

Excel

	Maths	Eng	Science	History
Ritesh	19	20	23	18
Pankaj				
Sonik				
Rohit				

Ritesh					-
Pankaj					-
Sonik	1	1	1		✓
Rohit					-

✓				
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✓				
✓				

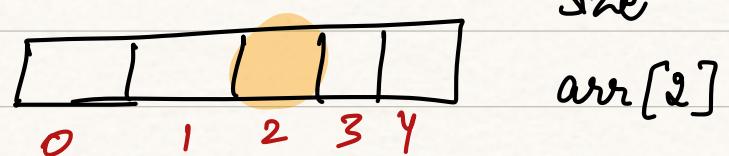
10 19 18 20

2D Array

an array of arrays

1D Array →

`int [] arr = new int [5];`



`arr[2]`

`int [] []`

`mat = new int [row] [col];`

↓ ↓
0 1 2 3

→ 0	0	1	2	3
→ 1			1	
→ 2	2			

`int [] [] mat = new int [r][c];`

$(r \times c)$
3 4

`1 → mat [1][2]`

indexes of row → 0 to $r-1$

`2 → mat [2][0]`

indexes of col → 0 to $c-1$

row index col index

Total number of elements = $3 \times 4 = 12$
($r \times c$)

Quiz → Create matrix with 2 rows and 5 columns.

`int [] [] mat = new int [2] [5];`

→

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

S.O.P (`mat [0][3]`);

S.O.P (`mat [2][0]`);

// Error → Array Index Out of Bounds

[N - no. of rows , M - no. of columns]

Ques. Given the value of N and M then $N \times M$ elements create a matrix of $(N \times M)$ size and then store the elements in matrix and then print it.

$$N = 3 \quad M = 4$$

	0	1	2	3
0	1	2	3	4
1	5	6	7	8
2	9	10	11	12

1 2 3 4
0th row

5 6 7 8
1st row

9 10 11 12
2nd row

i
↓
mat [0] [0]
mat [0] [1]
mat [0] [2]
mat [0] [3]

for (int j=0; j < M; j++) {
mat [0] [j] = cin.nextInt();

}

j = 0 \rightarrow mat [0] [0]
1 \rightarrow mat [0] [1]
2 \rightarrow mat [0] [2]
3 \rightarrow mat [0] [3]

$N = 3$

$M = 4$

$\Rightarrow \text{int } [] [] \text{ mat} = \text{new int } [N][M]; \quad i$

0

j

0

1

2

3

4

\swarrow

\swarrow

\swarrow

\swarrow

$\rightarrow \text{break}$

$\text{for (int } i=0; \quad i < N; \quad i++ \quad) \{$

$\rightarrow \text{for (int } j=0; \quad j < M; \quad j++ \quad) \{$

$\text{mat } [i] [j] = \text{scn. nextInt();}$

$\}$

$\}$

	0	1	2	3
0	1	2	3	4
1	5	6	7	8
2	9	10	11	12

$\rightarrow \begin{matrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \end{matrix} \leftarrow$

$(0,0)$

1

\swarrow

$(0,1)$

\swarrow

$(0,2)$

\swarrow

$(0,3)$

\swarrow

$(1,0)$

$\rightarrow \text{break}$

$(1,1)$

2

\swarrow

$(1,2)$

\swarrow

$(1,3)$

\swarrow

$(2,0)$

\swarrow

$(2,1)$

\swarrow

$(2,2)$

$\rightarrow \text{break}$

$(2,3)$

$3 \rightarrow \text{break}$

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

each row

```
    for ( int j=0 ; j < M ; j++ ) {
```

```
        S0·P ( mat [i] [j] + " " );
```

```
}
```

```
S0·P ln ( );
```

```
}
```

	0	1	2	3
0	1	2	3	4
1	5	6	7	8
2	9	10	11	12

Output → 1 5 9

Ques. Given a matrix print the first column
[0th index column].

↑ ↑
↓ ↓

1	→	mat [0][0]
5	→	mat [1][0]
9	→	mat [2][0]

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

S.O.P (mat[i][0]);

}

i = 0 → mat [0][0]
 1 → mat [1][0]
 2 → mat [2][0]
 3 → break

	0	1	2	3
0	1	2	3	4
1	5	6	7	8
2	9	10	11	12

Output

1	5	9
2	6	10
3	7	11
4	8	12

Ques. print matrix column wise (col by col).

for (int $j = 0$; $j < M$; $j++$) {

j

i

 for (int $i = 0$; $i < N$; $i++$) {

0

$0 \swarrow$

$1 \swarrow$

$2 \swarrow$

$3 \rightarrow \text{break}$

 S.O.P (mat[i][j] + " ");

$(0,0)$

$(1,0)$

$(2,0)$

1

$0 \swarrow$

$1 \swarrow$

$2 \swarrow$

$3 \rightarrow \text{break}$

 S.O.P();

}

$N = 3$ $M = 4$

$(0,1)$

$(1,1)$

each
column,

	0	1	2	3
0	1	2	3	4
1	5	6	7	8
2	9	10	11	12

(2,1)

2

0 ↳

1 ↳

2 ↳

3 → break

Output →

1 5 9
2 6 10
3 7 11
4 8 12

(0,2)

(1,2)

(2,2)

(0,3)

(1,3)

(2,3)

3

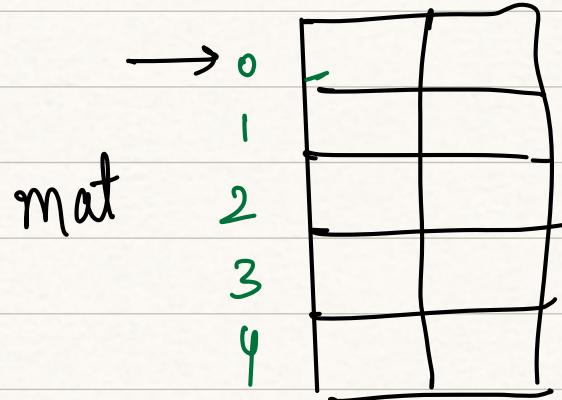
0 ↳

1 ↳

2 ↳

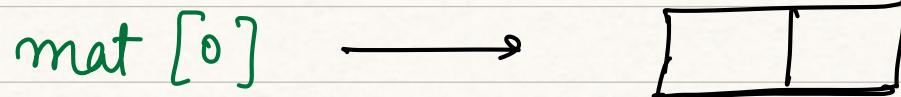
3 → break

·
4 → break



an array of arrays

number of rows = mat.length → 5



number of columns → mat[0].length → 2

mat[3].length → 2

Quiz-

Diagram of a 2D grid representing a matrix $(N \times M)$.

The grid has N rows and M columns.

Row indices i range from 0 to $N-1$, with 0 at the top and $N-1$ at the bottom.

Column indices j range from 0 to $M-1$, with 0 on the left and $M-1$ on the right.

Cells are labeled as follows:

- Cell $(0, 0)$ is orange and contains 1 .
- Cell $(0, M-1)$ is blue and contains 4 .
- Cell $(N-1, 0)$ is green and contains 2 .
- Cell $(N-1, M-1)$ is pink and contains 3 .
- Cells $(1, 0), (1, 1), \dots, (1, M-1)$ are white.
- Cells $(2, 0), (2, 1), \dots, (2, M-1)$ are white.
- Cells $(\dots, 0), (\dots, 1), \dots, (\dots, M-1)$ are white.

$1 \rightarrow 0, 0$

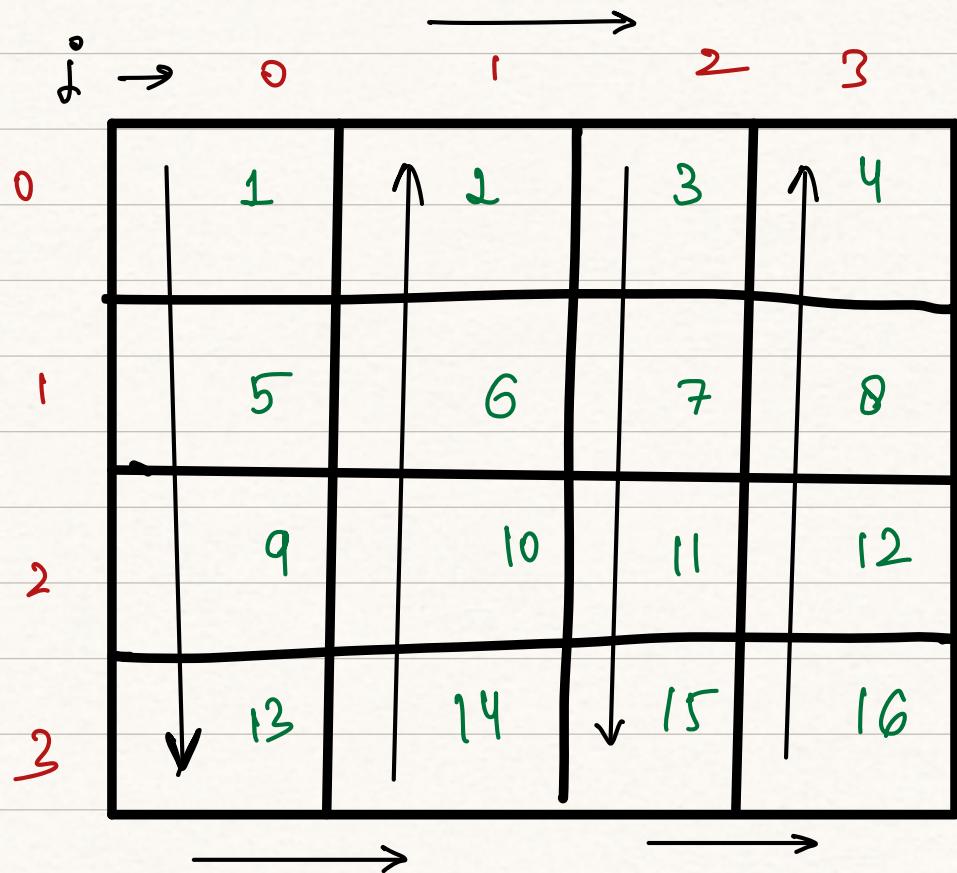
$2 \rightarrow N-1, 0$

$3 \rightarrow N-1, M-1$

$4 \rightarrow 0, M-1$

Ques.

Wave point



N, M
 $\downarrow \downarrow$

[even indexes]

Top to Bottom $\rightarrow 0, 2$

Bottom to Top $\rightarrow 1, 3$

[odd indexes]

O/P $\rightarrow 1 \ 5 \ 9 \ 13 \ 14 \ 10 \ 6 \ 2 \ 3 \ 7 \ 11 \ 15 \ 16 \ 12 \ 8 \ 4$

top to bottom $\rightarrow i \rightarrow (0 \text{ to } N-1)$

bottom to top $\rightarrow i \rightarrow (N-1 \text{ to } 0)$

for (int $j = 0$; $j < N$; $j++$) {

if ($j \% 2 == 0$) {

// print top to bottom

for (int $i = 0$; $i < N$; $i++$) {

SOP (mat[i][j] + " ");

}

}
else {

// print bottom to top

for (int $i = N-1$; $i \geq 0$; $i--$) {

SOP (mat[i][j] + " ");

}

}

}

$j \rightarrow$	0	1	2	3
0	1	↑ 2	3	↑ 4
1	5	6	7	8
2	9	10	11	12
3	↓ 13	14	↓ 15	16
→		→		

O/P →

1 5 9 13 14 10 6 2

3 7 11 15 16 12 8 4

$N=4 \quad M=4$

(0,0)

(1,0)

(2,0)

(3,0)

(3,1)

(2,1)

(1,1)

(0,1)

(0,2)

(1,2)

(2,2)

(3,2)

(3,3)

(2,3)

(1,3)

(0,3)

$j \rightarrow$

0

1

2

3

even/odd

even

[top to bottom]

odd

[bottom to top]

even

top to bottom

odd

bottom to top

$i \rightarrow$

0 ↘

1 ↘

2 ↘

3 ↘

4 → break

3 ↘

2 ↘

1 ↘

0 ↘

-1 → break

0 → (N-1)

(N-1) → 0

Doubts

Insert that

$$N = 5$$

2, 3, 1, 4, 2

Approach:-

$x = 3 \rightarrow$ position

$y = 5 \rightarrow$ element

index = 2

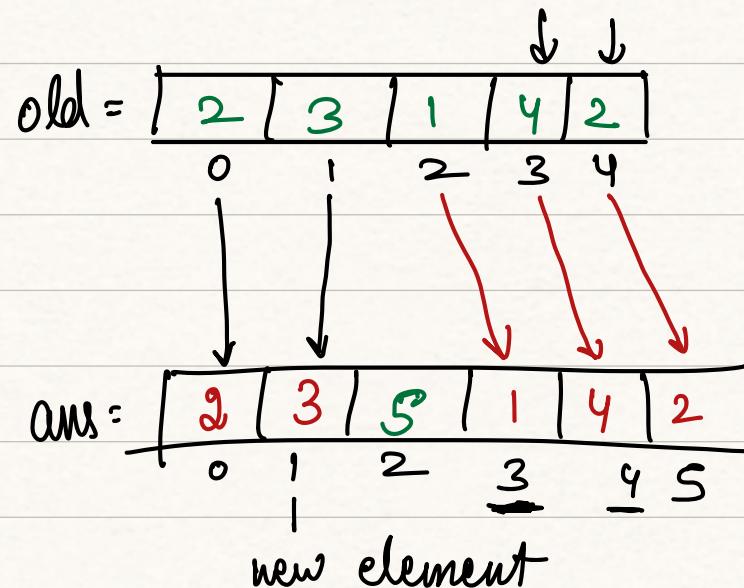
Step 1 $\rightarrow 0 \rightarrow$ index - 1
elements remain same

$$\text{ans}[i] = \text{old}[i]$$

Step 2 $\rightarrow \text{ans}[\text{index}] = y;$

Step 3 $\rightarrow \text{index} + 1 \rightarrow \text{ans.length} - 1$
elements shift one place
already

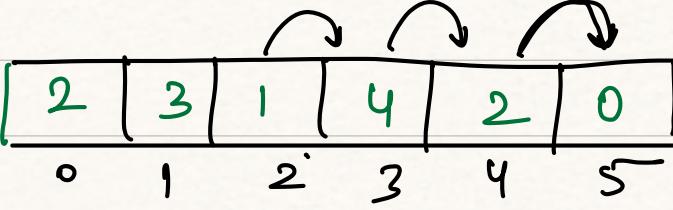
$$\text{ans}[i] = \text{old}[i-1]$$



$x = 3$

$y = 5$

Approach 2
 $\text{index} = x \rightarrow$



$N+1$

for ($\text{int } i = N ; i \geq x ; i--$) {
 $\text{arr}[i] = \text{arr}[i-1]$;

$3 \geq 3 \Leftarrow$

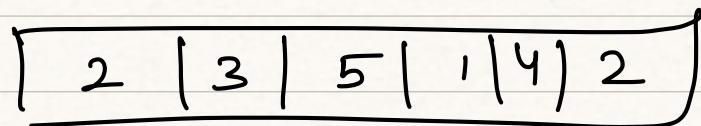
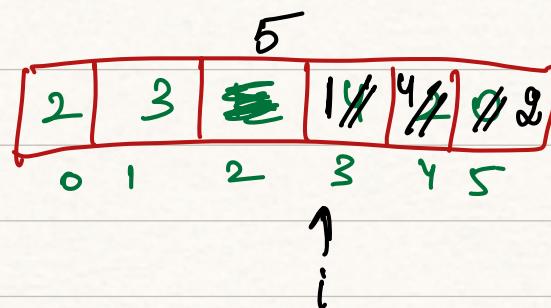
}

$\text{arr}[\text{index}] = y$; // $\text{arr}[2] = 5$

$\text{arr}[5] = \text{arr}[4]$

$\text{arr}[4] = \text{arr}[3]$

$\text{arr}[3] = \text{arr}[2]$



$N = 5$

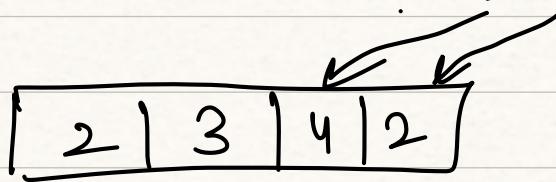
2 3 1 4 2

old =

2	3	1	4	2
0	1	2	3	4

$x = 3$

$\boxed{\text{index} = x - 1} = 2$



ans =

2	3	4	2
0	1	2	3

$[0 \rightarrow 1]$ 0 → index - 1
elements will remain same

ans [i] = old [i]

ans [2] = old [3]
ans [3] = old [4]

$[2 \rightarrow 3]$ index → ans.length - 1

ans [i] = old [i + 1]

2 \Rightarrow T

N \Rightarrow 5 (size)

1 2 3 4 5 (elements of array)

N \Rightarrow 3

9 11 13

int t = scu.nextInt();

while (t > 0) {

int N = scu.nextInt();

int[] arr = new int[N];

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

arr[i] = scu.nextInt();

}

t -- ;

}

Inverse of Array

size = 5

A = [3, 1, 0, 2]
index → 0 1 2 3

indexes → 0 → 4

inv Array = [2 1 3 0]
0 1 2 3

index	element	"
0	3	ans[3] = 0
1	1	ans[1] = 1
2	0	ans[0] = 2
3	2	ans[2] = 3

int [] ans = new int[N];

for (int i = 0; i < N; i++)
 int element = A[i];

i

ans [element] = i;

}

right shift an array

N = 5

arr = { 1, 2, 3, 4, 5 }

ans = { 5, 1, 2, 3, 4 }

$\text{arr} = \{ 5, 1, 2, 3, 4 \}$

~~for (int i = 0; i < 1 = false - ; i++) {
 arr[i+1] = arr[i];
}~~

$i = 0 \quad |$

$\text{arr}[2] = \text{arr}[1]$

$\text{arr} = \{ 1, 1, 1, 3, 4 \}$

$\text{int last} = A[N-1]; \quad // \text{last} = 5$

~~for (int i = N-1; i >= 1; i--) {
 arr[i] = arr[i-1];
}~~

$\text{arr}[4] = \text{arr}[3]$

$\text{arr}[3] = \text{arr}[2]$

$\text{arr}[2] = \text{arr}[1]$

$\text{arr}[1] = \text{arr}[0]$

{

$A[0] = \text{last};$

void

return; → exit the function

fun (int[] A);

A = x404

A[3] = 98;

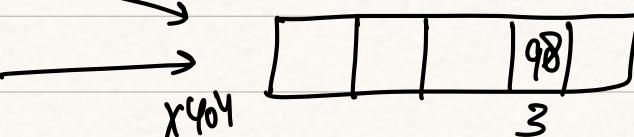
main () {

 fun (arr);

A

arr

x404



}

S.O.P in (arr); // address
x404

64	83	56
----	----	----

```
int[] fun (int[] arr) {  
    int[] newArr = {64, 83, 56};
```

return newArr;

}

arr = {10, 20, 30, 40, 50};

arr = fun (arr);

arr = {64, 83, 56}