TUTORIAL - 3

(D-12)
ROLL NO: U19CS012

1) A[m][m]

W (width) = 4 bytes

Addr(A[1][1]) = 1500 — (i) (Column-Major)

Addr(A[4][5]) = 1608 — (ii)

Using Column Major, Address of A[i][j] = Base + W × [(I - L_r) + M × (J - L_c)]
(M: size of row)

$L_r = 0$, $L_c = 0$, Base = B, M = m

B + 4 × ((1-0) + m(1-0)) = 1500 — (i)

B + 4 (1+m) = 1500 — (1)

B + 4 × ((4-0) + m(5-0)) = 1608 — (ii)

B + 4 (4 + 5m) = 1608 — (2)

(2) - (1)

4(3 + 4m) = 108

$$\left[m = \frac{(27-3)}{4} = 6 \right]$$

ANSWER: m = 6 order of matrix (6×6)

2) P[15][10]

W (width) = 8 bytes Stored: Row-major

P[0][0] = 1400 // Base Address

Addr(P[10][7]) = (?)

Using Row-Major, Addr(P[i][j]) = Base + W × [(i - L_r) × N + (j - L_c)]

$L_r = 0$, $L_c = 0$, Base = B, N = 10 (column)

Addr(P[10][7]) = 1400 + 8 × [(10-0) × 10 + (7-0)]

= 1400 + 8 × (107)

= 2256

ANSWER: Addr (P[10][7]) = 2256

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(D-12)
Roll No: 019CS012

3.) Given: A[m][n], W(width) = 4 bytes

Addr(A[1][1]) = 1500

Addr(A[4][5]) = 1608

Stored Column Major wise Addr(A[i][j]) = B + W × ((i - Lr) + M(j - Lc))

(M = size of row = m)

$B + 4((1-0) + m(1-0)) = 1500$ — ①

$B + 4((4-0) + m(5-0)) = 1608$ — ②

$4(3 + 4m) = 108$

$[m = 6]$

ANSWER: Number of Rows (i.e m) = 6

4.) D[-2...10][3...8] [M = no. of row = 10 - (-2) + 1 = (13)]

W(width) (double) = 8 bytes [N = no. of column = 8 - 3 + 1 = (6)]

Base Address = 4110

Stored in Column Major Addr(A[i][j]) = B + W × ((i - Lr) + M(j - Lc))

(M = size of row = m)

Addr(D[4][5]) = (?)

$D[4][5] = B + W \times ((i - Lr) + M \times (j - Lc))$

$= 4110 + 8 \times ((4 - (-2)) + (13 \times (8 - 3)))$

$= 4110 + 8 \times (6 + 65)$

$= 4110 + 568$

$= 4678$

ANSWER: Address of D[4][5] = 4678

(U19CS012)

5.) AR [-4 .... 6, -2 .. 12] $L_r = -4$ M (rows) = 6 - (-4) + 1 = 11

Row Major $L_c = -2$ N (columns) = 12 - (-2) + 1 = 15

Addr (AR[2][3]) = 4142 A[i][j] = B + W * [(i - L_r) * N + (j - L_c)]

Width (W) = 2 bytes

Base Address (B) = (?)

AR[2][3] = B + 2 * [((2 - (-4)) * 15) + (3 - (-2))]

4142 = B + 2 * [(6 * 15) + 6]

4142 = B + 2 * [96]

B = 4142 - 192

B = 3950

ANS: Base Address = 3950

6.) M [10][10] $L_r = 0$ $L_c = 0$ M = N = 10 (row, col)

Width (W) = 4 bytes

M[0][0] = 1840 // Base Address (B)

Stord: Row Major A[i][j] = B + W * [N * (i - L_r) + (j - L_c)]

Addr (M[4][8]) = (?)

M[4][8] = 1840 + 4 * [10 * (4 - 0) + 8]

= 1840 + 4 * [48]

= 1840 + 192

= 2032

ANS: Address of M[4][8] = 2032

7.) B[10][7] $L_r = 0$ $L_c = 0$ M (row) = 10

Width (W) = 2 bytes N (col) = 7

Addr (B[x][1]) = 1012

Addr (B[7][3]) = 1060

Stord Column major

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(U19CS012)

$B[7][3] = \text{Base} + w \times (M \times (i - L_r) + (j - L_c))$

(Row Major)

Column

$1060 = B + 2((7-0) + 10 \times (3-0))$

$B = 1060 - 2(37)$

$[B = 986] \quad -①$

$B[x][1] = B + 2 \times ((x-0) + (1-0) \times 10)$

$1012 = 986 + 2(x + 10)$

$\frac{26}{2} = x + 10$

$[x = 3]$

ANS: Value of $x = 3$

8.) $A[m \times m] \quad (L_r = 0 = L_c) \quad M = m \quad N = m$

Width (W) = 2 bytes

Addr(A[1][1]) = 1098

Addr(A[4][5]) = 1144

Stored column-major

m = (?)

Column Major

$A[i][j] = B + w \times [(i - L_r) + (M \times (j - L_c))]$

$1098 = B + 2(1 \times m) \quad -①$

$1144 = B + 2(4 \times m + (5-0)m) \quad -②$

②-①

$46 = 2(3m + 4m)$

$23 = 3 + 4m$

$4m = 20$

$[m = 5]$

ANS: Value of $m = 5$

(U19CS012)

$L_1\ U_1\ L_2\ U_2\ L_3\ U_3$

9.) Array [1..8, 1..5, 1..7]

W (width) (integer) = 4 bytes

Addr (A[5][3][6]) = (?)

(i) Row method
(ii) Column method

} Base Address = 900

$R = 8-1+1 = 8$

$C = U_2 - L_2 + 1$

$= 5-1+1$

$= 5$

Row major of

$A[i][j][k] = B + W * [(I-I_0) * C + (J-J_0) + (k-k_0) * RC]$

$5\ 3\ 6 = 900 + 4 * [((5-1) * 5) + (3-1) + (6-1) * 8 * 5]$

$= 900 + 4 * ((20) + 2 + 200)$

$= 900 + 888$

$A[5][3][6] = 1788$ —— (1) (Row major)

Column Major of

$A[i][j][k] = B + W * [(I-I_0) + (J-J_0) * R + (K-k_0) * RC]$

$5\ 3\ 6$

$= 900 + 4 * [(5-1) + (3-1) * 8 + (6-1) * 8 * 5]$

$= 900 + 4 * [4 + 16 + 200]$

$= 900 + 4 * [220]$

$= 900 + 880$

$A[5][3][6] = 1780$ —— (2) (Column major)

ANS: Address of A[5][3][6] Row major = 1788

Address of A[5][3][6] Column major = 1780

10.) A[90][30][40]

Column Major Order

BA = 10

R = 90 - 1 + 1 = 90

C = 30 - 1 + 1 = 30

Addr(A[20][20][30]) = (?)

First element A[1][1][1] = 1 each take 1 Byte

$A[i][j][k] = B + W * [(I - I_0) + (J - J_0) * R + (K - k_0) * RC]$

$= 10 + 1 * [(20 - 1) + (20 - 1) * 90 + (30 - 1) * 90 * 30]$

$= 10 + [19 + 1710 + 78300]$

$= 10 + 80029$

$A[20][20][30] = 80039$

ANS: Location of A[20][20][30] = 80039

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D-12
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