CSC212
Tutorial: Hashing

Assuming the keys are integers, denoted by $d_n d_{n-1} \ldots d_k \ldots d_2 d_1$ where d_i is the *i*-th decimal digit in the key, d_n being the leftmost decimal digit. The hash function *H(key)* is given by:

$$H(key) = (d_1 d_2 + d_{n-1} d_n + d_k) \bmod 11$$

where $d_1 d_2$ is a two digit number (composed by swapping the rightmost two digits), $d_{n-1} d_n$ is also a two digit number (composed by swapping the leftmost two digits), and $k = \lceil n/2 \rceil$. For example:

$$H(70934) = (43 + 07 + 9) \bmod 11 = 59 \bmod 11 = 4.$$

Assume the keys are: 1234, 519, 911, 7346, 0, 999, 99834, 54 and 40015.

(a) Compute *H(key)* for each of the above keys.
(b) Insert the above keys (in exactly the same order) in a hash table with open addressing (linear rehashing).
(c) Find the number of probes required to search for keys 54 and 11 in the above hash table.
(d) Repeat part (b) using an external chaining hash table.

Solution:

a)

H(1234) = (43 + 21 + 3) % 11 = 67 % 11 = 1

H(519) = (91 + 15 + 1) % 11 = 107 % 11 = 8

H(911) = (11 + 19 1) % 11 = 31 % 11 = 9

H(7346) = (64 + 37 + 4) % 11 = 105 % 11 = 6

H(0) = (0 + 0 + 0) % 11 = 0 % 11 = 0

H(999) = (99 + 99 + 9) % 11 = 207 % 11 = 9

H(99834) = (43 + 99 + 8) % 11 = 150 % 11 = 7

H(54) = (45 + 45 + 4) % 11 = 94 % 11 = 6

H(40015) = (51 + 04 + 0) % 11 = 55 % 11 = 0

Key	H(Key)
1234	1
519	8
911	9
7346	6

Key	H(Key)
999	9
99834	7
54	6
40015	0

b)

0	0	1
1	1234	1
2	54	8
3	40015	4
4		
5		
6	7346	1
7	99834	1
8	519	1
9	911	1
10	999	2

c)

-Number of probes for key 54 is 8

H(11) = (11 + 11 + 1) % 11 = 23 % 11 = 1
-Number of probes for key 11 is 4

d)