

University of Houston

COSC 3320: Algorithms and Data Structures  
Spring 2017

Homework 6

Due April 13, at the start of class

1. Insert, in this order, the following entries in an initially empty binary search tree:  $(9, b), (20, a), (1, f), (17, c), (13, a), (8, k), (4, d), (2, p), (11, w), (5, h), (22, r)$ . You are to draw the final binary search tree.
2. Let  $T$  be a binary search tree which implements a dictionary. Let  $v$  be a node of  $T$ , and  $T_v$  be the subtree rooted at  $v$ . Design a recursive algorithm **CountLE**( $v, k$ ) which, given an input node  $v$  and a key  $k$ , returns the number of entries in  $T_v$  with key at most  $k$ .
3. Design and analyze a simple and efficient non-recursive algorithm to determine the height of a  $(2, 4)$ -tree.
4. Let  $T$  be a  $(2, 4)$ -tree containing  $n$  entries with distinct, integer keys. Suppose every node  $v \in T$  maintains a variable  $v.size$  that stores the number of entries contained in the subtree rooted at  $v$  (denoted  $T_v$ ), included the entries in  $v$ . Design a recursive algorithm **Count** which, given an integer  $k$ , returns in  $O(\log n)$  time the number of entries in  $T$  with key less than  $k$ .