CS 561, HW4

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Due: November 4th

1. In the self-healing application of h-trees, the leaf nodes are associated with actual machines in a network, and the internal nodes represent additional "router nodes" (a scarce resource). To merge a list of h-trees, $h_1, h_2, \ldots, h_x$ we want to create a single new h-tree, h, which contains as leaf nodes all the leaf nodes in $h_1, h_2, \ldots, h_x$, and adds the smallest number of new internal nodes as possible.

   - Show how you can quickly merge a collection of x h-trees, each of size no more than n, into a single big h-tree by adding no more than $O(x \log n)$ additional internal nodes. What is the runtime of your algorithm?

   Hint: Think about how to set up a correspondence between binary numbers and h-trees, and binary addition and h-tree merging.

2. Find the optimal parenthesization for a matrix-chain product whose sequence of dimensions is: $(2, 3, 2, 2, 1)$. (Don't forget to include the table used to compute your result)

3. Show via induction that a full parenthesization of an n element expression has exactly $n - 1$ pairs of parenthesis.

   Exercise 15.2-5 (2nd edition)/15.2-6(3rd edition) (Counting number of ways to Parenthesizing)

4. Exercise 15.4-1 ("Determine an LCS")

5. Exercise 15.4-5 (note: monotonically increasing means non-decreasing, e.g. 1, 2, 2, 4, 5, 5, 7)

6. Exercise 15.4-6 (note: you can combine your solutions to this problem and the previous one, but solving the previous problem first will help with this problem.

7. Problem 15-4 (2nd)/ 15-6 (3rd) (Planning a company party)

8. Problem 15-5 (2nd)/ 15-7 (3rd) (Viterbi Algorithm)

9. Exercise 16.1-4 (2nd)/ 16.1-3 (Failed Greedy algs for Activity Selection)

10. "Professor Midas drives an automobile from Newark to Reno along I-80. His car's gas tank, when full, holds enough gas to travel n miles, and his map gives the distances between gas stations on his route. The professor wishes to make as few gas stops as possible along the way. Give an efficient method by which Professor Midas can determine at which gas stations he should stop, and prove that your strategy yields an optimal solution" - Exercise 16.2-4 (2nd edition)