Hash Table Analysis — Weihang Zheng

$h(k) = k \% m$ • Insert 15, 22, 36

i	Value
0	
1	15
2	22
3	
4	36
5	
6	

$15 \% 7 = 1$

$22 \% 7 = 1$

$36 \% 7 = 1$

• Remove 22

i	Value
0	
1	15
2	22(R)
3	
4	36
5	
6	

• Find 36

Search $h(36) = 36 \% 7 = 1$,

at 1, no 36,

~~Increase step by~~ probe 1 step,

found 22 Removed, probe $1+1 = 2$ steps

found 36 at index 4

• Insert 10

$10 \% 7 = 3$

i	Value
0	
1	15
2	22(R)
3	10
4	36
5	
6	

load factor $= \frac{4}{7} = 0.57$

Resize

~~Part b~~

0	
1	15
2	22(R)
3	10
4	36
5	
6	
7	
8	
9	
10	

Load factor
$= \frac{4}{11} < \frac{1}{2}$

Part b

insert ⓞ

15, 22, 36

$h_2(22) = 3 - 22\%3$
$= 2$

$h_2(36) = 3 - 36\%3$
$= 3$

0	
1	15
2	
3	22
4	36
5	
6	

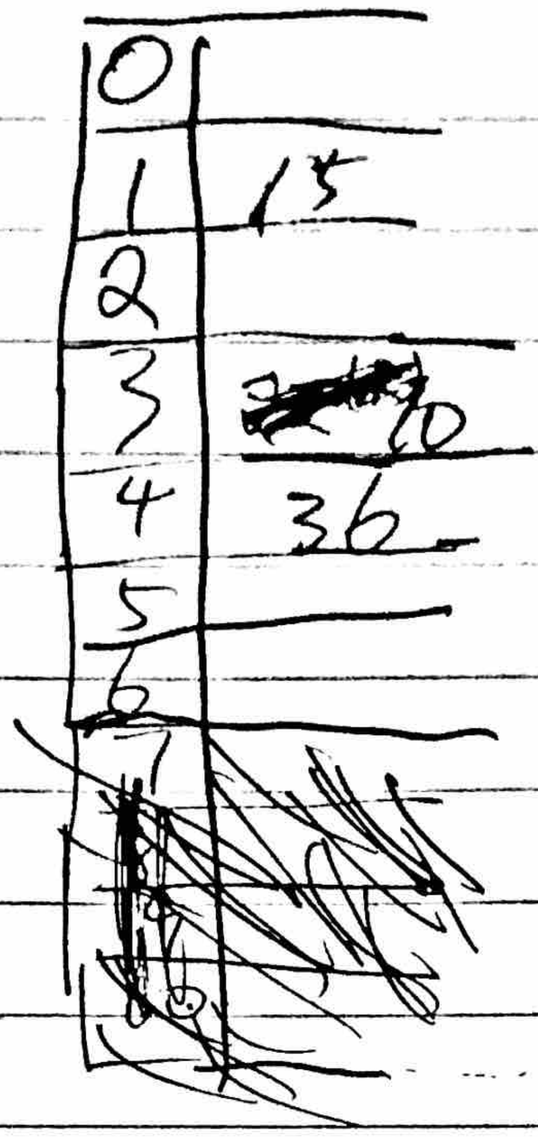
Remove 22

0	
1	15
2	
3	22(R)
4	36
5	
6	

Find 36:
$36\%7 = 1$
go to index 1,
find 15,
use $h_2(36) = 3$,
go to index $1+3=4$,
find 36.

~~Part~~ c Insert 10

10 & 7 = 3



part c.

$p = (1 - e^{-kn/m})^k$ 2n/3 -> True

$= (1 - e^{-3n/m})^3$

$= (1 - e^{-3(\frac{2}{3}m)/m})^3$ 3 hash functions

$= (1 - e^{-2})^3$

number of items

$\approx \frac{2m}{3} \div 2 = \frac{m}{3}$

$p = (1 - e^{-kn/m})^k$

$= (1 - e^{-3(\frac{1}{3}m)/m})^3$

$= (1 - e^{-1})^3 \approx 25.26\%$

Number of false positives on average would be $27 \times 0.25 \approx \boxed{7}$.