Algorithms (COT 6405): Solutions 9

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?

We use the example in Figure 14.4/13.4 (page 269/282) of the textbook to demonstrate that the new tree may differ from the original tree. The example shows the insertion of a node with value 4 into a red-black tree. If we then delete the value 4, we obtain a tree that differs from the initial tree. Note that, in this case, the deletion does not involve color changes or rotations.

Problem 2
Consider a binary search tree, and give an algorithm that prints all nodes whose keys are between two given values.

INORDER-RANGE-WALK(x, min, max)
if $x \neq$ NIL
  then if $min \leq key[x]$
    then INORDER-RANGE-WALK($left\text{-}child[x]$, min, max)
  if $min \leq key[x] \leq max$
    then print $key[x]$
  if $key[x] \leq max$
    then INORDER-RANGE-WALK($right\text{-}child[x]$, min, max)

The running time is $O(h+k)$, where h is the height of the tree, and k is the number of nodes whose keys are between the two given values.