COMP.4040 Quiz – Hash Table Sp2019

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1. Given the following input (3412, 3413, 1741, 3269, 2909, 6291, 6373, 5129) and the hash function h(k) = k mod 10, which of the following statement(s) true? Choose all correct ones.

(A.) 3269, 2909, 5129 hash to the same value

B. 3412 and 3413 hash to the same value

(C.) 1741, 6291 hash to the same value

D. 3413, 3269, 6291, 6373 each hashes to a different value

2. The keys 14, 18, 33, 4, 3, 23, 25 and 5 are inserted into an initially empty hash table in this given order. The hash table has 10 slots and uses chaining with hash function h(k) = k mod 10. What is the hash table after inserting all keys? (multiple numbers in the same slot represents a linked list to chain the numbers together in that order)

0	
1	
2	
3	3, 23, 33
4	4, 14
5	5, 25
6	
7	
8	18
9	

A

0	
1	
2	
3	23, 3, 33
4	4, 14
5	5, 25
6	
7	
8	18
9	

(B)

0	
1	
2	
3	33, 23, 3
4	14, 4
5	25, 5
6	
7	
8	18
9	

C

0	
1	
2	
3	33, 3, 23
4	14, 4
5	25, 5
6	
7	
8	18
9	

D

$h(14) = 14 \bmod 10 = 4$
$h(18) = 18 \bmod 10 = 8$
$h(33) = 33 \bmod 10 = 3$
$h(4) = 4 \bmod 10 = 4$ (collision)
$h(3) = 3 \bmod 10 = 3$ (collision)
$h(23) = 23 \bmod 10 = 3$ (collision)
$h(25) = 25 \bmod 10 = 5$
$h(5) = 5 \bmod 10 = 5$ (collision)

3. The keys 14, 18, 33, 4, 3, 23, 25 and 5 are inserted into an initially empty hash table in this given order. The hash table has 10 slots and uses open addressing with hash function h(k) = k mod 10 and linear probing. What is the hash table after inserting all keys?

0	
1	
2	
3	23
4	4
5	5
6	
7	
8	18
9	

A

0	
1	
2	5
3	33
4	14
5	4
6	3
7	23
8	18
9	25

B

0	
1	
2	
3	33
4	14
5	25
6	
7	
8	18
9	

C

0	5
1	
2	
3	33
4	14
5	4
6	3
7	23
8	18
9	25

D

$h(14,0) = 14 \bmod 10 = 4$
$h(18,0) = 18 \bmod 10 = 8$
$h(33,0) = 33 \bmod 10 = 3$
$h(4,0) = 4 \bmod 10 = 4$ (collision)
$h(4,1) = (4+1) \bmod 10 = 5$
$h(3,0) = 3 \bmod 10 = 3$ (collision)
$h(3,1) = 4$ (collision); $h(3,2) = 5$ (collision); $h(3,3) = 6$

$h(23,0) = 23 \bmod 10 = 3$ (collision)
$h(23,1) = 4$ (collision)
$h(23,4) = 7$
$h(25,0) = 25 \bmod 10 = 5$ (collision)
$h(25,4) = 9$
$h(5,0) = 5 \bmod 10 = 5$ (collision) --- $h(5,5) = 0$

4. (1) What is the load factor in Problem 2 above?

$$\alpha = \frac{8}{10} = \frac{4}{5}$$

(2) What is the load factor in Problem 3 above?

$$\alpha = \frac{8}{10} = \frac{4}{5}$$