

# Data Structure & Programming

## Arrays-I

DPP

Section-01

[NAT]

1. Consider a 1D array  $a$  with 9 elements. If the base address of the array is 108 and the size of each array element is 4 bytes, the address of  $a[7]$  is- \_\_\_\_\_  
(Assume array index starts from 0)

[NAT]

2. Consider a 1D array  $a[-127.....,+255]$  where -127 and +255 are the starting index and ending index of the array respectively. The number of elements in the array is \_\_\_\_\_.

[NAT]

3. Consider a 1D array  $a$  with 19 elements. If the base address of the array is 108 and the size of each array element is 4 bytes, the address of  $a[7]$  is- \_\_\_\_\_  
(Assume array index starts from -11)

[NAT]

4. Consider a 2D array  $a[-127 \text{ to } +255][-13 \text{ to } +14]$ . The number of elements in the array is \_\_\_\_\_.

[NAT]

5. Consider the natural numbers from 1 to 256 are stored in a 2D array  $\text{arr}[-28 \text{ to } 3][-3 \text{ to } 3]$ . Find the element present at location  $\text{arr}[-16][1]$ . (Suppose, the elements are stored in row-major order) \_\_\_\_\_

[NAT]

6. Consider the natural numbers from 1 to 256 are stored in a 2D array  $\text{arr}[-28 \text{ to } 3][-3 \text{ to } 3]$ . Find the address of the location  $\text{arr}[-16][1]$  if the starting address of the array is 625 and size of each element is 4 bytes. (Suppose, the elements are stored in row-major order) \_\_\_\_\_.

[NAT]

7. Consider the whole numbers from 0 to 127 are stored in a 2D array  $\text{arr}[0 \text{ to } 15][0 \text{ to } 7]$ . Find the element present at location  $\text{arr}[6][4]$ . (Suppose, the elements are stored in column-major order) \_\_\_\_\_

[NAT]

8. Consider a 2D array  $\text{arr}[-15 \text{ to } 15][-7 \text{ to } 7]$ . Find the address of the location  $\text{arr}[-1][5]$  if the starting address of the array is 500 and size of each element is 4 bytes. (Suppose, the elements are stored in column-major order) \_\_\_\_\_

## Answer Key

- |            |           |
|------------|-----------|
| 1. (136)   | 5. (89)   |
| 2. (383)   | 6. (977)  |
| 3. (180)   | 7. (70)   |
| 4. (10724) | 8. (2044) |



## Hints and Solutions

### 1. (136)

Address of  $a[7] = 108 + (7-0)*4 = 136$ .

### 2. (383)

Number of elements in the array  $= 255 - (-127) + 1 = 383$

### 3. (180)

Address of  $a[7] = 108 + (7 - (-11)) * 4 = 180$ .

### 4. (10724)

Number of elements in each row  $= 255 - (-127) + 1 = 383$

Number of elements in each column  $= +14 - (-13) + 1 = 28$

Number of elements in the 2D array  $= 383 * 28 = 10724$

### 5. (89)

Number of elements in each column  $= 3 - (-3) + 1 = 7$

The element present at  $\text{arr}[-16][1]$

$= (-16 - (-28)) * 7 + (1 - (-3) + 1)$

$= 89$ .

### 6. (977)

Number of elements in each column  $= 3 - (-3) + 1 = 7$

Address of location  $\text{arr}[-16][1]$

$= 625 + [(-16 - (-28)) * 7 + (1 - (-3))] * 4$

$= 977$

### 7. (70)

Number of elements in each row  $= 16$

The element present at  $\text{arr}[6][4] = (4-0) * 16 + (6-0) = 70$

### 8. (2044)

Number of elements in each row  $= 15 - (-15) + 1 = 31$

Address of location  $\text{arr}[-1][5]$

$= 500 + [(5 - (-7)) * 31 + (-1 - (-15))] * 4$

$= 2044$

# Data Structure & Programming

## Arrays-II

Section-02

[NAT]

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

[NAT]

2.

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

[NAT]

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- \_\_\_\_\_

[NAT]

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- \_\_\_\_\_.

[NAT]

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

[NAT]

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

[NAT]

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  $\text{arr}[-1][ -2]$  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.  
\_\_\_\_\_

[NAT]

8. Consider a 2D array  $\text{arr}[-4 \text{ to } +4][ -4 \text{ to } +4]$  stores a lower triangular matrix. Find the address of the location  $\text{arr}[-2][ -1]$  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.  
\_\_\_\_\_

## Answer Key

- |           |          |
|-----------|----------|
| 1. (5)    | 5. (13)  |
| 2. (120)  | 6. (25)  |
| 3. (2292) | 7. (564) |
| 4. (1132) | 8. (644) |



## Hints and Solutions

1. (5)

A lower triangular matrix is always a square matrix.

So, the number of rows in the array = 5.

2. (120)

Number of rows=Number of columns=7+7+1=15.

The sum of all elements-

$$= 15 + 14 + 13 + \dots + 3 + 2 + 1$$

$$= 120$$

3. (2292)

The address of the element  $\text{arr}[8][7]$  is-

$$= 1000 + \left( \frac{(8+16)(8+16+1)}{2} + (7 + 16) \right) \times 4$$

$$= 2292$$

4. (1132)

Number of non-zero elements in the  $-8^{\text{th}}$  row = 15

Number of non-zero elements in the  $-7^{\text{th}}$  row = 14

The address of  $\text{arr}[-6][4]$ -

$$= 1000 + (15+14+4)*4$$

$$= 1132$$

5. (13)

The element present at  $\text{arr}[1][2]$  in lower triangular matrix:

$$= 1 + 2 + 3 + 4 + 1 + 1 + 1$$

$$= 13.$$

6. (25)

Number of elements in each row/column=3+3+1=7

The element present at  $\text{arr}[1][2]$  in upper triangular matrix:

$$= 7 + 6 + 5 + 4 + 1 + 1 + 1$$

$$= 25$$

7. (564)

Number of elements in each row= 4+4+1=9

When stored in column-major order, upper triangular matrix becomes lower triangular.

The number of non-zero elements from  $\text{arr}[-4][0]$  to  $\text{arr}[-1][-2]$

$$= 1+2+3+3=9$$

The address of the element  $\text{arr}[-1][-2]$  is-

$$= 500 + (9-1)*8$$

$$= 564$$

8. (644)

Number of elements in each row= 4+4+1=9

When stored in column-major order, lower triangular matrix becomes upper triangular.

The number of non-zero elements from  $\text{arr}[-4][0]$  to  $\text{arr}[-2][-1]$

$$= 9+8+2=19$$

The address of the element  $\text{arr}[-2][-1]$  is-

$$= 500 + (19-1)*8$$

$$= 644$$



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