

## Written Assignment

Write your answers in a PDF document. It is due by 11:59 pm on Nov. 1, 2019. The assignment consists of three problems.

1. (40%) **Collision Resolution.** Given a sequence of inputs 5671, 133, 173, 8899, 444, 1979, 1999, insert them into a hash table of size 10. Suppose that the hash function is  $h(x) = x \% 10$ . Draw results 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  $g(x) = (7 - x) \% 7$ . **Note:** Using the positive remainder, e.g.  $-11 \% 5 = -11 - 5 * (-3) = 4$ .
2. (20%) **Hash Table Size.** Suppose we want to design a hash table containing at most 1000 elements using linear probing. We require that an unsuccessful search needs no more than 13 compares and a successful search needs no more than 10 compares on average. Please determine a proper hash table size  $n$ .
3. (40%) **Rehashing.** Show the result of rehashing the four hash tables in the Problem 1 in figures. Rehash using a new table size of 19, and a new hash function  $h(x) = x \% 19$ . **Note:** The order in rehashing depends on the order stored in the old hash table, not on their initial inserting order.