

Homework 3 (Posted 12th February, Due during or before class 19th February)

General Comment: Unless otherwise mentioned we consider binary search trees with keys as real numbers. Also, nodes and their keys will be used interchangeably.

Problem 1: 5+3+2 Analyze the Preorder Traversal. You have a list of n real numbers, and you want to form a binary search tree with them. What is the tree formation complexity? Would your answer change, if I tell you that when your tree has k nodes then its depth varies from that of a complete binary tree of k nodes by at most a constant?

Problem 2: 5 Sort a list of real numbers using a binary search tree. Analyze the complexity of your algorithm. Your grade depends on the complexity of your algorithm.

Problem 3: 7 You have a binary search tree. Consider a leaf l . B is the set of keys in the path of l including l and the root. A is the set of keys to the left of this path. C is the set of keys to the right of the path. Is the following statement true or false? Given any element a in A , b in B , c in C , $a \leq b \leq c$. Justify your answer.

Problem 4: 8 Node A is a leaf and node B is its parent in a binary search tree. Show that either B is the smallest element larger than A in the tree, or the largest element smaller than A .

Problem 5: 5 A strict binary tree is one where every node has 0 or 2 children. Prove that if there are n leaf nodes in a strict binary tree then the total number of nodes is $2n - 1$.