CSE 326 DATA STRUCTURES
HOMEWORK 4

Due: **Friday, November 2, 2007** at the beginning of class.

Problem 1. Splay Trees

(a) Weiss 4.27

(b) Weiss 4.28

Problem 2. Range queries

Consider the task of printing in order a range of values that are stored in a binary search tree. A call to `printRange(root, start, end)` would print out all values in the tree rooted at *root* that are between *start* and *end*, inclusive.

(a) Give pseudocode for an efficient recursive implementation of this function, using the prototype

`printRange(Node root, integer low, integer high)`.

(Hint: when $start < \texttt{findMin}(root) \wedge end > \texttt{findMax}(root)$, your code should have the same effect as a standard in-order traversal...)

(b) Analyze your algorithm, and prove that if the tree is complete (i.e. perfect and balanced) it runs in time $O(k + \log n)$ where n is the number of nodes in the tree, and k is the number of values printed out. (Hint: given this runtime bound, a natural proof approach would count the runtime as finding *start*, finding *end*, and doing constant work for every value in between...)

Problem 3. Hashing

Show the final table resulting from inserting 10, 15, 12, 3, 1, 13, 4, 17, and 8 into the following initially empty hash table implementations. Indicate if and when no more keys can be inserted into the table. Assume the table size is 11.

(a) Separate chaining.

(b) Linear probing.

(c) Quadratic probing.

(d) Double hashing, where the second hash function is $hash(x) = 5 - (x \bmod 5)$.