Tutorial 08 Tree and Heap

Question One: Binary Search Tree

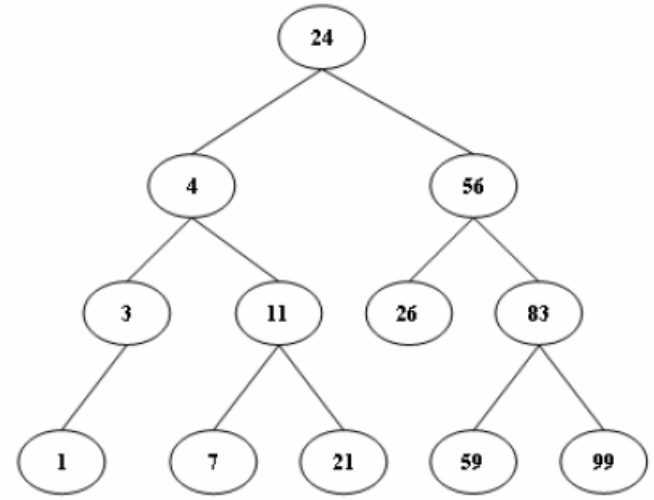
a) Show the Binary Search Tree which results after the integers `11, 24, 4, 1, 56, and 3` are added to an initially empty Binary Search Tree.

b) Now add the element `25` to the above Binary Search Tree.

c) List the elements of the tree from part b) in post-order.

d) Which node is the in-order predecessor of the root node from the Binary Search Tree in part b)?

e) Remove the nodes 56, 24, 21, 4 (in the order shown) from the Binary Search Tree below. Show the resulting Binary Search Tree.



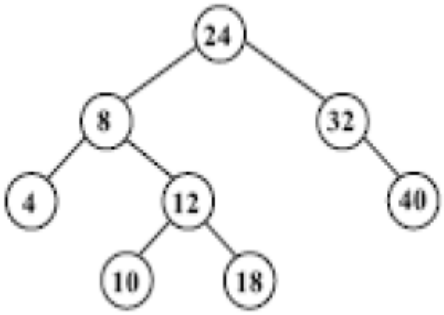
f) List the elements of your final Binary Search Tree in pre-order.

Question Two: AVL tree

An AVL tree is a binary search tree that the heights of the left and right sub-trees on any node differ by no more than 1. After each delete or insert operation the tree is checked and if it is no longer an AVL tree then the tree is restored into an AVL tree by rotations.

a) Construct an AVL tree that results from inserting the items: 6, 5, 2, 1, 3 and 4 into an empty AVL Tree.

b) Draw the resulting AVL Tree after inserting 14 into the AVL Tree below:

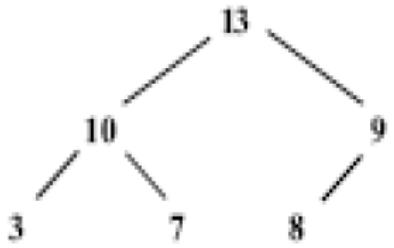


Question Three: Heap

A heap is a complete binary tree that is empty or whose root contains a search key greater than or equal to the search key in each of its children and whose root has heaps as its sub-trees. Consider an Array-Based implementation of a heap.

a) Inserting the keys 2, 3, 5, 1, 6 and 4 in sequence into an initially empty heap. What does the heap look like after performed a delete operation?

b) Given the following maxheap h:



Draw what the heap h would look like after performing each of the following pseudo code operations sequentially:

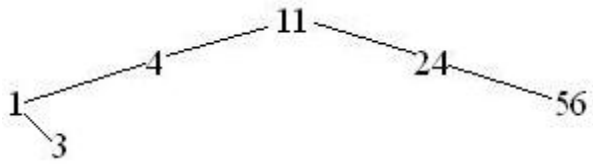
i. h.heapDelete();

ii . h.heapInsert(14);

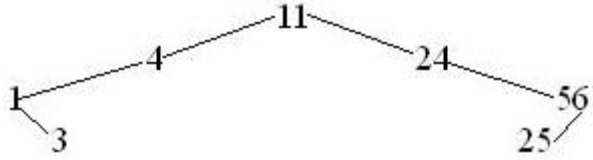
iii. h.heapInsert(12);

Answer

Q1.a



Q1.b



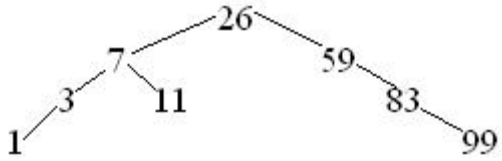
Q1.c

3 1 4 25 56 24 11

Q1.d

4

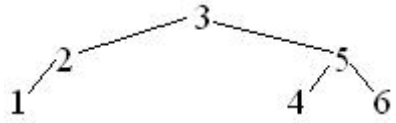
Q1.e



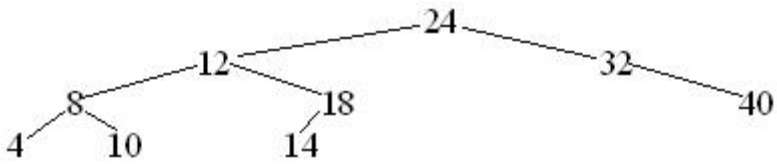
Q1.f

26 7 3 1 11 59 83 99

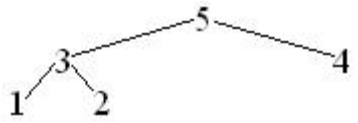
Q2.a



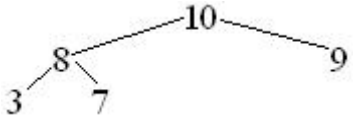
Q2.b



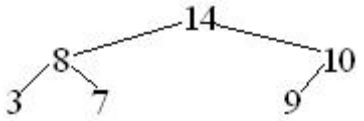
Q3.a



Q3.b.i



Q3.b.ii



Q3.b.iii