Data Structures & Algorithms 2
Tutorial 5
Hashing

Exercise 1

Given input {4371, 1323, 6173, 4199, 4344, 9679, 1989} and a hash function h(x) = x (mod () 10), show the resulting

1. separate chaining hash table
2. hash table using linear probing
3. hash table using quadratic probing
4. hash table with second hash function h2 (x) = 7 − (x mod 7)

Exercise 2

Show the result of rehashing the hash tables in Exercise 1.

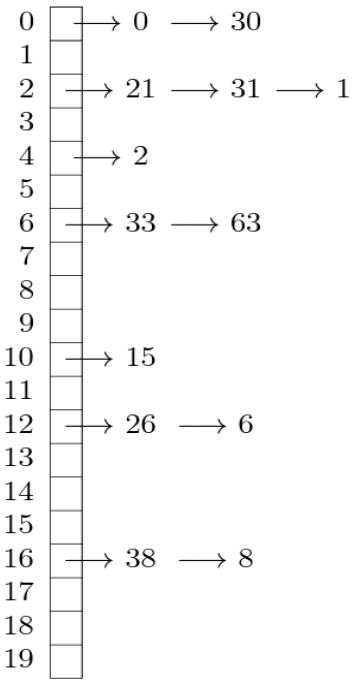
Exercise 3

What are the advantages and disadvantages of the various collision resolution Strategies ?

Exercise 4

Suppose you have a hash table and have inserted some elements. When you inspect it you see that the result looks as the figure below. You realize this is a problem.

a) What is the problem here?
b)Give an example of a hash function that could give rise to this behavior.
c)What would be a better hash function?



Exercise 5

Suppose n keys are chosen randomly and the hash function distributes the keys uniformly at random over {0, 1, …, m-1}.

a. What is the probability that n=2 independently chosen keys have the same hash value i.e. what is the probability there is a collision among those two keys?

b. What is the probability that there are no collisions among any of the n keys? Assume n <= m.

Exercise 6

Suppose you have the following keys:
ISB, LHR, KHI, MUX, MUR, PESH, QUE, FSB, BWP, SGD, RWP
You are given the following hash function:

(sum of first and second letter code) mod 13

(for example in ISB you just take the sum of letter code for I and letter code for S and then take the mod)
The letter codes are given in the following table. Note that multiple letters can have the same code. For example A, B and C all are assigned the code 1.

LETTER	CODE LETTER	LETTER	CODE LETTER
A,B,C	1	D,E,F	2

G,H,I	3	J,K,L	4
M,N,O	5	P,Q,R	6
S,T,U	7	V,W,X,Y,Z	8

a. You have a hash table with 13 buckets. Show how this hash table will be filled using linear probing.

b. You have a hash table with 13 buckets. Show how this hash table will be filled using quadratic probing.

c. You have a hash table with 13 buckets. Show how this table will be filled when separate chaining is used.