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Arrays - Part IV

Course on Data Structure

Pankaj Sharma • Lesson 5 • July 12, 2024

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CS & IT Engineering

Data Structure

Arrays- IV

Lecture Number- 05

By- Pankaj Sir

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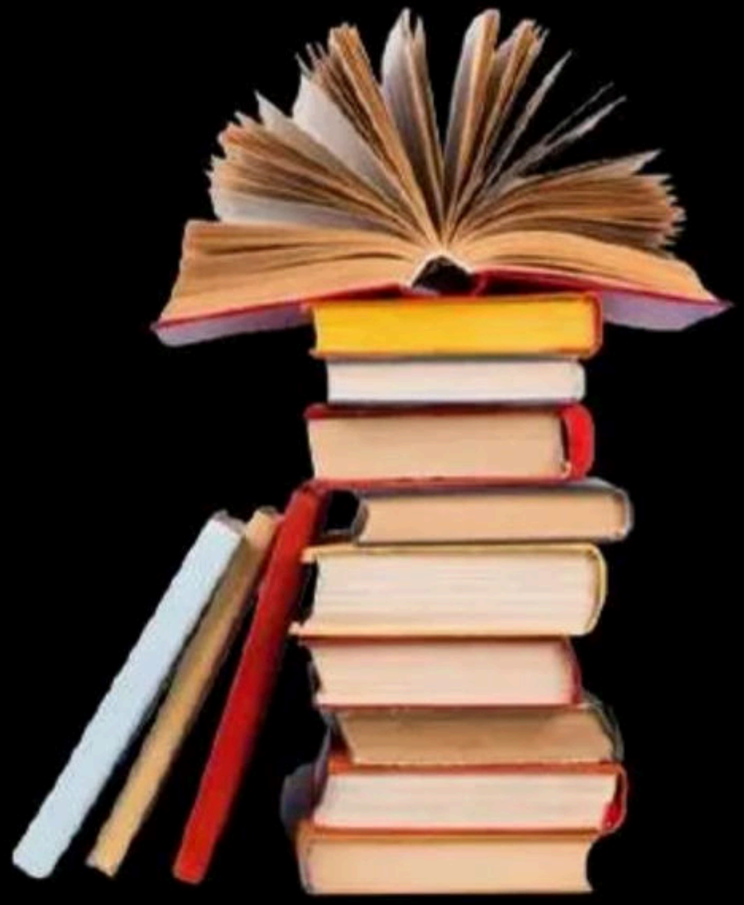
Topics

to be covered



1. Arrays

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Sparse matrix

(i) Lower triangular matrix

(ii) Upper triangular matrix

(iii) Tri-diagonal matrix

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Lower triangular matrix

A LTM is a square matrix

$(n \times n)$

$A_{12} = 0$

$A_{13} = 0$

$A_{14} = 0$

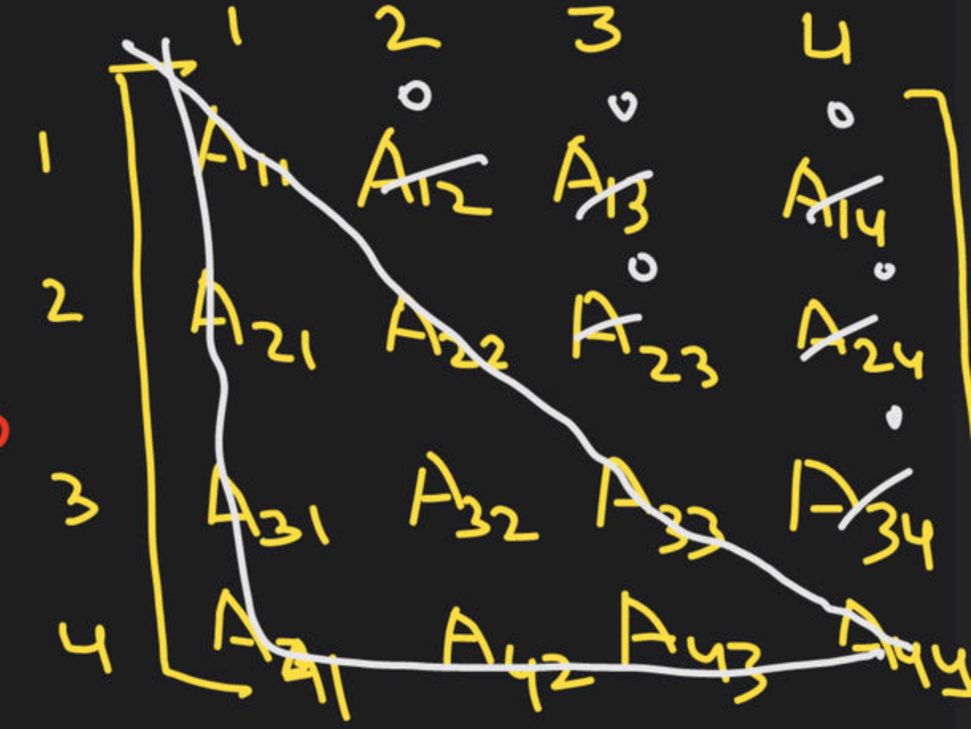
$A_{23} = 0$

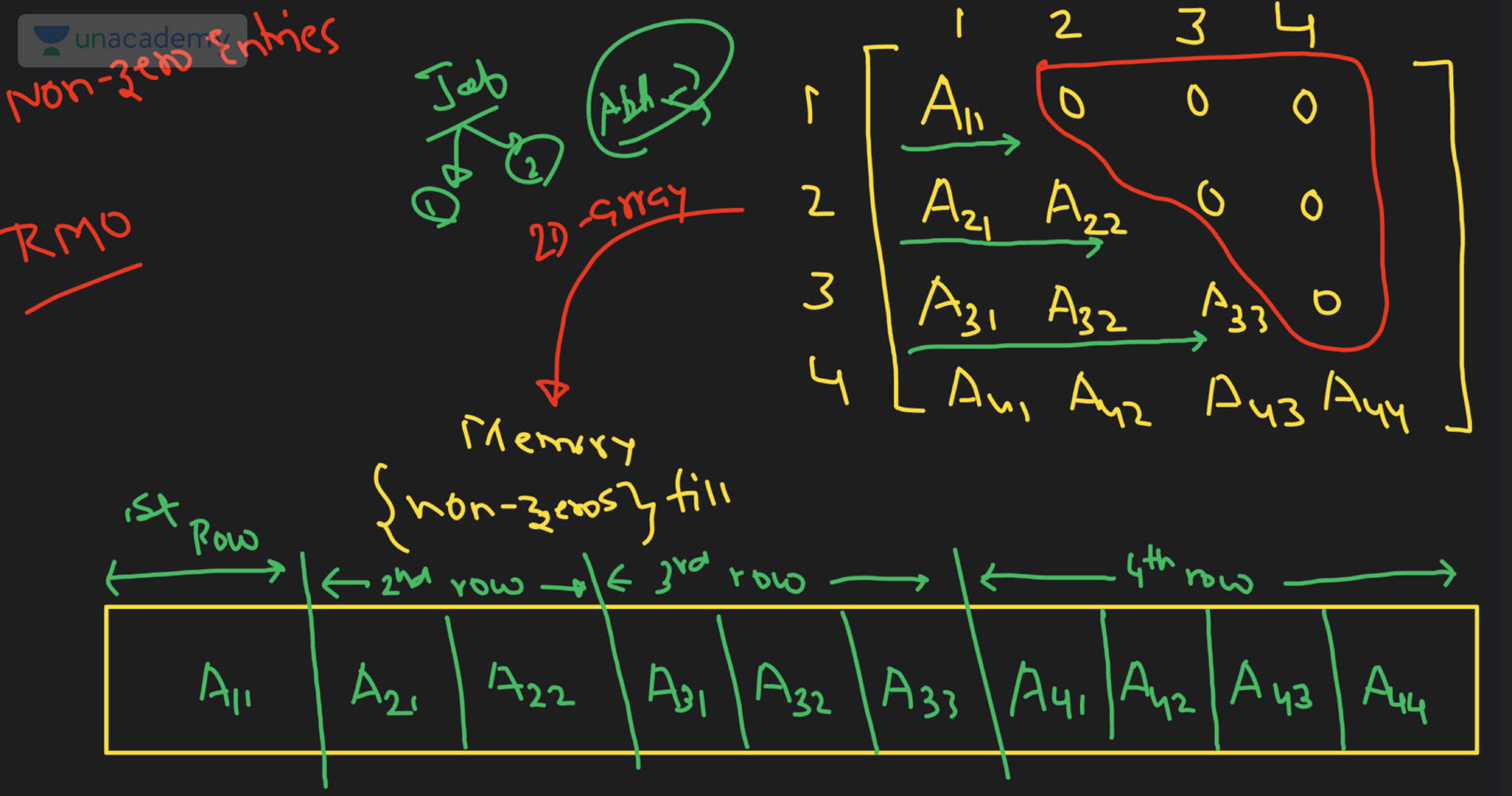
$A_{24} = 0$

$A_{34} = 0$

row ↓ col →

$$A_{ij} = 0 \quad i < j$$





Non-zero entries
RMO
Job
1
2
Abb
2D-array
Memory
{non-zeros} fill
1 2 3 4
A11 0 0 0
A21 A22 0 0
A31 A32 A33 0
A41 A42 A43 A44
1st Row
2nd row
3rd row
4th row
A11
A21
A22
A31
A32
A33
A41
A42
A43
A44

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Gdd(A_{43})

rows 1, 2, 3

rows already filled

= 1 to 3

= 3 − 1 + 1 = 3 rows

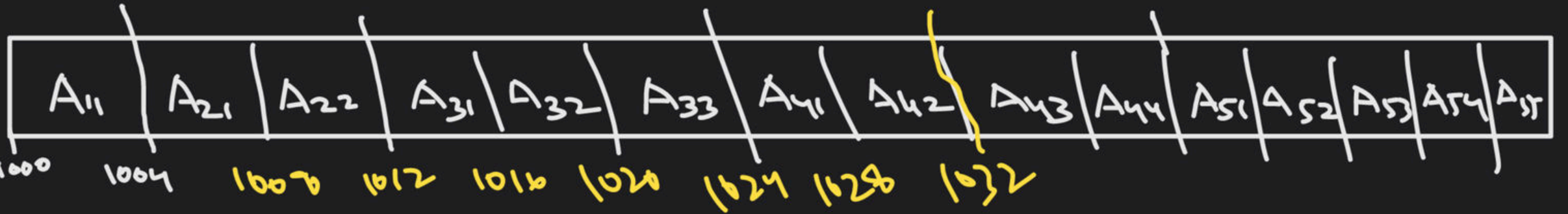
[1 + 2 + 3] = 6 ele

within row index 3, ele. already filled before A_{43} = 1 to 2

= 2 − 1 + 1 = 2

Total = 6 + 2 = 8 ele.

	1	2	3	4	5
1	A_{11}	0	0	0	0
2	A_{21}	A_{22}	0	0	0
3	A_{31}	A_{32}	A_{33}	0	0
4	A_{41}	A_{42}	A_{43}	A_{44}	0
5	A_{51}	A_{52}	A_{53}	A_{54}	A_{55}



RM10

$$
\begin{aligned}
&*(a+1)[1] \\
\Rightarrow\ &**(a+1+1) \\
=\ &**(a+2) \\
\Rightarrow\ &a[2][0] \\
&\hookrightarrow 15
\end{aligned}
$$

$A_{N \times N} \Rightarrow$ LTM

add(A_{ij})

- within row whose index is i

rows already filled

= index 1 to (i-1)

= i-1-1+1 = (i-1) rows

rows with index 1, 2, 3, .. (i-1)

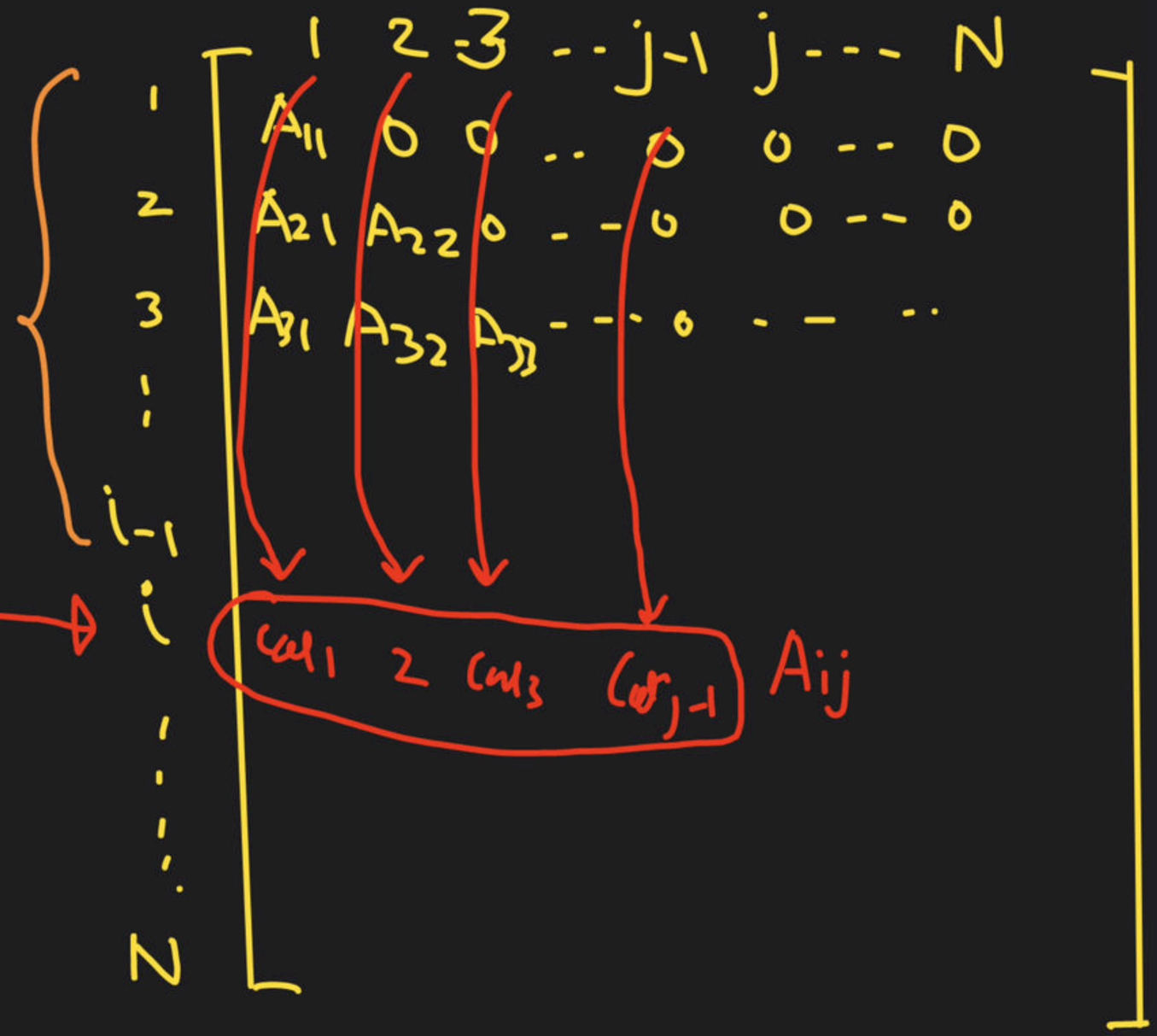
c!c = 1 to j-1

= j-1-1+1

= (j-1)

$1 + 2 + 3 + \cdots + (i-1)$

$= \frac{(i-1)(i)}{2}$



Total elem. already filled before $A_{ij} = \frac{(i-1)(i)}{2} + (j-1)$

Memory already filled $= \left[\frac{(i-1)(i)}{2} + (j-1)\right] w$

$Add(A_{ij}) = BA + \left[\frac{(i-1)(i)}{2} + (j-1)\right] w$ ✗

Ratna Nahi hai

LTM A[-5..5][-7..3], w = 2 bytes BA = 1000

addr(A[1][-2])

6 rows

-7 to -3

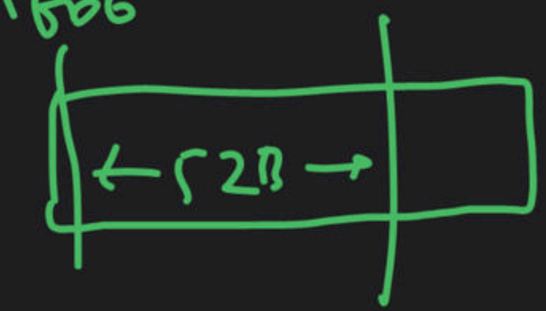
-3-(-7)+1 = 5

$\frac{6 \times 7}{2} = 21$

Total = 21+5 = 26 elements

Total memory = 26×2 = 52 Bytes

1000 + 52 = 1052



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A [-5..5]

A[1][-2]

-5 to 0

-5, -4, -3, -2, -1, 0

0 - (-5) + 1

0 + 5 + 1

= 6 rows

LTM → CMD

UTM — RMD, CMD

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Total Elements already filled before A_{43} = 8 ele.

w = 4 Bytes

Memory already filled = 8 × 4 = 32 Bytes

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THANK YOU!

Here's to a cracking journey ahead!