

Assignment 5

due Wednesday, February 27, 2008

1. Exercise 13.1-6, p 277. [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 287, (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 500,000 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 447, 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 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 $O(\log n)$.