06/07

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \xrightarrow{90^\circ} \begin{bmatrix} 7 & 4 & 1 \\ 8 & 5 & 2 \\ 9 & 6 & 3 \end{bmatrix}$$

a_{11}, a_{12}, a_{13} → a_{11}, a_{12}, a_{13}, a_{23}, a_{33}

order $(n+1-i)$

Jab bhi kuch bhi sol^n dikhna hai toh index likh ke solve karna hai

2^nd approach
$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \xrightarrow{T} \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix}$$

↓ ~~In~~ Interchange rows first element with last.

$$\begin{bmatrix} 7 & 4 & 1 \\ 8 & 5 & 2 \\ 9 & 6 & 3 \end{bmatrix}$$ ✓

* Yaha ka concept hai diagonal ke aage wale elements se swapping perform karna.

TRANSPOSE

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \rightarrow \begin{bmatrix} a_{11} & a_{21} & a_{31} \\ a_{12} & a_{22} & a_{32} \\ a_{13} & a_{23} & a_{33} \end{bmatrix}$$

FOR sq. matrix.
- NO extra space is required.

CODE

```
for (i=1 ; i≤n ; i++)
{
    for (j=i+1; j ≤ n ; j++)
    {
        Swap( a[i][j], a[j][i])
    }
}
```

O(1) ↓ space complex.   O(n^2) → Time complexity

For n×n matrix, #swaps = $\frac{n^2-n}{2}$ → # no of non-diagonal elements → upper triangle

Q. A matrix of order 100×100, find out no of swaps.

$$\begin{bmatrix} a_{11} & \cdots & a_{1,100} \\ \vdots & & \vdots \\ a_{100,1} & \cdots & a_{100,100} \end{bmatrix}$$

$\#swaps = \frac{n^2-n}{2}$

$= \frac{100^2-100}{2}$

$= 50 \times 99$

ELEMENTARY OPERATION ON MATRIX

1. INTERCHANGE OF ANY TWO ROWS AND COL.

$R_i \longleftrightarrow R_j$

eg. $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \xrightarrow{R_1 \longleftrightarrow R_2} \begin{bmatrix} 3 & 4 \\ 1 & 2 \end{bmatrix}$

$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \xrightarrow{C_1 \longleftrightarrow C_2} \begin{bmatrix} 2 & 1 \\ 4 & 3 \end{bmatrix}$

2. MULTIPLICATION OF ANY ~~TWO~~ ROW OR COL WITH NON ZERO K.

$R_i \longrightarrow KR_i$, $C_i \longrightarrow KC_i$

3. FOR ANY GIVEN ROW R_i we can write it as $R_i \rightarrow R_i + KR_j$, $C_i \rightarrow C_i + KC_j$

Q. $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$ $R_2 \longrightarrow R_2 - 2R_1$

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

$\boxed{IA = A}$

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

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

$R_1 \longleftrightarrow R_2$ for $\begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$

Now can we perform the given swapping with the help of matrix multiplication, ~~yes~~

1. Idendity matrix me rows swapping karke
2. given matrix ke left hand side se int karenge.

Q. $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 3 & 5 \\ 8 & 6 & 10 \end{bmatrix}$ $R_3 \longrightarrow R_3 - 2R_2$

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

$I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ $R_3 \rightarrow R_3 - 3R_2 \longrightarrow 0\ 2\ 0$

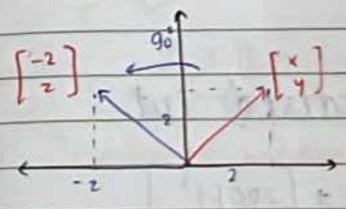
0 0 1
$-$ 0 2 0
0 -2 1

Here we transformed identity matrix as given elem opn, then multiple.

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & -2 & 1 \end{bmatrix}\begin{bmatrix} 1 & 2 & 3 \\ 4 & 3 & 5 \\ 8 & 6 & 10 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 3 & 5 \\ 0 & 0 & 0 \end{bmatrix}$$

VECTOR.

$\begin{bmatrix} x \\ y \end{bmatrix}$ $\rightarrow$ x axis, $\rightarrow$ y axis



$\begin{bmatrix} 1 \\ 0 \end{bmatrix} \rightarrow \begin{bmatrix} -1 \\ 0 \end{bmatrix}$

unit vector x-axis (positive) — unit vector x-axis (negative)

$$2\begin{bmatrix} 1 \\ 0 \end{bmatrix} + 2\begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$$

$$2\begin{bmatrix} -1 \\ 0 \end{bmatrix} + 2\begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} -2 \\ 2 \end{bmatrix}$$