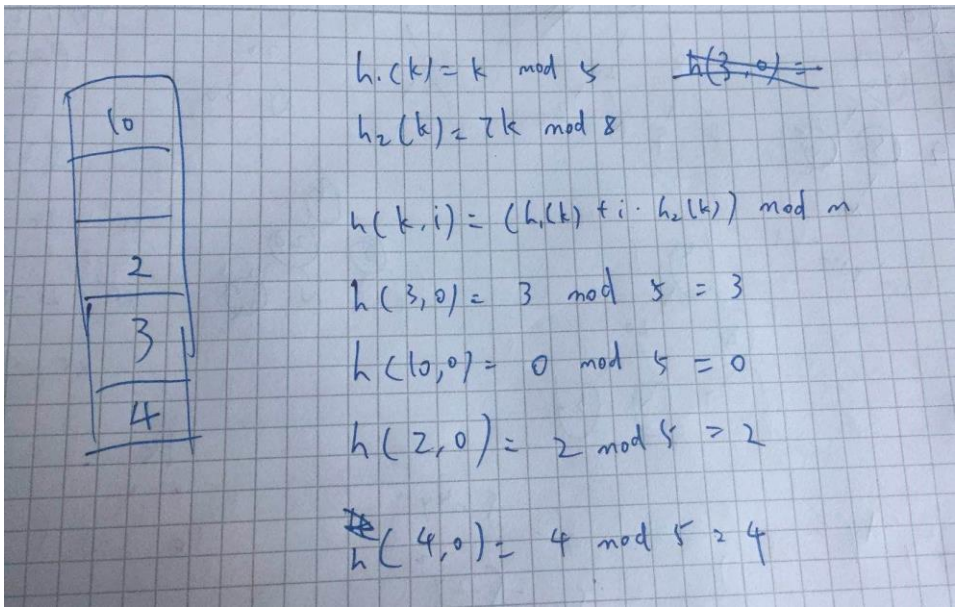
Problem 10.1

a)

double hashing function is h(k, i) = (h1(k)+i*h2(k)) mod m

In this sequence of <3, 10, 2, 4>, no collision has taken place, which is just h1(k) mod m. Also, h1(k) = k mod 5 which is m, when collision happen, i is 0, hash function equals k mod 5.



b)

hash_table.cpp

h' function = key % maxSize;

Idea of linear probing is to increment 1 if the current Hash-index is occupied. This means when h' function = key % (a number smaller than maxSize), the number of collisions will not be minimal, because this function can only return a Hash-index at most to the number being moduled. Take h' = function = key % 7 as an example, this function will only return up to index 6, and the index between 6 and maxSize will have to start at most from 6, which will eventually cost a lot of collision.

To prove the above statement, I have an int "Collison" in HashTable class which records how many collisions happen when a HashTable is full inserted. To be fair I used rand() with time as seed in the beginning for the keys. Below are collisions recorded when m=10.

num											average
3	35	38	38	34	35	38	35	35	34	36	35.8
7	22	11	24	25	22	24	18	18	16	14	19.4
10	12	17	16	13	8	12	17	10	4	13	12.2

This proves set h' function as key % maxSize is well-suited.

Problem 10.2

a)

counterexample:

activity:	A1	A2	A3	sort with shortest duration	A2	A3	A1
start:	1	4	5		4	5	1

finish:	5	6	8		6	8	5
duration:	5	2	3		2	3	5

greedy choice of selecting the activity with shortest duration: **A2** one activity.
globally optimal solution: **A1->A3** two activities.

In this counterexample, if the shortest activity is in between and crosses the boundaries of the neighbor activities, it will fail at producing the globally optimal solution.