CS261P Data Structures, Spring 2020
Worksheet - 28th April 2020
TA: Aftab Hussain
University of California, Irvine

Q.1. Name three data structure operations in the following algorithm (from Prof. Kevin's slide deck):

Dijkstra's Algorithm

Maintain

- Tentative distances D for each vertex
- Set S of vertices whose distance we are not yet sure of

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S = all vertices
D[start vertex] = 0
D[every other vertex] = +∞
While destination ∈ S:
   Find and remove from S a vertex v that has minimum D[v]
   For each edge v→w:
      D[w] = min(D[w], D[v] + length(v→w))
```

Q.2. Describe the Decorator Pattern in the context of describing data structures, with an example.

Q.3. How does the Decorator Pattern help you implement the data structure of a line segment, for the segment crossing detection algorithm?

Q.4. Write down the full form of LIFO. Name a data structure that works following LIFO.

Q.5. From which side of a FIFO queue of elements do you remove/dequeue elements?

Q.6. What is a deque?

Q.7. What is the amortized time of a data structure operation?

Q.8. Which analysis gives you more flexibility in estimating the time of a data structure operation?

Q.9. What is the worst case time complexity of incrementing the n-bit counter algorithm?

Q.10. What is the time complexity of incrementing the n-bit counter algorithm if you use a probabilistic analysis technique?

Q.11. What is the name of the type of analysis you used in question 10, and why is it not accurate or dependable?

Q.12. What's the result of the following operation: 1011 XOR 1001?

Q.13. What is the name of the C++ template class used for implementing Dynamic Arrays?

Q.14. Name the fundamental operations of a dictionary data structure.

Q.15. In order to map key-value pairs, a hashing data structure implementation utilizes a hash table and a _______ ?

Q.16. What property must we maintain when adding elements to a hash table?

Q.17. What do we do in order to maintain the property in Q.16?

Q.18. What you do in Q.17 would never involve changing the hash function. Correct?

Q.19. Write down the steps for implementing a common hashing function that maps a value, say a string, to an integer.

Q.20. Say A and B are two integers, what is the highest possible value of A modulo B?

Q.21. Write the basic pseudocode for the implementing the operations in Q.14. by using hashing.

Q.22. What is collision in hashing? Name some hashing techniques that address this problem.

Q.23. Very briefly describe what each of the techniques in Q.22 do differently to address the problem of collision.

Q.24. In hash chaining, each entry of the hash table consists of a collection of key-value pairs. We could use a vector (e.g. in C++) or an array list to implement those collections. What other data structure could we use to implement them?

Q.25. Name two disadvantages of hash chaining.

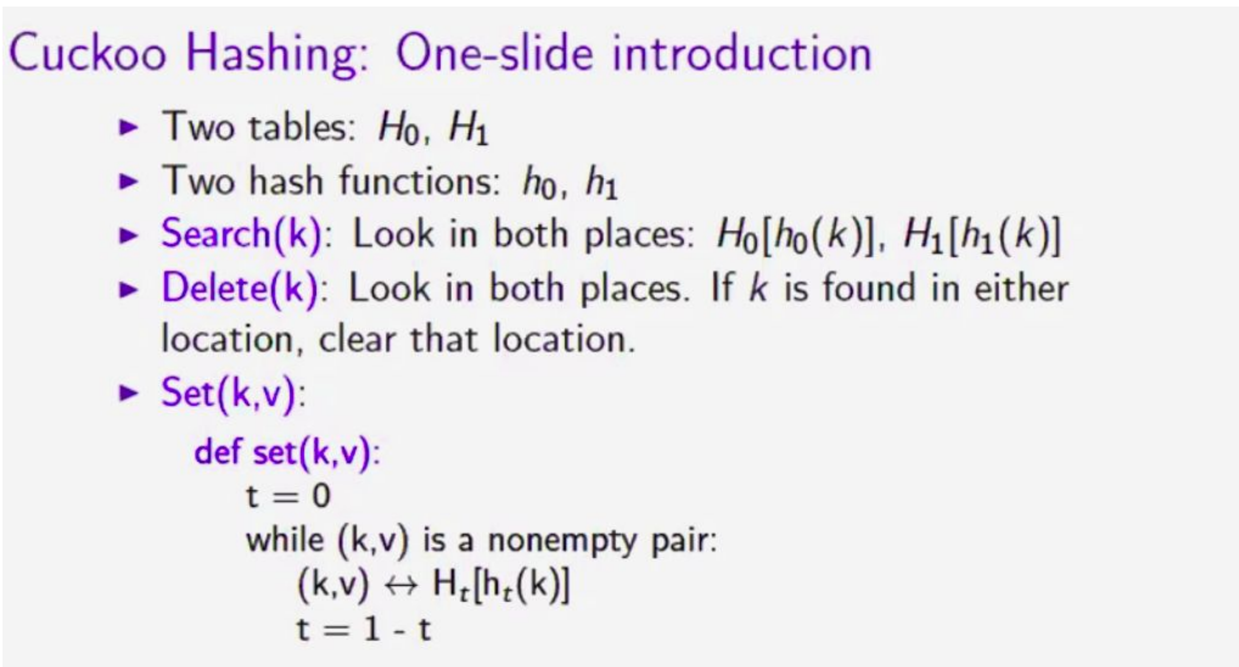
Q.26. In hash chaining, how can we ensure a set(k,v) operation to be always O(1)?

Q.27. Name one advantage of linear probing over hash chaining.

Q.28. What effect does a load factor of nearly 1 have on a set operation in a hash table implemented by linear probing?

Q.29. Name and describe two alternatives to Linear Probing.

Q.30. What's the role of the last line of the pseudocode below (from Prof. Kevin's slide deck)?



Q.31. You have a scenario where you have a dictionary that is built up once and you don't modify it much. Which hashing technique would you use for using (modifying/searching) this dictionary and why?