Date:

Matrix And Its Types

Matrix

A matrix is a rectangular array of numbers. The number in the array are called the entries in the matrix.

Size of Matrix

The size or dimension of a matrix is defined by the number of rows and columns it contains.

Types of Matrix

A matrix may have different types which may be classified as

1- **Row Matrix**

A row matrix is a matrix with only on row.

Row matrix of oder 1x3 is given as

Example $B = [a \quad b \quad c]$

2- **Column Matrix**

Date:

A column matrix is a matrix with only one column.

Column matrix of order 1X1 is given as

Example $C = [3]$

3- Vector Matrix

A column matrix of order 2X1 is called vector matrix. or a matrix which contains more than one row but only one column is called vector matrix.

Vector matrix of order 2X1 is given as

Example $D = \begin{bmatrix} -5 \\ 3 \end{bmatrix}$

4- Zero Matrix

Zero matrix is also called null matrix. A matrix which has all entries zero.

Example

$$A = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

5- Square Matrix

A square matrix is a matrix with an equal number of rows and columns.

Date:

Example

$$S = \begin{bmatrix} 2 & 0 \\ 6 & 3 \end{bmatrix}$$

6- Diagonal Matrix

A diagonal matrix is a square matrix that has all its elements zero except for those in the diagonal from top left to bottom right, which is known as the leading diagonal of the matrix.

Example

$$B = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 6 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

7- Scalar Matrix

A scalar matrix is a diagonal matrix where all the diagonal elements are equal.

Example

$$M = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

8- Triangular Matrix

If all the entries above the principle diagonal are zero, then it is called lower Triangular matrix and if all the entries

below the principal diagonal are zero then it is called upper triangular matrix.

Example

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

9- Rectangular Matrix

A matrix is said to be rectangular matrix if number of rows is not equal to number of columns.

Example

$$A = \begin{bmatrix} 3 & 1 & 3 & 2 \\ 5 & 7 & -1 & 0 \end{bmatrix}$$

10- Unit Matrix

A unit matrix is a diagonal matrix whose elements in the diagonal are all ones. It is also called identity matrix.

Example

$$P = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

11- Singleton Matrix

If a matrix has only one row and one column or only one element then it is called

Date:

Singleton matrix.

Example

$$A = [1]$$

12- Singular Matrix

If two rows or two columns are scalar multiple of one another then it is called singular matrix and determinant is always zero.

Example

$$A = \begin{bmatrix} 2 & 3 \\ 6 & 9 \end{bmatrix}$$

$$\det |A| = 18 - 18 = 0$$

Thus A is singular matrix.

13- Non-Singular Matrix

If two rows or two columns are not scalar multiple of one another and determinant is non-zero is called non-singular matrix.

Example

$$A = \begin{bmatrix} 2 & 3 \\ 6 & 10 \end{bmatrix}$$

$$|A| = 20 - 18 = 2$$

$$|A| \neq 0$$

Thus A is non-singular.

14- Idempotent Matrix

A matrix is said to be idempotent matrix, when multiply itself yeilds itself.

Or matrix A is said to be

Date:

idempotent if

$$A^2 = A$$

Example

$$A = \begin{bmatrix} 4 & -1 \\ 12 & -3 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 4 & -1 \\ 12 & -3 \end{bmatrix}\begin{bmatrix} 4 & -1 \\ 12 & -3 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 16-12 & -4+2 \\ 48-36 & -12+9 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 4 & -1 \\ 12 & -3 \end{bmatrix}$$

Thus $A^2 = A$

15- Symmetric Matrix

A symmetric matrix is a square matrix that is equal to its transpose.

$$A = \begin{bmatrix} 1 & 1 & -1 \\ 1 & 2 & 0 \\ -1 & 0 & 5 \end{bmatrix}$$

Example

$$A^T = \begin{bmatrix} 1 & 1 & -1 \\ 1 & 2 & 0 \\ -1 & 0 & 5 \end{bmatrix}$$

16- Skew Symmetric Matrix

A matrix is said to be skew when transpose of matrix is equal to negative of matrix.

$$A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \quad A^T = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$$

Date:

17- Hermitian Matrix

A square matrix is Hermitian, if it is equal to its complex conjugate transpose. $A = A'$

In term of matrix elements, this means that $a_{ij} = a_{ji}$. The entries on the diagonal of a Hermitian matrix are always real.

Example

$$A = \begin{bmatrix} 1 & 4-5i \\ 4+5i & 5 \end{bmatrix}$$

18- Skew Hermitian Matrix

A square matrix is a skew hermitian if it is equal to the negative of its complex conjugate transpose

$$A = -A'$$

In term of the matrix elements this means that $a_{ij} = -a_{ji}$

The entries on the digonal of a skew hermitian matrix are always pure, imaginary or zero.

Example

$$A = \begin{bmatrix} 0 & -4-5i \\ 4-5i & 0 \end{bmatrix}$$