Multi Dimensional Array

Multi Dimensional Array(2-D Array): A multi-dimensional array is an array of arrays. 2-dimensional arrays are the most commonly used. They are used to store data in a tabular manner.

Syntax of Declaration of Single Dimensional Array:

Type arrayname[row_size][column-size];

Example:

int A[10][5];

char B[5][5];

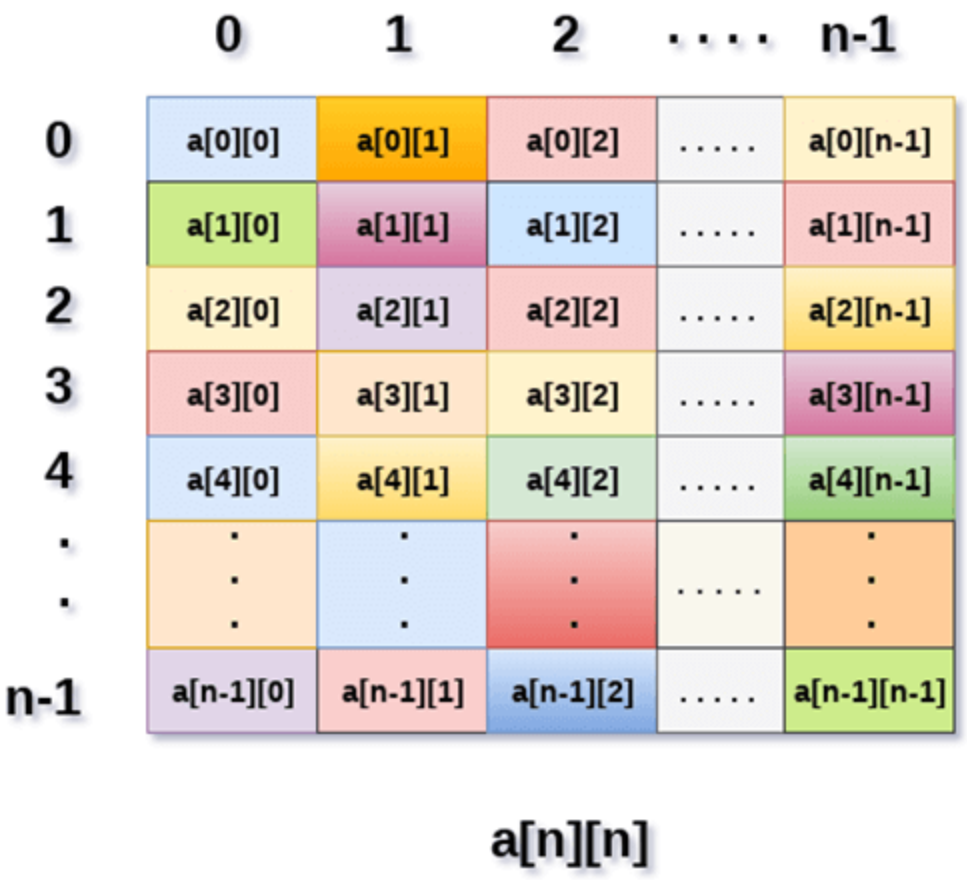
float C[6][6];

2D Array of size 3 x 5

2-D Array Initialization:

int A[3][5] = {{5,12,17,9,3},{13,4,8,14,1},{9,6,3,7,21}};

Representation of multi Dimensional Array:



Address Calculation in a multi Dimensional Array:

Address of an element of a multi dimensional array is calculated in two forms given below:

1. **Row Major Order**

   The address of an element in multi dimensional array using row major order is calculated using the following formula:

Address of A [I][J] = B + W * [N *(I – L_R) + (J – L_C)]

Where,

B= (Base Address): The address of first element in an array.

W= (width): storage size (in bytes) acquired by one element in array.

I= Row subscript of element whose address is to be found.

J = Column subscript of element whose address is to be found.

L_R = Lower limit of row, if not given assumed zero(0).

L_C = Lower limit of column, if not given assumed zero(0).

M= Number of rows of matrix.

N= Number of columns of matrix.

2. **Column Major Order**

The address of an element in multi dimensional array using column major order is calculated using the following formula:

Address of A [I][J] = B + W * [(I – L_R) +M* (J – L_C)]

Note: **if number of rows and columns of matrix is given as A [L_R ------U_R][L_C ----U_C] then,**

Number of rows M = (U_R –L_R) +1

Number of columns N = (U_C –L_C) +1

Examples:

Q1. An array X [-15…….10, 15……40] requires one byte of storage. If beginning location is 1500 determine the location of X [15][20].

Solution:
As number of rows and columns is not given, so first calculate number of rows and columns using formula,

Number of rows M = (U_R –L_R) +1

= (10-(-15)) + 1

= 26

Number of columns N = (U_C –L_C) +1

= (40 – 15) + 1

= 26

a. **Row major wise**

Address of A [I][J] = B + W * [N *(I – L_R) + (J – L_C)]

Where,
B= 1500
W= 1 byte
I= 15
J=20
N=26
L_R = -15
L_C = 15

Address of A [15][20] = 1500+1*[26*(15-(-15))+(20-15)]

= 1500 +1*[26*30+5]

= 2285

b. <u>Column major wise</u>

Address of A [I][J] = B + W * [(I – L_R) +M* (J – L_C)]

Address of A [15][20]= 1500+1*[(15-(-15))+26*(20-15)]

= 1500+1*[30+26*5]

= 1660