Algorithms: Assignment 9

Due date: November 6 (Wednesday)

Problem 1

Suppose that we apply RB-INSERT to add a node to a red-black tree, and then immediately call RB-DELETE to remove this node. Can the resulting tree differ from the initial tree? If the new tree is always the same as the initial tree, explain why; if not, give an example of a situation when it is different.

Problem 2

This problem is inherited from the midterm; you should write a solution even if you received the full credit for solving it during the midterm.

Suppose that we augment a normal programming language with an additional "magic" function, MAGIC-MAX(A, i, j). The arguments of this function include an array $A[1..n]$ and two indices, i and j, such that $1 \leq i \leq j \leq n$. The function sometimes returns the index of the largest element in $A[i..j]$, and sometimes the index of the second largest element in $A[i..j]$; its choice between the largest and second largest element is random. The magic property of this function is its speed; specifically, it returns an answer in *constant time.* Your task is to use this language to develop a procedure that sorts an array of real values in *linear time.* It must always return the correct sorting, and its *worst-case* time must be linear.