

Name:- Faham
ID = 15772
Sub = Linear Algebra.

$$\lambda = 2, 3$$

$$\lambda = 2$$

$$\begin{bmatrix} 6 & -8 & -2 \\ 4 & -5 & -2 \\ 3 & -4 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 4 \\ 8 \\ 0 \end{bmatrix}$$

$$\begin{aligned} 6x_1 - 8x_2 - 2x_3 &= 0 \\ 4x_1 - 5x_2 - 2x_3 &= 0 \end{aligned}$$

$$\begin{array}{ccc|ccc} x_1 & & & = -x_2 & & = x_3 \\ \hline -8 & -2 & 1 & 6 & 2 & 6 & -8 \\ -5 & -2 & 1 & 4 & 2 & 4 & -5 \end{array}$$

$$\frac{x_1}{6} = \frac{x_2}{4} = \frac{x_3}{2}$$

$$\therefore x_2 = \begin{bmatrix} 6 \\ 4 \\ 2 \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$$

Eigen vectors.

$$\begin{bmatrix} 7 & -8 & -2 \\ 4 & -4 & -2 \\ 3 & -4 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

Characteristic value.

$$\begin{aligned} 7x_1 - 8x_2 - 2x_3 &= 0 & \text{--- (1)} \\ 4x_1 - 4x_2 - 2x_3 &= 0 & \text{--- (2)} \end{aligned}$$

$$x_1 = -x_2 = x_3$$

$$\left| \begin{array}{cc|cc} -8 & -2 & 7 & -2 \\ -4 & -2 & 4 & -2 \end{array} \right| \rightarrow \left| \begin{array}{cc|cc} 7 & -8 & 7 & -8 \\ 4 & -4 & 4 & -4 \end{array} \right|$$

$$\frac{x_1}{16-t} = \frac{-x_2}{-6} = \frac{x_3}{-28-(32)}$$

$$\frac{x_1}{8} = \frac{x_2}{6} = \frac{x_3}{4}$$

$$X = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 8 \\ 6 \\ 4 \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \\ 2 \end{bmatrix}$$

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Q3:- Find the Eigen value and eigen vectors of the below Matrix?

Answer:- $A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & -1 \end{bmatrix}$

$(A - \lambda I) X = 0$

$\begin{pmatrix} 1 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{pmatrix} X = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$

~~1) 2) 3) 4) 5)~~

$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

$\begin{vmatrix} -3 & -2 \\ -4 & 1 \end{vmatrix} = -1$
 $\begin{vmatrix} 8 & -2 \\ 3 & 1 \end{vmatrix} = 1$
 $\begin{vmatrix} 8 & -3 \\ 4 & -3 \end{vmatrix} = 8$

$|A - \lambda I| = 0$

$\begin{vmatrix} 8-\lambda & -8 & -2 \\ 4 & -3-\lambda & -2 \\ 3 & -4 & 1-\lambda \end{vmatrix} = 0$

$\lambda^3 - \text{[sum of diagonal]} \lambda^2 + \text{[sum of diagonal products]} \lambda - |A| = 0$

$\lambda^3 - 6\lambda^2 + 11\lambda - 6 = 0$

$\lambda = 1, 2, 3$ - Eigen values.

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Q2:- Find inverse of a matrix?

Answer:- $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 5 & 6 & 0 \end{bmatrix}$

$$\det |A| = 1 \begin{vmatrix} 1 & 4 \\ 6 & 0 \end{vmatrix} - 2 \begin{vmatrix} 0 & 4 \\ 5 & 0 \end{vmatrix} + 3 \begin{vmatrix} 0 & 1 \\ 5 & 6 \end{vmatrix}$$

$$\begin{aligned} &= 1(0-24) - 2(0-20) + 3(0-5) \\ &= 1(-24) - 2(-20) + 3(-5) \\ &= -24 + 40 - 15 \\ &= -39 + 40 \\ &= 1 \end{aligned}$$

then if the determinant is 0, matrix has no inverse.

$$\begin{array}{ccc} + \begin{bmatrix} 1 & 4 \\ 6 & 0 \end{bmatrix} & - \begin{bmatrix} 0 & 4 \\ 5 & 0 \end{bmatrix} & + \begin{bmatrix} 0 & 1 \\ 5 & 6 \end{bmatrix} \\ + (0-24) & - (0-20) & + (0-5) \\ -24 & +20 & -5 \end{array}$$

$$- \begin{bmatrix} 2 & 3 \\ 6 & 0 \end{bmatrix} + \begin{bmatrix} 1 & 3 \\ 5 & 0 \end{bmatrix} - \begin{bmatrix} 1 & 2 \\ 5 & 6 \end{bmatrix}$$

$$- (0-18) + (0-15) - (6-10) \\ - (-18) \Rightarrow 18 + (-15) = -15 - (-4) = 4$$

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

$$+ (8-3) \quad - (4-0) \quad + (1-0)$$

$$+ 5 \quad \quad \quad 4 \quad \quad \quad 1$$

$$\text{Adj } A = \begin{bmatrix} -24 & 20 & -5 \\ 18 & -15 & 4 \\ 5 & 4 & 1 \end{bmatrix}^T$$

$$\text{Adj } A = \begin{bmatrix} -24 & 18 & 5 \\ 20 & -15 & -4 \\ -5 & 4 & 1 \end{bmatrix}$$

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

$$A^{-1} = \frac{1}{1} \begin{bmatrix} -24 & 18 & 5 \\ 20 & -15 & -4 \\ -5 & 4 & 1 \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} -24 & 18 & 5 \\ 20 & -15 & -4 \\ -5 & 4 & 1 \end{bmatrix} \text{Ans}$$

Kings Notes

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Q:- Solve the system of equations that corresponds to this augmented Matrix?

Answer:- $4x + 5y = 2$

$$\begin{aligned} x + 0y &= a \\ 0x + 1y &= b \end{aligned}$$

$$x - 2y = 7$$

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

$$\left[\begin{array}{cc|c} 1 & 0 & a \\ 0 & 1 & b \end{array} \right]$$

$R_1 \leftrightarrow R_2$

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

$-4R_1 + R_2 \rightarrow R_2$

$$\left[\begin{array}{cc|c} 1 & -2 & 7 \\ 0 & 13 & -26 \end{array} \right]$$

$\frac{1}{13} R_2 \rightarrow R_2$

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$$\left[\begin{array}{cc|c} 1 & -2 & 7 \\ 0 & 1 & -2 \end{array} \right]$$

$2R_2 + R_1 \rightarrow R_1$

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

$$x = 3, y = -2$$

Kings Notes

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