2nd & 4th Sem Combined (26.05.21) ①
Paper : Maths
Topic: Revision - III (Matrix) 15.04.2020

Recap contd...

Can you visualize a matrix of single (one) dimension (1x1)? It is just a number called scalar – one row, one column (RC)–

$A = \begin{bmatrix} 1 \end{bmatrix}_{(1\times1)}$ $A = \begin{bmatrix} a_{11} \end{bmatrix}_{(n\times m)}$

At a later stage, we will see that a scalar multiplies each and every element of a matrix.

Now, to discuss types of matrices, let us see what

2. Scalar matrix is.
Principal Diagonal has a common scalar element.
All ~~oo~~ other elements are zeros.

$$A = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 4 \end{bmatrix}_{(3\times3)} \qquad A = \begin{bmatrix} \lambda & 0 & \cdots & 0 \\ 0 & \lambda & \cdots & 0 \\ \vdots & & & \\ 0 & 0 & \cdots & \lambda \end{bmatrix}_{(n\times m)}$$

A Scalar Matrix needs to be a SQUARE MATRIX.

3. Null Matrix: This is really interesting. Here all elements are zeros and the matrix is symbolized by CAPITAL O. It is similar to zero in ordinary alzebra.

$$O = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}_{(2\times2)} \qquad O = \begin{bmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & & & \\ 0 & 0 & \cdots & 0 \end{bmatrix}_{(n\times m)}$$

Note that instead of writing A, we have written O to denote matrix.

However, this is also Null Mark ↓

$$O = \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}_{(3\times2)}$$

meaning thereby a Null Matrix need not be a square matrix.

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(~~Unfortunately, none of you posted your answer as of now. Or may be, you didn't work out.~~)

Matrix Operations:

2. Multiplication: This is slightly tricky. We have to remember:

A = 1st Matrix also called 'lead' Matrix
B = 2nd Matrix also called 'lag' Matrix.

Two matrices, A and B, can be multiplied (conformable for multiplication) only and only when:
Columns of 1st Matrix A (lead) is equal to Rows of 2nd Matrix B (lag). For instance:

$$A = [\;]_{(m \times n)} \times B = [\;]_{(n \times p)}$$

Numerically,

$$A = \begin{bmatrix} 2 & 3 & 0 \\ 5 & 1 & 2 \end{bmatrix}_{(2\times3)} \times B = \begin{bmatrix} 4 & 1 \\ 2 & 3 \\ 1 & 5 \end{bmatrix}_{(3\times2)}$$

$$\text{or } A \times B = AB = \begin{bmatrix} 2 & 3 & 0 \\ 5 & 1 & 2 \end{bmatrix} \begin{bmatrix} 4 & 1 \\ 2 & 3 \\ 1 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} (2\times4)+(3\times2)+(0\times1) & (2\times1)+(3\times3)+(0\times5) \\ (5\times4)+(1\times2)+(2\times1) & (5\times1)+(1\times3)+(2\times5) \end{bmatrix}$$

$$= \begin{bmatrix} (8+6+0) & (2+9+0) \\ (20+2+2) & (5+3+10) \end{bmatrix}$$

(You may skip this step.)

$$\text{or } AB = \begin{bmatrix} 14 & 11 \\ 24 & 18 \end{bmatrix}_{(2\times2)}$$

Note that the result is
$(m \times \cancel{n}) \times (\cancel{n} \times p) = (m \times p)$
or
$(2 \times \cancel{3}) \times (\cancel{3} \times 2) = (2 \times 2)$

Home Work:
Find BA ($B \times A$) from the above numerical example.

To be Contd...