Faculty of Information Technology, University of Moratuwa
BSc. (Hons) in Information Technology
BSc. (Hons) in Artificial Intelligence
Fundamentals of Programming IN1101

Level 1 – Semester 1 Lab Tutorial

MULTIDIMENSIONAL ARRAYS

Using C programming, it is possible to create an array that contains other arrays. The term "multidimensional array" refers to this type of array.
Take, for instance:

```
double x[3][4];
```

In this context, x is an array that has two dimensions. The array has a capacity of 12 different elements. One way to visualize the array is as a table with 3 rows and 4 columns in each row of the table.

	Column 1	Column 2	Column 3	Column 4
Row 1	x[0][0]	x[0][1]	x[0][2]	x[0][3]
Row 2	x[1][0]	x[1][1]	x[1][2]	x[1][3]
Row 3	x[2][0]	x[2][1]	x[2][2]	x[2][3]

Initializing Two-Dimensional Arrays

When initializing multidimensional arrays, it is possible to specify values enclosed in brackets for each row. The following is an initialization of the two-dimensional array.

```
int x[3][4] = {
        {0, 1, 2,  3},   /*  initializers for row indexed by 0 */
        {4, 5, 6,  7},   /*  initializers for row indexed by 1 */
        {8, 9, 10, 11}   /*  initializers for row indexed by 2 */
};
```

The nested braces, which point to the row that is to be written, are not required. The following initialization is the same as the one described in the earlier example.

```
int x[3][4] = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11};

// Alternatively, you might initialize the values as shown below:
int a[3][4]; // Declaration of the array
a[0][0] = 8; // Assign value 8 to the a[0][0] location
a[1][2] = 27; // // Assign value 27 to the a[1][2] location
```

Accessing Two-Dimensional Array Elements

Subscripts, or the array's row and column indexes, are used to locate a specific element in a two-dimensional array.

Example:

```c
#include <stdio.h>
int main ()
{
    // This is an array with five rows and two columns.
    // It looks like five single-dimensional arrays, with each having two elements
    int a[5][2] = { {1,2}, {3,4}, {5,6}, {7,8}, {9,10} };

    printf("0th array 0th element is %d\n",a[0][0]); // output is 1
    printf("3rd array 1st element is %d\n",a[3][1]); // output is 8

    int i, j;
    /* output each array element's value */
    for ( i = 0; i < 5; i++ )
    {
        for ( j = 0; j < 2; j++ )
        {
            printf("a[%d][%d] = %d\n", i,j, a[i][j] );
        }
    }

    return 0;
}
```

Exercises

1. Write a C program to create a multi-dimensional array of size 3x3 to initialize the following values. Then update the program to print the values as a matrix.

2	3	5
1	8	9
6	7	0

2. Update the above program to get the summation of each row.
3. Update the above program to get the summation of the diagonal values.
4. Write a C program that allow user to enter values for 3x3 matrix and print the output matrix.
5. Write a C program to find sum of two matrix of order 2*2 using multidimensional arrays where, elements of matrix are entered by user.
6. Multiply 2 matrices. (Use nested for loops)

Metrix1

2 2 3
3 2 4
1 3 4

Matrix 2

3 5 7
4 2 1
3 2 1

Expected output:

23 20 19
29 27 27
27 19 14