HABIB UNIVERSITY

Data Structures & Algorithms

CS/CE 102/171 Spring 2023

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Hash Table Operations – Collision Handling Using Separate Chaining

Student 1: _____

For a hash table with size = 10, and use addition method for hash function – Increase by 5 to map the given keys. Use Single Chaining with Linked Lists to resolve Collisions.

1. setitem(5)

- Hash Function = (key + 5)%10
- Slot index = (5 + 5)%10 = 0
- Slot index 0 is free so no collision and slot index 0 gets key = 5

0	**5**
1	
2	
3	
4	
5	
6	
7	
8	
9	

2. setitem(10)

- Hash Function = (key + 5)%10
- Slot index = (10 + 5)%10 = 5
- Slot index 5 is free so no collision and slot index 5 gets key = 10

0	5
1	
2	
3	
4	
5	**10**
6	
7	
8	
9	

3. setitem(52)

- Hash Function = (key + 5)%10
- Slot index = (52 + 5)%10 = 7
- Slot index 7 is free so no collision and slot index 7 gets key = 52

0	5
1	
2	
3	
4	
5	10
6	
7	**52**
8	
9	

4. setitem(6)

- Hash Function = (key + 5)%10
- Slot index = (6 + 5)%10 = 1
- Slot index 1 is free so no collision and slot index 1 gets key = 6

0	5
1	**6**
2	
3	
4	
5	10
6	
7	52
8	
9	

5. setitem(79)

- Hash Function = (key + 5)%10
- Slot index = (79 + 5)%10 = 4
- Slot index 4 is free so no collision and slot index 4 gets key = 79

0	5
1	6
2	
3	
4	**79**
5	10
6	
7	52
8	
9	

6. delitem(52)

- Hash Function = (key + 5)%10
- Slot index = (52 + 5)%10 = 7
- Go to slot index 7 to see if key 52 exists over there or not. It does, so it successfully removes the key from that slot index

0	5
1	6
2	
3	
4	79
5	10
6	
7	~~52~~
8	
9	

7. setitem(4)

- Hash Function = (key + 5)%10
- Slot index = (4 + 5)%10 = 9
- Slot index 9 is free so no collision and slot index 9 gets key = 4

0	5
1	6
2	
3	
4	79
5	10
6	
7	
8	
9	**4**

8. setitem(28)

- Hash Function = (key + 5)%10
- Slot index = (28 + 5)%10 = 3
- Slot index 3 is free so no collision and slot index 3 gets key = 28

0	5
1	6
2	
3	**28**
4	79
5	10
6	
7	
8	
9	4

9. getitem(79)

- Hash Function = (key + 5)%10
- Slot index = (79 + 5)%10 = 4
- Go to slot 4 to see if key = 79 exists. It does, so returns True. Table doesn't change

0	5
1	6
2	
3	28
4	79
5	10
6	
7	
8	
9	4

10. setitem(94)

- Hash Function = (key + 5)%10
- Slot index = (94 + 5)%10 = 9
- Slot index 9 already has a key, so make a chain of keys and link it slot 9

0	5		
1	6		
2			
3	28		
4	79		
5	10		
6			
7			
8			
9	●	**4**	**94**

11. delitem(4)

- Hash Function = (key + 5)%10
- Slot index = (4 + 5)%10 = 9
- Go to slot index 9 to see if key 4 exists over there or not. It does, so it successfully removes the key from that slot index

0	5	
1	6	
2		
3	28	
4	79	
5	10	
6		
7		
8		
9	●	**94**

12. delitem(4)

- Hash Function = (key + 5)%10
- Slot index = (4 + 5)%10 = 9
- Go to slot index 9 to see if key 4 exists over there or not. It does not, as it was removed in step 11, so returns error message

0	5	
1	6	
2		
3	28	
4	79	
5	10	
6		
7		
8		
9	●	94

13. setitem(17)

- Hash Function = (key + 5)%10
- Slot index = (17 + 5)%10 = 2
- Slot index 2 is free so no collision and slot index 2 gets key = 17

0	5	
1	6	
2	**17**	
3	28	
4	79	
5	10	
6		
7		
8		
9	●	94

14. setitem(57)

- Hash Function = (key + 5)%10
- Slot index = (57 + 5)%10 = 2
- Slot index 2 already has a key, so make a chain of keys and link it slot 2

0	5		
1	6		
2	●	**17**	**57**
3	28		
4	79		
5	10		
6			
7			
8			
9	●	94	

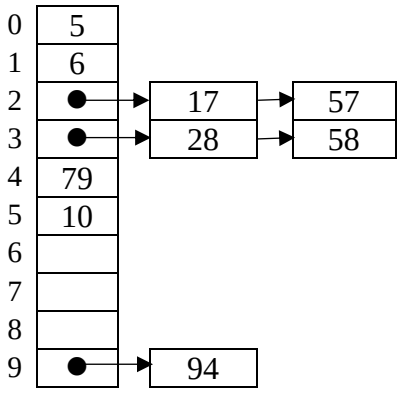
15. setitem(58)

- Hash Function = (key + 5)%10
- Slot index = (58 + 5)%10 = 3
- Slot index 3 already has a key, so make a chain of keys and link it slot 3

0	5		
1	6		
2	●	17	57
3	●	**28**	**58**
4	79		
5	10		
6			
7			
8			
9	●	94	

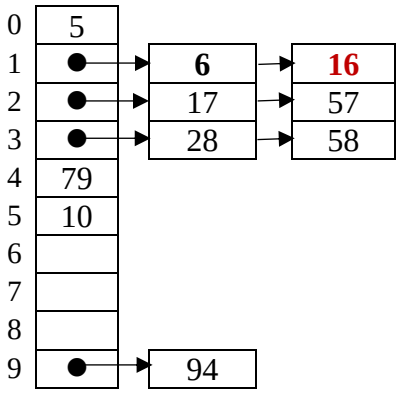
16. getitem(4)

- Hash Function = (key + 5)%10
- Slot index = (4 + 5)%10 = 9
- Go to slot index 9 to see if key 4 exists over there or not. It does not, so returns error message



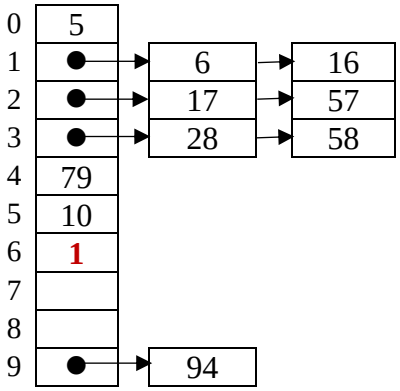
17. setitem(16)

- Hash Function = (key + 5)%10
- Slot index = (16 + 5)%10 = 1
- Slot index 1 already has a key, so make a chain of keys and link it slot 1



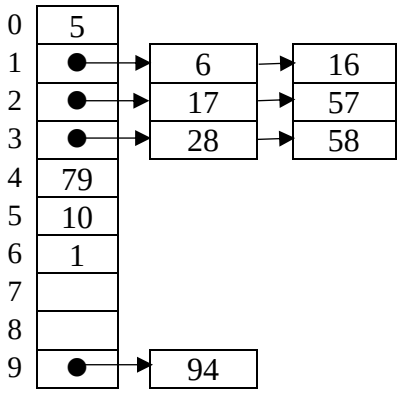
18. setitem(1)

- Hash Function = (key + 5)%10
- Slot index = (1 + 5)%10 = 6
- Slot index 6 is free so no collision and slot index 6 gets key = 1



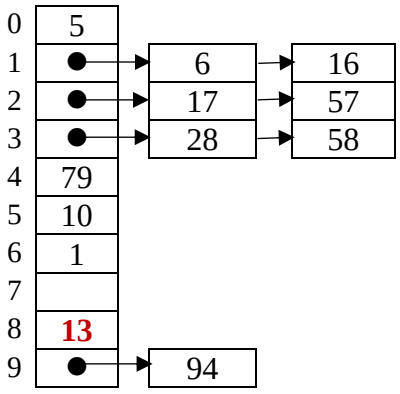
19. delitem(15)

- Hash Function = (key + 5)%10
- Slot index = (15 + 5)%10 = 0
- Go to slot index 0 to see if key 15 exists over there or not. It does not, so returns error message. Table remains the same



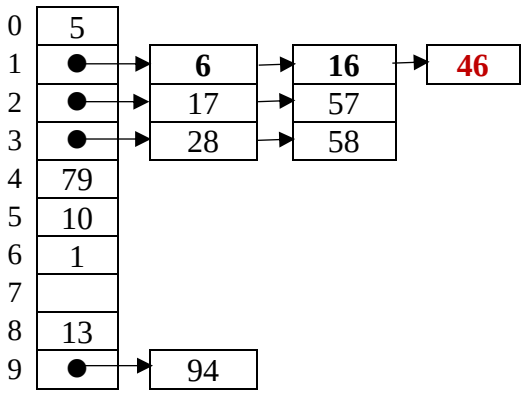
20. setitem(13)

- Hash Function = (key + 5)%10
- Slot index = (13 + 5)%10 = 8
- Slot index 8 is free so no collision and slot index 8 gets key = 13



21. setitem(46)

- Hash Function = (key + 5)%10
- Slot index = (46 + 5)%10 = 1
- Slot index 1 already has chain of keys, so add this to the existing chain, and link it with slot 1



- Final hash table with chained links looks like: