Assignment 7

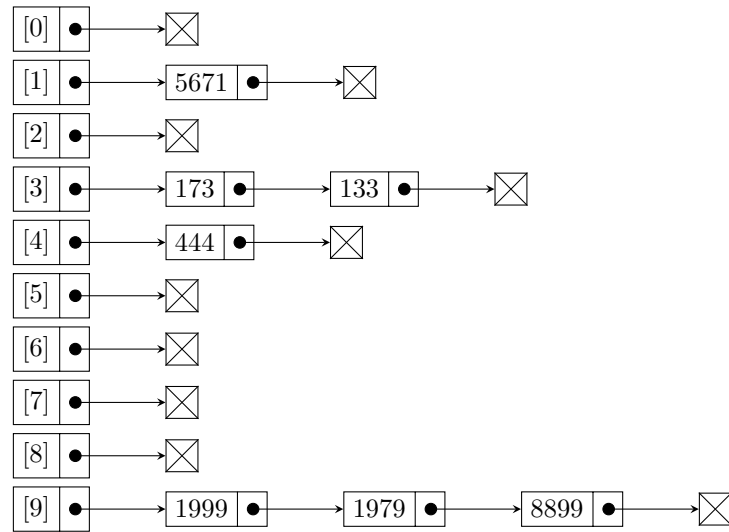Ziqi Zhao   October 27, 2019

7.1. **Collision Resolution.**

    (a) Hash table using separate chaining.

    (b) Hash table using linear probing.

1979	5671	1999	133	173	444				8899
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

    (c) Hash table using quadratic probing.

1979	5671		133	173	444			1999	8899
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

    (d) Hash table using double hashing, with the second hash function as
        $g(x) = (7 - x)\%7$.

	5671	1999	133	444	173		1979		8899
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

7.2. **Hash Table Size.**

Define the load factor as L, the expected number of comparisons in an unsuccessful search as $U(L)$, and the expected number of comparisons in a successful search as $S(L)$.

Then in linear probing, we have:

$$U(L) = \frac{1}{2} \left[1 + \left(\frac{1}{1-L} \right)^2 \right]$$

$$S(L) = \frac{1}{2} \left[1 + \frac{1}{1-L} \right]$$

According to the requirements:

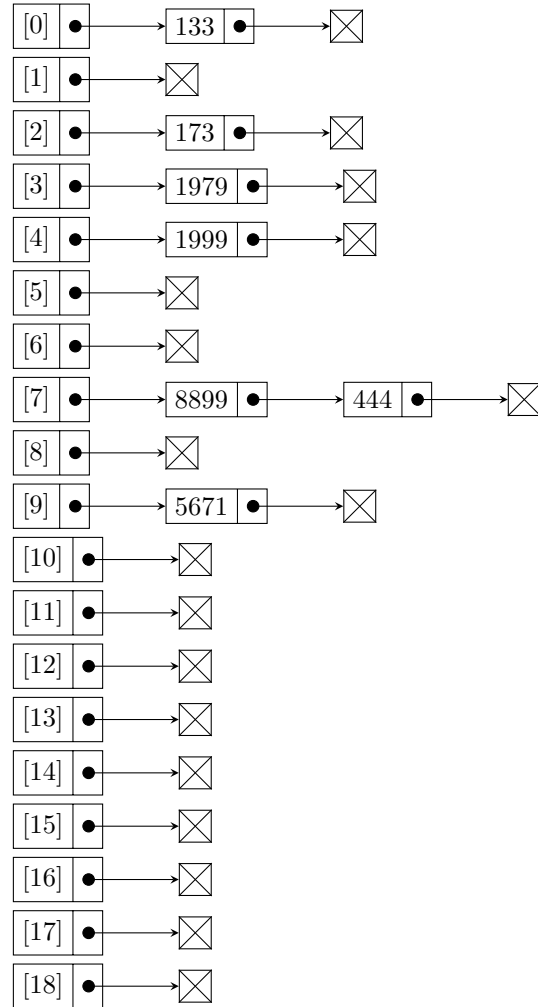$$\begin{cases} U(L) \le 13 \\ S(L) \le 10 \end{cases}$$

We have:

$$L = \frac{1000}{n} \le \frac{4}{5}$$

So we obtain the minimum of table size n:

$$n_{min} = 1250$$

7.3. **Rehashing.**

(a) Hash table using separate chaining.

[0]	→ 133 → ⊠
[1]	→ ⊠
[2]	→ 173 → ⊠
[3]	→ 1979 → ⊠
[4]	→ 1999 → ⊠
[5]	→ ⊠
[6]	→ ⊠
[7]	→ 8899 → 444 → ⊠
[8]	→ ⊠
[9]	→ 5671 → ⊠
[10]	→ ⊠
[11]	→ ⊠
[12]	→ ⊠
[13]	→ ⊠
[14]	→ ⊠
[15]	→ ⊠
[16]	→ ⊠
[17]	→ ⊠
[18]	→ ⊠

(b) Hash table using linear probing.

133		173	1979	1999			444	8899	5671
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]

(c) Hash table using quadratic probing.

133		173	1979	1999			444	8899	5671
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]

(d) Hash table using double hashing, with the second hash function as $g(x) = (7 - x)\%7$.

133		173	1979	1999			444		5671
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]
		8899						