 & -17 \\ 0 & 35 & 56 \\ 0 & -9 & 7 \end{bmatrix}$$

$-1(1)+1 = 0$

$-1(5)+(-4) = -9$

$-1(8)+(15) = 7$

xply R_2 by $-1/2$

$$\sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & 1 & 17/2 \\ 0 & 35 & 56 \\ 0 & -9 & 7 \end{bmatrix}$$

$0 \times -1/2 = 0$

$+2 \times +1/2 = 1$

$-17 \times -1/2 = 17/2$

$-35R_2 + R_3$

$$\sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & 1 & 17/2 \\ 0 & 0 & -483/2 \\ 0 & -9 & 7 \end{bmatrix}$$

$-35(0) + 0 = 0$

$-35(1) + 35 = 0$

$-35(17/2) + 56 = \frac{-595 + 112}{2}$

$= -483/2$

$9R_2 + R_4$

$$\sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & 1 & 17/2 \\ 0 & 0 & -483/2 \\ 0 & 0 & 167/2 \end{bmatrix}$$

$9(0) + 0 = 0$

$9(1) + (-9) = 0$

$9(17/2) + (7) = 167/2$

xply R_3 by $-2/483$

$$\sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & 1 & 17/2 \\ 0 & 0 & 1 \\ 0 & 0 & 167/2 \end{bmatrix}$$

$0 \times -2/483 = 0$

$0 \times -2/483 = 0$

$+\cancel{483}/\cancel{2} \times +\cancel{2}/\cancel{483} = 1$

$-167/2 \cdot R_3 + R_4$

Result ⇒
$$\sim \begin{bmatrix} 1 & 5 & 8 \\ 0 & 1 & 17/2 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

$-167/2(0) + 0 = 0$

$-167/2(0) + 0 = 0$

$-167/\cancel{2}(1) + 167/2 = 0$

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Linear Algebra

BS-SE 2^{nd} Semester

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