

- 1) Watch all pending lectures
- 2) Complete HW & assignments

9th June

Matrix

		0	1	2	3	4	5
0							
1							
2							
3							
4							

Rows _____

Column |

(1,3)

(2,5)

rows column

$M \times N$

	0	1	2	3	...	N-1
0				0,3		
1				1,3		
2	2,0	2,1	2,2	2,3	...	2,N-1
3				3,3		
⋮				⋮		
⋮				⋮		
M-1				M-1,3		

while I am moving in a column row index will keep changing

while I am moving in a row, column index will keep changing

```
for(i=0; i<M; i++) {
```

TC: $O(MN)$

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

SC: $O(1)$

```
}
```

Q1) Given $mat[M][N]$, print row wise sum?

TC: $O(NM)$

$mat[3][4]$

	0	1	2	3	
0	3	2	5	1	11
1	0	5	6	3	14
2	7	11	6	2	26

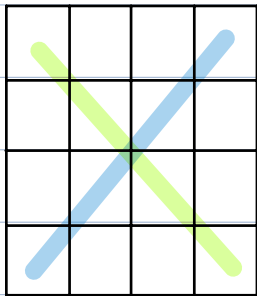
```
for(i=0; i<M; i++) {  
    sum=0  
    for(j=0; j<N; j++) {  
        sum = sum + A[i][j]  
    }  
    print (sum)  
}
```

Q2) Given a $mat[M][N]$, print column wise sum?

HW

0	1	2	3
3	2	5	1
0	5	6	3
7	11	6	2

Q3) Given a matrix $[N][N]$ print diagonals



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

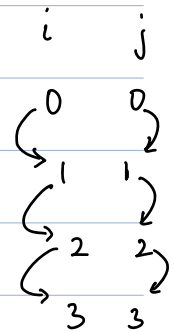
TC: $O(N^2)$

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

TC: $O(N)$

SC: $O(1)$

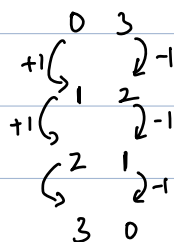
Green diagonal: 5 1 14 12



0,0	5	3	6	2
	0	1	0	-6
	-1	15	14	17
	4	7	11	12

```
i=0    j=0
while (i<N and j<N) {
    print (A[i][j])
    i++
    j++
}
```

5	3	6	0,3
0	1	0	1,2
-1	15	14	2,1
4	7	11	3,0



Blue diagonal: 2 0 15 4

```
i=0    j=N-1
while (i<N and j>=0) {
    print (A[i][j])
    i++
    j--
}
```

Q4) Print diagonal from right to left starting with (l, r)
 $(M \times N)$

	0	1	2	3	4
0	1	2	3	4	5
1	6	7	8	9	10
2	15	14	13	12	11
3	16	17	18	19	20

$l=0$ $r=3$

Ans: 4 8 14 16

$l=0$ $r=1$

Ans: 2 6

l
 $\hookrightarrow l+1$

r
 $\downarrow r-1$

$l=1$ $r=2$

Ans: 8, 14, 16

```

i = l      j = r
while (j >= 0 && i < M) {
    print(A[i][j])
    i++
    j--
}

```

$l=2$ $r=4$

Ans: 11, 19

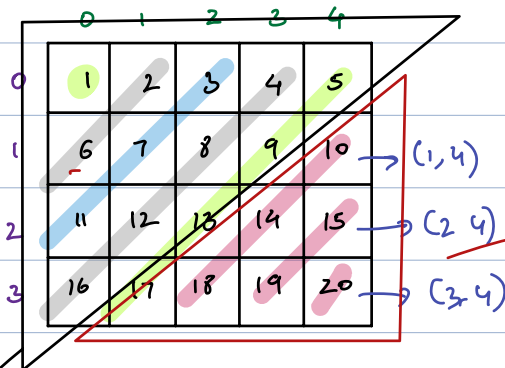
$l=0$ $r=3$

1 2

2 1

3 0

Q Print all diagonals from R-L for all diagonals starting from 0th row



1				
2	6			
3	7	11		
4	8	12	16	
5	9	13	17	

all diagonals starting at
0 row

```

for (c=0; c<N; c++) {
    i=0, j=c
    while (j>=0 && i<M) {
        print (A[i][j])
        i++
        j--
    }
}

```

all diagonals starting at
N-1 column except 0, N-1

```

for (c=1; c<=M-1; c++) {
    i=c, j=N-1
    while (j>=0 && i<M) {
        print (A[i][j])
        i++
        j--
    }
}

```

Break (10:44 - 10:54)

Q5) Given a $mat[N][N]$, find the transpose in place. → SC: $O(1)$
 Given input $mat[i][j]$ should update

	0	1	2	3	4
0	1	2	3	4	5
1	6	7	8	9	10
2	11	12	13	14	15
3	16	17	18	19	20
4	21	22	23	24	25

→

	0	1	2	3	4
0	1	6	11	16	21
1	2	7	12	17	22
2	3	8	13	18	23
3	4	9	14	19	24
4	5	10	15	20	25

8:

1, 2		2, 1
22:		
4, 1	Swap	1, 4
18		
3, 2		2, 3

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

```
    for(j=i; j < N; j++) {
```

```
        swap(A[i][j], A[j][i])
```

```
    }
```

Wrong

Correct

Swapping same elements
2 times

1	4	3
2	5	6
7	8	9

$i, j \rightarrow j, i$

output:

$j, i \rightarrow i, j$

1	4	7
2	5	8
3	6	9

	0	1	2	3	4
0	1	2	3	4	5
1	6	7	8	9	10
2	11	12	13	14	15
3	16	17	18	19	20
4	21	22	23	24	25



	0	1	2	3	4
0	1	6	11	16	21
1	2	7	12	17	22
2	3	8	13	18	23
3	4	9	14	19	24
4	5	10	15	20	25

$i \rightarrow (i \rightarrow n-1)$

$j \rightarrow (0 \rightarrow i-1)$

Google

Q6) Given mat $[N][N]$, rotate the matrix by 90° in clockwise direction from TR as reference, inplace

Input

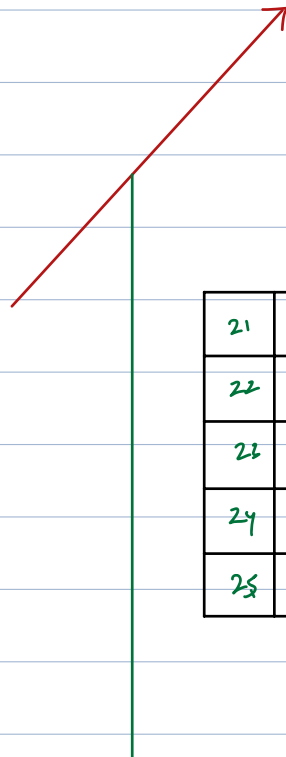
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

Output

21	16	11	6	1
22	17	12	7	2
23	18	13	8	3
24	19	14	9	4
25	20	15	10	5

Transpose

	0	1	2	3	4
0	1	6	11	16	21
1	2	7	12	17	22
2	3	8	13	18	23
3	4	9	14	19	24
4	5	10	15	20	25



21	16	11	6	1
22	17	12	7	2
23	18	13	8	3
24	19	14	9	4
25	20	15	10	5

Reverse each row

$x = 0$ $y = N-1$
 while $(x < y)$ {
 swap $(A[x][y], A[y][y])$

1) Transpose

TC: $O(N^2)$

2) Reverse each row

```
for (i=0; i<N; i++) {  
    x=0    y=N-1  
    while (x<y) {  
        swap(A[i][x], A[i][y])  
        x++  
        y--  
    }  
}
```

swap row A[i]

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

25	24	23	22	21
20	19	18	17	16
15	14	13	12	11
10	9	8	7	6
5	4	3	2	1

1) Reverse column

2) Reverse row