Computer Science And Information Technology

Data Structure & Programming

DPP: 1

Arrays

Q1 Consider an integer 2D array a[–7 to +7] [–7 to +7] that stores an upper triangular matrix uppertm where uppertm[i][j] is 1 for all i>=j. The sum of all the elements in the array is _____.

Q2 Consider an integer upper triangular 2D array arr[–8 to +7][–8 to +7] having base address 1000. If the size of integer is 4 bytes, the address of the element present at location arr[–6][4] is- _____.

Q3 Consider the natural numbers starting from 1 are stored in a lower triangular matrix arr[–3 to 3][–3 to 3]. Find the element present at location arr[1][2]. _____

Q4 Consider a program that identifies and prints all the "heads" in an array. An element in the array is defined as a head if it is greater than all the elements to its right side. Additionally, the rightmost element is always considered a head. For example, in the array {16, 17, 4, 3, 5, 2}, the heads are 17, 5, and 2. What is the best-case time complexity to identify all the heads in the array?

(A) O(n)
(B) $O(n^2)$
(C) O(n log n)
(D) $O(n^3)$

Q5 Let A be an array of 31 numbers consisting of sequence of 0's followed by a sequence of 1's. The problem is to find the smallest index i that A[i] is 1 by probing the minimum numbers of locations in A. The worst case number of probes performed by an optimal algorithm is _____

(A) 31 (B) 15
(C) 5 (D) 1

Q6 The average number of key comparison required for a successful search for sequential search on n items is

(A) $\frac{n}{2}$
(B) $\frac{n-1}{2}$
(C) $\frac{n+1}{2}$
(D) None of the above

Q7 Let A(1:8, –5:5, –10:5) be a three dimensional array. How many elements are there in hte array A?

(A) 1200 (B) 1408
(C) 33 (D) 1050

Q8 A one dimensional array A has indices 1....75. Each element is a string and takes up three memory words. The array is stored at location 1120 decimal. The starting address of A[49] is

(A) 1267 (B) 1164
(C) 1264 (D) 1169

Answer Key

Q1	120
Q2	1132
Q3	13
Q4	(A)
Q5	(C)
Q6	(C)
Q7	(B)
Q8	(C)

Hints & Solutions

Q1 Text Solution:

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

The sum of all elements-

= 15 +14 + 13 +.....+ 3 + 2 + 1

= 120

Q2 Text Solution:

Number of non-zero elements in the –8th row = 15 Number of non-zero elements in the –7th row = 14

The address of arr[–6][4]-

= 1000 + (15 + 14 + 4)*4 = 1132

Q3 Text Solution:

The element present at arr[1][2] in lower triangular matrix:

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

= 13.

Q4 Text Solution:

The best-case time complexity to identify all the heads in the array would be O(n), where n is the number of elements in the array.

This best case occurs when the array is sorted in descending order. In such a scenario, every element will be greater than all the elements to its right, making every element a "head." In this case, you only need to traverse the array once to identify all the heads.

Q5 Text Solution:

Here, since 0s are followed by 1s so we have a sorted sequence and we can apply binary search.

At each stage we compare with $\frac{(\text{low}+\text{high})^{\text{th}}}{2}$ element index and if it is 1 we check left and if it is 0 we check right.

Total worst case number of probes is $\lceil \log_2 31 \rceil = 5$

So, answer is 5.

Q6 Text Solution:

Expected number of comparisons

= 1 × Probability of first element being x + 2 × Probability of second element being x + ... x + n × Probability of last element being x.

$= \frac{1}{n} + \frac{2}{n} + \frac{3}{n} + \ldots + \frac{n}{n}$

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

$= \frac{n+1}{2}$

Q7 Text Solution:

Here they have specified the size

So 1:8 mean 8 elements (both are inclusive)

(–5:5) mean 11 elements

(–10:5) mean 16 elements

So no of elements will be (just like Multidimensional array will be) 8 × 11 × 16 = 1408

so option b

Q8 Text Solution:

Address of array + index × size of element when index starts from 0

In above question index starts from 1

so given Address of array = 1120, index = 49, size of element = 3

Address = 1120 + (49 – 1) × 3 = 1120 + 48 × 3 = 1120 + 144 = 1264