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B.Tech. Second Assessment – November 2016
Third Semester
(Computer Science and Engineering)

15CSE201 Data Structures and Algorithms

Time: Two hours Maximum: 50 Marks

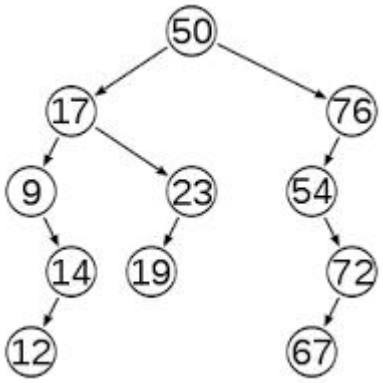
Answer all questions

1. Answer the following questions. [5 marks]
   a. What are the two properties that make a binary tree a binary heap?
   b. Construct a min heap with the following data elements .
   {32,78,1,22,46,98,39,11,25,61,56,63}

2. State whether the following statements about the binary tree is True or False. Justify your answers. [5 marks]
   a. If the depth of node x is greater than the depth of node y, where x and y are in the same path, then x is a descendant of y.
   b. If R is a subtree of S and S is a subtree of T, then R is a subtree of T.
   c. A tree is full/proper if and only if all of its leaves are at the same level.

3. The preorder traversal of the binary search tree are given as: 50,15,5,3,8,20,37,24,62. [5 marks]
   a. Construct the corresponding binary search tree.
   b. Give an algorithm to construct a binary search tree given its preorder traversal.
   c. What is the complexity of your algorithm?

4. Consider the following binary search tree. [5 marks]

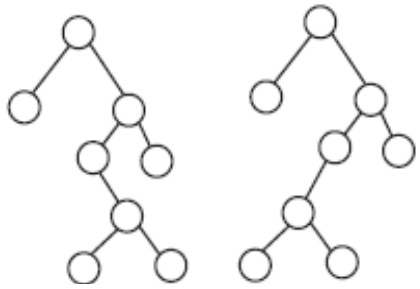


   a. Mark the balance factor of every node.

b. Identify the nodes whose insertions have caused imbalance and balance the tree so that it becomes an AVL tree using trinode restructuring. Please mention the nodes and show the rotations.

5. Answer the following questions related to binary expression trees. [5 marks]
   a. Draw the binary tree representing the expression E=(2a+b)(5x-y). (+,-,* operators can be used) .
   b. Write the preorder and postorder traversals of this tree.

6. Suppose T1 and T2 are two ordered, binary trees and let r1 and r2 be the roots of tree T1 and T2, respectively. Two such trees are similar if they have the same shape - in other words, if their natural drawings look the same. For example, the trees in the figure below are not similar. Write an efficient algorithm to test whether two such trees T1 and T2 have the same shape. It must be noted that for two similar trees the elements need not be the same, it is the structure that matters. What is the complexity of your algorithm? [5 marks]



7. A complete binary tree is stored in an array called treenodes, which is indexed from 1 to 99. The tree contains 85 elements. Are the following statements true or false? Justify your answer. [5 marks]
   a. Treenodes[42] is a leaf node.
   b. The rightchild of treenodes[12] is treenodes[25].
   c. The tree has seven levels that are full, and one additional level that contains some elements.

8. A path traversal attack aims to access files and directories that are stored in the root folder of any computer. The attacker program runs as a daemon process in the system. The attack can happen in any folder in the computer, and it affects all files and sub-folders in that folder. The corresponding folder is compromised and cannot be read. Your goal is to identify all the files and sub-folders that have been attacked. [5 marks]

   a. What data structure would you use to represent your folder structure and how would you mark if a folder or file is attacked?

b. Give an algorithm to print all the paths of the files that are within the folder that has been attacked.

9. Binary trees can be represented either in a linked representation or vector representation. Which of the representations is preferred for the following operations? Justify your answer. [5 marks]
    a. Support the rotation operations in an AVL tree
    b. Inorder traversal in a binary search tree
    c. Remove the second smallest element in a min-heap.

10. Consider a 4x4 chess board with white(w), black(b) cells alternatively represented. Construct a tree level by level by partitioning the chess board horizontally/vertically into equal halves until further subdivision cannot be done. Answer the following questions. [5 marks]
    a. What is the height of the tree for the 4x4 chessboard?
    b. Write a pseudo code to construct the chessboard from leaf node, given the pointer to the root node?