K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

Course: Data Structure

(Course Code : ENCS205)

UNIT-1: Foundations of Data Structures

School of Engineering & Technology
K.R. Mangalam University

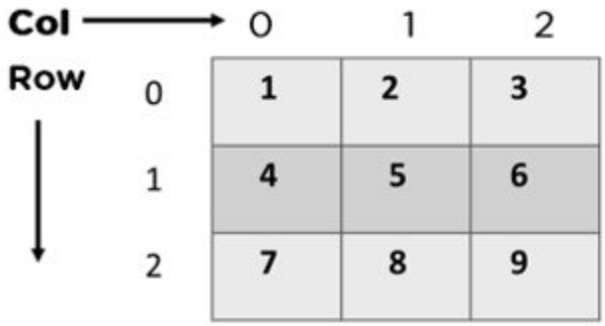
SESSION 11:

Multidimensional Array

Multi-Dimensional Arrays

In multi-dimensional arrays, we have two categories:

1. Two-Dimensional Arrays
2. Three-Dimensional Arrays



1. Two-Dimensional Arrays

In array involving two subscripts [] [] is known as a two-dimensional array. They are also known as the array of the array. Two-dimensional arrays are divided into rows and columns and are able to handle the data of the table.

Syntax: DataType ArrayName[row_size][column_size];

For Example: int arr[3][3]

Two-dimensional Array (2-D Array)


```
#include <iostream>
using namespace std;

int main() {
    // Declare and initialize a 2D array (3x3 matrix)
    int matrix[3][3] = {
        {1, 2, 3},
        {4, 5, 6},
        {7, 8, 9}
    };

    // Declare an array to store the transpose
    int transpose[3][3];

    // Compute the transpose of the matrix
    for (int i = 0; i < 3; i++) {
        for (int j = 0; j < 3; j++) {
            transpose[j][i] = matrix[i][j];
        }
    }
```

Explanation:

2D Array Declaration and Initialization: The matrix variable is declared as a 2D array and initialized with integers in a 3x3 layout. This represents a simple square matrix.

Transpose Calculation: A nested loop iterates through each element of the matrix. Elements are swapped between rows and columns to create the transpose, which is stored in the transpose array.

Output: The program first prints the original matrix and then the transposed matrix. Each element is accessed using its row (i) and column (j) indices.

2. **Three-Dimensional Arrays**

When we require to create two or more tables of the elements to declare the array elements, then in such a situation we use three-dimensional arrays.

Syntax: DataType ArrayName[size1][size2][size3];

For Example:

```
int a[2][2][3];
```

Three-dimensional Array(3-D Array)

- Three dimensions
- An array of 2-dimensional arrays.

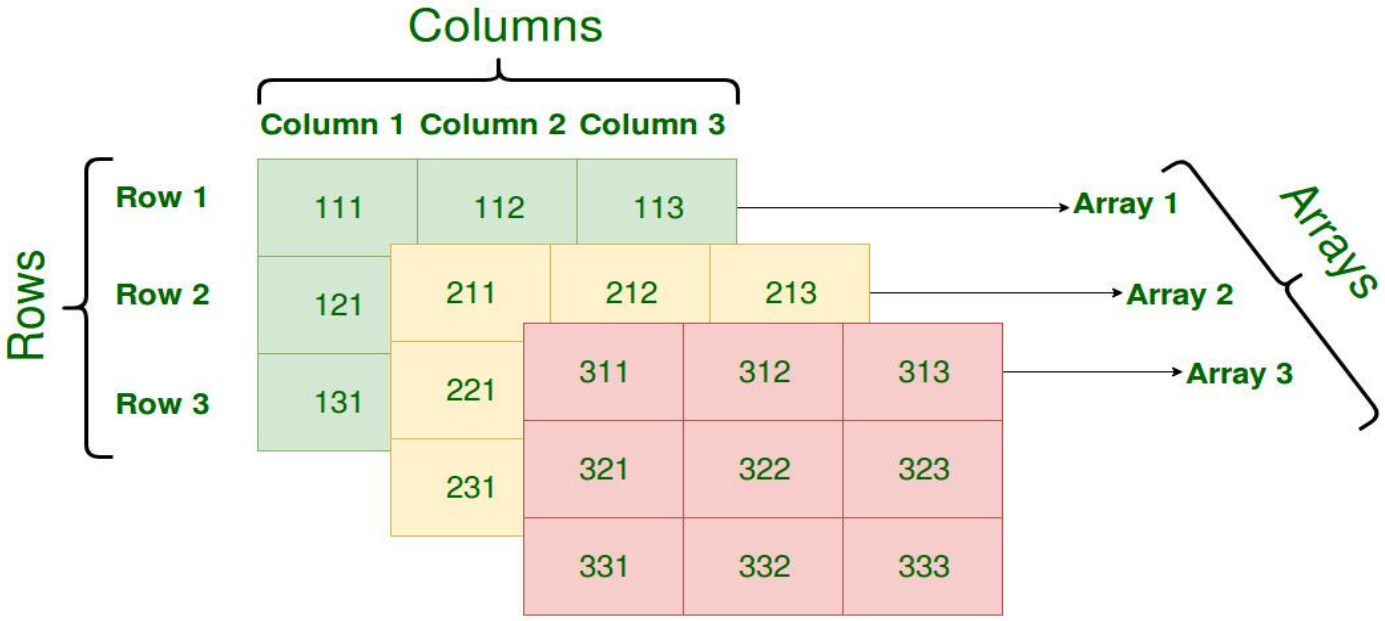


Fig.9: Examples of Three -dimensional Array

Situation- Based Questions

Q1 You are working on a scientific simulation that involves modeling weather patterns across a geographical area. Each grid cell in the simulation has various weather attributes, but many cells have default values due to the sparse nature of weather phenomena. Which type of array would you use to represent the weather data efficiently?

Q2 You are developing a game where players move around on a game board represented by a grid. Each cell in the grid can either be empty or contain an obstacle. How would you represent this game board using arrays, and which type of array would be most appropriate?

Situation- Based Questions

Q3 You are developing a program to manage a library's collection of books. Each book has a different number of authors, and you want to efficiently store this information. Which type of array would you select for representing the authors of each book?

Situation- Based Questions (Answers)

A1: Sparse array, as it efficiently handles datasets with many default or empty values, which is common in weather simulations.

A2: 2D array, as it provides a grid-like structure that matches the layout of the game board.

A3: Dynamic array (ArrayList in Java, list in Python), as it can dynamically resize to accommodate varying numbers of authors for each book.

THANK YOU