31/8/19

2 Linear Data Structure

* Array :

Ans Array is Collection of elements having same data type.

=> Representation Of Array

Ans There is 2 ways as follow :

(1) Row Major Representation
(2) Column " "

(1) Row Major

	0	1	2	3
0	8	6	5	4
1	3			→
2				
3				

→

row wise

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(2) Column Major

	0	1	2	3
0	3	17		
1	5			
2	6			
3	8			

Column wise

* Calculate address for array elements int a[3][4]. Base addr. = 1050. Find addr. Of Element a[2][3].

	0	1	2	3
0	1050	52	54	56
1	58	60	62	64
2	66	68	70	72

row wise

	0	1	2	3
0	50	56	62	68
1	52	58	64	70
2	54	60	66	72

Column wise

1072 1072

* $A_1 = [\underbrace{\overset{L_r}{5}, \ldots, \overset{U_r}{10}}_{\text{row}} , \underbrace{\overset{L_c}{-5} \ldots \overset{U_c}{+9}}_{\text{column}}]$

Find A[8][-2]

L_r = Lower Row, L_c = Lower Column
U_r = Upper Row, U_c = Upper Column

No. Of row = $U_r - L_r + 1$
$= 10 - 5 + 1$
$= 6$

No. Of Column = $U_c - L_c + 1$
$= 9 - (-5) + 1$
$= 15$

Row Major Formula

$$a[i][j] = \text{Base} + \text{Size}\,[c * (i - L_r) + (j - L_c)]$$

C = no. Of Column
i = row index
j = Column index
Size = Data type

$$a[8][-2] = 10 + 2\,(15 * (8-5) + (-2-(-5)))$$

$$= 10 + 2\,(15 * (3) + 3))$$

$$= 10 + 2\,(45 + 3)$$
$$= 10 + 2\,(48)$$
$$= 10 + 96 = 106$$

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Column Major Formula

$a[i][j] = \text{Base} + \text{Size}\,((i - L_r) + R * (j - L_c))$

R = no. of row

$a[8][-2] = 10 + 2\,((8-5) + 6\,(-2+5))$

$= 10 + 2\,((3) + 6\,(3))$

$= 10 + 2\,(3 + 18)$

$= 10 + 2\,(21)$

$= 10 + 42$

$= 52$

* Given a 2 dimensional array $Z_1(2:9,\ 9:18)$ stored in Column major Order with Base addr. 100 & Size of Each element is 4 bytes. Find $Z_1(4, 12)$

$R = 9 - 2 + 1$ $\quad$ $C = 18 - 9 + 1$

$= 8$ $\quad$ $= 10$

$a[4, 12] = 100 + 4\,((4-2) + 8\,(12-9))$

$= 100 + 4\,((2) + 8\,(3))$

$= 100 + 4\,(26)$

$= 100 + 104 = 204$

* $Z_1 (1:8, 7:14)$

$R = 8 - 1 + 1$
$= 8$

$C = 14 - 7 + 1$
$= 8$

$B = 100$, $S = 4$, $A_1 (4, 12) = (?)$

$a[4, 12] = 100 + 4 (8 * (4-1) + (12-7))$

$= 100 + 4 (8 * 3 + 5)$
$= 100 + 4 (24 + 5)$
$= 100 + 4 (29)$
$= 100 + 116$
$= 216$

* Row major

$a[i][j] = Base + Size (c * (i - L_r) + (j - L_c))$

$r = (1 : 4)$
$C = (5 : 8)$ Base addr. = 2000
$S = 2$ bytes
$a[3][7]$

$a[3][7] = 2000 + 2(4*(3-1)+(7-5))$

$= 2000 + 2(8+2)$

$= 2000 + 20$

$= 2020$

* int a[4][5]

a[3][4] = (?) and a[2][2] = (?)

Base = 1020

Row major = Base + Size $(C*(i-L_r) + (j-L_c))$

R = 4, C = 5

$= 1020 + 2(5*(3-0) + (4-0))$

$= 1020 + 2(15+4)$

$= 1020 + 2(19)$

$= 1020 + 38$

$= 1058$

Column Major = Base + Size $((i - L_r) + R(i - L_c))$

$= 1020 + 2(3 + 16)$

$= 1020 + 2(19)$

$= 1058$

* $a[2][2]$

row $= 1020 + 2(5 * (2) + (2))$

$= 1020 + 2(10 + 2)$

$= 1020 + 24$

$= 1044$

Column $= 1020 + 2(2 + 4(2))$

$= 1020 + 2(10)$

$= 1020 + 20$

$= 1040$

* Sparse Matrix

→ There may be a situation in which a matrix containing more number of 0 values then non-zero values.

→ Two ways of Representation:

① Triplet Representation

② Linked "

a) Triplet Representation

	0	1	2	3	4	5	6
0		12					
1			23				
2				13			
3					64		
4		47				25	
5					81		63

$6 \times 7 = 42 \times 2$

$= 84$ byte

Index	No. of row	No. of col.	Value
0	6	7	8
1	0	1	12
2	1	2	23
3	2	3	13
4	3	4	64
5	4	1	47
6	4	5	25
7	5	4	81
8	5	6	63

* Linked Representation