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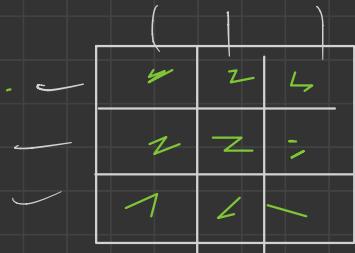
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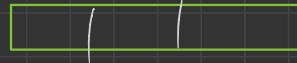
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## 2-D Arrays



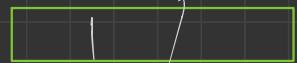
arr1



arr2

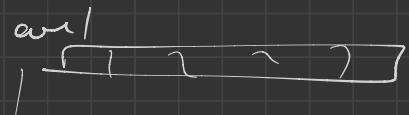


arr3



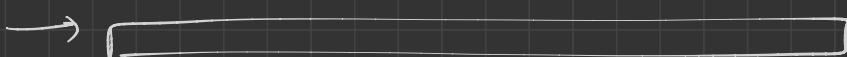
→ Ques:-

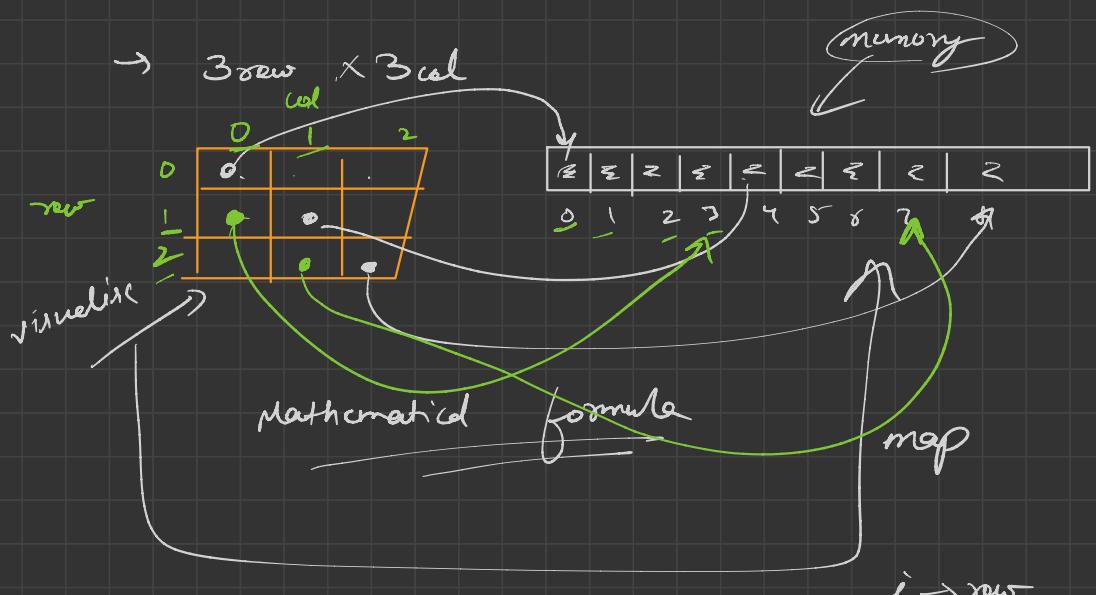
10 rows, 10 col



arr10

arr 1000 rows × 1000 col





$$= c \times i + j \quad J \Rightarrow \text{col}$$

$$\begin{aligned}
 L^{\text{ext}} & \text{ row } , 0^{\text{th}} \text{ col} \\
 & = 3 \times 1 + 0 \\
 & = \boxed{3}
 \end{aligned}$$

$$\begin{aligned}
 2^{\text{nd}} \text{ row } , 1^{\text{st}} \text{ col} & \Rightarrow c \times i + j
 \end{aligned}$$

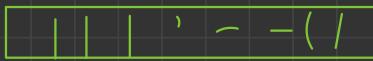
$$\begin{aligned}
 & \Rightarrow 3 \times 2 + 1 \\
 & = \boxed{7}
 \end{aligned}$$

①

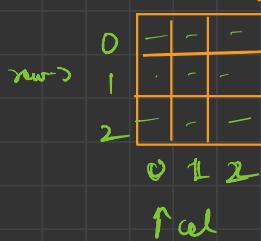
Create 2D array

1D →

int arr[10];



int arr [3][3];



input → ?

1D array  
→ cin >> arr[i]

2D array

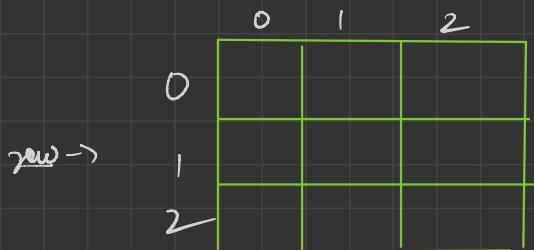
→ cin >> arr[i][j]

Output ?

1D  
→ cout >> arr[i] col

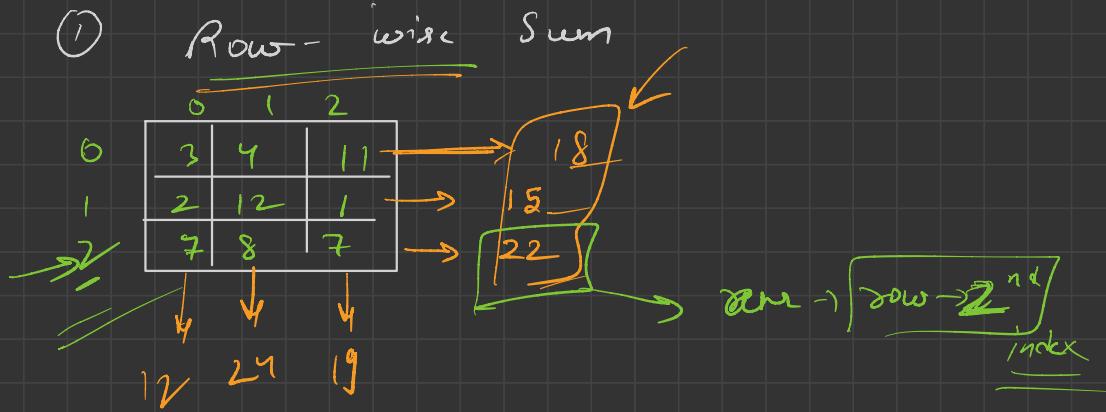
2D

→ cout << arr[i][j]

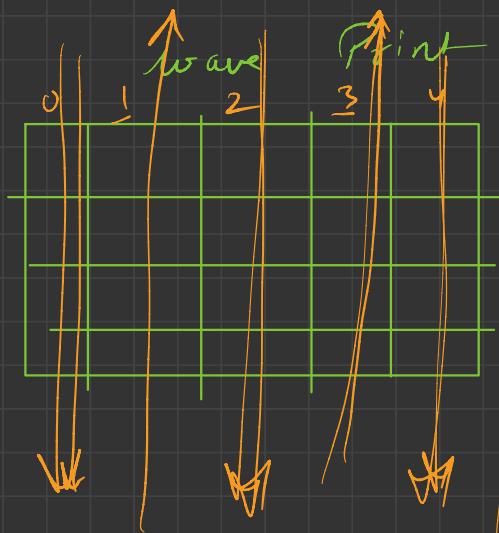


arr[2][1]

arr[2][2]



② Largest Row Sum → ?



arr[5][1]

Obj -

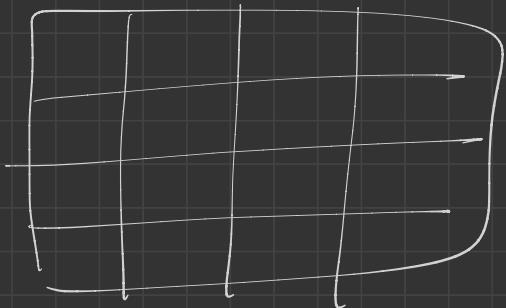
col Index → Odd  
Bottom to Top

col Index → even or 0  
Top to Bottom

# Spiral Print

start row  
start col  
end row  
end col

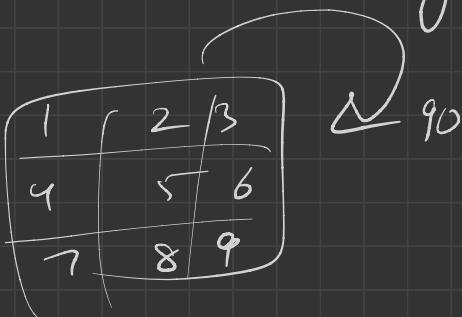
1	2	3
4	5	6
7	8	9



## Approach:-

- Print starting row Row
- Ending column print Col
- Ending row point Rows
- starting col point Cols

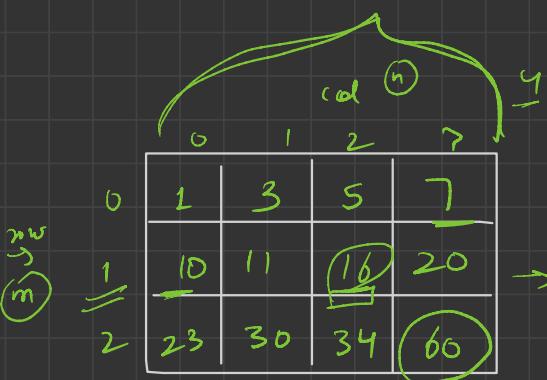
① Rotate matrix by 90 degrees



## Homework

The diagram illustrates the relationships between three concepts:

- Binary Search** is connected by a curved arrow to **Linear Array**.
- Linear Array** is enclosed in a box labeled **1D**.
- Linear Array** is also connected by a curved arrow to **2D - Arrays**, which is enclosed in a separate oval.



$$1/k = \Theta(n) \quad n = \text{rows} \times \text{cols}$$

$O(\log(\text{row} \times \text{col}))$  (c)

| 10 | 11 | 16 | 20 | 23 | 30 | 34 | 50

4 5 [6] 7 8 9 10 11

$\text{start} = 0$

$\text{end} = \text{row} \times \text{col} - 1$

$$T(6) = \Theta(\log n)$$

$(\text{row} \times \text{col} - 1)$

$$\frac{6}{1} / \underline{\underline{\text{cal}}} = \underline{\underline{12}} \Rightarrow$$

$(3 \times 4 - 1)$

$(12 - 1)$

(11)

mid

↓

Case 1:  $\text{arr}[\text{mid}] \geq \text{target}$   
↳ found → return

(Case 2)  $\rightarrow \text{arr}[\text{mid}] < \text{target}$   
 $s = \text{mid} + 1$

(Case 3)  $\rightarrow \text{arr}[\text{mid}] > \text{target}$   
 $e = \text{mid} - 1$

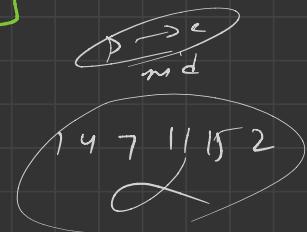
row index      col Index

mid

matrix [ ] [ ]

Search 2D matrix  $\rightarrow$  II

Case 1:  $\text{arr}[\underline{\text{mid}}] = \underline{\text{target}}$   
 $\rightarrow$  return ans :-



$$\text{target} = 10$$

Case 2  $\text{arr}[\underline{\text{mid}}] < \underline{\text{target}}$

$\rightarrow$  row++

$$9 < 10$$

Case 3  $\text{arr}[\underline{\text{mid}}] > \underline{\text{target}}$

$\rightarrow$  col--

$$17 > 10$$