CIS 313 Intermediate Data Structures
Winter 2010

Assignment 5

due Wednesday, February 24, 2010

1. Exercise 13.1-6, p 312. [**6 points**]
2. Give a binary tree which can be colored as a red-black tree but which is not an AVL tree. [**4 points**]
3. Do *(i)* exercise 13.3-2, p 322, *(ii)* then insert 35, 37, 22, *(iii)* and finally delete 19 and 31. Show the tree after each phase (and more if you wish). [**8 points**]
4. Let T be a tree storing 200,000 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**]
5. Exercise 18.2-1, p 497, but change the minimum degree from 2 (which would be a (2,4)-tree) to 3. [**6 points**]
6. Let T and U be two **red-black** 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 be destroyed in the process. [**8 points**]
7. Show how to use a heap to find the k^{th} largest of a set of n elements in $O(n + k \log n)$ time [**6 points**]

Total: 46 points

Notes:

- *Q1:* As usual, *internal* node means actual node and *external* node means a null.
- *Q2:* Of course, here we are just considering the shape of the tree. You are to show a tree which could be colored as a RB tree but is too out of balance to be an AVL tree.
- *Q6:* Try to adapt the solution of the same (2,4)-tree problem.
- *Q7:* Use the fact that heap-build is $O(n)$ and heap-delete is $O(\log n)$.