

# Java - Introduction to Programming

## Lecture 11

### 2D Arrays In Java

It is similar to 2D matrices that we studied in 11th and 12th class.

- a. Creating a 2D Array - with **new** keyword

```
int[][] marks = new int[3][3];
```

- b. Taking a matrix as an input and printing its elements.

```
import java.util.*;

public class TwoDArrays {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);
        int rows = sc.nextInt();
        int cols = sc.nextInt();

        int[][] numbers = new int[rows][cols];

        //input
        //rows
        for(int i=0; i<rows; i++) {
            //columns
            for(int j=0; j<cols; j++) {
                numbers[i][j] = sc.nextInt();
            }
        }

        for(int i=0; i<rows; i++) {
            for(int j=0; j<cols; j++) {
                System.out.print(numbers[i][j]+" ");
            }
            System.out.println();
        }
    }
}
```

```
}
```

c. Searching for an element x in a matrix.

```
import java.util.*;

public class TwoDArrays {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);
        int rows = sc.nextInt();
        int cols = sc.nextInt();

        int[][] numbers = new int[rows][cols];

        //input
        //rows
        for(int i=0; i<rows; i++) {
            //columns
            for(int j=0; j<cols; j++) {
                numbers[i][j] = sc.nextInt();
            }
        }

        int x = sc.nextInt();

        for(int i=0; i<rows; i++) {
            for(int j=0; j<cols; j++) {
                //compare with x
                if(numbers[i][j] == x) {
                    System.out.println("x found at location (" + i + ", " + j +
                    ")");
                }
            }
        }
    }
}
```

## Homework Problems

1. Print the spiral order matrix as output for a given matrix of numbers.  
[Difficult for Beginners]

For example: for the given matrix,

|    |    |    |    |    |     |
|----|----|----|----|----|-----|
| 1  | 5  | 7  | 9  | 10 | 11  |
| 6  | 10 | 12 | 13 | 20 | 21  |
| 9  | 25 | 29 | 30 | 32 | 41  |
| 15 | 55 | 59 | 63 | 68 | 70  |
| 40 | 70 | 79 | 81 | 95 | 105 |

Spiral order is given by:

1 5 7 9 10 11 21 41 70 105 95 81 79 70 40 15 9 6 10 12 13 20 32 68 63 59 55  
25 29 30 29.

### APPROACH :

Algorithm: (We are given a 2D matrix of  $n \times m$  ).

1. We will need 4 variables:

- a. *row\_start* – initialized with 0.
- b. *row\_end* – initialized with  $n-1$ .
- c. *column\_start* – initialized with 0.
- d. *column\_end* – initialized with  $m-1$ .

2. First of all, we will traverse in the row *row\_start* from *column\_start*

to `column_end` and we will increase the `row_start` with 1 as we have traversed the starting row.

3. Then we will traverse in the column `column_end` from `row_start` to `row_end` and decrease the `column_end` by 1.

4. Then we will traverse in the row `row_end` from `column_end` to `column_start` and decrease the `row_end` by 1.

5. Then we will traverse in the column `column_start` from `row_end` to `row_start` and increase the `column_start` by 1.

6. We will do the above steps from 2 to 5 until `row_start <= row_end` and `column_start <= column_end`.

```
import java.util.*;

public class Arrays {

    public static void main(String args[]) {

        Scanner sc = new Scanner(System.in);

        int n = sc.nextInt();

        int m = sc.nextInt();

        int matrix[][] = new int[n][m];

        for(int i=0; i<n; i++) {

            for(int j=0; j<m; j++) {

                matrix[i][j] = sc.nextInt();

            }

        }

        System.out.println("The Spiral Order Matrix is : ");

        int rowStart = 0;
```

```

int rowEnd = n-1;

int colStart = 0;

int colEnd = m-1;

//To print spiral order matrix

while(rowStart <= rowEnd && colStart <= colEnd) {

    //1

    for(int col=colStart; col<=colEnd; col++) {

        System.out.print(matrix[rowStart][col] + " ");

    }

    rowStart++;

    //2

    for(int row=rowStart; row<=rowEnd; row++) {

        System.out.print(matrix[row][colEnd] + " ");

    }

    colEnd--;

    //3

    for(int col=colEnd; col>=colStart; col--) {

        System.out.print(matrix[rowEnd][col] + " ");

    }

    rowEnd--;

    //4

    for(int row=rowEnd; row>=rowStart; row--) {

```

```

        System.out.print(matrix[row][colStart] + " ");

    }

    colStart++;

    System.out.println();

}

}

}

```

2. For a given matrix of N x M, print its transpose.

```

import java.util.*;

public class Arrays {

    public static void main(String args[]) {

        Scanner sc = new Scanner(System.in);

        int n = sc.nextInt();

        int m = sc.nextInt();

        int matrix[][] = new int[n][m];

        for(int i=0; i<n; i++) {

            for(int j=0; j<m; j++) {

                matrix[i][j] = sc.nextInt();

            }

        }

    }

}

```

```
System.out.println("The transpose is : ");

//To print transpose

for(int j=0; j<m ;j++) {

    for(int i=0; i<n; i++) {

        System.out.print(matrix[i][j]+" ");

    }

    System.out.println();

}

}
```