

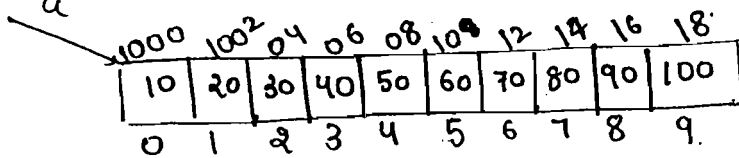
Array:

EX1  $\text{int } a[10] = \{10, 20, 30, 40, 50 \dots 100\}$   
 (declaration)

Identifier / variable / fn name.  
 iden

→ scan from left due to LL or LR parser  
 Top down Bottom up

$\text{int } a[10]$  a is array of (size 10) having elements as integer.  
 a  
 winner



a is array which contain 10 elements where everyone is Integer

Integer = 2 Bytes

$j-i$  → gives elements before j  
 $j-i+1$  → gives elements including j

x {  $\text{stop.}$   
 $(\text{int } a)[10]$   
 a is a Integer

(Brackets) ( ) have Left to Right associative.  
 (it come first it will be done)

print a : 1000 will print (array name print gives Base address will print)

print variable name : print the value of that value

$$\text{LOC}(a[3]) = 1000 + (5-0) * 2 = 1010$$

for LOC → (&) reference.  
 \* Dereference

$$\text{LOC}(a[9]) = 1000 + (9-0) * 2 = 1018$$

using this formula anyone can be accessed  
 ↓  
 Random access.

EX 2

A [75.....330]      330 - 75 + 1 = 276 elements  
 ↙ starting index      ↘ ending index

BA = 1000, c = 10 (size)

$$a[290] = 1000 + 290 \times 10 = 1000 + 2900 = 3900$$

$$a[290] = \cancel{3900} \text{ (3150)}$$

(290 - 75)
215 × 10
2150
1000
3150

EX 3

A [-90]      (591)      500 - (-90) + 1 = 591  
 500  
 BA = 0, c = 5 Bytes

$$\text{LOC}(A[393]) = 0 + (393 - (-90)) \times 5$$

$$= 0 + (393 + 90) \times 5$$

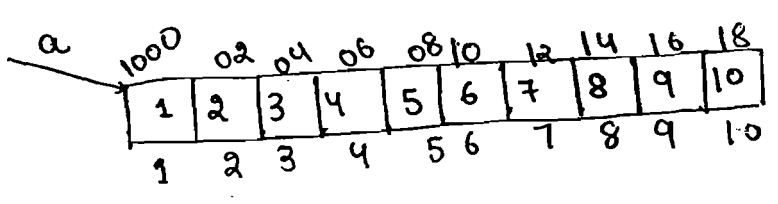
$$= 2415$$

1	393
	92
4	485
	* 5
	2415

NOTE

A [lb.....ub]  
 BA, c.  

$$\text{LOC}(A[i]) = BA + (i - lb) \times c$$



$$\text{LOC}(a[3]) = 1000 + (3 - 1) \times 2 = 1000 + 4 = 1004$$

extra.

Note  
 By default array index start from 0 not from 1 because  
 no need to calculate offset value (subtraction)  
 (No need to perform extra subtraction)

2D-Array:

int A [1.....4, 1.....3]  
 1 2 3       $4-1+1 = 4$  rows  
                                   $3-1+1 = 3$  columns.

1	a <sub>11</sub>	a <sub>12</sub>	a <sub>13</sub>
2	a <sub>21</sub>	a <sub>22</sub>	a <sub>23</sub>
3	a <sub>31</sub>	a <sub>32</sub>	a <sub>33</sub>
4	a <sub>41</sub>	a <sub>42</sub>	a <sub>43</sub>

Row major order

4 x 3 = 12 elements = 12 slots needed to store

1000	02	04	06	08	10	12	14	16	18	20	22
a <sub>11</sub>	a <sub>12</sub>	a <sub>13</sub>	a <sub>21</sub>	a <sub>22</sub>	a <sub>23</sub>	a <sub>31</sub>	a <sub>32</sub>	a <sub>33</sub>	a <sub>41</sub>	a <sub>42</sub>	a <sub>43</sub>
0	1	2	3	4	5	6	7	8	9	10	11

Row wise storing

How many bytes needed  
 $1022 - 1000 + 1 = 22 + 1 = 23$  Bytes.

1st row : 2nd-row : 3rd row : 4th row

$$\begin{aligned} \text{LOC}(A[4][3]) &= 1000 + 3 * 4 (2) \\ &= 1000 + 12 * 2 \\ &= 1024 \end{aligned}$$

$$\begin{aligned} &(4-1) (3-1) \\ &3 * 2 * 2 \\ &6 * 2 \\ &= 12 \end{aligned}$$

$$\begin{aligned} \text{LOC}(A[4][3]) &= 1000 + [(4-1) * 3 + (3-1)] * 2 \\ &= 1022 \end{aligned}$$

$$\begin{aligned} &(3-1) * 4 (2) \\ &2 * 8 \end{aligned}$$

Ans

$$\begin{aligned} \text{Loc}(a[2][3]) &= 1000 + [(2-1) * 3 + (3-1)] * 2 \\ &= 1000 + [3 + 2] * 2 \\ &= 1000 + 10 \\ &= 1010 \end{aligned}$$

$$\begin{aligned} &\frac{(3) * 3}{9 + 2} \\ &11 * 2 \\ &1000 + 22 \\ &= 1022 \end{aligned}$$

ex 2

row  $\Rightarrow 76 - 29 + 1 = 48 \Rightarrow 108 \text{ c.}$

A = [29.....76, 93.....200]

BA = 1000, c = 10 Row major order

$$\begin{aligned} \text{LOC}(A[70][190]) &= 1000 + [(70-29) * 108 + (190-93)] * 10 \\ &= 1000 + [4428 + 20] * 10 \\ &= 1000 + 44480 \\ &= 45480 \end{aligned}$$

$$\begin{array}{r} 70 \\ 29 \\ \hline 41 \\ 108 \\ \hline 432 \times \\ \hline 4428 \end{array}$$

$$\begin{array}{r} 76 \quad 200 \\ 29 \quad 93 \\ \hline 47 \quad 107 \\ 190 - 93 \\ \hline 44480 \\ 1000 \\ \hline 45480 \end{array}$$

$$\text{ex(3)} \quad A[-200 \dots +200, -300 \dots -150]$$

$$200 - (-200) + 1 \qquad -150 - (-300) + 1$$

$$\qquad \qquad \qquad -150 + 300 + 1$$

$$\qquad \qquad \qquad 150 + 1$$

$$\qquad \qquad \qquad = 151$$

$$BA = 0, c = 1, \text{RMO}$$

$$\text{LOC}[A[-3][70]] = D + \left[ \begin{matrix} 0 & -3 - (-200) \\ + & [-150 - (-300)] \end{matrix} \right] * 151$$

$$= 197 * 151 + 130$$

$$= 29747 + 130$$

$$= 29877$$

$$\begin{array}{r} 200 \\ - 3 \\ \hline 1 \\ 300 \\ - 5 \\ \hline 295 \end{array}$$

$$\begin{array}{r} 4 \quad 197 \\ + 151 \\ \hline 31 \quad 197 \\ 1985 \times \\ 197 \times \\ \hline 29747 \end{array}$$

$$\begin{array}{r} 300 \\ - 170 \\ \hline 130 \end{array}$$

NOTE:  $ub_1 - lb_1 + 1 = nr$   
 $A[lb_1 \dots ub_1, lb_2 \dots ub_2]$   
 $BA + c, \text{RMO}$

$$\text{LOC}(A[i][j]) = BA + \left[ (i - lb_1) * nc + (j - lb_2) \right] * c$$

NOTE:  
column Major order = 48 = 108

$$\text{ex(4)} \quad A[29 \dots 76, 93 \dots 200]$$

$$BA = 1000, c = 10, \text{CMO}$$

$$\text{L}(A[70][190]) = 1000 + \left[ (190 - 93) * 48 + (70 - 29) \right] * 10$$

$$= 1000 + [87 * 48 + 41] * 10$$

$$= 47970$$

$$\begin{array}{r} 190 \\ 93 \\ \hline 87 \\ 70 \\ - 29 \\ \hline 41 \end{array}$$

$$\begin{array}{r} 87 \\ 48 \\ \hline \end{array}$$

last element address = last elem add  
in RMO in CMO

$$A = [-200 \dots +200, -300 \dots -150]$$

$$BA = 0 \quad C = 1 \quad \text{rmo}$$

$$\text{LOC}(A[-3][-170]) = 0 + [(-170 + 300) \times 401 + (-3 + 200)] \times 1$$

$$= 130 \times 401 + 197$$

$$= 52327$$

$$\begin{array}{r} 300 \\ 170 \\ \hline 1230 \end{array}$$

$$\begin{array}{r} 401 \\ 13 \\ \hline 1203 \\ 401 \times \\ \hline 52130 \\ 197 \\ \hline 52327 \end{array}$$

NOTE:  $A(a_{b1} \dots a_{b1} \quad a_{b2} \dots a_{b2})$   $BA$   
 $= nr$   $c$

$$\text{LOC}(A[i][j]) = BA + [(j - a_{b1}) \times nr + (i - a_{b1})] \times c$$

### 3D-array

EX(1)

$$A[23 \dots 49, 2 \dots 19, 11 \dots 29]$$

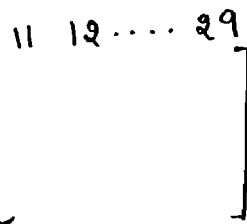
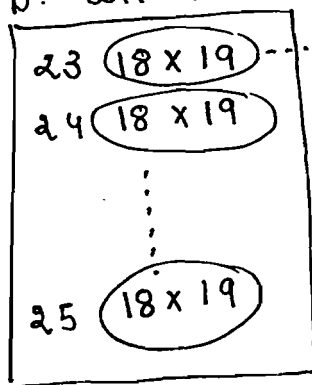
$$\begin{array}{l} \text{no of 2D} = 49 - 23 + 1 \\ 26 + 1 \\ 27 \end{array}$$

$$\begin{array}{l} n_1 = 19 - 2 + 1 \\ 17 + 1 \\ 18 \end{array}$$

$$\begin{array}{l} n_2 = 29 - 11 + 1 \\ 18 + 1 \\ 19 \end{array}$$

$$18 \times 19 \Rightarrow 2D$$

3D: collections of 2D.



① collects of elements  
 $\downarrow$   
 11D

② collection of 2D  
 $\downarrow$   
 2D

$$BA = 1000, \quad C = 10, \quad \text{rmo}$$

$$\text{LOC}(A[40][15][20]) = 1000 + [(40 - 23) \times 27 + (15 - 2) \times 19 + (20 - 11)] \times 10$$

size of this  
 $(18 \times 19)$

$$= 61700$$

$$\begin{array}{r} 40 \\ 23 \\ \hline 17 \\ 27 \\ \hline 9 \end{array}$$