Tutorial 2

CS 213: Data Structures and Algorithms
Autumn 2021

1. Given that k elements have to be stored using a hash function with target space n, what is an estimate of the probability of a collision?

2. Work out the following example for chaining as well as linear hashing for the modulo N hash function. Use N = 13, and execute the following steps:
   Insert 14, 15, 68, 40, 18, 66, 28, 56, 17, 99, 41.
   Delete 40, 56, 17, 41.
   Insert 20, 31.

3. Suppose you want to store a large set of pairs of numbers (a_i, b_i), for example, (name, address). You have operations which are addition, deletion and inspection of elements in this set. You also have queries whether a particular name or address is there in the set, and if so then count them and delete all such entries. How would you design your hash tables?

4. Suppose a binary tree has n nodes and has the property that either a node has 0 descendants or 2 descendants. What can be its maximum height?

5. The employees in a company are organized into teams. Each team has a hierarchical structure. Each employee may be a member of at most 3 teams. How would you represent such a structure? How will you answer simple questions such as, "Does employee A have the same boss B in two different ways?" Every team must meet together for one hour in a week. How many distinct hours are required for the whole company? Can you write a program to compute a simple approximation to this number?