Homework assignment 10:
Due date: 2020

1. Given the below objects, hash function h(x) = x mod 10, hash the objects using
   i) separate chaining,
   ii) linear probing with f(i) = i,
   iii) quadratic probing with f(i) = i^2.

   1.1. 4371, 1323, 6173, 4199, 4344, 9679, 1989
   1.2. 12, 22, 222, 19, 129, 578, 101, 100

2. Given hash function h(x) = $\lfloor x \rfloor$, a hash table of size 13, hash the objects using
   i) linear probing with f(i) = i,
   ii) quadratic probing with f(i) = i^2.

   to hash the below numbers: (Draw the resulting hash table.)

   2.1. 2.12, 2.31, 6.21, 2.99, 2.56, 11.94, 11.00.
   2.2. 921.9999, 18.81, 61.01, 76.78, 58.12, 13.4, 26.876, 70.87, 39.13.

3. When using separate chaining to handle collisions, suppose we insist upon keeping each list in sorted order by merging newly hashed objects into the list. How does this modification affect the running times for
   a) successful searches,
   b) unsuccessful searches,

   Explain the algorithm you will use for searching and for insertion.

4. Given two lists of integers of sizes *m* and *n* respectively, describe an algorithm that runs in time *O*(*m+n*) that computes the intersection of the lists. Argue that your algorithm is correct, and has the desired running time.
5. Suppose that we are storing a set of *m* keys into a hash table of size *n*. Show that if the keys are drawn from a universe *U* with $|U| > nm$, then *U* has a subset of size *m* consisting of keys that all hash to the same slot, so that the worst-case searching time for hashing with chaining is $\Theta(m)$. (Hint: Use pigeonhole principle)