Algorithms Homework 4

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1 Question 13.3-2

Show the red-black trees that result after successively inserting the keys 41, 38, 31, 12, 19, 8 into an initially empty red-black tree.

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2 Question 13.4-3

In Exercise 13.3-2, you found the red-black tree that results from successively inserting the keys 41, 38, 31, 12, 19, 8 into an initially empty tree. Now show the red-black trees that result from the successive deletion of the keys in the order 8, 12, 19, 31, 38, 41.

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3 Question 14.1-3

Show how OS-SELECT(T.root, 10) operates on the red-black tree T of Figure 14.1

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4 Question 14.1-5

Given an element x in an n-node order-statistic tree and a natural number i, how can we determine the ith successor of x in linear order of the tree in $\mathcal{O}(\lg n)$ time?

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5 Question 14.1-6

Observe that whenever we reference teh size attribute of a node in either OS-SELECT or OS-RANK, we use it only to compute a rank. Accordingly, suppose we store in each node its rank in the subree of which it is the root. Show how to maintain this information during insertion and deletion. (Remember that these two operations can cause rotations).

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6 Question 14.1-7

Show how to use an order-statistic tree to count the number of inversions (see problem 2-4) in an array of size n in time $\mathcal{O}(n \lg n)$