

Data Structures & Programming

DPP: 2

CS & IT

Trees

- Q1** The minimum number of nodes in AVL tree of height 6 is _____.
(Assume that the height of the root node is 1)
- Q2** Consider the following statements:
P: An AVL tree is a height-balanced complete binary tree.
Q: A heap is necessarily a complete binary tree.
 Which of the following statement(s) is/are CORRECT?
 (A) P only
 (B) Q only
 (C) Both P and Q
 (D) Neither P nor Q
- Q3** The total number of ways in which a max-heap can be constructed with the keys-7, 6, 1, 4, 5, 2, 3 is _____.
- Q4** Consider the following statements:
P: If the root node of a BST is deleted, it can be replaced by inorder predecessor.
Q: If the root node of a BST is deleted, it can be replaced by preorder successor.
 Which of the following is/are CORRECT?
 (A) P only
 (B) Q only
 (C) Both P and Q
 (D) Neither P nor Q
- Q5** Consider the following operations in a BST-
 INSERT(23), INSERT(17), INSERT(25), INSERT(4),
 INSERT(21), INSERT(1), INSERT(7), DELETE(17),
 DELETE(23).
 The post-order traversal of the resultant BST is
 (A) 1, 7, 4, 21, 25
 (B) 1, 4, 7, 25, 21
 (C) 1, 4, 21, 7, 25
 (D) None of the above
- Q6** Which of the following sequence(s) of array form a heap?
 (A) 23, 17, 14, 6, 13, 10, 1, 12, 7, 5
 (B) 1, 5, 10, 6, 7, 12, 13, 14, 17, 23
 (C) 23, 17, 14, 7, 13, 10, 1, 5, 6, 12
 (D) 1, 5, 10, 12, 13, 7, 14, 17, 23, 6
- Q7** Consider the following statements:
P: The accepted balanced factor in an AVL tree are -1, 0 and +1.
Q: The height of an AVL tree with n nodes is given as $\text{ceil}(\log_2 n)$.
 The number of INCORRECT statements is _____.
- Q8** Construct an AVL tree with the following keys:
 12, 10, 15, 14, 13, 17, 8
 The immediate left child key value of the root node of the AVL tree is _____.



Answer Key

Q1 20~20

Q2 (B)

Q3 80~80

Q4 (A)

Q5 (A, B, C)

Q6 (B, C)

Q7 0~0

Q8 12~12



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Hints & Solutions

Q1 Text Solution:

The minimum number of nodes in an AVL tree of height 'h' is given by-

$$n(h) = n(h-1) + n(h-2) + 1$$

$$n(1) = 1, n(2) = 2, n(3) = 4, n(4) = 7, n(5) = 12,$$

$$n(6) = 20$$

Q2 Text Solution:

P: INCORRECT. An AVL tree is not necessarily a complete binary tree.

Q: CORRECT. A heap is necessarily a complete binary tree.

Q3 Text Solution:

$$T(n) = 1 + \binom{n-1}{k} * T(k) * T(n-k-1)$$

Here $n = 7, k = 3$

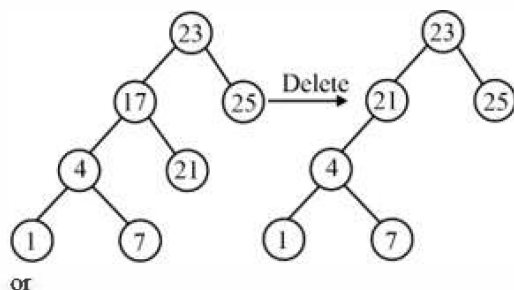
$$T(7) = 1 + \binom{6}{3} * T(3) * T(3)$$

Now, $T(3) = 2$

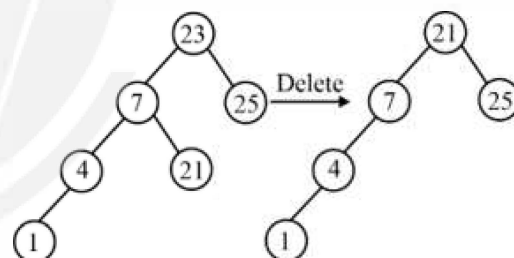
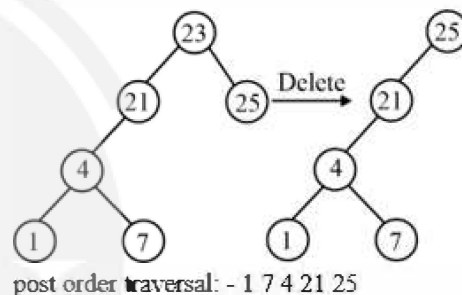
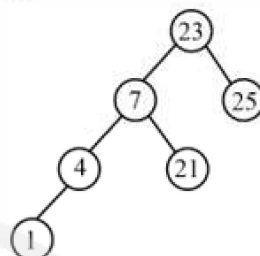
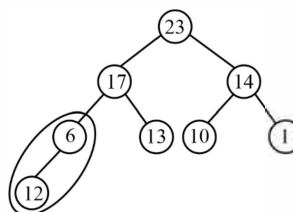
$$T(7) = 1 + \binom{6}{3} * 2 * 2 = 80$$

Q4 Text Solution:

If the root node of a BST is deleted, it can be replaced by inorder predecessor/successor.

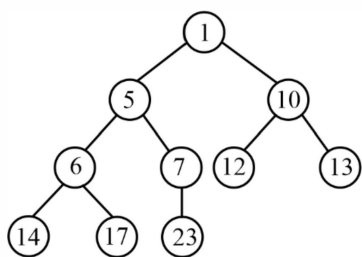
Q5 Text Solution:


or


Q6 Text Solution:


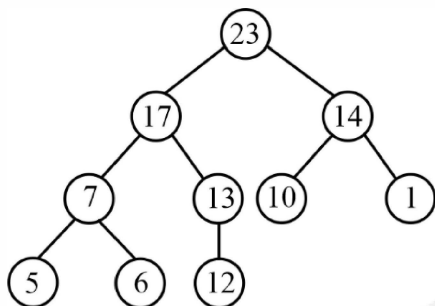
Not possible defies max-heap property
(b)





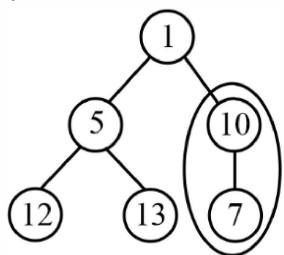
Satisfies min-heap property

(c)



Satisfies max-heap property.

(d)



Not possible defies min-heap property

Q7 Text Solution:

P: The accepted balanced factor in an AVL tree are -1 , 0 and $+1$.

Q: The height of an AVL tree with n nodes is given as $\text{ceil}(\log_2 n)$.

Both the statement are CORRECT.

Q8 Text Solution:

Resultant AVL tree.

