Assignment 4

due Wednesday, February 15, 2012

1. Insert into an initially empty 2-3-4 tree, in the order given, the following values:

   12, 13, 17, 10, 4, 6, 9, 15, 30, 25, 20, 40.

   Show the intermediate steps after each insertion that causes a split. [6 points]

2. Insert the values above into an initially empty red-black tree. [6 points]

3. Let $T$ and $U$ be two (2,4)-trees storing $n$ and $m$ items, respectively, such that any item in $T$ has a key less than the keys of all items in $U$. Describe an $O(\lg n + \lg m)$ method for joining the trees into a single tree that stores all the items in $T$ and $U$. The original $T$ and $U$ may be destroyed in the process.

   • Give high-level pseudo-code for performing the join. You may use already existing find, insert, and delete routines.

   • Briefly explain why the time is $O(\lg n + \lg m)$.

   [8 points]

4. Let $T$ be a tree storing 20,000 items. What is the worst case height of $T$ in the following cases?

   (a) $T$ is an AVL tree
   (b) $T$ is a (2,4) tree
   (c) $T$ is a red-black tree
   (d) $T$ is a binary search tree

   [8 points]

Total: 28 points