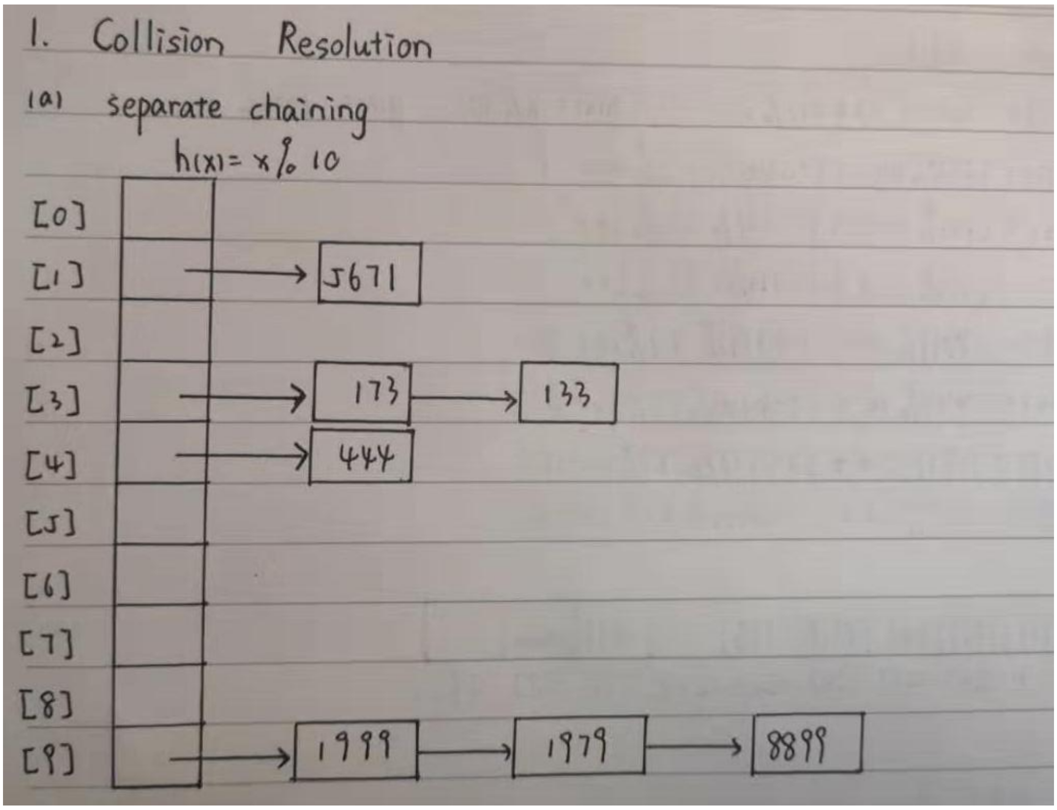
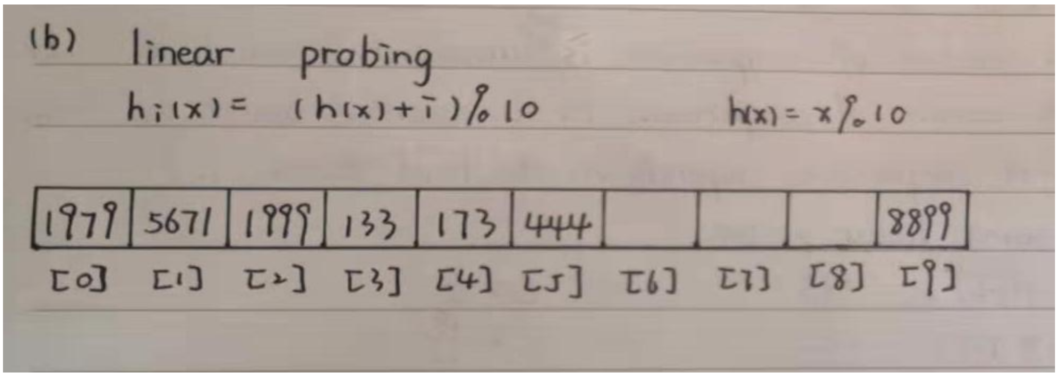
1. Collision Resolution

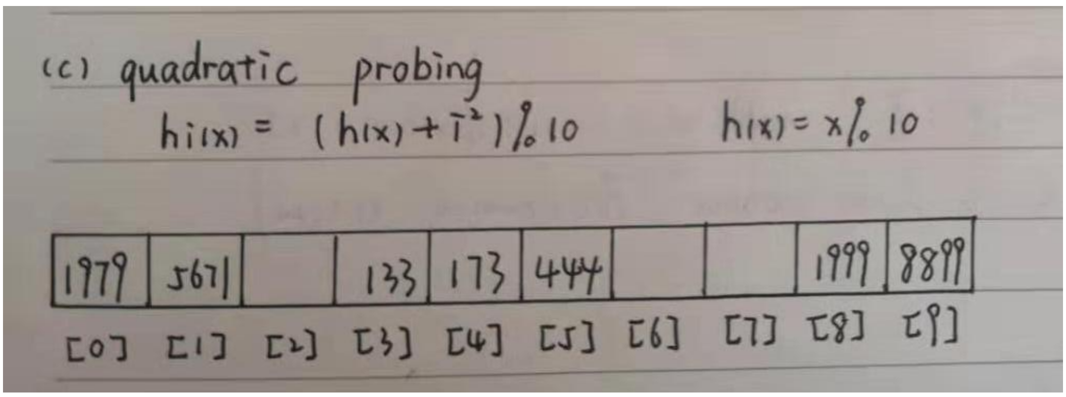
(a) separate chaining



(b) linear probing



(c)quadratic probing



(d)double hashing

(d) double hashing

$h_i(x) = (h(x) + i \cdot g(x))\,\%\,10$. $\quad h(x) = x\,\%\,10 \quad g(x) = (7-x)\,\%\,7$

$\Rightarrow h(5671) = 5671\,\%\,10 = 1 \qquad h(133) = 133\,\%\,10 = 3$

$h(173) = (173\,\%\,10 + (7-173\,\%\,7))\,\% = 5 \qquad h(8899) = 8899\,\%\,10 = 9$

$h(444) = 444\,\%\,10 = 4 \qquad h(1979) = (1979\,\%\,10 + (7-1979)\,\%\,7) = 7$

$h(1999) = (1999\,\%\,10 + (7-1999)\,\%\,7)\,\%\,10 = 2$

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

2. Hash Table Size

2. Hash Table Size

Define the load factor $L = \frac{|S|}{n}$

Define the expected number of comparisons in an unsuccessful search as $U(L)$

Define the expected number of comparisons in a successful search as $S(L)$

(Because the number of comparisons depends on the load factor L)

And because of using linear probing:

$$U(L) = \frac{1}{2}\left[1 + \left(\frac{1}{1-L}\right)^2\right] \le 13 \quad \Rightarrow L \le \frac{4}{5}$$

$$S(L) = \frac{1}{2}\left(1 + \frac{1}{1-L}\right) \le 10 \quad \Rightarrow L \le \frac{18}{19}$$

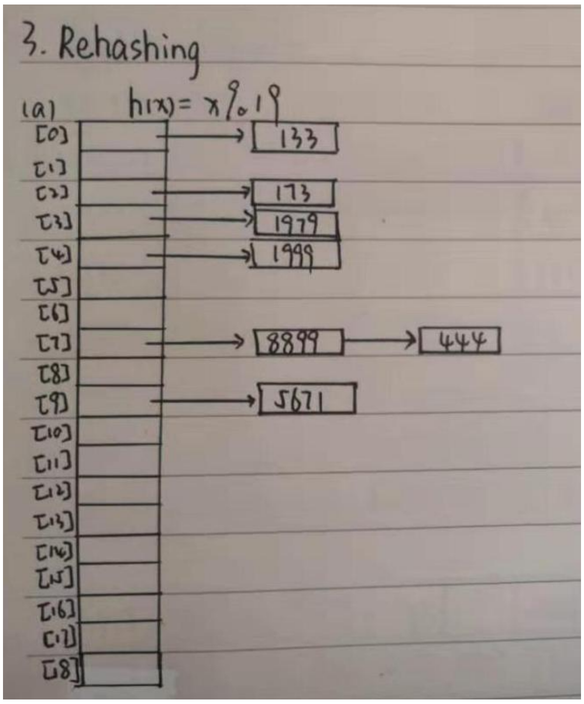
$$\Rightarrow L \le \frac{4}{5}$$

For the factor $L = \frac{|S|}{n} \le \frac{4}{5}$, table size $n \ge \frac{5}{4} \times 1000 = 1250$

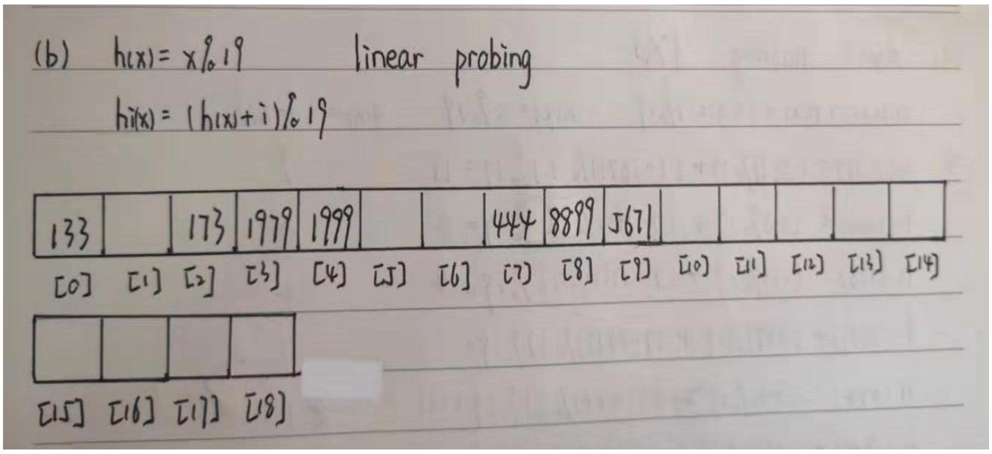
Pick n as a prime number. For example, $n = 1259$

3. Rehashing

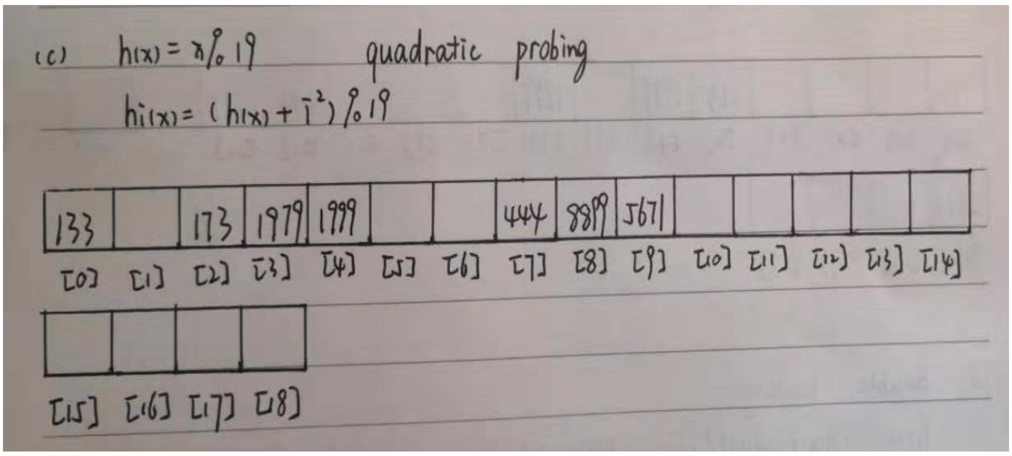
(a) separate chaining



(b) linear probing



(c)quadratic probing



(d)double hashing

(d) double hashing

$h_i(x) = (h(x) + i \cdot g(x)) \% 19$ $\quad h(x) = x \% 19$ $\quad g(x) = (7-x) \% 7$

$\Rightarrow h(5671) = 5671 \% 19 = 9$ $\quad h(1999) = 1999 \% 19 = 4$

$h(133) = 133 \% 19 = 0$ $\quad h(444) = 444 \% 19 = 7$

$h(173) = 173 \% 19 = 2$ $\quad h(1979) = 1979 \% 19 = 3$

$h(8899) = (8899 \% 19 + (7-8899) \% 7) \% 19 = 12$

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

[15]	[16]	[17]	[18]