Mahidol University

ITCS113
Fundamentals of Programming

Lecture 7 - 2-D Array

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Agenda

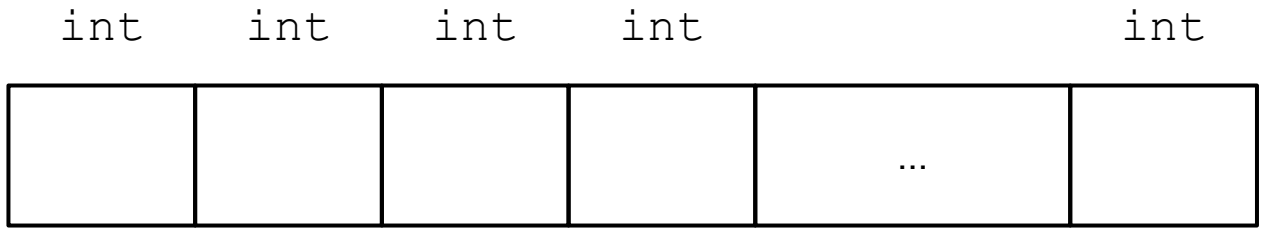
- Multidimensional Array
- 2D Array
- Loop Statement with 2D Array

Multidimensional Array

Problem with 1D

Suppose we would like to store a lab score of a student. A 1-D array is defined as follows:

```
int lab_scores[15];
```



Multidimensional Array

- Multidimensional arrays are arrays with **two or more** dimensions.
- All elements are of the same type.

```
// Define an n-D array
datatype arrayName[size_1][size_2]...[size_n];
```

Multidimensional Array

1D → 2D

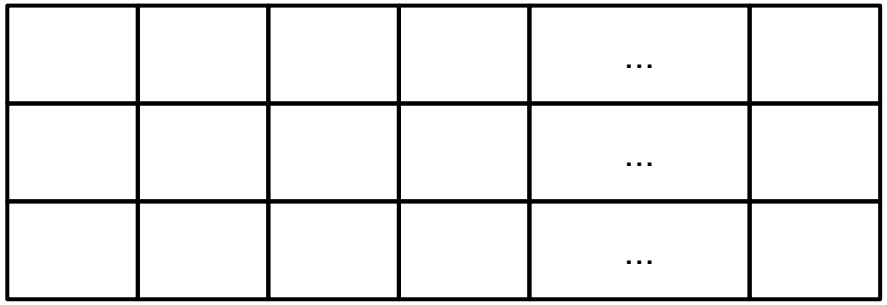
Multidimensional Array

2D → 3D

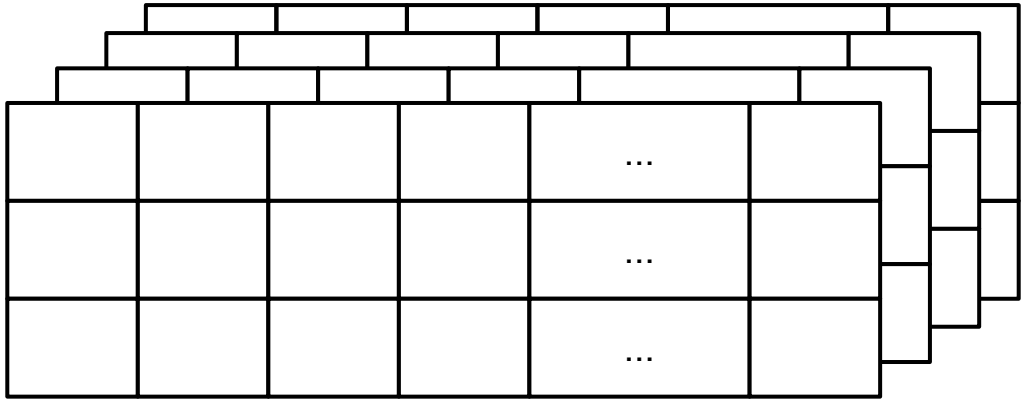
Multidimensional Array

1-D array

2-D array



3-D array



Applications

- Student scores
- Store datasets
- Images (W,H,C)
- Videos (T,W,H,C)
- ...

Size of house (square m.)	# of bedrooms	# of bathrooms	Newly renovated	Price (10,000฿)
52.3	1	2	N	115
103.4	3	3	Y	280
99.8	2	2	Y	210

Reference: [1,2]

2-D Array

2-D Array

A 2-D array can be conceptually thought of as a **table** or a **matrix**, consisting of rows and columns of values.

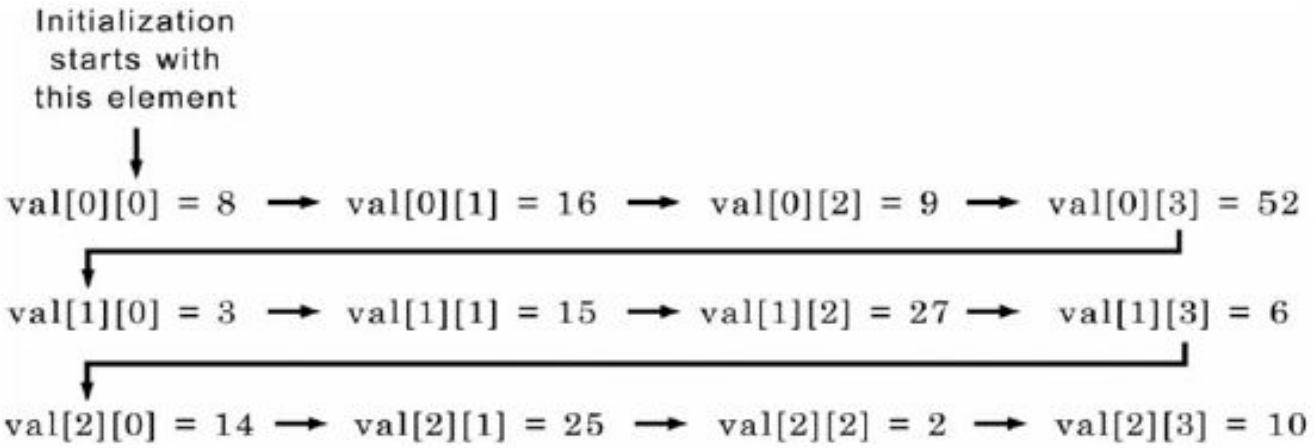
```
int lab_scores[38][15];
```

2-D Array: Initialization

2-D Array - Initialization

The inner braces can be omitted:

```
int val[3][4] = { 8,16,9,52,3,15,27,6,14,25,2,10 };
```



8	16	9	52
3	15	27	6
14	25	2	10

Initialization is done in **row order**.

Question 1

What are inside these 2D arrays?

```
int grades1[3][3] = {9,6,8,7,10,3,10,9,9};
int grades2[2][4] = {{6,8,9,5},{10,3,7,5}};
```


Question 1

Then, based on these:

```
int grades1[3][3] = {9,6,8,7,10,3,10,9,9};
int grades2[2][4] = {{6,8,9,5},{10,3,7,5}};
```

What are the outputs?

```
printf("%d\n", grades1[0][2]);
printf("%d\n", grades1[1][0] + grades1[0][1]);
printf("%d\n", grades1[1][1] + grades2[0][3]);
printf("%d\n", grades1[0][3] + grades2[4][1]);
```

Loop through 2-D Array

Loop with 2-D Array: Row-by-Row

```
int val[3][4] = { {8,16,9,52},
                  {3,15,27,6},
                  {14,25,2,10} };
```

8	16	9	52
3	15	27	6
14	25	2	10

Loop with 2-D Array: Col-By-Col

```
int val[3][4] = { {8,16,9,52},
                  {3,15,27,6},
                  {14,25,2,10} };
```

8	16	9	52
3	15	27	6
14	25	2	10

Lab Exercises