Recitation 12: Hashing

Problem 1

For this problem, we consider using *balanced binary trees* as dictionaries.

a. What makes a tree a balanced binary tree?

b. Arrange the following word list into an (alphabetically) sorted balanced binary tree (There are several possibilities, see how many you can find):

bison, tiger, elephant, alpaca, rhea, koala

c. List some of the benefits of using a balanced binary tree. List some of the drawbacks.

(with regard to a hash-based dictionary, or in general.)

Problem 2

Find the average-case insertion, deletion, and lookup times for a hash table under the Simple Uniform Hashing Assumption, where the table has m buckets:

a. $m = \Theta(n^2)$ buckets.

b. $m = \Theta(\sqrt{n})$ buckets.

c. $m = \Theta(2^n)$ buckets.

Problem 3: Word Breaking

We are given a string of characters $x = x_1x_2...x_n$ and access to a dictionary D. We want to separate the string into chunks, each of which is a word in D. For example, you might be given the string

$$x = \text{solongandthanksforallthefish}$$

and you would want to know if it is possible to break this string up into dictionary words, like:

so long and thanks for all the fish

a. Identify subproblems of this problem

b. Come up with a recurrence relation for this problem. Hint: the values of this recurrence are going to be “True" or “False"

c. How can you use backtracking to find a partition of x?

d. How long does it take to fill out the recurrence table?