Problem Set 4

Due: Wednesday, October 4, 2017 at noon

Problem 4.1 [Dynamic Dictionary with Working-Set Property].

A binary search tree has the ***worst-case working-set property*** if every access x_i costs $O(\log t_i)$ worst-case time, where t_i is the number of distinct keys accessed since the last access to key x_i.

Describe and analyze a dynamic dictionary (not necessarily a BST) that has the working-set property. Your data structure should:

(a) use $O(n)$ space, where n is the current number of items in the dictionary;

(b) support searching for key x_i in $O(\log t_i)$ worst-case time, where t_i is the number of distinct keys accessed since the insertion or last access to the key x_i; and

(c) support insertions and deletions in $O(\log n)$ amortized time.

Hint: Consider representing your dictionary as a list of binary search trees of increasing size.