[CSL202] **2024-25-M**

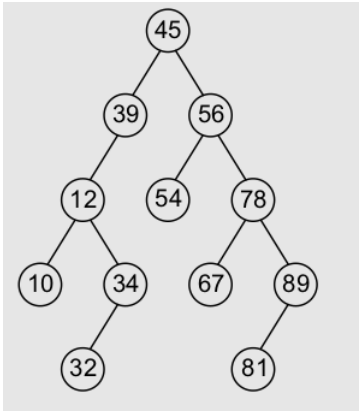
TUTORIAL III

Date: **Aug 30, 2024**.

1. For the set of $\{2, 4, 6, 12, 16, 17, 21, 25\}$ of keys, draw binary search trees of heights 2, 3, 4, 5, and 6.
2. Suppose the following eight numbers are inserted in order into an empty binary search tree T:

   $$50, 33, 44, 22, 77, 35, 60, 40$$

   Draw the tree T.
3. Consider the binary search tree T given below.



   (a) Find the in-order traversal.
   (b) What is the successor of 34.
   (c) Insert 22, 33, 44, and 77 to the tree. Draw the final tree.
   (d) Draw the tree after deleting the node 34 from T.
   (e) Draw the tree after deleting the node 56 from T.
4. Suppose that we have numbers between 1 and 1000 in a binary search tree, and we want to search for the number 363. Which of the following sequences could not be the sequence of nodes examined?

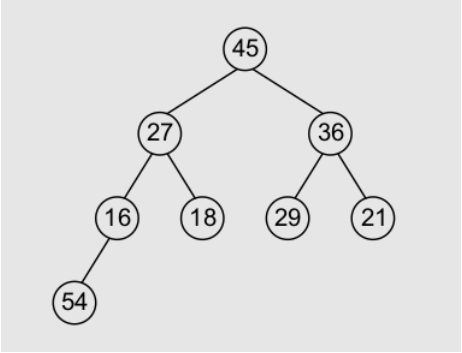
   (a) 2, 252, 401, 398, 330, 344, 397, 363.
   (b) 925, 202, 911, 240, 912, 245, 363.
   (c) 935, 278, 347, 621, 299, 392, 358, 363.
5. TRUE/FALSE: If a node in a binary search tree has two children, then its successor has no left child.
6. Let T be a Binary search tree. Let T' be a tree obtained from T by swapping the values of exactly two nodes in T. Given the tree T', design an algorithm to get T from T'.

7. Let T be a BST. "The lowest common ancestor (LCA) is defined between two nodes u and v as the lowest node in T that has both u and v as descendants (here we allow a node to be a descendant of itself)". Given a BST T, and two nodes u and v, design an algorithm to find the lowest common ancestor (LCA) of u and v.

8. Last lecture we have introduced (i) complete binary tree and (ii) MAX HEAP.

   (a) state whether the following binary tree is a complete binary tree or not.

   (b) state whether the following binary tree is MAX HEAP or not.



9. (a) State whether the following binary tree is MAX HEAP or not.

   (b) We can also represent a MAX HEAP using an array as shown in the figure below. If i is the index of a node, then what is the index of its parent, left child, right child.

   (c) Given an array respresentation of an n-element MAX HEAP, what are the indices of leaf nodes (leaves).