

2D Arrays-1

Lecture- 14

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What and Why?

P, C, M → 6 students

Tables

0	1	2	3	4	5	6
91	90	81	75	100	56	68

List

P	C	M
90	95	65
91	100	56
92	99	91
81	98	87
82	91	88
83	90	89

Representation of 2D array → indexing

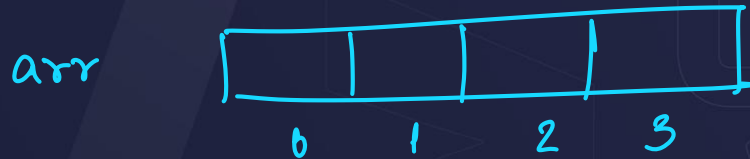
→ matrix
→ grid

brr

	0	1	2	3	4
0	(0,0)	(0,1)	(0,2)	(0,3)	(0,4)
1	(1,0)	(1,1)	(1,2)	(1,3)	(1,4)
2	(2,0)	(2,1)	(2,2)	(2,3)	(2,4)
3	(3,0)	(3,1)	(3,2)	(3,3)	(3,4)

4 x 5

cout << brr[2][3];



arr[index]

index → 0 to n-1

Declaration of a 2-Dimensional Array

```
int arr[4][2];
```

While initializing a 2D array it is necessary to mention the second (column) dimension, whereas the first dimension (row) is optional.

Correct

```
int arr[2][3];
```

```
int arr[ ][3];
```

Incorrect

```
int arr[2][ ];
```

```
int arr[ ][ ];
```

```
int a[5];
```



```
int arr[3][3];
```

```
arr[0][0] = 4;
```

```
arr[1][2] = 8;
```

	0	1	2
0	4		
1			8
2			

	0	1	2
0	1	2	3
1	4	5	6
2	7	8	9

```
int arr[3][3] = { {1, 2, 3}, {4, 5, 6}, {7, 8, 9} };
```

2D Arrays are also array of arrays

Initialisation of a 2-Dimensional Array

- ✓ `int arr[4][2] = { { 1234, 56 }, { 1256, 43 }, { 1434, 32 }, { 1312, 96 } } ;`
- ✓ `int arr[4][2] = { 1234, 56, 1256, 43, 1434, 32, 1312, 96 } ;`
- ✓ `int arr[2][3] = { 12, 34, 56, 78, 91, 23 } ;`
- ✓ `int arr[][3] = {12, 34, 56, 78, 91, 23 } ;`
- ✗ `int arr[2][] = { 12, 34, 56, 78, 91, 23 } ;`

Traversal through 2D array

Output

```
int arr[3][3] = { 1, 2, 3, 4, 5, 6, 7, 8, 9 };
```

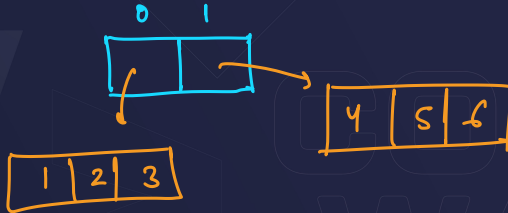
	0	1	2
0	1	2	3
1	4	5	6
2	7	8	9

arr[0][0] arr[0][1] arr[0][2]

Array of Arrays

```
int arr[2][3] = {1, 2, 3, 4, 5, 6};
```

	0	1	2
0	1	2	3
1	4	5	6



Taking 2D array as input from the user

Very Simple

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Ques : Write a program to store roll number and marks obtained by 4 students side by side in a matrix.

	0	1	2	3	
Roll no.	0	6	20	14	12
Marks	1	80	89	99	83

or

	0	1
0	6	80
1	20	89
2	14	99
3	12	83

Roll No Marks

Ques: Write a C++ program to find the largest element of a given 2D array of integers.



```
int max = arr[0];

for (int i = 1; i < n; i++)
{
    if (max < arr[i])
        max = arr[i]
}

cout << max;
```

Ques : Write a program to print sum of all the elements of a 2D matrix. *Ditto Same → C.W. attempt*

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Ques : Write a program to add two matrices.

	0	1	2
0	1	2	3
1	4	5	6

2×3
 $a[2][3]$

+

	0	1	2
0	7	8	9
1	10	11	12

2×3
 $b[2][3]$

=

	0	1	2
0	8	10	12
1	14	16	18

2×3
 $res[2][3]$

$$b[i][j] = b[i][j] + a[i][j];$$

***Ques :** Write a program to print the transpose of the matrix entered by the user and store it in a new matrix.

	0	1	2
0	1	2	3
1	4	5	6

$arr[m][n]$ 2×3
 $m \times n$

$(0,0)$ $(0,1)$ $(0,2)$

$(1,0)$ $(1,1)$ $(1,2)$

	0	1
0	1	4
1	2	5
2	3	6

3×2
 $n \times m$

$t[n][m]$

	0	1	2
0	1	2	3
1	4	5	6

$arr[m][n]$ 2×3
 $m \times n$

	0	1
0	1	4
1	2	5
2	3	6

$t[n][m]$ 3×2
 $n \times m$

$$t[0][0] = arr[0][0]$$

$$t[0][1] = arr[1][0]$$

$$t[1][0] = arr[0][1]$$

Ques : Write a program to change the given matrix with its transpose.
[Leetcode 867]

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Q, you are given a matrix / 2D-Array of size $(n \times n)$.
Change this matrix into its transpose.

1	2	3		1	4	7
4	5	6	→	2	5	8
7	8	9		3	6	9

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

arr[4][4]
(i==j) → copy

	0	1	2	3
0	(0,0)	(0,1)	(0,2)	(0,3)
1	(1,0)	(1,1)	(1,2)	(1,3)
2	(2,0)	(2,1)	(2,2)	(2,3)
3	(3,0)	(3,1)	(3,2)	(3,3)

i arr[4][4]

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

arr[4][4]

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

arr[4][4]

Ques : Write a program to rotate the matrix by 90 degrees clockwise.
 [Leetcode 48]

1	2	3	→	7	4	1
4	5	6		8	5	2
7	8	9		9	6	3

Hint 1: Transpose

1	2	3
4	5	6
7	8	9

transpose
→

1	4	7
2	5	8
3	6	9

7	4	1
8	5	2
9	6	3

If we reverse
each row of transposed
matrix

1	2
3	4

transpose
→

1	3
2	4

←
reverse

3	1
4	2

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1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

1	5	9	13
2	6	10	14
3	7	11	15
4	8	12	16

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

transpose

reverse

1 5 9 13
j i

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

1 5 9 13
 0,0 0,1 0,2 0,3

1) Matrix Multiplication

2) Spiral Printing

} → Next Lecture

Thank you !!

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