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Date: 1 120 Day: M T W T F S

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Class BS Software Engineering

Section B

Subject linear algebra.

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Submitted to

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PH 2.

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$$\begin{bmatrix} 3 & 4 & 5 \\ 2 & -1 & 4 \text{ Id} \\ 5 & -2 & 7 \end{bmatrix}$$

Solution

Let Suppose $A = \begin{bmatrix} 3 & 4 & 5 \\ 2 & -1 & 4 \text{ Id} \\ 5 & -2 & 7 \end{bmatrix}$

Now first find the determinant of A.

$$|A| = \begin{vmatrix} 3 & 4 & 5 \\ 2 & -1 & 4 \text{ Id} \\ 5 & -2 & 7 \end{vmatrix}$$ Expanding by $R_1$.

$$|A| = 3\begin{vmatrix} -1 & 3 \\ -2 & 7 \end{vmatrix} - 4\begin{vmatrix} 2 & 3 \\ 5 & 7 \end{vmatrix} + 5\begin{vmatrix} 2 & -1 \\ 5 & -2 \end{vmatrix}$$

$|A| = 6 \neq 0$.

adjoint by Coefficient minor

$$A_{ij} = \begin{bmatrix} 3 & 4 & 5 \\ 2 & -1 & 3 \\ 5 & -2 & 7 \end{bmatrix}$$

p.T.O.

Equation

# PH3.

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$A_{11} = 3\begin{vmatrix} -1 & 3 \\ -2 & 7 \end{vmatrix} = 3(-7+6) = 3.$

$A_{11} = 3.$

$A_{12} = -4\begin{vmatrix} 2 & 3 \\ 5 & 7 \end{vmatrix} = -4(14-15) = 4$

$A_{12} = 4.$

$A_{13} = 5\begin{vmatrix} 2 & -1 \\ 5 & -2 \end{vmatrix} = 5(-4+5) = 5$

$A_{13} = 5.$

$A_{21} = 2\begin{vmatrix} -1 & 3 \\ -2 & 7 \end{vmatrix} = 2(-7+6) = -2$

$A_{21} = -2$

$A_{22} = 1\begin{vmatrix} 3 & 5 \\ 5 & 7 \end{vmatrix} = 1(21-25) = -4$

$A_{22} = -4$

$A_{23} = 5\begin{vmatrix} 3 & 4 \\ 5 & -2 \end{vmatrix} = -20.$

P.T.O.

P#4

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$A_{13} = 5(-20) =$

$A_{13} = -130$

$A_{31} = 5\begin{vmatrix} 4 & 5 \\ -1 & 3 \end{vmatrix} = 5(12+5)$

$A_{31} = 85$

$A_{32} = 4\begin{vmatrix} 3 & 5 \\ 2 & 3 \end{vmatrix} = 4(9-10) = -4$

$A_{32} = -4$

$A_{33} = 5\begin{vmatrix} 3 & 4 \\ 2 & -1 \end{vmatrix} = 5(-3-8)$.

$A_{33} = -55$

Now finding Inverse.

$A^{-1} = \frac{1}{|A|} adj(A)$

P.T.O.

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Adjoint (A)

$$A = \begin{bmatrix} a_{11}a_1 & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

$$A = \begin{bmatrix} -3 & 4 & 5 \\ -2 & -4 & -130 \\ 100 & -4 & -5 \end{bmatrix}$$

Now $A^{-1} = \frac{1}{|A|}$ adjoint.

$$A^{-1} = \frac{1}{6}\begin{bmatrix} -3 & 4 & 5 \\ -2 & -4 & -130 \\ 100 & -4 & -55 \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} -3/6 & 4/6 & 5/6 \\ -2/6 & -4/6 & -130/6 \\ 100/6 & -4/6 & -55/6 \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} -\frac{1}{2} & \frac{2}{3} & \frac{5}{6} \\ -1/3 & -2/3 & -\frac{130}{6} \\ 50/3 & -2/3 & -55/6 \end{bmatrix}$$

Ans.

Q#6.

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$2x + 2y + 4z = 18$

$x + 3y + 2z = 13$

$3x + 2y - 3z = 14$.

Sol

Now writing Augmented matrix form

$$\begin{bmatrix} 2 & 2 & 4 \\ 1 & 3 & 2 \\ 3 & 2 & -3 \end{bmatrix} = \begin{bmatrix} 18 \\ 13 \\ 14 \end{bmatrix}$$

Augmented matrix:

$$\begin{bmatrix} 2 & 2 & 4 & | & 18 \\ 1 & 3 & 2 & | & 13 \\ 3 & 2 & -3 & | & 14 \end{bmatrix} \quad R_1 = \frac{1}{2} R_1$$

$$\sim \begin{bmatrix} 1 & 1 & 2 & | & 9 \\ 1 & 3 & 2 & | & 13 \\ 3 & 2 & -3 & | & 14 \end{bmatrix} \quad R_1 - R_1, \quad R_3 = R_3 - 3R_1$$

$$\sim \begin{bmatrix} 1 & 1 & 2 & | & 9 \\ 0 & 2 & 0 & | & 4 \\ 0 & -2 & -3 & | & -13 \end{bmatrix} \quad R_2 = \frac{1}{2} R_2$$

$$= \begin{bmatrix} 1 & 1 & 2 & | & 9 \\ 0 & 1 & 0 & | & 2 \\ 0 & -2 & -3 & | & -13 \end{bmatrix} \quad R_3 = R_3 + 2R_2$$

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$$= \left[\begin{array}{ccc|c} 1 & 1 & 2 & 9 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & -3 & -9 \end{array}\right] \quad R_1 - R_2$$

$$= \left[\begin{array}{ccc|c} 1 & 0 & 2 & 7 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & 3 \end{array}\right] \quad \frac{1}{3}R_3.$$

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

General term.

$$\left[\begin{array}{ccc|c} x_1 & y_1 & z_1 & \\ x_2 & y_2 & z_2 & = \\ x_3 & y_3 & z_3 & \end{array}\right] \left[\begin{array}{c} 1 \\ 2 \\ 3 \end{array}\right]$$

$$x_1 + 0y_1 + 0z_1 = 1$$
$$0x_2 + 1y_1 + 0z_1 = 2$$
$$0x_3 + 0y_3 + z_3 = 3.$$

$$x_1 = 1, \quad y_1 = 2, \quad z = 3$$

PH 8.

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Q#6 $\begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 3 \\ 1 & 3 & 4 & 0 \end{bmatrix}$

Sol

$$= \begin{bmatrix} 1 & 3 & 4 & 3 \\ 1 & 3 & 4 & 1 \\ 1 & 3 & 4 & 0 \end{bmatrix} \frac{1}{3}R_2$$

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

$$= \begin{bmatrix} 1 & 3 & 4 & 3 \\ 1 & 3 & 4 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix} R_1 - R_1$$

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

Rank of matrix is 2

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Q11 $x_1 + x_2 + x_3 = 0$.
$2x_2 - 3x_3 = 8$.
$5x_1 - 3x_3 = 8$.

Sol writing the form of matrix.

$$\left[\begin{array}{ccc|c} 1 & 3 & 1 & 0 \\ 0 & 2 & -3 & 8 \\ 5 & 0 & -5 & 10 \end{array}\right] \frac{1}{2}R_2$$

$$\left[\begin{array}{ccc|c} 1 & 3 & 1 & 0 \\ 0 & 1 & -4 & 4 \\ 5 & 0 & -5 & 10 \end{array}\right] \frac{1}{5}R_3$$

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

th. Solution of Equations. are not unique or $^{nd}$ infinit Solution.

the Equation is inConsistan Equation.

PH 10

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9#5 $3x_1 + 5x_2 - 4x_3 = 0$

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

$0x_1 + x_2 - 8x_3 = 0$

writing Augmented matrix

Let $A = \begin{bmatrix} 3 & 5 & -4 & 0 \\ -3 & -25 & 4 & 0 \\ 0 & 1 & -8 & 0 \end{bmatrix}$

$= \begin{bmatrix} 1 & 5/3 & -4/3 & 0 \\ -3 & -25 & 4 & 0 \\ 0 & 1 & -8 & 0 \end{bmatrix} \begin{matrix} \frac{1}{3}R_1 \\ R_2 + 3R_3 \end{matrix}$

$= \begin{bmatrix} 1 & 5/3 & -4/3 & 0 \\ 0 & -10 & 0 & 0 \\ 0 & 1 & -8 & 0 \end{bmatrix}$

$= \begin{bmatrix} 1 & 5/3 & -4/3 & 0 \\ 0 & -1 & 4 & 0 \\ 0 & 0 & -12 & 0 \end{bmatrix} \begin{matrix} \frac{1}{4}R_2 + 3R_3 \\ R_3 + 3R_2 \end{matrix}$

$\begin{bmatrix} 1 & 5/3 & -4 & 0 \\ 0 & 1 & 4 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \; 12R_3$

p# 11

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$x_1 + \frac{5}{2}x_2 - 4x_3 \geq 0$.

$x_2 + 4x_3 \geq 0$

$0x_3 \geq 0$

$x_1 - 4x_3 \geq 0$

$x_1 + 4x_3 = 0$

$x_1 \geq 4x_3$

$x_2 = 4x_3$.

$x_3 = 0x_3$.

Q14 Diagonalizable or not.

$$\begin{bmatrix} 11 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$$

Let $(A - \lambda I) = 0$.

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

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

$= 4-\lambda(3-\lambda)(1-\lambda)-8) - 2(1-\lambda)(4-\lambda)+4$
$-2(20+6-2\lambda)$

$= 4-\lambda(3-3\lambda-\lambda+\lambda^2-8) - 2(-5+5\lambda-14)$
$-2(-10+6-2\lambda)$

$= \lambda^3+8\lambda^2-11\lambda-20) + (10-10\lambda-8)$
$-40-4\lambda+4\lambda^2$

$\lambda^3+8\lambda^2-11\lambda-20+10-10\lambda-8+40\lambda$

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$$x^3 + 8x^2 - 17x + 10 = 0.$$

Ans