CSE332 Data Abstractions, Summer 2012
Homework 3

Due: **Thursday, July 12, 2012** by the end of the last quiz section that day. You work should be readable as well as correct. You should refer to the written homework guidelines on the course website.

This assignment has **4** questions.

For all problems, it may help with partial credit to show other intermediate steps.

Problem 1. Ordinary & Boring Binary Search Trees

This exercise is about ordinary binary search trees, not balanced search trees. That is, use the algorithms of Figures 4.22 and 4.25 (these figures are the same in both the 2^{nd} and 3^{rd} editions of the textbooks).

(a) Show the binary search tree that results from inserting the keys 186, 039, 991, 336, 778, 066, 564, 154, 538, 645 and 256, in this order, into an initially empty binary search tree. You need only show the final tree.

(b) Show the result of deleting the key 186 from the final tree of part (a). In the event of deleting a node with 2 children, replace it with its *successor* (the minimum value child in the right tree), and not its predecessor.

Problem 2. AVL Trees

(a) Show the AVL tree that results from inserting the keys 186, 039, 991, 336, 778, 066, 564, 154, 538, 645 and 256, in this order, into an initially empty tree. Show the AVL tree after each insertion (including possible rotations) is completed.

(b) Show the result of deleting the keys 186, 336 and 538 from the final tree of part (a). You should show the AVL tree after each deletion (including possible rotations). In the event of deleting a node with 2 children, replace it with its successor (the minimum value child in the right tree), and not its predecessor.

Problem 3. Splay Trees

(a) Show the splay tree that results from inserting the keys 186, 039, 991, 336, 778, 066, 564, 154, 538, 645 and 256, in this order, into an initially empty tree. Show the splay tree after each insertion (including splayings) is completed. You should use the find/split technique for insertion.

(b) Show the result of finding the keys 186 and 336 from the final tree of part (a). You should show the splay tree after each find (including splayings).

(c) Show the result of deleting the key 066 from the final tree of part (b). In the event of deleting a node with 2 children, replace it with its successor (the minimum value child in the right tree), and not its predecessor.

Problem 4. B Trees
Show the result of inserting 12, 10, 15, 4, 1, 17, 3, 13, 8 in that order into an initially empty B tree with $M = 3$ and $L = 2$. (Recall that what the text, lecture, and this problem call a B tree is what many call a B+ tree.) Show the tree after each insertion, clearly labeling which tree is which.

In an actual implementation, there is flexibility in how insertion overflow is handled. However, in this problem, follow these guidelines:

- Always use splitting and not adoption.
- Split leaf nodes by keeping the smallest 2 elements in the original node and putting the 1 largest element in the new node.
- Split internal nodes by keeping the 2 children with the smaller values attached to the original node and attach the 2 children with the larger values to the new node.