

CS & IT ENGINEERING

Data Structure & Programming



Arrays-II

DPP 02 Discussion Notes



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TOPICS TO BE COVERED

01 Question

02 Discussion

Q.1

Consider a lower triangular 2D array $\text{arr}[][5]$ with 15 elements.
The number of rows in arr is- 5 **[NAT]**



Q.2

Consider an integer 2D array $a[-7 \text{ to } +7] [-7 \text{ to } +7]$ that stores an upper triangular matrix uppertm where $\text{uppertm}[i][j]$ is 1 for all $i \leq j$. The sum of all the elements in the array is 120.

	1	2	3	4
1	1	1	1	1
2	0	1	1	1
3	0	0	1	1
4	0	0	0	1

Row col
1 1, 2, 3, 4

$a_{ij} = 0 \quad i > j$

$$= 4 + 3 + 2 + 1 \\ = \frac{4 \times 5}{2} = 10$$

[NAT]

	1	2	3	4
1	x	x	x	x
2	0	x	x	x
3	0	0	x	x
4	0	0	0	x

$$7 - (-7) + 1$$

$$= 15$$

$$15 \times 15$$

$$15 + 14 + 13 + \dots + 1$$

$$= 1 + 2 + \dots + 13 + 14 + 15$$

$$= \frac{15 \times 16^8}{2} = \underline{120}$$

Q.3



Consider an integer lower triangular 2D array $\text{arr}[-16 \text{ to } +15][-16 \text{ to } +15]$ having base address 1000. If the size of the integer is 4 bytes, the address of the element $\text{arr}[8][7]$ is- 2292

RMO

$\text{arr}[8][7]$

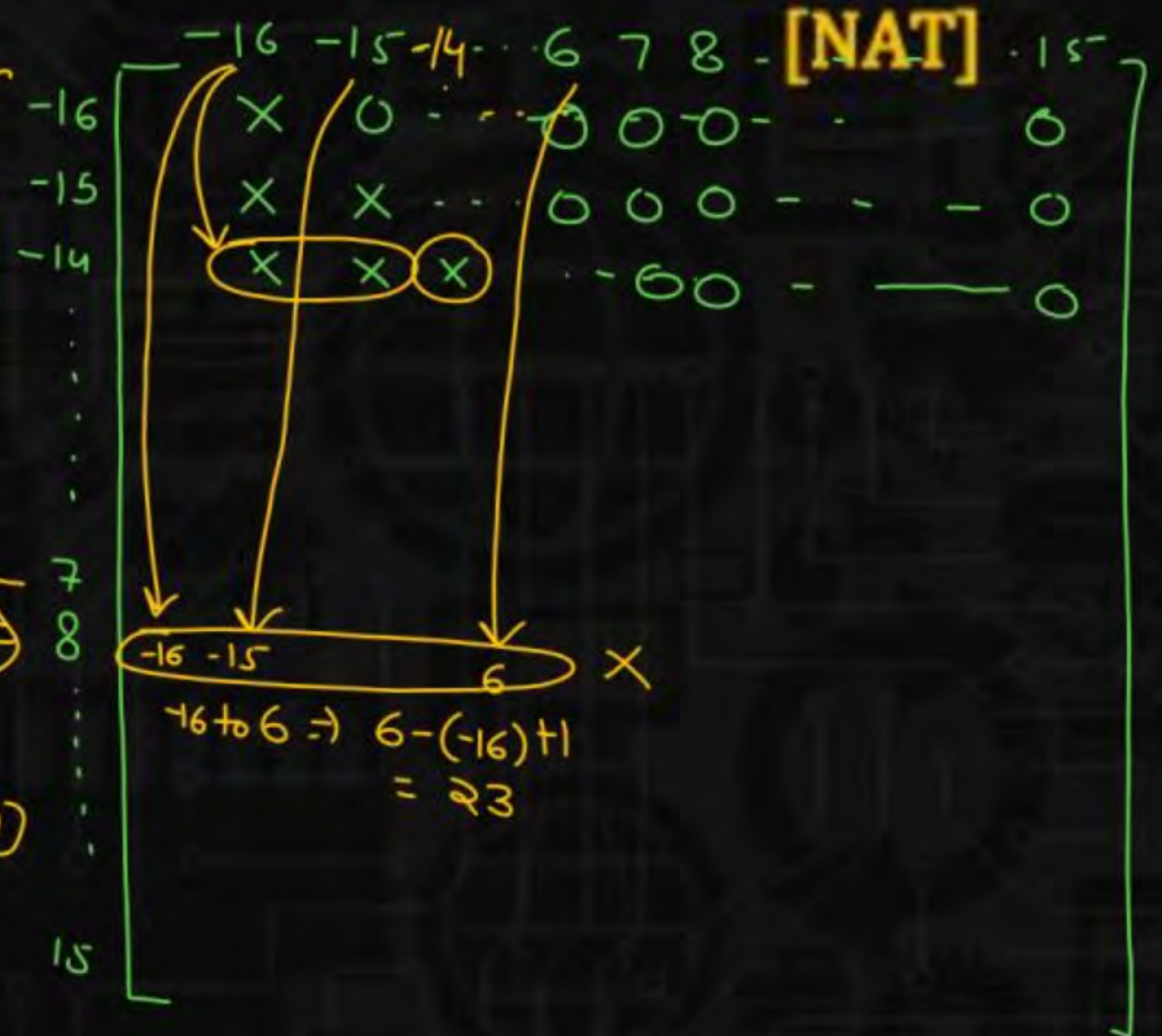
Rows already filled = $-16 \text{ to } 7$
 $= 7 - (-16) + 1$
 $= 24$

$$1 + 2 + 3 + \dots + 24 = \frac{24 \times 25}{2} = 300 \Rightarrow$$

within row with index 8
elements already filled before $\text{arr}[8][7]$

Total ele already filled = $300 + 23 = 323$

Rows
already
filled



Memory already filled = $323 \times 4 = 1292$ bytes



add

$$= 1000 + 1292$$

$$= \textcircled{2292}$$

Q.4



Consider an integer upper triangular 2D array $\text{arr}[-8 \text{ to } +7][-8 \text{ to } +7]$ having base address 1000. If the size of integer is 4 bytes, the address of the element present at location $\text{arr}[-6][4]$ is-

1164

$$\# \text{ of rows} = 7 - (-8) + 1 = 16$$

$$\# \text{ of cols} = 16$$

$$1^{\text{st}} \text{ row} = 16$$

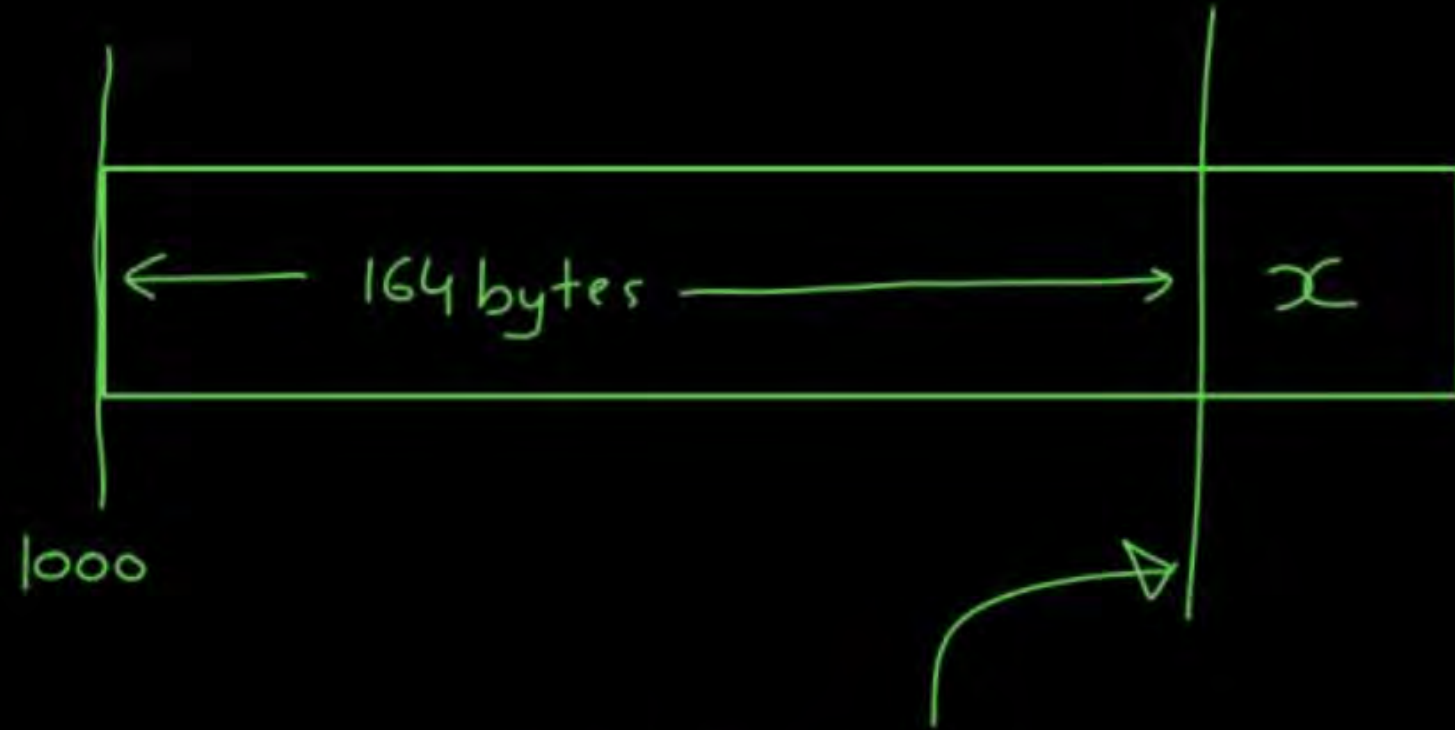
$$2^{\text{nd}} \text{ row} = 15$$

$$3^{\text{rd}} \text{ row} = 4 - (-6) = 10$$

$$\begin{aligned} \text{Total ele. already filled before } \text{arr}[-6][4] &= 16 + 15 + 10 \\ &= 41 \text{ elements} \end{aligned}$$

$$\begin{aligned} \text{Memory already filled} &= 41 \times 4 \\ &= 164 \text{ bytes} \end{aligned}$$





$$1000 + 164 = 1164$$

Q.5



Consider the natural numbers starting from 1 are stored in a lower triangular matrix $\text{arr}[-3 \text{ to } 3][-3 \text{ to } 3]$. Find the element present at location $\text{arr}[1][1]$. 15

$\text{arr}[1][1]$

$$\begin{aligned} & -3 \text{ to } 0 \\ & 0 - (-3) + 1 \\ & = 4 \end{aligned}$$

$$\begin{aligned} & 1 + 2 + 3 + 4 \\ & = \frac{4 \times 5}{2} \\ & = 10 \end{aligned}$$

Total ele. already filled before $\text{arr}[1][1] = 14$

In row
with index 1
ele. already
filled

$$\begin{aligned} & = -3 \text{ to } 0 \\ & = 0 - (-3) + 1 \\ & = 4 \end{aligned}$$

	-3	-2	-1	0	1	2	3
-3	X						
-2	X	X					
-1	X	X	X				
0	X	X	X	X			
1	X	X	X	X	X		
2	X	X	X	X	X	X	
3	X	X	X	X	X	X	X

[NAT]

15

Q.6



Consider the natural numbers starting from 1 are stored in a upper triangular 2D array $\text{arr}[-3 \text{ to } 3][-3 \text{ to } 3]$. Find the element present at location $\text{arr}[1][2]$.

RMO

24

$$\begin{aligned}\# \text{ of col} &= -3 \text{ to } +3 \\ &= +3 - (-3) + 1 \\ &= 7\end{aligned}$$

$$\# \text{ of rows} = 7$$

1st $\Rightarrow 7$
2nd $\Rightarrow 6$
3rd $\Rightarrow 5$
4th row $\Rightarrow 4$

Total = 22

rows already filled

$$\begin{aligned}&= -3 \text{ to } 0 \\ &= 0 - (-3) + 1 \\ &= 4 \text{ rows}\end{aligned}$$

$\text{arr}[1][2]$ within \Rightarrow row with index 1, ele. already filled before
 $\text{arr}[1][2] \Rightarrow 2-1 = 1 \text{ element}$

	-3	-2	-1	0	1	2	3 [NAT]
-3	X	X	X	X	X	X	X
-2	0	X	X	X	X	X	X
-1	0	0	X	X	X	X	X
0	0	0	0	X	X	X	X
1	0	0	0	0	X	X	X
2	0	0	0	0	0	X	X
3	0	0	0	0	0	0	X

Q.6



Consider the natural numbers starting from 1 are stored in a upper triangular 2D array $\text{arr}[-3 \text{ to } 3][-3 \text{ to } 3]$. Find the element present at location $\text{arr}[1][2]$.

RMO

24

$$\begin{aligned}\# \text{ of col} &= -3 \text{ to } +3 \\ &= +3 - (-3) + 1 \\ &= 7\end{aligned}$$

$$\# \text{ of rows} = 7$$

$$1^{\text{st}} \Rightarrow 7$$

$$2^{\text{nd}} \Rightarrow 6$$

$$3^{\text{rd}} \Rightarrow 5$$

$$4^{\text{th}} \Rightarrow 4$$

$$\text{Total} = 22$$

rows already filled

$$\begin{aligned}&= -3 \text{ to } 0 \\ &= 0 - (-3) + 1 \\ &= 4 \text{ rows}\end{aligned}$$

$\text{arr}[1][2]$

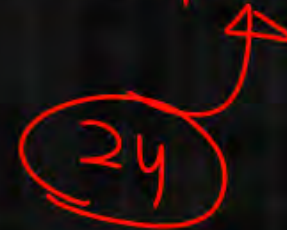
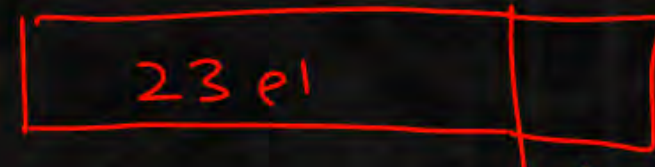
within \Rightarrow

row with index 1, ele. already filled before $\text{arr}[1][2] \Rightarrow 2-1 = 1 \text{ element}$

Total ele. already **[NAT]**

filled before $\text{arr}[1][2]$

$$= 23 \text{ elements}$$



9 elements
 $9 \times 8 = 72$ bytes

← 72 bytes	x
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= 500 + 72
= 572

-4	X	X	X	X	X	X	X	X	[NAT]
-3	O	X	X	X	X	X	X	X	
-2	O	O	X	X	X	X	X	X	
-1	O	O	O	(X)	X	X	X	X	
0	O	O	O	O	X	X	X	X	
1									
2									
3									
4									

[illegible]

Q.7



Consider a 2D array $\text{arr}[-4 \text{ to } +4][-4 \text{ to } 4]$ stores an upper triangular matrix. Find the address of the location $\text{arr}[-1][-1]$ if the starting address of the array is 500 and size of each element is 8 bytes. Assume that elements are stored in column-major order.

$\text{arr}[-1][-1]$

within col index -1
ele. already filled before
 $\text{arr}[-4][-1]$
 $= -4 \text{ to } -2$
 $= -2 - (-4) + 1$
 $= -2 + 4 + 1 = 3$

No. of cols filled
 $= -4 \text{ to } -2$
 $= -2 - (-4) + 1$
 $= 3 \text{ cols}$
 $1 + 2 + 3$
 $= 6 \text{ elements}$

	-4	-3	-2	-1	0	1	2	3	4
-4	X	X	X	X	X	X	X	X	X
-3	0	X	X	X	X	X	X	X	X
-2	0	0	X	X	X	X	X	X	X
-1	0	0	0	X	X	X	X	X	X
0	0	0	0	0	X	X	X	X	X
1						X	X	X	X
2							X	X	X
3								X	X
4									X

[NAT]

Total ele already filled before $\text{arr}[-1][-1]$
 $= 9 \text{ ele.}$

Q.7

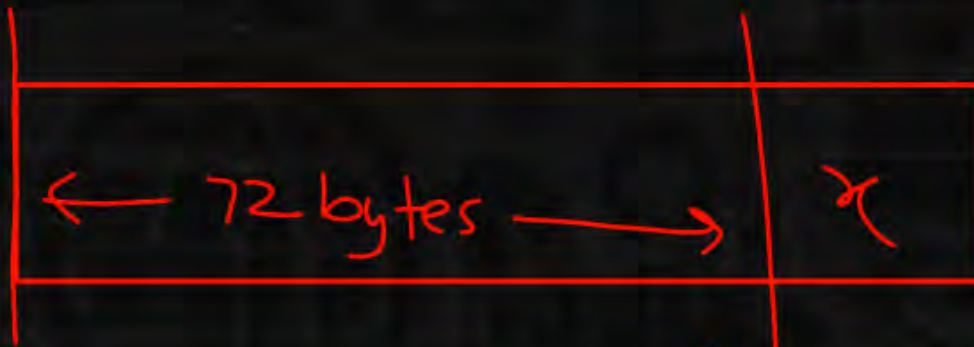


Consider a 2D array $\text{arr}[-4 \text{ to } +4][-4 \text{ to } +4]$ stores an upper triangular matrix. Find the address of the location $\text{arr}[-1][-1]$ if the starting address of the array is 500 and size of each element is 8 bytes. Assume that elements are stored in column-major order.

572

Memory already filled
= 9×8 bytes
= 72 bytes

500



$$500 + 72 = 572$$

	-4	-3	-2	-1	0	1	2	3	4	
-4	x	x	x	x	x	x	x	x	x	[NAT]
-3	0	x	x	x	x	x	x	x	x	
-2	0	0	x	x	x	x	x	x	x	
-1	0	0	0	x	x	x	x	x	x	
0	0	0	0	0	x	x	x	x	x	
1						x	x	x	x	
2							x	x	x	
3								x	x	
4									x	

Total ele
already
filled before
 $\text{arr}[-1][-1]$
= 9 ele.

580

Total ele already filled = 10

Memory already filled = 10×8 bytes = 80 bytes

80 bytes →

	-4	-3	-2	-1	0	1	2	3	4	[NAT]
-4	X									
-3	X	X								
-2	X	X								
-1	X	X	X	X						
0	X	X	X	X	X					
1	X	X	X	X	X	X				
2	X	X	X	X	X	X	X			
3	X	X	X	X	X	X	X	X		
4	X	X	X	X	X	X	X	X	X	

$$y - (-4) + 1$$

500

← 80 bytes → | x

