Date:

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ID :- 15784

Dep :- Software engineering

Semister :- 2nd.

Section :- A

Darsi Notes

Q1 $x_1 - 3rd(ID)x_2 + x_2 = 0$ ID :- 15784

$2x_2 - 8x_3 = 8$

$5x_1 - 5x_3 = 10$

Solve $x_1 - 7x_2 + x_3 = 0$

$2x_2 - 8x_3 = 8$

$5x_1 - 5x_3 = 10$

$$\left[\begin{array}{ccc|c} 1 & -7 & 1 & 0 \\ 0 & 2 & -8 & 8 \\ 5 & 0 & -5 & 10 \end{array}\right]$$

$$\sim \left[\begin{array}{ccc|c} 1 & -7 & 1 & 0 \\ 0 & 2 & -8 & 8 \\ 0 & +35 & -10 & 10 \end{array}\right] R_3 - 5R_1$$

$$\sim \left[\begin{array}{ccc|c} 1 & -7 & 1 & 0 \\ 0 & 1 & -4 & 4 \\ 0 & +5 & -2 & 1 \end{array}\right] \begin{array}{l} R_2/4 \\ R_3/5 \end{array}$$

$$\left[\begin{array}{ccc|c} 1 & -7 & 1 & 0 \\ 0 & 1 & -4 & 4 \\ 0 & 5 & -2 & 1 \end{array}\right] R_3 - 5R_2$$

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$$\left[\begin{array}{ccc|c} 1 & -7 & 1 & 0 \\ 0 & 1 & -4 & 4 \\ 0 & 0 & -22 & 20 \end{array}\right] \quad R_3 - 5R_2$$

Consistent because of !

$$-22x_3 = -20$$
$$x_3 = \frac{-20}{22}$$
$$x_3 = \frac{10}{11}$$

$$x_2 - 4x_2 = 4$$
$$x_2 = 4 + 4x_3$$
$$x_2 = 8$$

$$x_1 - 7x_2 + x_3 = 0$$
$$x_1 = 7x_2 - x_3$$
$$x_1 = 7(8) - \frac{10}{11}$$
$$x_1 = 56 - \frac{10}{11}$$
$$x_1 = \frac{616 - 10}{11}$$
$$x_1 = \frac{606}{11}$$

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Q2 Page 3

Find the inverse of A $\begin{bmatrix} 3 & 4 & 5 \\ 2 & -1 & 8 \\ 5 & -2 & 7 \end{bmatrix}$

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$|A| = 3(-7+16) - 4(14-40) + 5(-4+5)$

$= 3(9) - 4(-26) + 5(1)$

$= 27 - 104 + 5$

$= -72$

Cofactor $A = \begin{bmatrix} 3 & 4 & 5 \\ 2 & -1 & 8 \\ 5 & -2 & 7 \end{bmatrix}$

$a_{11} = (-1)^{1+1}(-7+16) = (-1)^2(9)$

$a_{12} = (-1)^{1+2}(14-40) = (-1)^3(-26) = \cdot 26$

$a_{13} = (-1)^{1+3}(-4+5) = (-1)^4(1) = 1$

$a_{21} = (-1)^{2+1}(28+10) = (-1)^3(38) = 38$

$a_{22} = (-1)^{2+2}(21-25) = (-1)^4(-4) = -4$

$a_{23} = (-1)^{2+3}(-6-20) = (-1)^5(-26) = -26$

$a_{31} = (-1)^{3+1}(32+5) = 37$

$a_{32} = (-1)^{3+2}(24+10) = 34$

$a_{33} = (-3-8) = -11$

~~Transpose~~

$\begin{bmatrix} 9 & -26 & 1 \\ 38 & -4 & -26 \\ 37 & 34 & 11 \end{bmatrix}$

$\begin{bmatrix} 9 & 38 & 37 \\ -26 & -4 & 34 \end{bmatrix} \rightarrow$ Transpose

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Q3 Solve the following linear equation by Guass - Jordan Method.

Sol:-

$$\begin{bmatrix} 2 & 2 & 4 & 18 \\ 1 & 3 & 2 & 13 \\ 3 & 2 & -3 & 14 \end{bmatrix} R_1 \times \tfrac{1}{2} R_1 \leftrightarrow$$

Solution

$$\left[\begin{array}{ccc|c} 2 & 2 & 4 & 18 \\ 1 & 3 & 2 & 13 \\ 3 & 2 & -3 & 14 \end{array}\right] \times (1/2)$$

$R_1/2 \to R_2$

$$\left[\begin{array}{ccc|c} 1 & 1 & 2 & 9 \\ 1 & 3 & 2 & 13 \\ 3 & 2 & -3 & 14 \end{array}\right] \times (1/2)$$

$R_2 - 1 \times R_1 \to R_2$

$$\left[\begin{array}{ccc|c} 1 & 1 & 2 & 9 \\ 0 & 2 & 0 & 4 \\ 3 & 2 & -3 & 14 \end{array}\right] \times (-3)$$

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$R_3 - 3 \times R_1 \to R_3$

$$\left(\begin{array}{ccc|c} 1 & 1 & 2 & 9 \\ 0 & 2 & 0 & 4 \\ 0 & -1 & -9 & -13 \end{array}\right)$$

$R_2/2 \to R_2$

$$\left(\begin{array}{ccc|c} 1 & 1 & 2 & 9 \\ 0 & 1 & 0 & 2 \\ 0 & -1 & -9 & -13 \end{array}\right) \times (1)$$

$R_3 - (-1) \times R_2 \to R_3$

$$\left(\begin{array}{ccc|c} 1 & 1 & 2 & 9 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & -9 & 11 \end{array}\right) \times (-1/9)$$

$R_3/-9 \to R_3$

$$\left(\begin{array}{ccc|c} 1 & 1 & 2 & 9 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & 11/9 \end{array}\right)$$

$R_1 - 2 \times R_3 \to R_1$

$$\left(\begin{array}{ccc|c} 1 & 1 & 0 & -59/9 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & 11/9 \end{array}\right) \times (-1)$$

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Q: Show that this matrix is Diagonisable.

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

Solution.

$A = CDC^{-1}$

$\det(A - \lambda I_3) = 4$

$$A - \lambda I_3 = \begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 11 & 1 \end{bmatrix} - \begin{bmatrix} \lambda & 0 & 0 \\ 0 & \lambda & 0 \\ 0 & 0 & \lambda \end{bmatrix}$$

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

$$= 4-\lambda \begin{vmatrix} 3-\lambda & 2 \\ 4 & 1-\lambda \end{vmatrix} -2 \begin{vmatrix} -5 & 2 \\ -2 & 1-\lambda \end{vmatrix} -2 \begin{vmatrix} -5 & 3-\lambda \\ -2 & -4 \end{vmatrix} =$$

$= 4-\lambda((3-\lambda)(1-\lambda)-8) -2(-5(1-\lambda)+4) -2(-20+2(3-\lambda) = 0$

$= 4-\lambda[3-3\lambda-\lambda+\lambda^2-8] -2[-5+5\lambda+4] -2[-20+6-2\lambda] = 0$

$= 4-\lambda[\lambda^2-4\lambda-5] -2[5\lambda-1] -2(-14-2\lambda] = 0$

$= 4\lambda^2+16\lambda-26-\lambda^3+4\lambda^2+5\lambda-10\lambda+2+28+4\lambda = 0$

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$= -\lambda^3 + 8\lambda^2 + 15\lambda + 10 = 0$

$\lambda = 9.65$

$\lambda = -0.82$

$\lambda = -0.829$

for $\lambda = -965$

P.r ...

$$A \cdot \lambda I_3 \begin{bmatrix} -8.65 & 2 & -2 \\ -5 & -6.65 & 2 \\ -2 & 4 & -8.65 \end{bmatrix}$$

for $\lambda = -0.82$

$$A - \lambda I_3 = \begin{bmatrix} 4.82 & 2 & -2 \\ -5 & 3.82 & 2 \\ -2 & 4 & 1.82 \end{bmatrix}$$

In end or only one 1 eigenspa— of 2 basis vecte. ose tota

So matric in A is not diagonalizabil

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Q5 $3x_1 + 5x_2 - 4x_3 = 0$ — (1)
$-3x_1 - 25x_2 + 4x_3 = 0$ — (2)
$6x_1 + x_2 - 8x_3 = 0$ — (3)

Solution

$$A = \begin{bmatrix} 3 & 5 & -4 \\ -3 & -15 & 4 \\ 6 & 1 & -8 \end{bmatrix} \times \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Add eq4 (1) and (2)

$$3x_1 + 5x_2 - 4x_3 = 0$$
$$-3x_1 - 25x_2 + 4x_3 = 0$$

$$-20x_2 = 0$$
$$x_2 = 0$$

Add eq4 (1) and 3

$$3x_1 + 5x_2 - 4x_3 = 0$$
$$6x_1 + x_2 - 8x_3 = 0$$

$$9x_1 + 6x_2 - 12x_3 = 0$$

$$9x_1 = 12x_3$$

$$x_1 = \frac{4}{3}x_3$$

$$\begin{bmatrix} x_1 = 4x_3 \\ x_2 = 0 \\ x_3 = 0 \end{bmatrix}$$

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Q6 $A = \begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 3 \\ 1 & 3 & 4 & 0 \end{bmatrix}$

Maximum Possible Rank for Matrix A is 3 if

$|A| = 0$

Rank = No of non zero

$|A| = \begin{vmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 3 \\ 1 & 3 & 4 & 0 \end{vmatrix}$

$R_3 - R_1$

$1 - 1 = 0$

$3 - 3 = 0$

$4 - 4 = 0$

$0 - 3 = -3$

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

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

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

$R_2 - R_1$

$1 - 1 = 0$

$3 - 3 = 0$

$4 - 4 = 0$

$3 - 3 = 0$

Rank = 2

Darsi N