Algorithms: Assignment 6

Due date: October 26 (Thursday)

Problem 1 (4 points)
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 (6 points)
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.

Let $T(n)$ be the number of distinct binary trees with n nodes.

(a) Prove that $T(n) = \Omega(2^n)$.

(b) Prove that $T(n) = \Omega(3^n)$.

Problem 3 (bonus)
This is an optional problem, which is also from the midterm. It allows you to get 2 bonus points toward your final grade.

Determine an asymptotically tight bound for the running time of the following algorithm, and give a derivation of your bound:

NUMBER-TYPER(n)
if $n \leq 1$
    return
for $i = 1$ **to** n
    do print i
for $i = 1$ **to** $n - 1$
    do NUMBER-TYPER(i)