

Ve281 Data Structures and Algorithms

Written Assignment Three

This assignment is announced on Oct. 19, 2018. It is due by 5:40 pm on Oct. 26, 2018. The assignment consists of four problems.

1. (40%) Given a sequence of inputs 4371, 1323, 6173, 4199, 4344, 9679, 1989, insert them into a hash table of size 10. Suppose that the hash function is $h(x) = x \% 10$. Show the result for the following implementations:
 - (a) Hash table using separate chaining. Assume that the insertion is always at the beginning of each linked list.
 - (b) Hash table using linear probing.
 - (c) Hash table using quadratic probing.
 - (d) Hash table using double hashing, with the second hash function as $h_2(x) = (7 - x) \% 7$.
2. (40%) Show the result of rehashing the four hash tables in the Problem 1. Rehash using a new table size of 19, and a new hash function $h(x) = x \% 19$. (**Hint:** The order in rehashing depends on the order stored in the old hash table, not on their initial inserting order.)
3. (10%) Suppose we want to design a hash table containing at most 600 elements using linear probing. We require that an unsuccessful search needs no more than 8.5 compares and a successful search needs no more than 3 compares on average. Please determine a proper hash table size.
4. (10%) A full node in a binary tree is a node with two children. Prove that the **number of full nodes** plus one is equal to the **number of leaves** in a nonempty binary tree.