Object Oriented Programming Lab

FALL - 2022

LAB 04

FAST National University of
Computer and Emerging Sciences

Learning Outcomes

In this lab you are expected to learn the following:

- 2D Dynamic Pointers
- Dynamic Memory Allocation
- ND Dynamic Pointers

2D Dynamic Pointers

2D Pointers Declaration:

```cpp
#include <iostream>
using namespace std;
int main()
{
    int rowCount = 4;
    int colCount = 5;
    int **a = new int *[rowCount];
    for (int i = 0; i < rowCount; ++i)
    {
        a[i] = new int[colCount];
        // OR
        *(a + i) = new int[colCount];
    }
    return 0;
}
```

The above, for colCount= 5 and rowCount = 4, would produce the following:
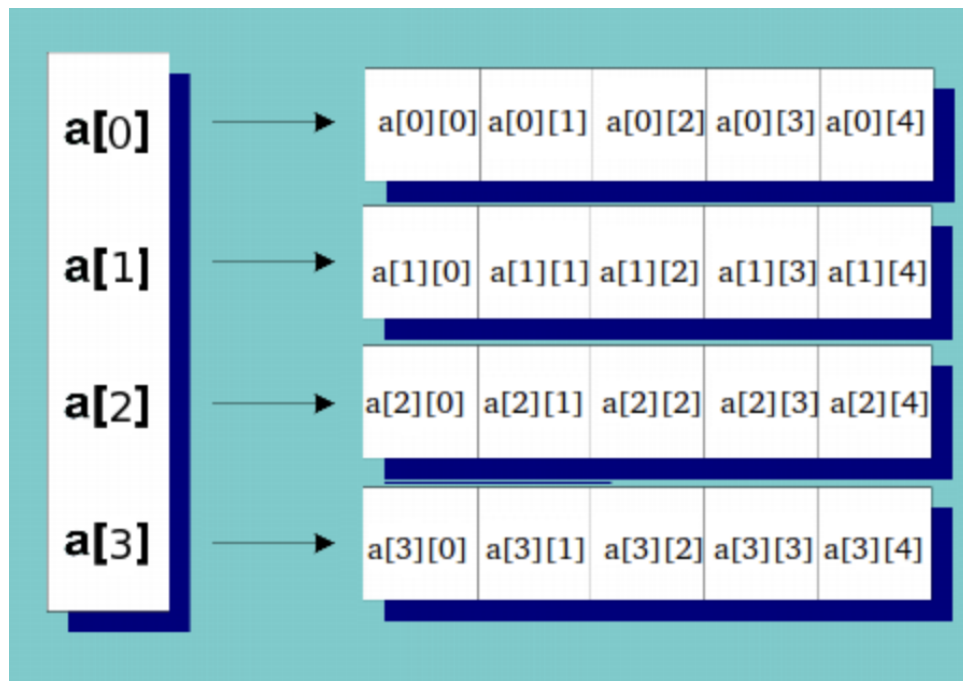
2D Pointers Declaration and Initialization:

```cpp
#include <iostream>
using namespace std;
int main()
{
    int rowCount = 4;
    int colCount = 5;
    int **a = new int *[rowCount];
    for (int i = 0; i < rowCount; ++i)
    {
        a[i] = new int[colCount];
        // OR
        *(a + i) = new int[colCount];
    }
    for (int i = 0; i < rowCount; ++i)
    {
        for (int j = 0; j < colCount; ++j)
        {
            a[i][j] = i + j;
            // OR
            *(*(a + i) + j) = i + j;
        }
    }
    for (int i = 0; i < rowCount; ++i)
    {
        for (int j = 0; j < colCount; ++j)
        {

            cout << *(*(a + i) + j) << " ";
        }
        cout << endl;
    }

    return 0;
}
```

Lab Tasks

Q 1. Write a function that receives three arguments:

(i) a 2D pointer p;

(ii) number of rows;

(iii) number of columns cols;

and return sum of the edges (boundary rows and columns which are shown as red area in the following figure) of the 2D array. Remember you have to calculate the sum of values at edges of the array shown as red area in the given figure only.

Prototype:

int calculateSum(int** p, int rows, int cols)

Q 2. Write a function to interchange the specified cols in the matrix. The function should receive the following arguments:

(i) a 2D pointer p;

(ii) number of rows;

(iii) number of cols;

(iv) the col numbers to be exchanged

And return the updated matrix with interchanged cols.

Prototype:

int** interchangeCols(int** p,int rows, int cols, int c1, int c2);

Q 3. Write a function that receives the following arguments:

(i) two 2D pointer p;

(ii) number of rows of both matrices;

(iii) number of columns of both matrices

and return the product of both matrices.

Prototype:

int** MatMul (int ** matrix1, int ** matrix2, int rowM1, int colM1, int rowM2, int colM2)

Q 4.

Declare and initialize a 3D dynamic array with the following size:

(i) 4 Pages

(ii) 2 Rows

(iii) 3 Columns

And initialize it with the following elements using loops:

```
0       1       2
1       2       3

1       2       3
2       3       4

2       3       4
3       4       5

3       4       5
4       5       6
```

Prototype:

```
int ***create3D(int pages, int rows, int cols)
```