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Address Calculation

Row Major Order :

Address of A[R][C]=BA+W[(R-LBR)*N+(C-LBC)]

Column Major Order :

Address of A[R][C]=BA+W[(I-LBR)+(J-LBC)*M]

Where : BA = Base Address W=Size of elements I,J=Find or determine the location LBR=Lower Bound of row N= Number of columns LBC=Lower bound of column

- **LBR & LBC=0** and UBR =N and UBC=M : if 2- DEMENSIONAL ARRAY IS IN THE FORM OF **A[N][M]**
  FOR EXAMPLE -> **A[20][30]**

- BUT IF 2- DEMENSIONAL ARRAY IS IN THE FORM OF **A[LBR……..N][LBC……LBCM]** FOR EXAMPLE -> **A[2……..20][4……..30]**

M=UBC-LBC+1; **N=UBR - LBR+1;**

Solved Examples

A double dimension array DA[20][40] is stored in computer's main storage. Every element of DA requires 8 bytes of memory. If the base address of DA is 1000 then calculate the address of DA[20][30] when the array is stored as: i)Row Major ii)Column Major

N = 20, M = 40, BA = 2000, W = 8, R = 20, C = 30 LBC=0,LBR=0

Row Major: Address of DA[R][C] = BA + W * (R-LBR) * M + (C-LBC))

Address of DA[20][30]= 2000 + 8 * ((20-0) * 40 + (30-0))

= 8640

Col Major: Address of DA[r][c] = BA + W * (R-LBR) + (C-LBC)*N)

Address of DA[20][30]= 2000 + 8 * ((20-0) + (30-0)*20)

= 6960

A double dimension array DD[5..25][7..30] is stored in computer's main storage. Every element of DD requires 4 bytes of memory. If the base address of DD is 1000 then calculate the address of DD[17][25] when the array is stored as: i) Row Major ii) Column Major

lbr = 5, ubr = 25, N = ubr - lbr + 1 = 25 - 5 + 1 = 21

lbc = 7, ubc = 30, M = ubc - lbc + 1 = 30 - 7 + 1 = 24
Base = 1000, W = 4, r = 17, c = 25

Row Major:	Address of DD[r][c]	=	Base + W * ((r - lbr) * M + (c - lbc))
	Address of DA[17][25]	=	1000 + 4 * ((17 - 5) * 24 + (25 - 7))
		=	**2224**
Col Major:	Address of DD[r][c]	=	Base + W * ((r - lbr) + (c - lbc) * N)
	Address of DA[17][25]	=	1000 + 4 * ((17 - 5) + (25 - 7) * 21)
		=	**2560**

A double dimension array MAT[20][25] is stored in computer's main storage as row wise. If the address of MAT[24][8] is 3932 and address of MAT[33][21] is 4884, then find the base address, width (W) and also calculate the address of MAT[27][19].

N = 40, M = 25
Base + W * (24 * 25 + 8) = 3932 Or, Base + 608 * W = 3932 …… (1)
Base + W * (33 * 25 + 21) = 4884 Or, Base + 846 * W = 4884 …… (2)
Subtracting (1) from (2)
Base + 846 * W = 4884
Base + 608 * W = 3932
238 * W = 952
W = 952 / 238 = 4
Substituting the value of W in (1)
Base + 4 * 608 = 3932
Base = 3932 - 2432 = 1500

Address of MAT[27][19] = 1500 + 4 * (27 * 25 + 19) = 4276

A double dimension array MAT[20][30] is stored in computer's main storage as column major. If the address of address of MAT[15][23] is 4850 and address of MAT[12][18] is 4232, then find the base address, width (W) and also calculate the address of MAT[16][25].

ROW = 20, COL = 30
Base + W * (15 + 23 * 20) = 4850 Or, Base + 475 * W = 4850 …… (1)
Base + W * (12 + 18 * 20) = 4232 Or, Base + 372 * W = 4232 …… (2)
Subtracting (2) from (1)
Base + 475 * W = 4850
Base + 372 * W = 4232
103 * W = 618
W = 618 / 103 = 6
Substituting the value of W in (1)
Base + 6 * 475 = 4850
Base = 4850 - 2850 = 2000

Address of MAT[16][25] = 2000 + 6 * (16 + 25 * 20) = 5096

Try Yourself

1. An array x[8][20] is stored in the memory with each element requiring 2 bytes of storage. If the base address of the array is 2500, calculate the location of x[5][5] when the array x is stored using the column major order and row major order.

2. An array Arr[1..20][1..20] is stored in the memory with each element requiring 4 bytes of storage. If the base address of array Arr is 2000, determine the location of Arr[15][9] when the array Arr is stored in (1) Row wise and (2) Column wise.

3. An array MAT[30][10] is stored in the memory row wise with each element occupying 8 bytes of memory. Find out the base address and the address of the element MAT[15][5], if the location of MAT[5][7] is stored at the address 3000.

4. An array MAT[20][25] is stored in the memory with each element requiring 2 bytes of storage. If the base address of MAT is 4000 MAT[[12][8] when the array stored in (i) RMO and (ii) CMO

5. An array ARR[15][20] is stored in the memory, along the row with each element occupying 4 bytes . Find out the base address and the address of the element ARR[3][2] if the element ARR[5][2] is stored at the address 1500.

6. Each element of an array Data[20][50] required 4 bytes of storage, Base address of data is 2000, determine the location of Data[10][10] when the array is stored as (a) row major (b) column major

7. An array A[11][21] is stored in the memory with each element requiring 2 bytes of storage. If the base address of array in memory is 300, determine the location of a[5][31] when the array is A stored by (i) Row major (ii) Column major

8. 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

9. An array ARR[15][35] is stored in the memory along the column with each of its elements occupying 8 bytes. Find out the bas address and the address of an element Arr[2][5], if the location Arr[5][10] is stored at the address 4000.

10. An array Arr[35][15] is stored in the memory along the row with each of its elements occupying 4 bytes. Find the bas address and the address of an element Arr[20][5], if the location Arr[2][2] is stored at the address 3000.

11. *An array arr[15][20] is stored in the memory along the row with each element occupying 4 bytes. Find out the base address and address of the element arr[3][2], if the element arr[5][2] is stored at the address 1500.*

12. *An array MAT[30][10] is stored in the memory column wise with each element occupying 8 bytes of memory. Find out the bas address and the address of element MAT[5][7] is stored at the address 1000.*

13. If an array B[11][8] is stored as column wise and B[2][2] is stored at 1024 and B[3][3] at 1084, find the address of B[5][3] and B[1][1].

14. An array Arr[50[100] is stored in the memory along the row with each element occupying 2 bytes. Find out the address of the location ARR[20][50] if location of Arr[20][30] is 1350.

15. An array x[30][10] is stored in the memory with each element requiring 4 bytes of storage. If the base address of x is 4500, find out memory locations of x[12][8] and x[2][4], if the content is stored along the row.

16. An array ARR[15][35] is stored in the memory along the column with each of its elements occupying 8 bytes. Find out the base address and the address of an element ARR[2][5] , if the location is stored at the address 4000

17. An array X[15][10] is stored in memory with each element requiring 2 bytes of storage. If the base address of array is 2000, calculate the location of X [7][8] when the array is stored by (1) row major order (2) column major order.

18. X [1..6][1….10] is a two dimensional array. The first element of the array is stored at Location 100. Each element of the array occupies 6 bytes. Find the memory location of X[2][4] when (i) array is stored row wise. (ii)array is stored column wise

19. Each element of an array A[-20..20,10..35] requires one byte of storage. If the array is stored in column major order beginning location 500, determine the location of A[0,30].

20. An array S[35][15] is stored in the memory along the row with each of its elements occupying 4 bytes. Find out the memory location for the element S[20][5], if an element S[2][2] is stored at the memory location 3000.

21. Given the two dimensional array a[10][20] base address of a is 100 and width of each element is 4 bytes. Find the location of a[8][15] when the array is stored as column-wise and row-wise

22. An array A[-2..8][-2..5] is stored in the memory along the column with each element occupying 4 bytes. Find out the address of the element A[3][2].