

Multi Dimensional Array(2-D Array)

Address Calculation in a multi Dimensional Array

1. An array $\text{Arr}[15][20]$ is stored in the memory along the row with each element occupying 4 bytes of memory. Find out the Base address and address of the element $\text{Arr}[3][2]$, if the element $\text{Arr}[10][25]$ is stored at the address 1500.

Solution:

Total no. of Rows $R=15$

Total no. of Columns $C=20$

Lowest Row $lr=0$

Lowest Column $lc=0$

Size of element $W=4$ bytes

$\text{Arr}[I][J]$ i.e., $\text{Arr}[5][2]=1500$

Arrangement Order: Row wise

Base Address $B=?$

$\text{Arr}[I][J]=B+W(C(I-lr)+(J-lc))$

$\text{Arr}[5][2]=B+4(20(5-0)+(2-0))$

$1500=B+408$

$B=1092$

Base Address = 1092.

$\text{Arr}[3][2]=B+W(C(3-0)+(2-0))$

$=1092+4(20(3-0)+(2-0))$

=1092+248

=1340

Arr[3][2]=1340.

2. An array **VAL[1..15][1..10]** is stored in the memory with each element requiring 4 bytes of storage. If the base address of array **VAL** is 1500, determine the location of **VAL[12][9]** when the array **VAL** is stored (i) Row wise (ii) Column wise

Solution:

Base address B=1500

Element width w=4 bytes

Total rows r=15

Total columns c=10

ARR[I][J] = ARR[12][9] => I=12, J=9

Lowest row index lr=

Lowest column index lc=0

(i) **Row wise**

$$\text{VAL}[I][J] = B + w(c(I - lr) + (J - lc))$$

$$\text{VAL}[12][9] = 1500 + 4(10(12-1) + (9-1))$$

$$= 1500 + 472$$

$$= 1972$$

(ii) **Column wise**

$$\text{VAL}[I][J] = B + W(I-lr) + R(J-lc)$$

$$=1500+4((12-1)+15(9-1))$$

$$=1500+4(131)$$

$$=1500+524$$

$$=2024$$