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Arrays - Part III

Course on Data Structure

Pankaj Sharma • Lesson 4 • July 11, 2024

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CS & IT Engineering

Data Structure

Arrays- III

Lecture Number- 04

By- Pankaj Sir

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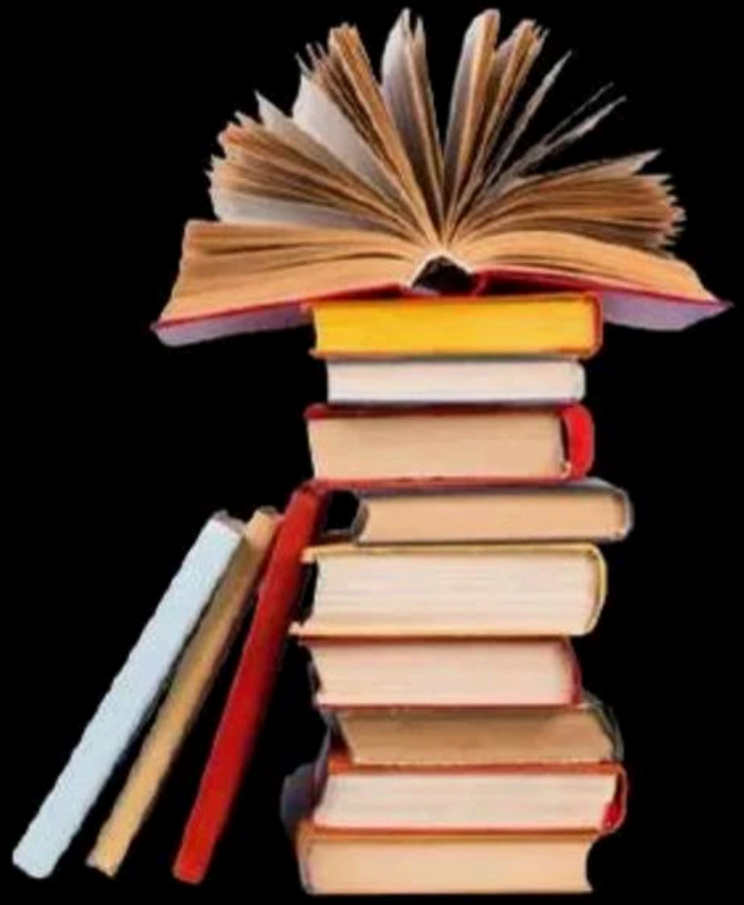
Topics

to be covered



1. Arrays

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$A[3][3][5]$

RMO

$w = 4$ Bytes, $BA = 1000$

$addr(A_{2\,2\,3})$

$A[3][3][5]$

How many index already filled

$= 0$ to 1

$= 1 - 0 + 1 = 2$

2×15

How many index already filled

$= 0$ to 1

$= 1 - 0 + 1 = 2$

2×5

How many index

$= 0$ to 2

$= 2 - 0 + 1$

$= 3$

Every index in this dim

$= 3 \times 5$

$= 15$ ele

Every index in this dim

$= 5$ ele

Total ele already filled before A_{223}

$= (2 \times 15 + 2 \times 5 + 3)$

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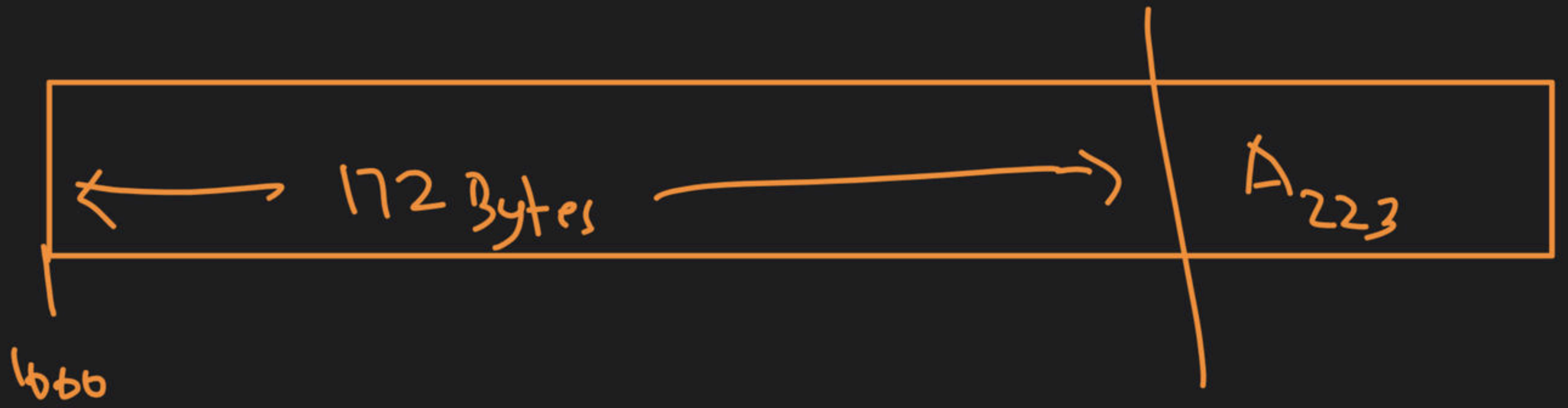
Total ele. already filled = 43

Memory already filled = $43 \times 4 = 172$ Bytes



$\text{addr}(A_{223}) = 1000 + 172 = 1172$

A[5][6][4]

w = 2 Bytes

BA = 1000

add(A_{342})

0 to 2
2 - 0 + 1
= 3

0 to 3
3 - 0 + 1
= 4

0 to 1
1 - 0 + 1
2

(3 x 24 + 4 x 4 + 2)

A[5][6][4]

Every index
= 6 x 4 = 24 ele

Every index
= 4 ele

Total ele. already filled
= (3 x 24 + 4 x 4 + 2)
= 72 + 16 + 2 = 90 ele.

Memory already filled = 90 X 2 = 180 Bytes.

= 1060 + 180 = 1180

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$A[-5..5][-3..3][-5..5]$

$5-(-5)+1$ $\quad 3-(-3)+1$ $\quad 5-(-5)+1$

$w = 2$ bytes

$BA = 1000$

Every index = 7×11

Every index = 11

add(A_{000})

Total ele.

$= (5 \times 7 \times 11 + 3 \times 11 + 5)$

$= 423$ ele.

-5 to -1

$= -1-(-5)+1$

$= 5$

$5 \times 7 \times 11$

-3 to -1

$-1-(-3)+1$

$= 3$

3×11

-5 to -1

$-1-(-5)+1$

$= 5$

Memory already filled = 423 x 2 = 846 Bytes

1000 + 846

= 1846

w = 2 byte

BA = 1600

add(A_{0523})

$A[-5..5][-10..10][-3..3][-4..4]$

11 21 7 9

Every index = 21 x 7 x 9

Every index = 7 x 9

Every index = 9

add(A_{0523})

-5 to -1

= -1 - (-5) + 1

= 5

-10 to 4

4 - (-10) + 1

= 15

-3 to 1

1 - (-3) + 1

= 5

-4 to 2

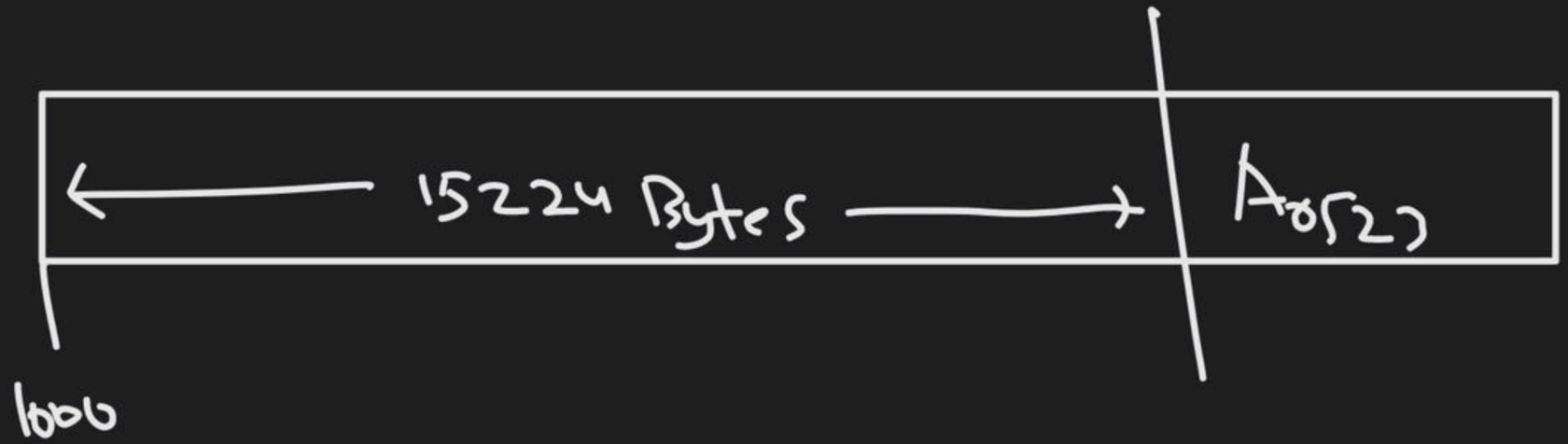
2 - (-4) + 1

= 7

Total no. of elem =

$(5 \times 21 \times 7 \times 9 + 15 \times 7 \times 9 + 5 \times 9 + 7) = 7612$ ele

Memory already filled = $7612 \times 2 = 15224$ Bytes



$\text{add}(A_{or[23]}) = 1000 + 15224$

$= 16224$ ✓

RMQ

$A[-10..10][-5..8][-4..6][-3..3]$ (21, 14, 11, 7)

$\omega = 2B$

$BA = 0$

Every index = $14 \times 11 \times 7$

Every index = 11×7

Every index = 7

addr($A_{-3,-1,0,0}$)

-10 to -4	-5 to -2	-4 to -1	-3 to -1
$-4-(-10)+1$	$-2-(-5)+1$	$-1-(-4)+1$	$-1-(-3)+1$
$= 7$	$= 4$	$= 4$	$= 3$

Total ele. already filled =

$$(7 \times 14 \times 11 \times 7 + 4 \times 11 \times 7 + 4 \times 7 + 3)$$

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Memory already filled

$$= (7 \times 14 \times 11 \times 7 + 4 \times 11 \times 7 + 4 \times 7 + 3) \times 2$$

$$= 15770 \text{ Bytes}$$

[Calculation is performed by Students

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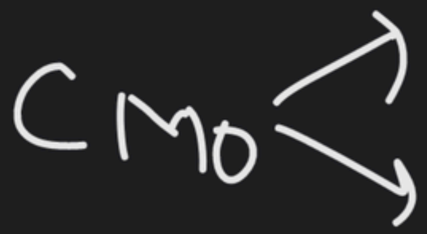
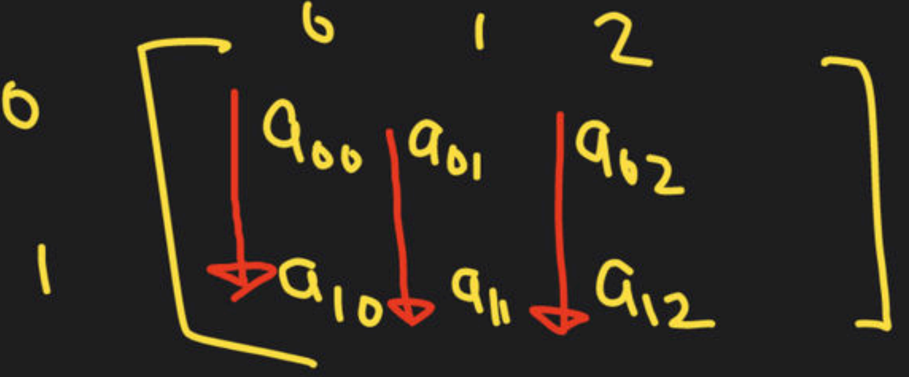
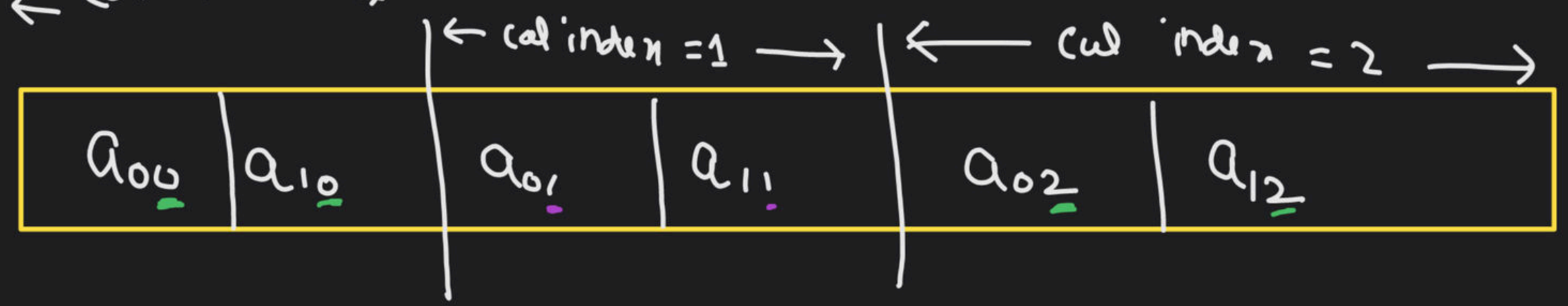
Gate 2-dim ×



Column-Major Order

int a[2][3]





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int a[3][4];

add(a_{23}) ①

How many cal. already filled before cal. with index = 3

- 0 to 2 = 2 - 0 + 1 = 3 cals

	0	1	2	3
0	a_{00}	a_{01}	a_{02}	a_{03}
1	a_{10}	a_{11}	a_{12}	a_{13}
2	a_{20}	a_{21}	a_{22}	a_{23}

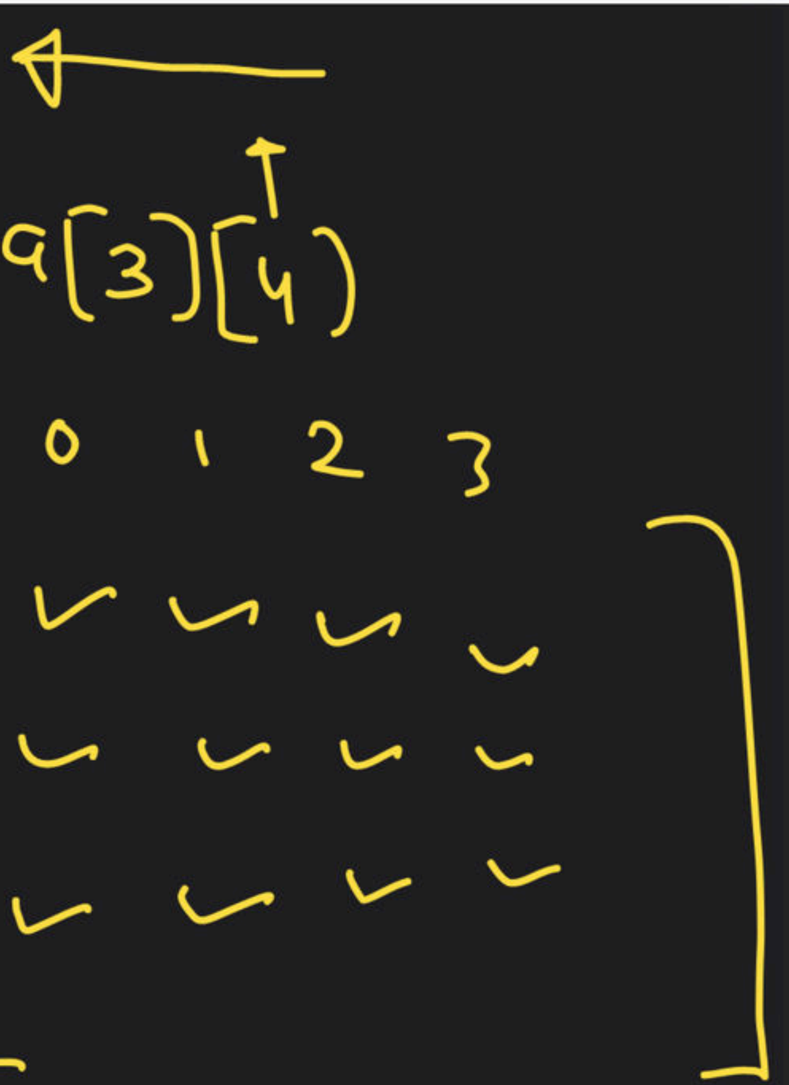
← cal index = 0 →			← cal index = 1 →			← cal index = 2 →			← cal index = 3 →		
a_{00}	a_{10}	a_{20}	a_{01}	a_{11}	a_{21}	a_{02}	a_{12}	a_{22}	a_{03}	a_{13}	a_{23}

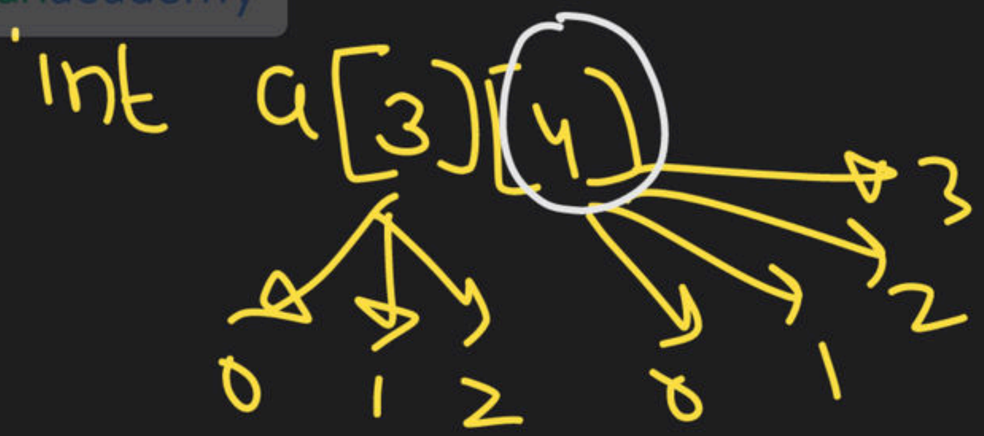
3 rows & 2 ele

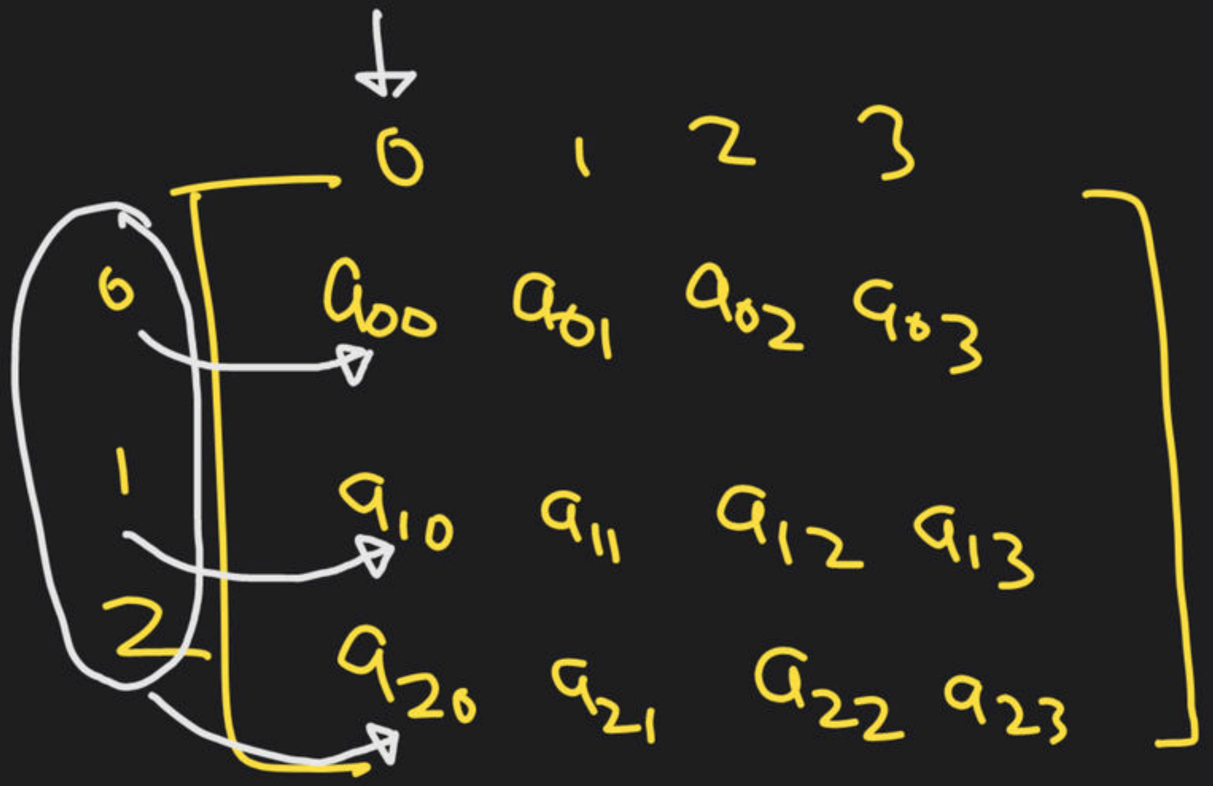
int a[3][4]

↳ Every index in this dim = 3 ele.

int a[3][4]




int a[3][4]
0 1 2
0 1 2 3


0 1 2 3
0
1
2
a_{00} a_{01} a_{02} a_{03}
a_{10} a_{11} a_{12} a_{13}
a_{20} a_{21} a_{22} a_{23}

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int a[3][4];

add(a_{23})

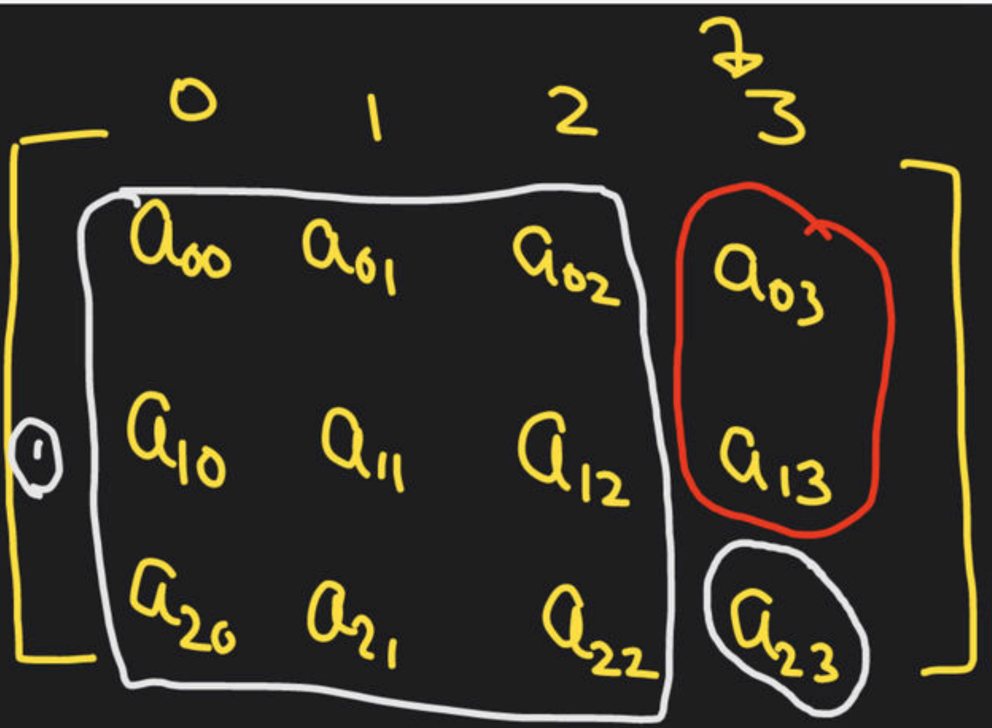
Within col index 3 ele already filled

= 0 to 1

= 1 - 0 + 1 = 2 ele.

How many col. already filled before col. with index = 3

0 to 2 = 2 - 0 + 1 = 3 cols



← col index = 0 →			← col index = 1 →			← col index = 2 →			← col index = 3 →		
a_{00}	a_{10}	a_{20}	a_{01}	a_{11}	a_{21}	a_{02}	a_{12}	a_{22}	a_{03}	a_{13}	a_{23}

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Q

$A[-5..6][-3..3]$ (12 elements: $6-(-5)+1$)

CMO

$w = 2$ Byte

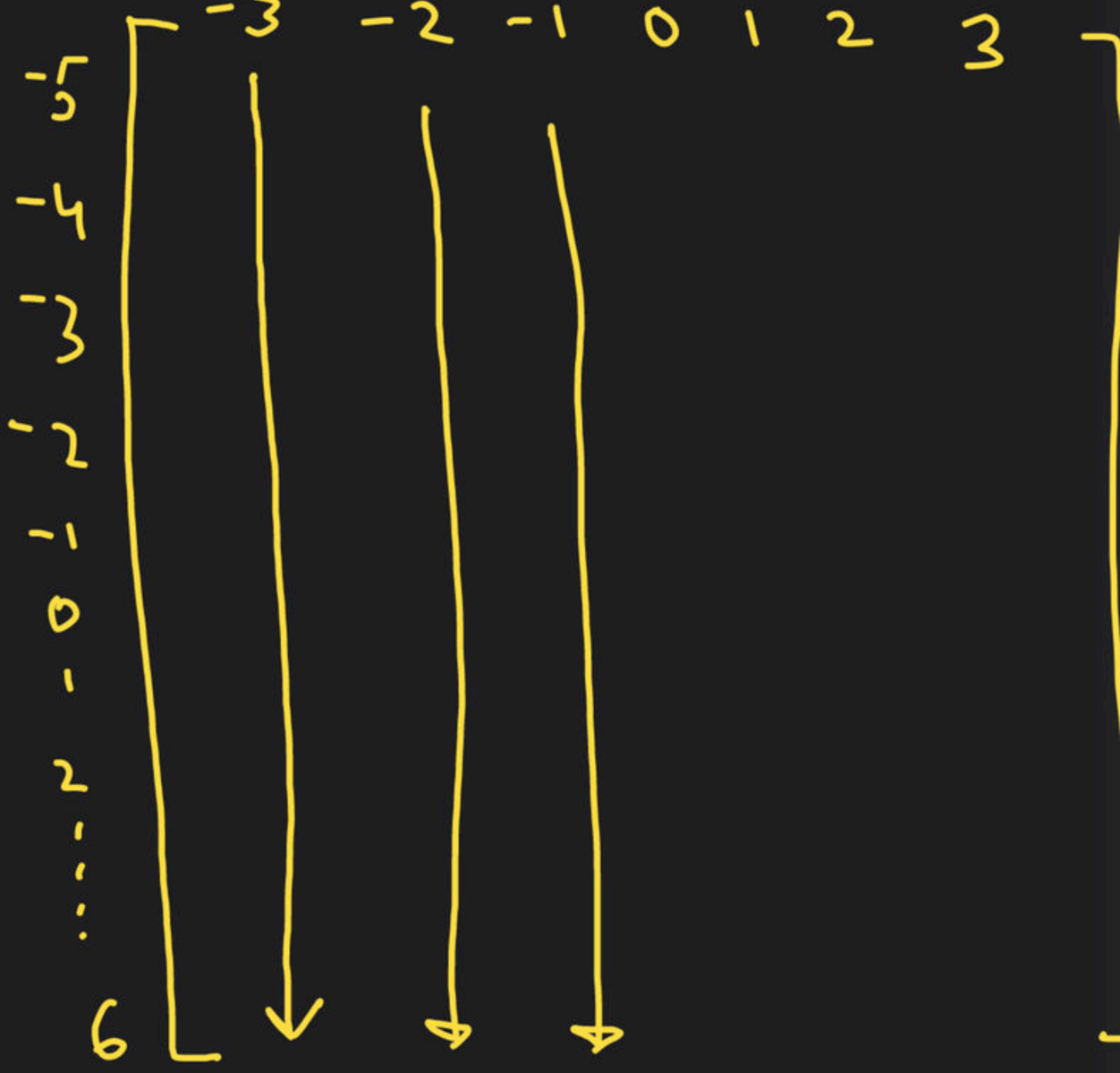
$BA = 1000$

$Add(A_{00})$

-3 to -1

$= -1-(-3)+1$

$= 3$ cols



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Q

$$A\underset{6-(-5)+1}{\overset{12}{\longleftarrow}}\begin{bmatrix}-5..6\end{bmatrix}\begin{bmatrix}-3..3\end{bmatrix}$$

CMO

W = 2 Byte

BA = 1000

Add($A_{0\,0}$)

-5 to -1

$= -1-(-5)+1$

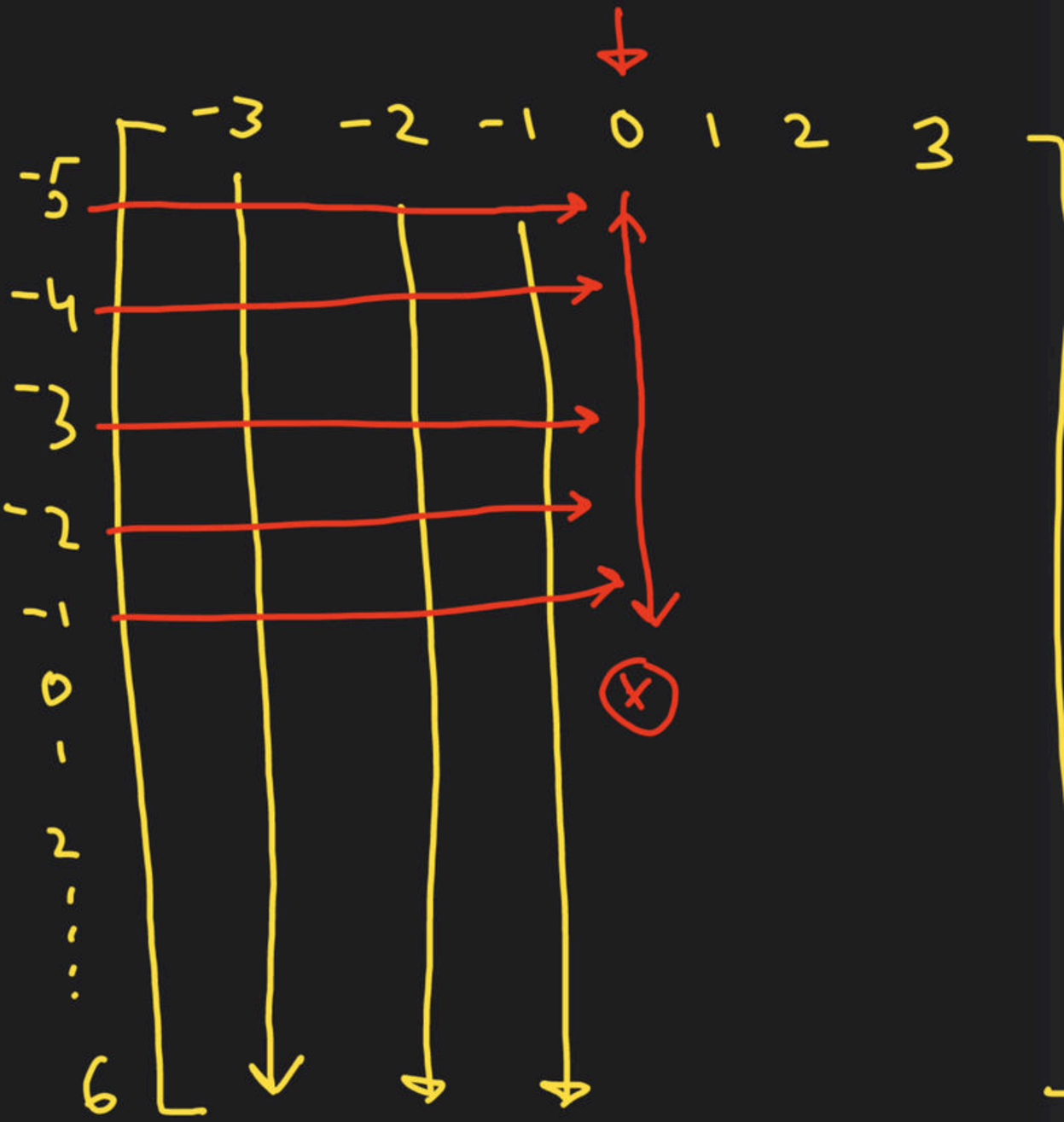
$= 5$

-3 to -1

$= -1-(-3)+1$

$= 3$ cols

$3 \times 12 + 5 = 41$ ele.



Total elem. already filled before A_{00} = 41 ele.

Memory already filled = 41 x 2 = 82 Bytes.

add(A_{00}) = 1000 + 82 = 1082

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$N_1 \quad N_2 \quad N_3$

$A[2][3][4]$

↳ Every index = ~~3~~ 3×2

Every index = 2

Note

↳ 2-D

$A[n_1][n_2][n_3]$

$\Big($ $n_1 + n_2 \times N_1 + n_3 \times N_2 \times N_1 \Big)$

Doubt ? C++ & MATLAB

12th → ↓ ↓ ↓

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THANK YOU!

Here's to a cracking journey ahead!