2D Arrays in C++

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Why 2D Arrays?

- One dimensional arrays are great, but why make such a fuss and create two dimensional arrays?
- What do we really gain from using a two dimensional array?
- What are some sensible uses of two dimensional arrays?

Declaring an Array

- Model:

  type name[row_size][column_size]

  – *type: The data type, example: int*

  – *name: The name of the array, example: grades*

  – *row_size: The row capacity of the array, example: 10*

  – column_size: The column capacity of the array, ex. 5

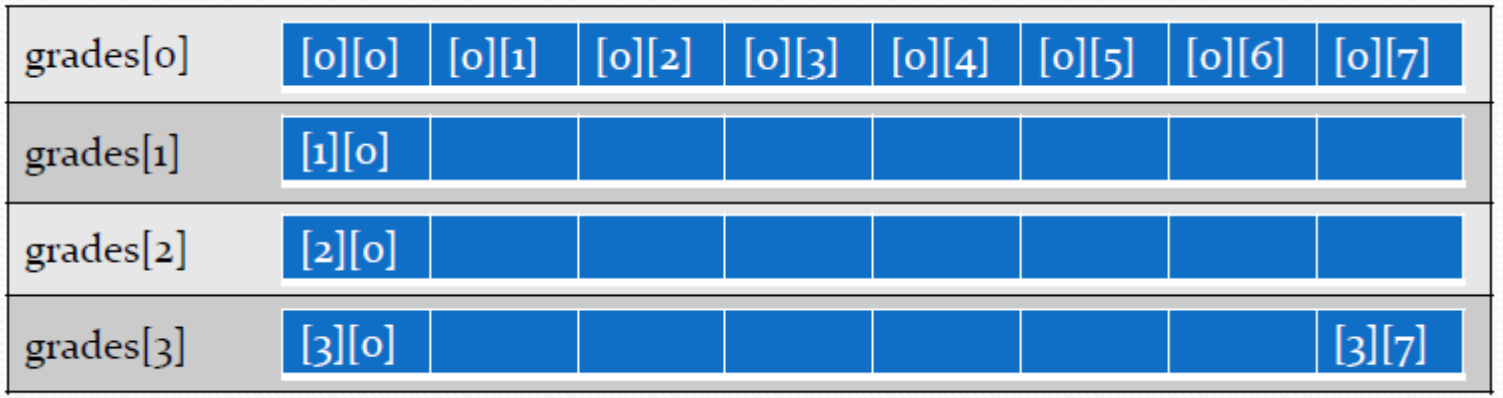
- int grades[22][6];
- string students[2][22];

Understanding parts of a 2D array

- Say we have the following array:

  int grades[4][8];

- Here is the graphical representation:



Understanding parts of a 2D array

- Same array:
  - int grades[4][8];
- In English the *grades variable is describe as an* ***array*** **of array of integers**

- While *grades[0], grades[1], … grades[3] are* ***array of*** **integers**

- And *grades[0][0] is simply an* ***integer***

Accessing Elements in the 2d Array

- If we have an 2D array declare as the following:
  - int grades[5][10];
- The elements of the array are as follows:
  - grades[0]
  - grades[1]
  - grades[2]
  - grades[3]
  - grades[4]
- Each “element” represent an array of 10 elements

Accessing Elements in the 2d Array

- We can assign values to **grades[0] as follows:**
  - grades[0][0] = 89;
  - grades[0][1] = 93;
  - grades[0][2] = 85;
  - grades[0][3] = 88;
  - grades[0][4] = 100;
  - grades[0][5] = 89;
  - grades[0][6] = 83;
  - grades[0][7] = 85;
  - grades[0][8] = 78;
  - grades[0][9] = 99;
- Likewise for grades[1], grades[2], grades[3], grades[4]

Printing elements of the 2D array

- So can we print out all the grades in the following manner?
  - cout << grades[0] << endl;
  - cout << grades[1] << endl;
  - cout << grades[2] << endl;
  - cout << grades[3] << endl;
  - cout << grades[4] << endl;
- Why or why not?

Printing an element of a 2D array

- We can use a for loop to printing out elements of the array grades[0]
- Code would look like this:

```
for ( int i = 0 ; i < 10 ; ++i )
        cout << grades[0][i] << " ";
cout << endl;
```

Printing Entire 2D array

- So if we need an array to print out elements of grades[0], then naturally to print out all the grades[x] we will need to employ a second loop.
- Code looks like this:

```
for( int r = 0 ; r < 5 ; ++r )
{
    for( int c = 0 ; c < 10 ; ++c )
        cout << grades[r][c] << " ";
    cout << endl;
}
```

Initializing the 2D array

- Sometimes we want to pre-initialize the array, we can do the following:
  - int lookup[3][2] = { {97, 93}, {87, 83}, {77, 73} };

- Sometimes we want to initialize the entire array to zero, we can do the following:
  - int sums[5][10] = {0};
    - {0} is a special code to C++, {1} doesn't work.

2D Arrays and Functions

2D Arrays and Functions

- Like regular arrays, two dimensional arrays can be passed into sub functions, and they are always passed by reference.

- It is important to note:
  - If the function is trying to access the entire 2D array or
  - An element of the 2D array, the 1D array.

Example of passing 2D array

- To pass entire 2D array into the function
  - int gradesSet[10][20];
  - printAllScore(gradesSet);
  - void printAllScore(int gradesSet[][20], int row, int col)

- The **COLUMN SIZE of the 2D array MUST be provided** while row size is optional.

Passing one element of 2D array

- To pass 1 element of the 2D array into the function
  - int gradesSet[10][20];
  - printRowScore(gradesSet[0]);
  - printRowScore(gradesSet[1]);
  - printRowScore(gradesSet[2]);
  - printRowScore(gradesSet[3]);
  - printRowScore(gradesSet[4]);

  - void printRowScore(int grades[], int col)