Iqra National University.
Linear Algebra Major Assignment for Spring 2020.
Semester: II, BS-SE.

Q1. Compute adjoint of;

(i) $A = \begin{bmatrix} 1 & 2 & \text{2nd-ID} \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{bmatrix}$ ∵ 2nd-ID - 2nd number of your ID.

(ii). $B = \begin{bmatrix} 3 & 4 & 5 \\ 2 & -1 & 8 \\ 5 & -2 & 8 \end{bmatrix}$

Q2. Find the cofactors of A_{21}, A_{31}, A_{33} if

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

Q3. Find Eigen values and Eigen vectors if

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 3 & 2 \\ -1 & 1 & 2 \end{bmatrix} \quad \& \quad I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Name : Saad Bin Tariq **ID** : 5534

Subject : Linear Algebra **Teacher** : Sir Sakeel

NAME:- Saad Bin Tariq TEACHER Sir Shakeel PgNo 1

ID 5534 DEPARTMENT BE(E)

Course:- Linear Algebra

QNo 1:- Compute adjoint of:

(i) $A = \begin{bmatrix} 1 & 2 & 2nd-ID \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{bmatrix}$: 2nd-ID - 2nd number of your ID:-

Sol:-

ID = 5534

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

$$A = \begin{bmatrix} 1 & 2 & 5 \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{bmatrix} \longrightarrow \begin{bmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \\ A_{31} & A_{32} & A_{33} \end{bmatrix}$$

$$A_{11} = \begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix} = (6-1) = 5$$

$$A_{12} = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} = [4-3] = 1$$

$$A_{13} = \begin{bmatrix} 2 & 3 \\ 3 & 1 \end{bmatrix} = [2-9] = -7$$

$$A_{21} = \begin{bmatrix} 2 & 5 \\ 1 & 2 \end{bmatrix} = [4-5] = -1$$

$$A_{22} = \begin{bmatrix} 1 & 5 \\ 3 & 2 \end{bmatrix} = [2-15] = -13$$

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$$A_{23} = \begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix} = [1-6] = -5$$

$$A_{31} = \begin{bmatrix} 2 & 5 \\ 3 & 1 \end{bmatrix} = [2-15] = -13$$

$$A_{32} = \begin{bmatrix} 1 & 5 \\ 2 & 1 \end{bmatrix} = [1-10] = -9$$

$$A_{33} = \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix} = [3-4] = -1$$

$$\begin{bmatrix} 5 & 1 & -7 \\ -1 & -13 & -5 \\ -13 & -9 & -1 \end{bmatrix} \begin{bmatrix} + & - & + \\ - & + & - \\ + & - & + \end{bmatrix}$$

$$= \begin{bmatrix} 5 & -1 & -7 \\ 1 & -13 & 5 \\ -13 & 9 & -1 \end{bmatrix}$$ Co factor of Matrix

$$\boxed{A^T = \begin{bmatrix} 5 & 1 & -13 \\ -1 & -13 & 9 \\ -7 & 5 & -1 \end{bmatrix}}$$ adjoint of Matrix

QNo 1

Part 2

ii) $B = \begin{bmatrix} 3 & 4 & 5 \\ 2 & -1 & 8 \\ 5 & -2 & 8 \end{bmatrix}$

Sol:-

$B = \begin{bmatrix} 3 & 4 & 5 \\ 2 & -1 & 8 \\ 5 & -2 & 8 \end{bmatrix} \begin{bmatrix} B_{11} & B_{12} & B_{13} \\ B_{21} & B_{22} & B_{23} \\ B_{31} & B_{32} & B_{33} \end{bmatrix}$

Sol-

$B_{11} = \begin{bmatrix} -1 & 8 \\ -2 & 8 \end{bmatrix} = B_{11}\left[-16-(-8)\right] = -8$

$B_{12} = \begin{bmatrix} 2 & 8 \\ 5 & 8 \end{bmatrix} = B_{12}\left[16-40\right] = -24$

$B_{13} = \begin{bmatrix} 2 & -1 \\ 5 & -2 \end{bmatrix} = B_{13}\left[-4-(-5)\right] = 1$

$B_{21} = \begin{bmatrix} 4 & 5 \\ -2 & 8 \end{bmatrix} = B_{21}\left[32-(-10)\right] = 42$

$B_{22} = \begin{bmatrix} 3 & 5 \\ 5 & 8 \end{bmatrix} = B_{22}\left[24-25\right] = -1$

$B_{23} = \begin{bmatrix} 3 & 4 \\ 5 & -2 \end{bmatrix} = B_{23}\left[(-6-20)\right] = -26$

$B_{31} = \begin{bmatrix} 4 & 5 \\ -1 & 8 \end{bmatrix} = B_{31}\left[32-(-5)\right] = 37$

$B_{32} = \begin{bmatrix} 3 & 5 \\ 2 & 8 \end{bmatrix} = B_{32}\left[(24-10)\right] = 14$

$B_{33} = \begin{bmatrix} 3 & 4 \\ 2 & -1 \end{bmatrix} = B\left[(-3-8)\right] = -11$

$\begin{bmatrix} -8 & +24 & +1 \\ -42 & -1 & +26 \\ 37 & -14 & -11 \end{bmatrix}$ Co factor of Matrix

$B^T = \begin{bmatrix} -8 & -42 & 37 \\ +24 & -1 & -14 \\ +1 & +26 & -11 \end{bmatrix}$ adjoint of Matrix

Q No:-2
Find the cofactors of A_{21}, A_{31}, A_{33} if

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

Sol:-

$A_{21} = (-1)^{2+1} \, |A_{21}|$

$(-1)^3 \begin{vmatrix} -2 & 3 \\ -3 & 2 \end{vmatrix}$

$= (-1)^3 (-4-(-9))]$

$= -1 \times (-4+9)$

$= -1 \times (5)$

$\boxed{A_{21} = -5}$

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$$A_{33} = (-1)^{3+3} \begin{vmatrix} 1 & -2 \\ -2 & 3 \end{vmatrix}.$$

$$= (-1)^6 \left(3-(4)\right)$$

$$= (1) \times (-1)$$

$$= (-1)$$

$$\boxed{A_{33} = -1}$$