# Alg1. TD1. Matrix:

## Chapter ① Matrix

Ex. $A = \begin{pmatrix} 1 & 2 & 7 \\ 4 & 5 & -3 \end{pmatrix}$ is a matrix of size $2\times 3$.

Ex: $Z = \begin{pmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{pmatrix}$ is a zero matrix of size $3\times 2$.

Ex: $S = \begin{pmatrix} 1 & 2 & 0 \\ 3 & -2 & 5 \\ -4 & 0 & 1 \end{pmatrix}$ is a square matrix of order 3.

Ex. $T_u = \begin{pmatrix} 1 & 2 \\ 0 & 3 \end{pmatrix}$ is an upper triangular matrix

Ex $T_L = \begin{pmatrix} 2 & 0 & 0 \\ -1 & 0 & 0 \\ 4 & -2 & 5 \end{pmatrix}$ is a lower triangular matrix.

Ex $D = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ is a diagonal matrix.

Ex. $I_3 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ is an identity matrix.

Ex. $A = \begin{pmatrix} 1 & 2 & 4 \\ -2 & 3 & 0 \end{pmatrix}$, then $A^t = \begin{pmatrix} 1 & 2 & 4 \\ -2 & 3 & 0 \end{pmatrix}^t = \begin{pmatrix} 1 & -2 \\ 2 & 3 \\ 4 & 0 \end{pmatrix}$.

Ex. $B = \begin{pmatrix} 1 & -2 \\ -2 & 3 \end{pmatrix} \Rightarrow B^t = \begin{pmatrix} 1 & -2 \\ -2 & 3 \end{pmatrix}^t = \begin{pmatrix} 1 & -2 \\ -2 & 3 \end{pmatrix} = B$

$B$ is symmetric because $B^t = B$.

Ex. $C = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \Rightarrow C^t = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} = -\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} = -C$

$C$ is skew-symmetric because $C^t = -C$.

QA ① Is $A=B$? If $\underset{2\times 2}{A}=\begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix}$, $B=\underset{2\times 3}{\begin{pmatrix}1 & 2 & 0\\ 3 & 4 & 0\end{pmatrix}}$ No!

$\begin{pmatrix}1 & 1\\ 2 & 4\end{pmatrix}$ ② What is $A+B$? if $A=\begin{pmatrix}1 & 2\\ 0 & 1\end{pmatrix}$, $B=\begin{pmatrix}0 & -1\\ 2 & 3\end{pmatrix}$.

③ What is $A \overset{?}{+} 2B$? if $\underset{2\times 3}{A}=\begin{pmatrix}1 & 2 & 3\\ 4 & 5 & 6\end{pmatrix}$, $B=\underset{3\times 2}{\begin{pmatrix}1 & 0\\ 0 & 1\\ 2 & 3\end{pmatrix}}$.

$A+2B$ is not computable. No

④ What is $\lambda A$? If $\lambda=2$, $A=\begin{pmatrix}1 & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 1\end{pmatrix}$.

15 mins.

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

③ ? $A^t+2B$ ✓

? $A+2B^t$ ✓

Ex $A=\underset{2\times 3}{\begin{pmatrix}1 & 2 & 3\\ 1 & 0 & -2\end{pmatrix}}$, $B=\underset{3\times 2}{\begin{pmatrix}-1 & 0\\ 1 & 2\\ 0 & -3\end{pmatrix}}$

$$AB=\begin{pmatrix}1 & 2 & 3\\ 1 & 0 & -2\end{pmatrix}\begin{pmatrix}-1 & 0\\ 1 & 2\\ 0 & -3\end{pmatrix}=\begin{pmatrix}1 & -5\\ -1 & 6\end{pmatrix}$$ ✓

$$(1)(-1)+(2)(1)+(3)(0)=1$$
$$(1)(0)+(2)(2)+(3)(-3)=-5$$
$$(1)(-1)+(0)(1)+(-2)(0)=-1$$
$$(1)(0)+(0)(2)+(-2)(-3)=6$$

QA.) $I = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$, $J = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, $A = \begin{pmatrix} 1 & 2 \\ -2 & 0 \\ 1 & -1 \end{pmatrix}$, $B = \begin{pmatrix} 0 & 1 & 0 \\ -1 & 0 & 2 \end{pmatrix}$

① $IA = ?$ ② $BI = ?$ ③ $AB = ?$ ④. $BA = ?$

QA/

$I = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$, $J = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

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

LUN TOLA
LAB THAVRITH
Hong kimleng
Ek Vong Panharith
HEANG LEAB HENG
KHENG DALISH
[2:39 PM] KONG SONARY
Mengheab Vathnak
DORN DAWIN
LONG CHANN LEAP
NGIM PHANHA
LORM VANNAK
Chum Piseth
LENGMOUYHONG
KOH TITO
LIM SENGLY
[2:51 PM] CHORN CHANLAKHNA
Horn Bunroth
Hok Ratanak
MEN SEMA
KRY CHANSODA
EAB PISEY
CHHON CHANNLY

Proof:

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

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

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

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

③. $AB = \begin{pmatrix} 1 & 2 \\ -2 & 0 \\ 1 & -1 \end{pmatrix} \begin{pmatrix} 0 & 1 & 0 \\ -1 & 0 & 2 \end{pmatrix}$

$= \begin{pmatrix} -2 & 1 & 4 \\ 0 & -2 & 0 \\ 1 & 1 & -2 \end{pmatrix}$ ✓

④. $BA = \begin{pmatrix} 0 & 1 & 0 \\ -1 & 0 & 2 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ -2 & 0 \\ 1 & -1 \end{pmatrix}$

$= \begin{pmatrix} -2 & 0 \\ 1 & -4 \end{pmatrix}$ ✓

Corollary: $I$ is identity matrix

- $AI = A$
- $IA = A$
- $AB \neq BA$
- $AB$ is computable if the size of $A$ and $B$ is of the form $(m \times n)$ and $(n \times p)$

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