

CSE 331 Algorithms and Data Structures

Homework 3 (Due by Thursday's class on **10/3**)

9/26/2013

All the problems refer to the 3rd Edition of the textbook. You can borrow the TA's or mine if you don't have the third edition.

No late homework 3 will be accepted because I will distribute the solution right after the deadline. You need the solution to prepare for the exam.

1. Do Weiss textbook problem 4.5 (6 points)
2. Do Weiss textbook problem 4.9. For part a, show the tree after each insertion. (a. 8 points; b. 2 points)
3. Do Weiss textbook problem 4.19. Show the tree after each insertion and rotation. (11 points)
4. Problem 4.48 (5 points).
5. What is the minimum number of nodes in an AVL tree of height 0? What are the minimum number of nodes in AVL trees of heights 1, 2, and 3? Let $N(h)$ be the minimum number of nodes in an AVL tree with height h . Define a recursive function for $N(h)$. (6 points)
6. Professor W thinks he has discovered a remarkable property of binary search trees. Suppose that the search for key k in a binary search tree ends up in a leaf. Consider three sets: A , the keys to the left of the search path; B , the keys on the search path; and C , the keys to the right of the search path. Professor W claims that any three keys $a \in A$, $b \in B$, and $c \in C$ must satisfy $a \leq b \leq c$. Give a smallest possible counterexample to the professor's claim. (4 points) Note that the intersection of A , B , and C cannot empty. i.e. a single node tree is not a counter example.

7. Given a node in a BST, it is sometimes important to be able to find its successor in the sorted order determined by an inorder tree walk. If all keys are distinct, the successor of a node x is the node with the smallest key greater than $\text{key}[x]$. The structure of a BST allows us to determine the successor of a node easily. Describe a procedure that returns the successor of a node x in a binary search tree if it exists, and NIL if x has the largest key in the tree. (Hint: in order to consider all cases, find each node's successor in the tree for Exercise 4.27. Then generalize your observations.) (8 points)