/* Addressing an element at a particular in 2-d- Array

Let A[3][4]

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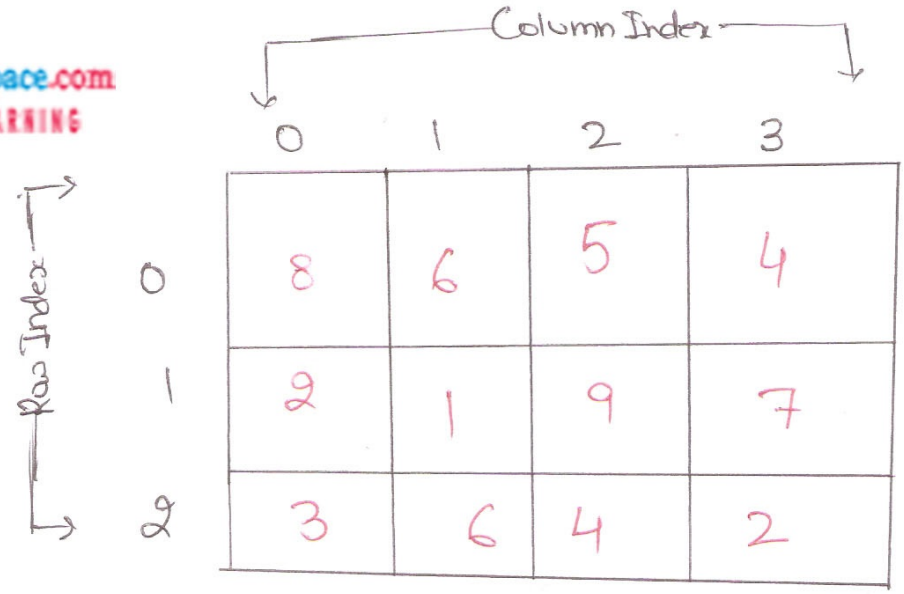


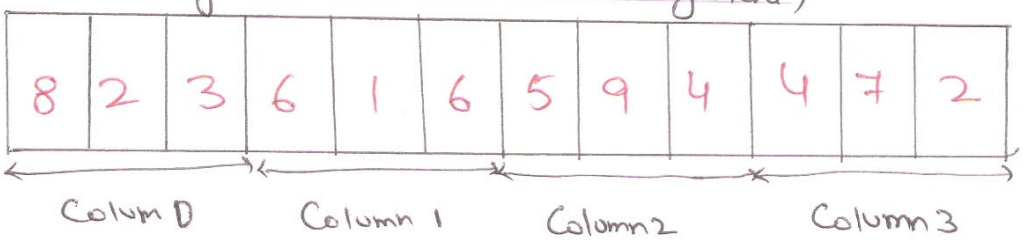
2-d Array

While Storing the elements of 2D-Array in Memory, these are allocated Contiguous memory locations. Therefore - 2D Array must be linearized So as to enable their storage.

Two ways to linearize it
→ Row Major
→ Column Major

Row Major (Row wise)

Column-Major (Column-wise-Arrangement)



Row Major System:-

The address of a location in Row Major System

Address of A[i][j] = B+w*[N*(i-Lr)+(j-Lc)]

Column Major System →

The address of a location in Column Major System

Address of A[i][j] column major wise = B+w*[(i-Lr)+M*(j-Lc)]

Where

B= Base address

i = Row Subscript of element whose address to be found.

j = Column Subscript of element whose address to be found.

W = Storage Size of an element

Lr = Lower limit of row/start row index of matrix, if not given then assume 0 (zero)

Lc = Lower limit of column/ start column index of → of matrix, if not given then assume 0 (zero)

M = Number of rows of the given matrix

N = Number of column of the given matrix

** Usually no. of rows and column of a matrix are given like A[10][15], A[5][2] but if it's given as.

A[Lr...Ur][Lc.....Uc]

So in this case number of rows and column will be calculated as.

rows(M) = (Ur-Lr)+1

Column(N) = (Uc-Lc)+1

Example :

An Array X[-15.....10,15.....40] requires one byte of Storage and the beginning location is 1500 so determine the location of X[15][20]

Solution

→ we have to find the No. of Rows and Columns of matrix X

$M = (U_r - L_r) + 1 \Rightarrow [10 - (-15)] + 1 \Rightarrow 26$

$N = (U_c - L_c) + 1 \Rightarrow [40 - 15] + 1 \Rightarrow 26$

(i) Row Major Wise Calculation of X[15][20]

B = 1500, W = 1 byte, I = 15, J = 20, L_r = -15, L_c = 15

N = 26

Address of A[i][j] = B + W * [N * (i - L_r) + (j - L_c)]

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

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

= 1500 + 785 = 2285

(ii) Column Major Wise Calculation of X[15][20]

B = 1500, W = 1; i = 15, j = 20, L_r = -15, L_c = 15 M = 26

X[15][20] = B + W * [(i - L_r) + M * (j - L_c)]

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

= 1500 + 1 * [30 + 26 + 5] = 1500 + 1 * (160)

= 1660