Today's agenda

- Intro to 2D Arrays
- Print matrix row wise
- Print matrix Col wise
- Print matrix in wave form
- Array list

Q) Two Sum

↳ Given N array elements, check if there exists a pair (i,j) such that arr[i] + arr[j] = k and i != j

Note: i and j are index value, k is given sum.

ex: arr[7] : { 2 -1 0 3 2 5 7 }

k=8 ↳ true

arr[4] : { 1 3 -2 6 }

k=5 ↳ false

arr[5] : { 2 4 -3 7 10 } (0 1 2 3 4)

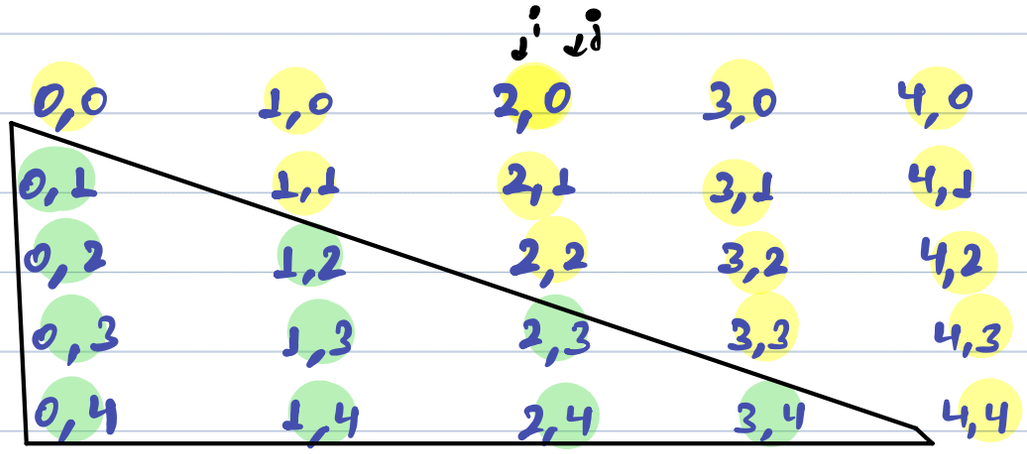
k=8 ↳ false ↳ arr[1] + arr[4] = 8

arr[6] : { 3 5 1 8 3 7 }

k=6 ↳ true

arr[5]: { 3 5 1 8 3 }
(0 1 2 3 4)

K=6



i → 0 1 2 3

j → {1 2 3 4} {2 3 4} {3 4} {4}

//Pseudo code

```
Public static boolean twoSum(int[] arr, int k){
    int N = arr.length;

    for(int i=0; i<=N-2; i++){          // i<N-1
        for(int j=i+1; j<=N-1; j++){    // j<N
            if(arr[i]+arr[j]==k){return true;}
        }
    }

    return false;
}
```

T.C: O(N²)

S.C: O(1)

```
for (int i=0; i<=N-2 ; i++){
    for (int j= i+1;j <=N-1 ;j++){
        if (arr[i]+arr[j]==k){return true;}
    }
}
return false;
```

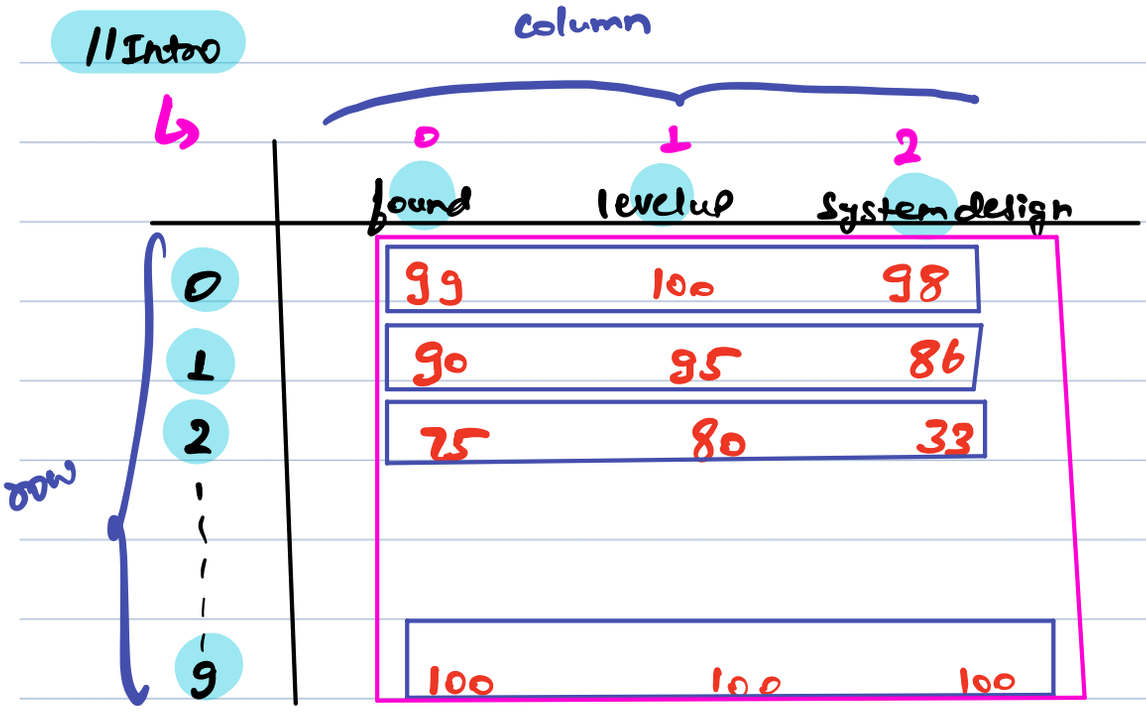
(i <= N-1 or i < N)

(j <= N-1 or j < N)

i	j	Count
0	[1, N-1]	N-1
1	[2, N-1]	N-2
2	[3, N-1]	N-3
⋮	⋮	⋮
N-2	[N-1, N-1]	1

$\frac{N(N-1)}{2}$

$\frac{N^2}{2} - \frac{N}{2} = O(N^2)$



Syntax

↳ `int[][] arr = new int[5][3];`

arr	0	1	2
0	0	0	0
1	20	0	0
2	0	0	0
3	0	0	0
4	0	0	0

`S.O.P(arr[3][2]);`

`arr[1][0] = 20;`

5x3

↳ 5*3 = 15 elements

Q) Print matrix rowwise

↳ Print the given mat[n][m] rowwise.

arr[4][5]:

	0	1	2	3	4
0	10	20	30	40	50
1	60	70	80	90	100
2	110	120	130	140	150
3	160	170	180	190	200

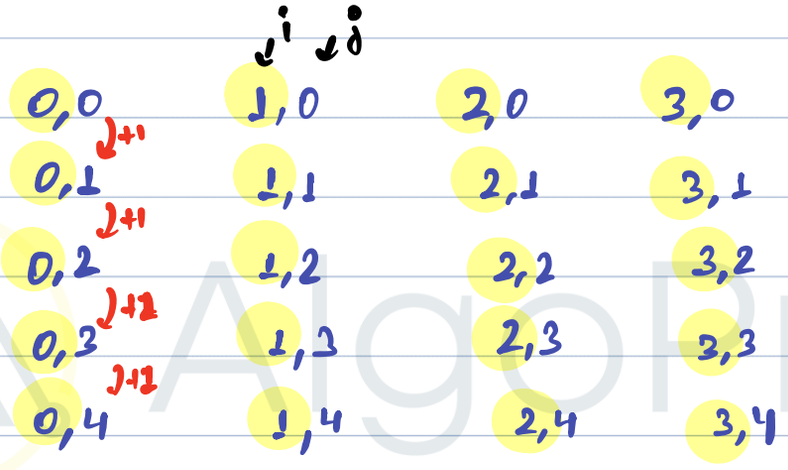
4×5

10 20 30 40 50

60 70 80 90 100

110 120 130 140 150

160 170 180 190 200



i = 0 1 2 3

j → {0 1 2 3 4} {0 1 2 3 4} {0 1 2 3 4} {0 1 2 3 4}

//Pseudo code

```
Public static void rowwise (int[][] arr){
    int n = arr.length; //no. of rows
    int m = arr[0].length; //no. of col

    for(int i=0; i<n ; i++){
        for(int j=0; j<m; j++){

            System.out.print(arr[i][j]+" ");

        }

        System.out.println();

    }
}
```

arr

	0	1	2	3	4
0	10	20	30	40	50
1	60	70	80	90	100
2	110	120	130	140	150
3	160	170	180	190	200

4x5

```
Public static void rowwise (int[][] arr){
    int n = arr.length;      // no. of rows
    int m = arr[0].length;   // no. of col
    for(int i=0; i<n; i++){
        for(int j=0; j<m; j++){
            System.out.print(arr[i][j]+" ");
        }
        System.out.println();
    }
}
```

n = 4 m = 5

i	j
0	0 1 2 3 4 5→exit
1	0 1 2 3 4 5→exit
2	

10 20 30 40 50
60 70 80 90 100
→

// Input

Run Code | Untitled | Save | Java

```java
// "static void main" must be defined in a public class.
public class Main {
    public static void main(String[] args) {
        Scanner scn = new Scanner(System.in);

        int n = scn.nextInt();//row no
        int m = scn.nextInt();//col no
        int[][] arr = new int[n][m];

        for(int i=0;i<n;i++){
            for(int j=0;j<m;j++){
                // System.out.print(arr[i][j]);
                arr[i][j] = scn.nextInt();
            }
        }

        for(int i=0;i<n;i++){
            for(int j=0;j<m;j++){
                System.out.print(arr[i][j]+" ");
            }
            System.out.println();
        }

        int[][] arr1 ={{10,20,30,40},
                       {50,60,70,80},
                       {100,200,300,400}};

        System.out.println(arr1.length);
        System.out.println(arr1[0].length);
    }
}
```

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Output: Finished | Clear Console

```
Finished in 179 ms
10 20 30 40
50 60 70 80
90 100 120 130
3
4
```

stdin

```
3 4
10 20 30 40
50 60 70 80
90 100 120 130
```

Break till 10:45 pm

Q) Print matrix colwise

Print the given mat[n][m] colwise.

arr[4][5]:

	0	1	2	3	4
0	10	20	30	40	50
1	60	70	80	90	100
2	110	120	130	140	150
3	160	170	180	190	200

10 60 110 160
20 70 120 170
30 80 130 180

i j

0 0 | 0 1 | 0 2 | 0 3 | 0 4
1 0 | 1 1 | 1 2 | 1 3 | 1 4
2 0 | 2 1 | 2 2 | 2 3 | 2 4
3 0 | 3 1 | 3 2 | 3 3 | 3 4

```
Public static void colwise (int[][] arr){
    int n = arr.length;      // no. of rows
    int m = arr[0].length;   // no. of col

    for (int j=0; j<m; j++ ){
        for (int i=0; i<n ; i++ ){

            System.out.print (arr[i][j] + " ");

        }

        System.out.println();

    }
}
```

T.C: O(m*n)

S.C: O(1)

Q) Print matrix in wave form

↳ Print the given mat[n][m] in wave form.

arr[4][5]:

	0	1	2	3	4	
0	10	20	30	40	50	L-R → 10 20 30 40 50
1	60	70	80	90	100	R-L → 100 90 80 70 60
2	110	120	130	140	150	L-R → 110 120 130 140 150
3	160	170	180	190	200	R-L → 200 190 180 170 160

L-R → (0, 2, 4 . . .) → even rows

R-L → (1, 3, 5 . . .) → odd rows

```
for(int i=0; i<n; i++) {
    if(i%2==0){
        for(int j=0; j<m; j++){
            System.out.print(arr[i][j]+" ");
        }
    }
    else{
        for(int j=m-1; j>=0; j--){
            System.out.print(arr[i][j]+" ");
        }
    }
    System.out.println();
}
```

T.C: O(m*n)

S.C: O(1)

→ ArrayList or dynamic array