

**CSC 225 SPRING 2016**  
**ALGORITHMS AND DATA STRUCTURES I**  
**ASSIGNMENT 3**  
**UNIVERSITY OF VICTORIA**

1. Suppose that we are given a sequence  $S$  of  $n$  elements, each of which is an integer in the range  $[0, n^2 - 1]$ . Describe a simple method for sorting  $S$  in  $O(n)$  time. (Hint: Think of alternate ways of viewing the elements so that you can use Radix-Sort.)
2. Demonstrate the insertion of the keys 5, 28, 19, 15, 20, 33, 12, 17, 10 into a hash table with collisions resolved by chaining. Let the table have 9 slots and let the hash function be  $h(k) = (2k + 5) \bmod 9$ .
3. Consider inserting the keys 10, 22, 31, 4, 15, 28, 17, 88, 59 into a hash table of length  $t = 11$  using open addressing with primary hash function  $h_1(k) = k \bmod t$ . Illustrate the result of inserting the keys using linear probing, quadratic probing and using double hashing with  $h_2(k) = 1 + (k \bmod (t - 1))$ .
4. Suppose we use double hashing to resolve collisions; that is, we use the hash function  $h(k, i) = (h_1(k) + ih_2(k)) \bmod t$ . Show that if  $t$  is even and  $h_2(k)$  is even for some key  $k$ , then the probe sequence for  $k$  examines at most half the slots in the table before returning to slot  $h_1(k)$ .