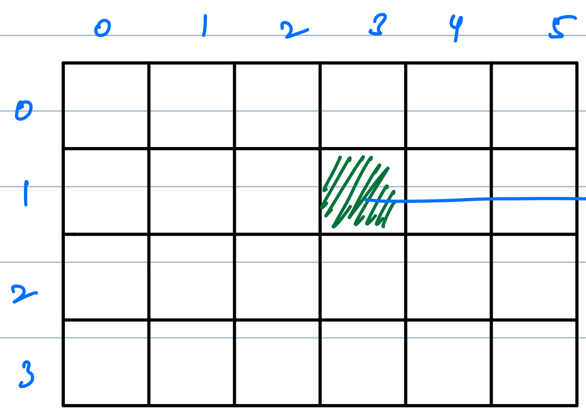
google sheets / chess / calendar

2D Matrix → rows and columns



cell → (row, col)

(1, 3)

cells → no of rows * no of col.

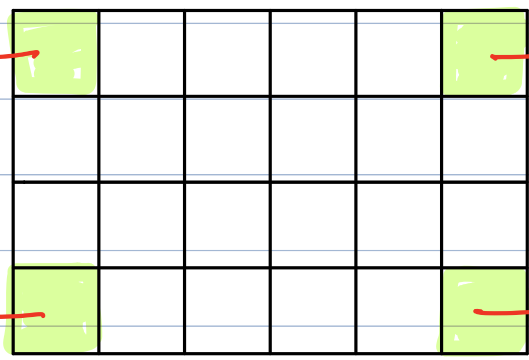
4 * 6

rows   col^n

int mat [4][5];

0,0

0, M-1

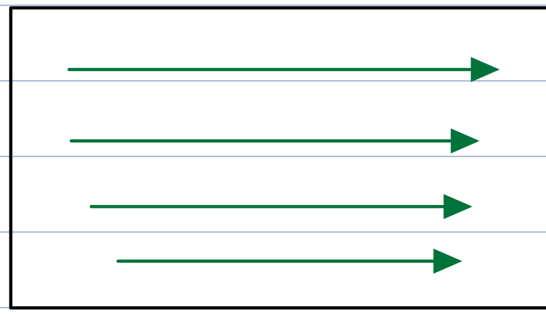


N-1, 0

(N-1, M-1)

- 2D matrix N*M. Print all elements row by row

0,0	0,1	0,2	0,3
1,0	1,1	1,2	1,3
	⋮		



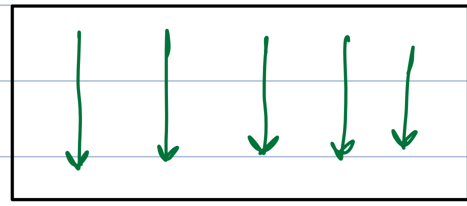
```
for( i=0; i<N; i++)
{
        for( j=0; j<M; j++)
        {
                print( arr[i][j]);
        }
}
```

T.C: O(N*M)

row-wise sum

```
for( i=0; i<N; i++)
{               int sum=0;
        for( j=0; j<M; j++)
        {
                sum += arr[i][j];
        }
}
```

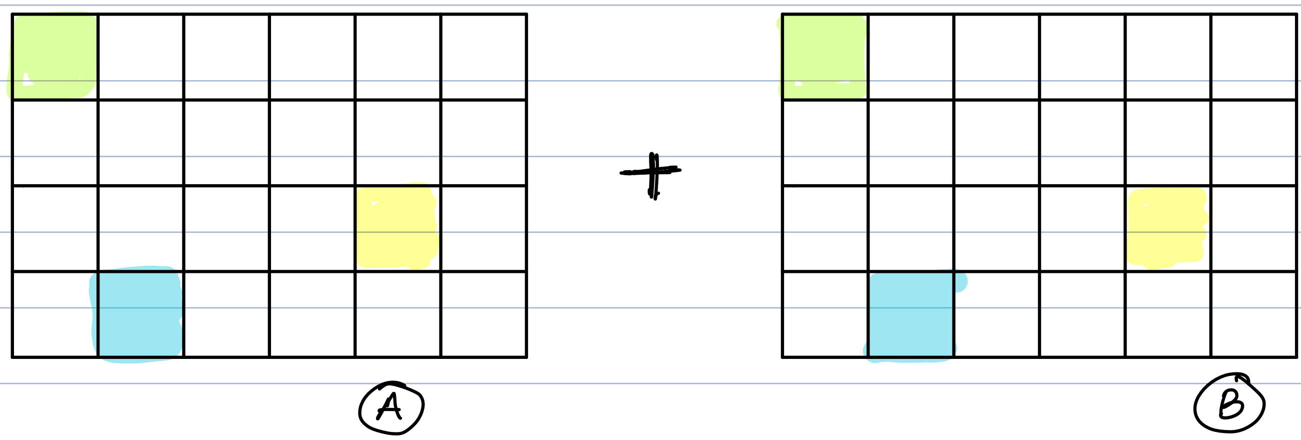
col-wise sum



```
for( j=0; j<M; j++)   → fix col
{                int sum=0;
      for( i=0; i<N; i++)
      {
              sum += arr[i][j];
      }
}
```

- Given matrices A and B. Add 2 matrices.

2 matrices can only be added if of same dimensions.



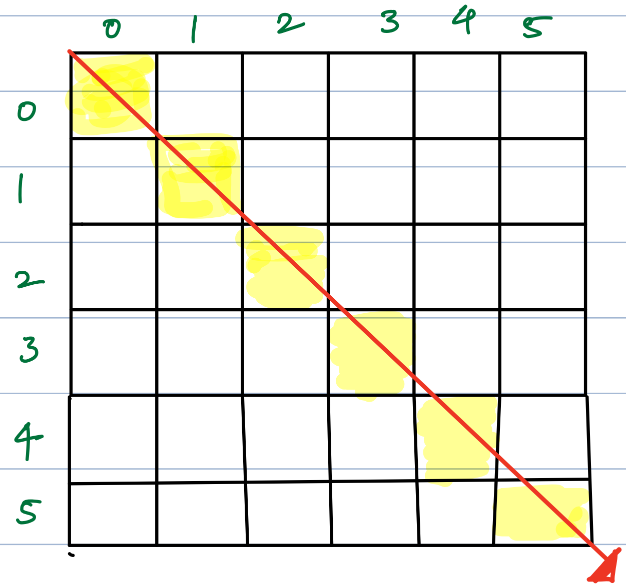
$$\boxed{res[i][j] = A[i][j] + B[i][j]}$$

```
for( i=0 → N)
    for( j=0 → M)
        res(i,j) = A[i][j] + B[i][j];
```

• N * N matrix. Print the diagonal of the matrix.

$\boxed{i == j}$

0,0
1,1
2,2
3,3
4,4
5,5



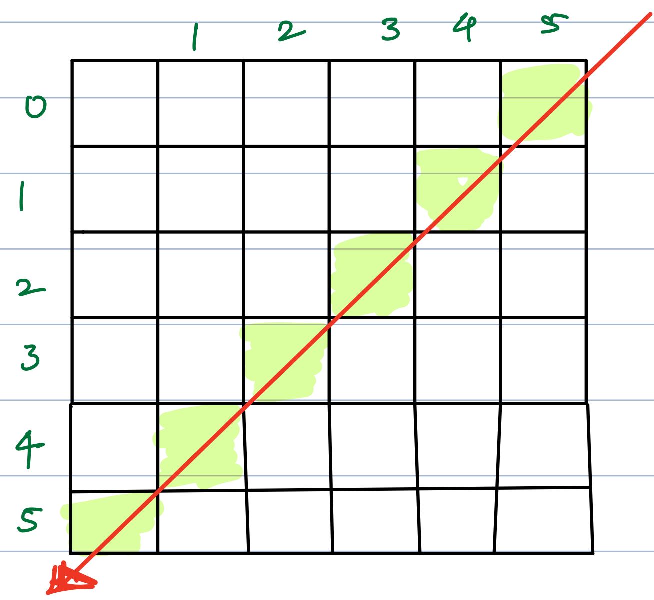
row, col

for(i=0; i<N; i++)

i
⋮
j

print(arr[i][i]);

T.C: O(N)
S.C: O(1)



0,5
1,4
2,3
3,2
4,1
5,0

0, N-1

1, N-2

i, j

i++, j--;

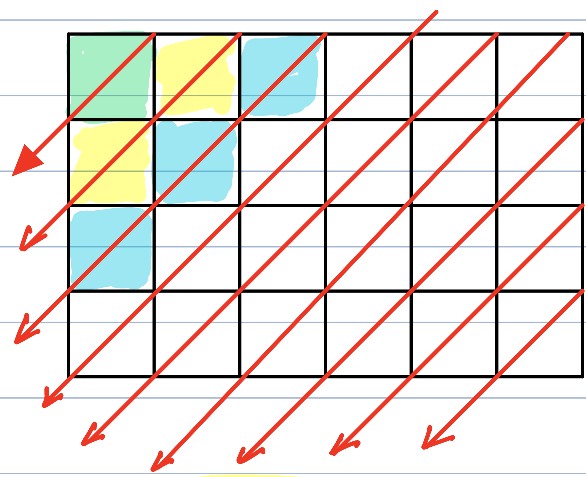
```
i = 0, j = N-1
while( i<N && j>=0)
{
    print(arr[i][j]);
        i++;
        j--;
}
```

i, N-(i+1)

= $\boxed{i,\ N-i-1}$

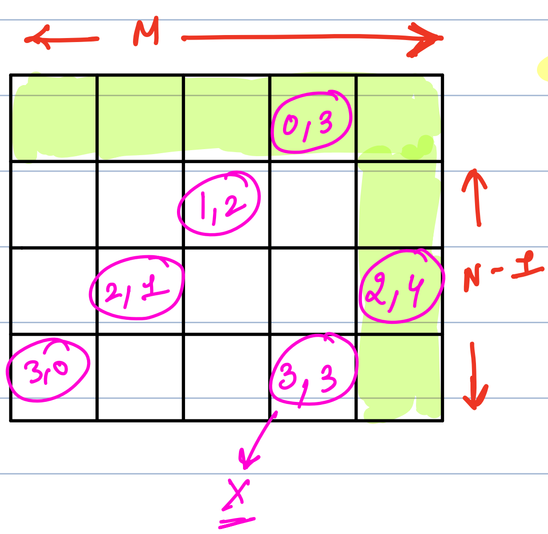
arr[i][N-i-1]

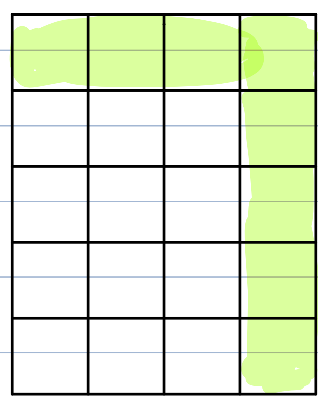
Rectangular Matrix (N*M)



M+N-1 diagonals

350*475





```
printDiagonal ( int i, int j , int mat[][])
{
        while( i<N && j>=0)
        {     print( mat[i][j] );
                 i++;
                 j--;
        }
}
```

```
// 0th row
for( j=0; j<M; j++)
{
        printDiagonal ( 0, j, mat);
}
```

```
//   col = M-1
for( i=1; i<N; i++)
{
        printDiagonal ( i, M-1, mat);
}
```

T.C: O(N*M)
S.C: O(1)

o square Matrix (N×N). Find Transpose of Matrix.

-3	-2	0
1	6	9
3	5	4

Transpose ⟹

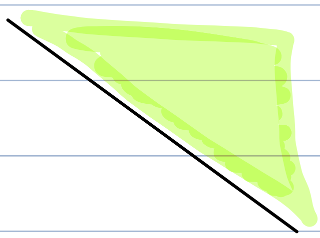
-3	1	3
-2	6	5
0	9	4

0^{th} row ⟹ 0^{th} col

1^{st} row ⟹ 1^{st} col

⋮

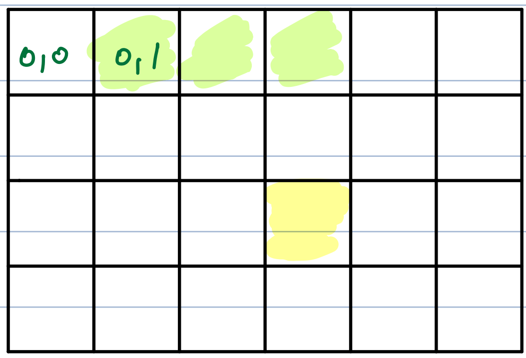
A[i][j] → A[j][i]



i, j ⟹ j, i

$\boxed{\begin{array}{l} T.C: O(N^2) \\ S.C: O(1) \end{array}}$

```
for( i=0; i<N; i++)
{
    for( j=0; j<N; j++)      j=i+1
    {
        swap( arr[i][j], arr[j][i]);
    }
}
```



4*6

$(i,j) \rightarrow (j,i)$

6*4

```
for( i=0; i<N; i++)
{
    for( j=0; j<M; j++)
    {
            res[j][i] = mat[i][j];
    }
}
```

T.C: O(N*M)

S.C: O(N*M)

- Rotate matrix (N×N) by 90° clockwise

$$\begin{bmatrix} 1 & 3 & 4 & 2 \\ 2 & 9 & 6 & -1 \\ -3 & 12 & 8 & 7 \\ 10 & -2 & 0 & -9 \end{bmatrix} \xrightarrow{90^\circ \circlearrowright} \begin{bmatrix} 10 & -3 & 2 & 1 \\ -2 & 12 & 9 & 3 \\ 0 & 8 & 6 & 4 \\ -9 & 7 & -1 & 2 \end{bmatrix}$$

$\Downarrow$ Transpose

$$\begin{bmatrix} 1 & 2 & -3 & 10 \\ 3 & 9 & 12 & -2 \\ 4 & 6 & 8 & 0 \\ 2 & -1 & 7 & -9 \end{bmatrix} \xrightarrow{\text{reverse rows}}$$

$\boxed{i, j \Rightarrow j, i}$

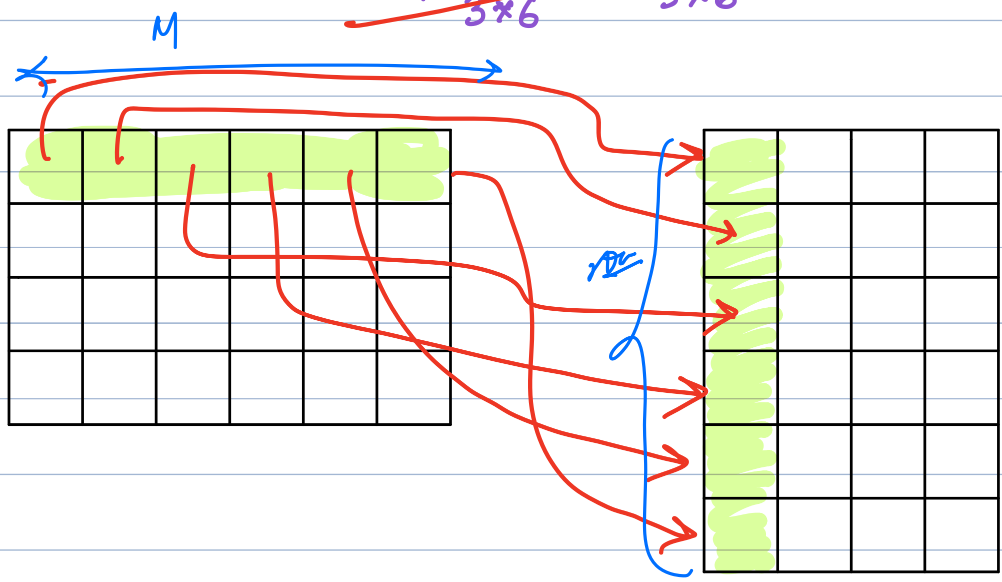
$\boxed{i, j \Rightarrow ?, ?}$

$\downarrow$

HW

Q Two Matrices A and B. Multiply Two matrices.

~~A_{3*6} B_{3*6}~~



A: $N * x$

B: $x * M$

Res: $N * M$

$-1*2 + 2*3 + 3*-6 + 0*0 + 4*2 = -8$

-1	2	3	0	4
-3	6	2	1	0

	2		
	3		
	-6		
	0		
	2		

$4*5$ $5*4$

	-8		
	0		

A: i (row)

B: j (col) → res[i][j]

$$\boxed{res[i][j] = \sum_{k=0}^{k<x} A[i][k] * B[k][j]}$$

A: $a*b$

B: $b*c$

$a*c$

T.C: $O(a*b*c)$

```
for( i=0; i<a; i++)
{
    for( j=0; j<c; j++) res[i][j]=0;
    {
        for( k=0; k<b; k++)
            res[i][j]+=A[i][k] * B[k][j];
    }
}
```

Recap →

- matrix
- print → row by row
  - col by col
- Add^n
- Diagonal → square
  - → Rectagular
- Traspose
- 90°
- Multiplication