CPT 111 – Principles of Programming
Week 12 Programming Lab
# TWO-DIMENSIONAL ARRAY

Learning Outcomes:
- Describe two-dimensional array with multiple values and range.
- Apply two-dimensional array elements in data processing.
- Demonstrate arrays as function arguments.

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1. In a program you need to store the populations of B40, M40 and T20 categories of 12 countries.

   a. Define the arrays that may be used in parallel to store the populations of each categories.
   b. Construct a loop that uses these arrays to print each of its population of each categories.
   c. Modify into a two-dimensional array, and do (a) and (b).

2. Define a two-dimensional array of `ints` named `grades`. It should have 30 rows and 10 columns.

3. How many elements are in the following array?

   ```
   double sales[6][4];
   ```

4. Describe a statement that assigns the value 56893.12 to the first column of the first row of the array defined in Question 3.

5. Describe a statement that displays the contents of the last column of the last row of the array defined in Question 3.

6. Define a two-dimensional array named `settings` large enough to hold the table of data below. Initialize the array with the values in the table.

| | | | | |
|---|---|---|---|---|
| 12 | 24 | 32 | 21 | 42 |
| 14 | 67 | 87 | 65 | 90 |
| 19 | 1 | 24 | 12 | 8 |

7. Define a function called `displayArray7`. The function should accept a two-dimensional array as an argument and display its contents on the screen. The function should work with any of the following arrays:

```
int hours[5][7];
int stamps[8][7];
int autos[12][7];

int cats[50][7];
```

8. Look at the following array definition.

```
int numberArray[9][11];
```

Describe a statement that assigns 145 to the first column of the first row of this array.
Describe a statement that assigns 18 to the last column of the last row of this array.

9. `values` is a two-dimensional array of `float`s with 10 rows and 20 columns. Describe C++ code that sums all the elements in the array and stores the sum in the variable `total`.

10. `myMatrix` is a two-dimensional array with 10 rows and 10 columns. Describe C++ code to find the sum of the elements of its main diagonal from top-left to bottom-right.

11. An application uses a two-dimensional array defined as follows.

```
int days[29][5];
```

Describe code that sums each row in the array and displays the results.
Describe code that sums each column in the array and displays the results.

12. The Lo Shu Magic Square is a grid with 3 rows and 3 columns shown in below. The Lo Shu Magic Square has the following properties:

- The grid contains the numbers 1 through 9 exactly.
- The sum of each row, each column, and each diagonal all add up to the same number.

In a program you can simulate a magic square using a two-dimensional array. Define a function definition that accepts a two-dimensional array as an argument and determines whether the array is a Lo Shu Magic Square. Test the function in a program.

| | | | **15** |
|---|---|---|---|
| 4 | 9 | 2 | **15** |
| 3 | 5 | 7 | **15** |
| 8 | 1 | 6 | **15** |
| **15** | **15** | **15** | **15** |

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