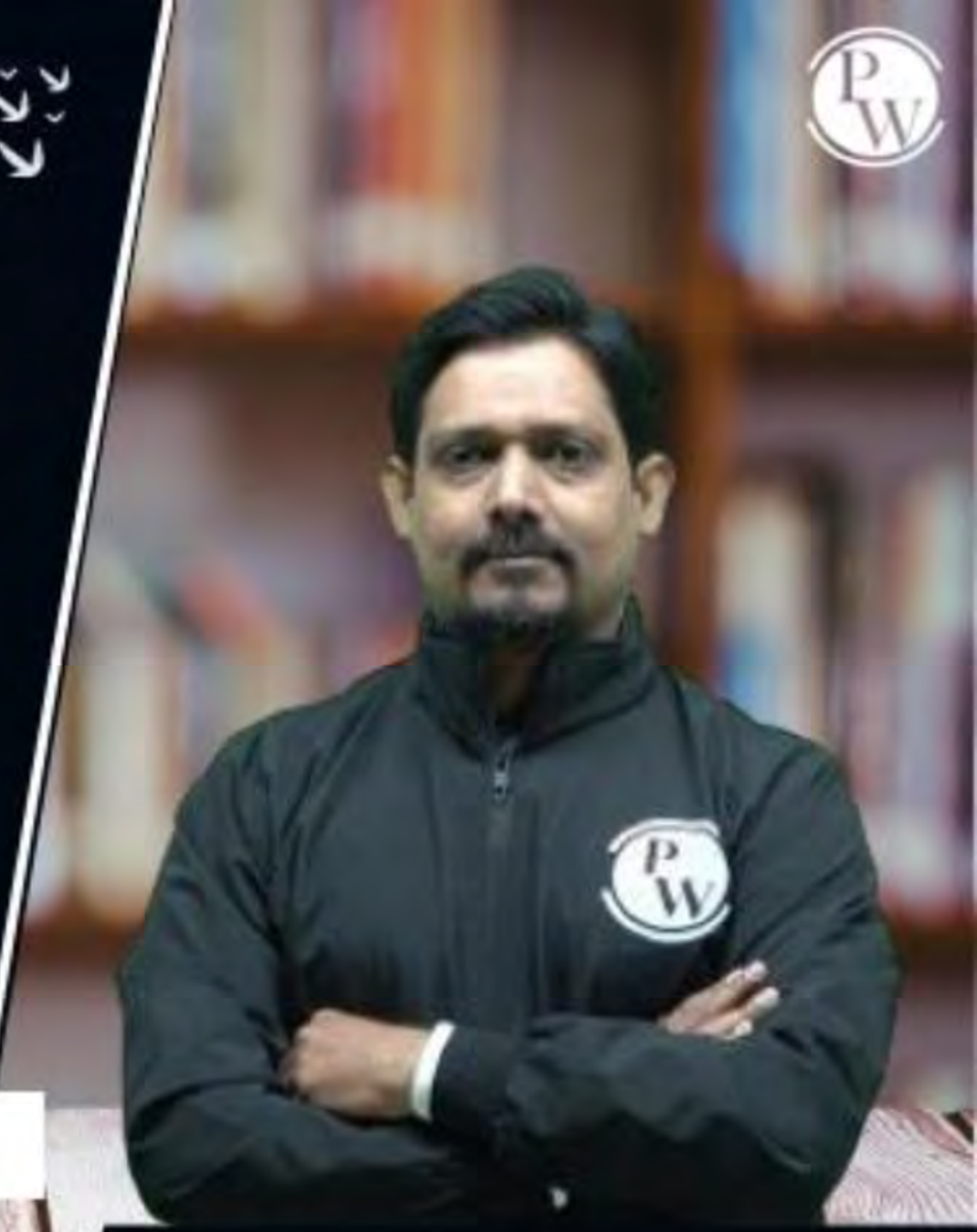
Computer Science & IT

Data Structure & Programming

Array 04

Lecture No. 04



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Recap of Previous Lecture

- Topic
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- Topic

Lower Triangular Matrix

Row major

Column major

Slide

Topics to be Covered

Topic

Topic

Topic

Topic

Topic

3-D Matrix (C-language)

practice problem

Tridiagonal Matrix (Square Matrix)

Slide

LTM :

$$BA + \left[\frac{i(i-1)}{2} + (j-1) \right] \times Size$$

Row major order

$$BA + \left[n(j-1) - \frac{(j-1)(j-2)}{2} + (i-j) \right] \times Size$$

Column major order

Topic : 3-D Matrix (C – Language)

A [1...3] [1...2] [1..2]

3 × 2 × 2 = 12

frame

Row

column

Each frame consists of 2 Rows 2 Columns

No. of elements in each frame : Size of Row * Size of column

2 * 2 = 4

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Topic : 3-D Matrix (C – Language)

frame

① 1 2 3 4

② 5 6 7 8

③ 9 10 11 12

Column-1 Column-2

Row-1 Row-2

C Language

BA = 100

Size = 2B

frame-1 frame-2 frame-3

Memory location

1	2	3	4	5	6	7	8	9	10	11	12
100	102	104	106	108	110	112	114	116	118	120	122

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Topic : 3-D Matrix (C – Language)

A[3][2][1]

1. Before 3rd frame No. frams completed

(3-1) = 2

No. of element in each frame

Size of Rows * Size of column

2*2 = 4

total = 2*4 = 8

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Topic : 3-D Matrix (C – Language)

A[3][2][1]

2. we are in 2nd Row of 3rd frame

No. of rows completed

(2 - 1) = 1 ✓

No. of element in each Row = 2

total : 1 * 2 = 2

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Topic : 3-D Matrix (C – Language)

A[3][2][1]

3. In 3rd frame 2nd Row we are in

first column

No. of column arranged (1-1)=0

Total = 8+2+0 = 10

Address of A[3][2][1] = 100 + 10x2 = 120

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Topic : 3-D Matrix (C – Language)

$A[LB_1 \ldots UB_1][LB_2 \ldots UB_2][LB_3 - UB_3]$

Size of frame (No. of elements)

$$(UB_2 - LB_2 + 1) * (UB_3 - LB_3 + 1)$$

Size of Rows * Size of column

Size of Row (No. of element)

$$\frac{}{(UB_3 - LB_3 + 1)}$$

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Topic : 3-D Matrix (C – Language)

$A[LB_1..UB_1][LB_2..UB_2][LB_3..UB_3]$

BA is Base Address

Address of $A[i][j][k]$

Size of frame

$$BA + [(i - Lb_1) \times (Ub_2 - Lb_2 + 1)(Ub_3 - Lb_3 + 1) +$$

$$(j - Lb_2) \times (Ub_3 - Lb_3 + 1) + \quad \rightarrow \text{Size of Row}$$

$$(k - LB_3)] \times \text{Size}$$

Slide

Topic : 3-D Matrix (C – Language)

#Q if 3-D array declared as

A[1..100][1..100][1...100]

Size of each element is 2 B

Base Address is 1000 then what is Address of

A[50][49][48] is _____.

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$A[50][49][48]$

$$1000 + [(50-1) \times 100 \times 100 + (49-1) \times 100 + (48-1)] \times 2$$

$$1000 + [4900000 + 4800 + 47] \times 2$$

$$1000 + 494847 \times 2$$

$$= 990694$$

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A[-10 ..15][10..20][-3...12]

The No. of elements in 3-D array ——— ?

No. of frames * No. of Rws * No. of columns

15-(-10)+1 *(20-10+1) * (12-(-3)+1)

26 X 11 * 16 = 4576

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Topic : Tridiagonal Matrix

$2n-2$

$n=4$

The Non zero elements in $3\times4-2=10$

3 diagonals — Main diagonal ✓

— above main diagonal

— below main diagonal

a_{11}	a_{12}	0	0
a_{21}	a_{22}	a_{23}	0
0	a_{32}	a_{33}	a_{34}
0	0	a_{43}	a_{44}

← above main diagonal

← Main diagonal

↑ below main diagonal

4×4 Tridiagonal No. of Non zero elements : $4+3+3=10$

n×n Tridiagonal No. of Non zero element is $n+n-1+n-1$

$=3n-2$

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Topic : Tridiagonal Matrix

$2+3+3 = 8$

a_{11}	a_{12}	0	0
a_{21}	a_{22}	a_{23}	0
0	a_{32}	a_{33}	a_{34}
0	0	a_{43}	a_{44}

3 Rows are arr

* Row major

a_{11}	a_{12}	a_{21}	a_{22}	a_{23}	a_{32}	a_{33}	a_{34}	a_{43}	a_{44}
100	102	104	106	108	110	112	114	116	118

Address of A[i][j]

Before ith Row No. of Rows arranged $(i-1)$ ✓

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Topic : Tridiagonal Matrix

No. of elements $(i-1)$ Rows is

$$(i-1)\times 3 - 1$$

← first Row

$$(4-1)\times 3 - 1$$

$$3\times 3 - 1 = 8 \checkmark$$

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Topic : Tridiagonal Matrix

a_{11}	a_{12}	0	0
a_{21}	a_{22}	a_{23}	0
0	a_{32}	a_{33}	a_{34}
0	0	a_{43}	a_{44}

$i>1$ $(i-1)^{th}$ Row : $(i-1)\times 3-1$

i^{th} Row :

$i=1$ $(i-1)=0$

$i=3, j=2$ Ans. 0

$i=3, j=3$ Ans 1

$i=3$ $j=4$ Ans-2

$(j-i+1)$

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Topic : Tridiagonal Matrix

$$BA + [(i-1)\times 3 - 1 + j - i + 1] \times S$$

$$BA + (3i - 3 - 1 + j - i + 1) \times S$$

$$\boxed{BA + (2i + j - 3) \times Size}$$

a_{11}

$$100 + (2\times 1 + 1 - 3)\times 2 = 100 + (3-3)\times 2 = 100$$

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Topic : Tridiagonal Matrix

Column major order

LCTM Row major

$$BA + \left[n(i-1) - \frac{(i-1)(i-2)}{2} + (j-i) \right] \times s_{1 \times n}$$

Column major

$$BA + \left[\frac{j(j-1)}{2} + (i-1) \right] \times s$$

Slide

Topic : Question

#Q Consider the LTM consists of 45 non zero elements. If

The dimension is n*n then the value of n is _____

Non zero

$$\frac{n(n+1)}{2} = 45$$

$$n^2 + n - 90 = 0$$

$$n^2 + 10n - 9n - 90 = 0$$

$$(n+10)(n-9) = 0$$

$$n = 9$$

$1+2+3+\cdots+n$

Slide

if in 10×10 LTM Non zero element is x = 55

and 10×10 Tridiagonal matrix Non zero is y

x+2y is _____?

10×10 - LTM

$\frac{n(n+1)}{2} = \frac{10\times11}{2} = 55$

3n-2

3×10-2

= 28

55+28×2 = 55+56 = 111

Topic : Question

#Q If natural number are stored in Array A[-10..10][20..30]

Then the number stored in A[5][15] is

Topic : Question

#Q Consider the LTM a[-4..4][0…8].Non zero elements are stored in row major order. What is the address of A[0][3]. Base address is 1000 and size of each element is 2B.

2 mins Summary

Topic

3-D array c language

Topic

practice problem

Topic

Tridiagonal Matrix.

Topic

Topic

Slide

THANK - YOU

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