

## Algorithms

## 'Heap Algorithm' &amp; 'Backtracking and Branch-Bound'

DPP

## [MCQ]

1. Consider the statements.

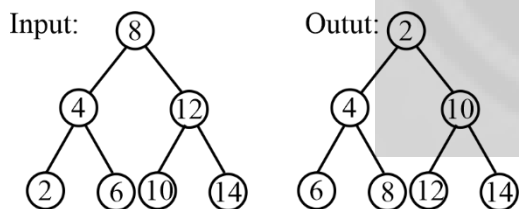
S1: Merge-sort, quick-sort and bubble sort are comparison-based sorting algorithms

S2: A reverse-sorted array (ie. ....decreasing order) is always max-heap

- (a) Only S1 is true  
(b) Only S2 is true  
(c) Both S1 and S2 are true  
(d) Neither S1 nor S2 is true.

## [MCQ]

2. Consider a binary search tree which is also a complete binary tree. The problem is to convert the BST which is given into a minheap with the condition that, all the values in the left subtree of a node should be less than all the values in the right subtree of the node. This condition is applied on all the nodes in the process of converting BST into minheap.



What will be the worst-case time complexity (tightest) of given problem, if we can take auxiliary space of  $O(n)$ ?

- (a)  $O(n)$  (b)  $O(n^2)$   
(c)  $O(\log n)$  (d)  $O(n \log n)$

## [MCQ]

3. How many different min-heap are possible with keys 1 2 3 4 5?

- (a) 5 (b) 6  
(c) 7 (d) 8

## [MCQ]

4. What is the maximum number of exchanges required to order an array of 5 elements using the selection sort?

- (a) 1 (b) 2  
(c) 3 (d) 4

## [NAT]

5. Number of undirected graph (not necessarily connected) can be constructed by given set  $V = [1, 2, 3, 4]$  of 4 vertices are \_\_\_\_.

## [NAT]

6. The number of spanning trees of an undirected completed graph with 7 nodes is \_\_\_\_

## [MCQ]

7. consider the following statements

**S1:** Backtracking is an algorithm technique for solving problems recursively by trying to build a solution incrementally.

**S2:** Time complexity of N-Queens algorithm is  $O(n!)$

Which statement is true?

- (a) only S1  
(b) only S  
(c) Both S1 and S2 are true  
(d) Neither S1 nor S2 is true

## Answer Key

- |        |               |
|--------|---------------|
| 1. (c) | 5. (64 to 64) |
| 2. (a) | 6. (16807)    |
| 3. (d) | 7. (c)        |
| 4. (d) |               |

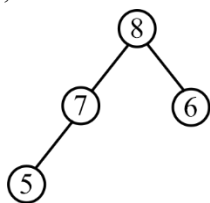


## Hints & Solutions

1. (c)

S1(true): All are comparison-based sorting algorithms.

S2(true): 8, 7, 6, 5



2. (a)

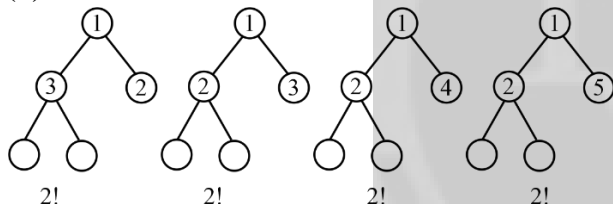
(i) Create an array  $x[]$  of size  $n$ , where  $n$  is the number of nodes in the given BST

2. Perform the inorder traversal of the BST and copy the node values in the  $x[]$  in sorted order.

3. Now perform the preorder traversal of tree.

4. While traversing the root during the preorder traversal, one by one copy the values from the  $x[]$  to the nodes.

3. (d)



4. (d)

In selection sort, with each pass, at most one swap is performed, so array with 5 elements will perform 4 passes and with each pass there will be 1 swap.

$\therefore$  d is correct.

5. (64 to 64)

As number of undirected graphs is

$$2^{(n(n-1)/2)}$$

6. (16807)

Number of spanning trees for an undirected complete graph with  $n$  nodes

$$n = n^{n-2}$$

7. (c)

True(S1): Backtracking is an algorithm technique for solving problems recursively by trying to build a solution incrementally.

True (S2): Time complexity of N-Queens algorithm is  $O(n!)$



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