Technische Universität München
Fakultät für Informatik
Lehrstuhl für Effiziente Algorithmen
Prof. Dr. Harald Räcke
Chintan Shah

Wintersemester 2014-15
Assignment 5
November 10, 2014

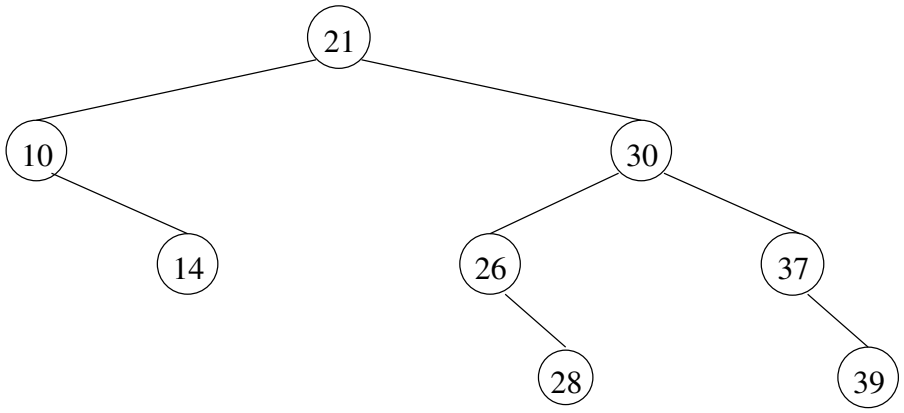
Efficient Algorithms and Datastructures I

Question 1 (10 Points)

Show that any arbitrary binary tree with n internal nodes can be transformed into any other arbitrary binary tree with n internal nodes using $O(n)$ rotations.

Question 2 (10 Points)

Is the following binary tree an AVL tree? If not, rebalance it to an AVL tree.



Carry out the following operations sequentially on the tree so that it remains an AVL tree and show what the tree looks like after each operation(always carry out each operation on the result of the previous operation):

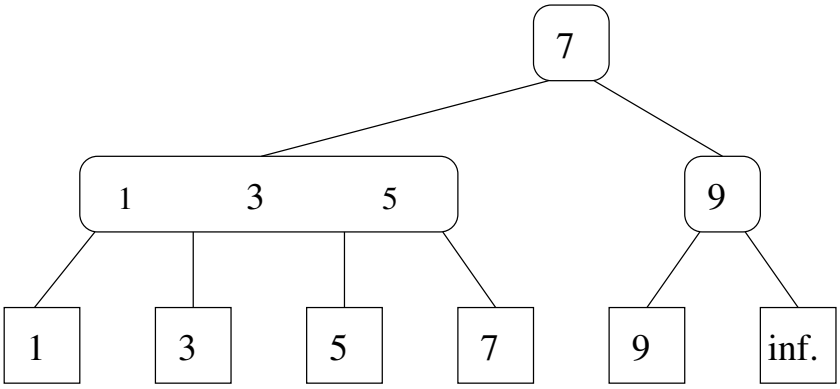
1. Insert 16
2. Delete 30
3. Insert 22
4. Insert 27

Question 3 (10 Points)

1. While inserting a node z in a red-black tree, what happens if z and its parent are red but z has no grandparent?
2. While deleting a node from an AVL tree, if node z is the only unbalanced node($|balance_{node}| > 1$) with a balance of -2(the right subtree of z has more height) and the right child of z has a balance of 0, how do we rebalance this tree?
3. If we insert a node in a red-black tree and then immediately delete the same node, is the resulting tree always identical to the original tree? Explain.

Question 4 (10 Points)

Carry out the following operations sequentially on the (2,4) tree shown below so that it remains a (2,4) tree and show what the tree looks like after each operation(always carry out each operation on the result of the previous operation):



1. Insert(4)
2. Delete(3)
3. Delete(1)