Fourth Quiz

You have 15 minutes from the start of class to complete this quiz. Read the questions with care; work with deliberate speed. Don't give us more than we ask for. The usual instructions apply. Good luck!

Problem 1 (25 points)

The Orange County Registrar of Voters has asked your help with computerizing the voter registration list. For each registered voter, your system will store the voter's name, address, party affiliation, and a unique Voter ID (a 12-character string). You decide to use a table (a map) to implement the list of voters, with the Voter ID as the key. You consider four different data structures for your implementation:

Structure I — An unordered linked list, plus an additional single integer to store the number of items in the table.

Structure II — An ArrayList, which you will maintain in order by Voter ID.

Structure III — A reasonably balanced binary search tree, ordered by Voter ID.

Structure IV — A hash table with an ideally random hash function based on the Voter ID, in which collisions are resolved by linear chaining.

(a) (20 points) Complete the following table, giving the best (closest-fit) O-notation for each task on each data structure, assuming that each task is implemented in Java using the most efficient algorithm available (without changing the structure described above). Assume there are v voters in the collection and that the hash table's size is t.

Tasks:	I: Linked List	II: ArrayList	III: BST	IV: Hash Table
Add a new voter				
Find a voter, given the ID				
Find all voters matching a given zip code				
Remove a voter, given the ID				
Print all the voters in order by name				

(b) (1 point) Which, if any, of the data structures, based on the operations shown above, would never be the best choice (because another data structure is an equivalent or better alternative for every task)?

(c) (1 point) Thinking about the potential real-world uses of a computerized voter registration list, which is likely to occur more frequently: Adding a new voter or finding (looking up) a voter in the system?

(d) (2 points) According to your table above, which of the four data structures should you choose to optimize the most frequently occurring operation you identified in part **(c)**?

(e) (1 point) Suppose we want to look up voters given the voter's name (since voters may not have or know their Voter ID). Briefly describe one difficulty with this approach or one change to one of the data structures that would make lookup by name more efficient.