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Matrices

Array / Collection of objects in rectangular form is called matrix.

$$A_{2\times 3} = \begin{bmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{bmatrix}$$

$$\begin{pmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{pmatrix}$$

$$\begin{pmatrix} x & x \\ x & \\ x & x \end{pmatrix}$$ → not a matrix.

$$A_{m\times n} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ \vdots & & & & \\ a_{m1} & a_{m2} & a_{m3} & \cdots & a_{mn} \end{bmatrix}$$

A

Construct a matrix 'A' of order 2×3

$A = \{a_{ij}\}$ such that

$a_{ij} = \frac{i^2 - j}{2}$

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

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Row matrix/vector

Matrix having only one row

$$A = \begin{pmatrix} -1 & 0 & 2 \end{pmatrix}$$

Column matrix/vector

only one column

$$\vec{v} = \begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} x \\ x \\ x \\ x \end{pmatrix}$$

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Horizontal Matrix

no. of rows < no. of columns

$$\begin{bmatrix} x & x & x & x \\ x & x & x & x \end{bmatrix}$$

Square matrix

rows = columns

$$\begin{bmatrix} x & x & x \\ x & x & x \\ x & x & x \end{bmatrix}$$

Vertical matrix

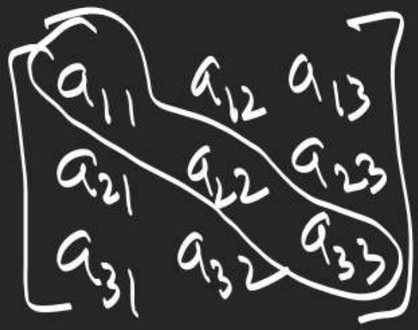
rows > columns

Null matrix

all elements are zero

$$O_{3\times 2} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$

Square matrix



- Principle diagonal elements
a_{ii}

- Trace of matrix
$$Tr(A) = \sum_{i=1}^{n} a_{ii}$$

$A_{n \times n}$

- Determinant of matrix
$$|A| = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = a_{11}(a_{22}a_{33} - a_{23}a_{32}) - a_{12}(a_{21}a_{33} - a_{23}a_{31}) + a_{13}(a_{21}a_{32} - a_{31}a_{22})$$

- Singular matrix
$|A| = 0$

- Non Singular matrix
$|A| \neq 0$.

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Square matrix

Identity matrix $= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = I$

Others

Triangular matrix

Diagonal matrix $\rightarrow (a_{ij} = 0 \ \forall \ i \neq j)$

Upper triangular matrix

$(a_{ij} = 0 \quad \forall \ i > j)$

Lower triangular matrix

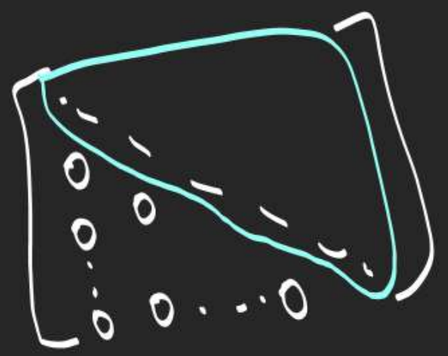
$(a_{ij} = 0 \ \forall \ i < j)$

Scalar matrix

Others

$a_{ii} = K$

$\begin{bmatrix} K & 0 & 0 \\ 0 & K & 0 \\ 0 & 0 & K \end{bmatrix}$



$\text{diag}(-1 \quad 0 \quad 2 \quad 3) = \begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 3 \end{bmatrix}$