Quiz-2
Data Structures

Set A

16th Feb Time Allowed: **45** minutes

INSTRUCTIONS

1. This paper contains **Multiple choice questions** .
2. Marking Scheme

   Multiple correct : +3,-1,0 -> correct, incorrect, not attempted

   Fill in th blanks : +5,0,0 -> correct, incorrect, not attempted

   All MCQs may have more than one correct option.

   All fill in the blanks and MCQs need to be marked on last page.
3. Roll No and answers to be marked on last page .

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1. For an tree T, let LR(T) be no of nodes which are the only children of their parent and n be total no of nodes in the tree. We define LT(T) = LR(T)/n . Which of the following statements are true ?
   (a) For any non empty AVL tree T, LT(T) $\leq \frac{1}{2}$
   (b) For any binary tree T, if LT(T) $\leq \frac{1}{2}$ then height(T) = $O(log(n))$
   (c) For any binary tree T, if there are $\theta(n)$ nodes which are the only children of their parents, all of which are leaves, then height(T) = $O(log(n))$
   (d) None of these

2. How many distinct Max Heap can be made from 5, 6, 7 distinct integers respectively ?

   (a) 8, 20, 80

   (b) 8, 20, 76

   (c) 8, 18, 80

   (d) 7, 18, 76

3. Select the correct statements.

   (a) A node u is an proper ancestor of a node v if v is contained in the subtree rooted at u.

   (b) The depth of a node is the number of edges in the unique path from the root to the node.

   (c) The height of a node is the length of the longest path from node to a leaf.

   (d) A full binary tree is a tree in which every node other than the leaves has two children

4. For a 2-3 tree in which 10 unique values are inserted, find the maximum and the minimum number of splits that may happen during insertions .

5. Starting with an empty AVL tree, following operations were performed on the tree: Inserting elements : 10.20.15,25,30,16,18,19 followed by deleting 30 from the tree. Answer the question with the root of the resultant tree and the leaves in increasing order.

6. Select the correct statements.

   (a) Given two heaps with n elements each, it is possible to construct a single heap comprising all 2n elements in O(n) time.

   (b) Building a heap with n elements can be done in O(n) time.

   (c) Maximum element in min heap can always be found in O(logn) time.

   (d) In a heap of depth d, there must be at least 2^d elements. (Assume depth of root is zero)

7. A priority queue can be implemented as a heap because: (Priority Queue is an extension of queue with every item has a priority associated with it and always element with high priority is dequeued before an element with low priority.)

(a) The root can be easily be identified as the topmost priority.

(b) The heap is not always sorted so any value can be the top priority.

(c) The heap always has a left bottom node that can be the top priority.

(d) None of the above.

8. Let us define the following trees:
Full Binary Tree: A full binary tree (sometimes proper binary tree or 2-tree) is a tree in which every node other than the leaves has two children.
Complete Binary Tree: A complete binary tree is a binary tree in which every level, except possibly the last, is completely filled, and all nodes are as far left as possible.
A single node is a tree of depth zero

   What is the minimum number of nodes in a full binary tree with depth 3 and in a complete binary tree with depth 4 respectively?

   (a) 8, 15 (b) 15,8 (c) 16,7 (d) 31,16 (e) 31,7

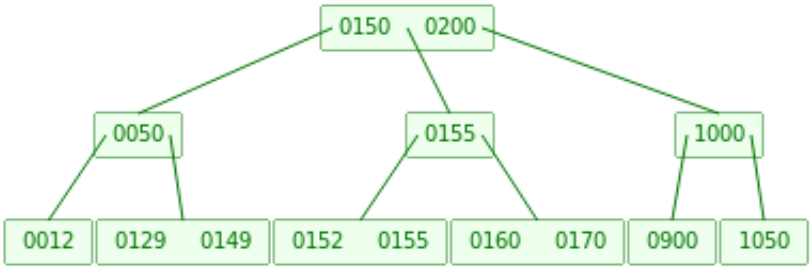
9. In a full binary tree if number of internal nodes is I, then number of leaves L are?

   (a) L = 2I (b) L = I + 1 (c) L = I - 1 (d) L = 2I - 1

10. How many distinct binary search trees can be created out of 4 distinct keys?

    (a) 5 (b) 14 (c) 24 (d) 42

11. Minimum No. of keys to be deleted in the given 2-3 tree to reduce the height



    of tree by 1 is _____

12. What are the worst case and average case complexities of insertion in binary search tree?

    (a) O(n), O(n)

(b) O(logn), O(logn)

(c) O(logn), O(n)

(d) O(n), O(logn)

13. A min heap is constructed by inserting all elements in range from [1,1023] in some order. The maximum depth at which node 9 can appear in the tree is

14. When searching for the key value 60 in a binary search tree, nodes containing the key values 10, 20, 40, 50, 70 80, 90 are traversed, not necessarily in the order given. How many different orders are possible in which these key values can occur on the search path from the root to the node containing the value 60?

    (a) 35 (b) 64 (c) 128 (d) 5040

15. You are given the Inorder and Preorder traversals. Which of the following represents valid binary tree.

    (a) Inorder: 3, 2, 4, 1, 6, 5
    Preorder: 1, 2, 3, 4, 5, 6

    (b) Inorder: 3, 2, 4, 1, 6, 5
    Preorder: 6, 2, 3, 4, 5, 1

    (c) Inorder: 3, 2, 1, 5, 4, 6
    Preorder: 1, 2, 3, 4, 5, 6

    (d) Inorder: 3, 2, 4, 1, 6, 5
    Preorder: 6, 2, 3, 4, 5, 1

16. Given two Balanced binary search trees, B1 having n elements and B2 having m elements, what is the time complexity of the best known algorithm to merge these trees to form another balanced binary tree containing m+n elements ? (m > n)

    (a) θ (m+n)

    (b) θ (mlog(n))

    (c) θ (nlog(m))

    (d) θ (mn)

17. Minimum number of nodes in a Binary Search Tree with atleast 2 nodes whose Inorder successor is a leaf is

18. The preorder traversal sequence of a binary search tree is 30, 20, 10, 15, 25, 23, 39, 35, 42. Which one of the following is the postorder traversal sequence of the same tree?

    (a) 10, 20, 15, 23, 25, 35, 42, 39, 30

    (b) 15, 10, 25, 23, 20, 42, 35, 39, 30

    (c) 15, 20, 10, 23, 25, 42, 35, 39, 30

    (d) 15, 10, 23, 25, 20, 35, 42, 39, 30

19. The number of ways in which the numbers 1, 2, 3, 4, 5, 6, 7 can be inserted in an empty binary search tree, such that the resulting tree has height 6 is

Roll No : _____

Answers:

	A	B	C	D	E
1	①	②	③	④	⑤
2	①	②	③	④	⑤
3	①	②	③	④	⑤
6	①	②	③	④	⑤
7	①	②	③	④	⑤
8	①	②	③	④	⑤
9	①	②	③	④	⑤
10	①	②	③	④	⑤
12	①	②	③	④	⑤
14	①	②	③	④	⑤
15	①	②	③	④	⑤
16	①	②	③	④	⑤
18	①	②	③	④	⑤

4 _____

5 _____ , _____

11 _____

13 _____

17 _____

19 _____