CSE 100: Algorithm Design and Analysis
Key Topics of Midterm Exam 3 Spring 2019

* Disclaimer: I do not guarantee that the following list is complete.

This exam will cover Chapters **15, 16**.

1. Chapter 15.
   (a) Recall that you learned 4 examples of dynamic programming: Fibonacci numbers, Rod Cutting, Matrix chain multiplication, Computing LCS.
   (b) Can you fill out a DP table? For example, can you fill out the DP table for LCS to compute the length of LCS? We can ask this question for each of the four DP problems.
   (c) Bottom up approach vs Top down approach. For example, given a bottom-up DP, can you give a pseudocode of top-down approach using memoization? We saw how to do this for Fibonacci and Rod Cutting.
   (d) For each problem, can you give the recursion?
   (e) Given a recursion, can you give an efficient implementation (pseudocode) of the recursion using DP?
   (f) Can you describe a DP based algorithm? (I'll often just ask you to give an algorithm for computing the optimum, for example, the maximum profit one can get out of a rod of length n). To get full points, you must have the following: 1. DP table entries, 2. Recursion 3. In which order you compute the entries, and 4. What is the optimum.
   (g) Can you construct an optimal solution? For example, outputting a rod cutting to generate the maximum revenue.
   (h) Can you analyze the running time? You must specify 1. the number of DP entries/subproblems, 2. RT for computing each entry 3. RT for computing the optimum.
2. Chapter 16.
   (a) We covered two examples of greedy algorithms. Interval Selection (Activity Selection) and Huffman code.
   (b) There could be many different greedy algorithms. If a greedy algorithm is not optimal, can you find a counter example? (that is, an example for which the algorithm fails to produce an optimal solution).
   (c) We learned a key lemma to prove the optimality of EF for the Interval Selection problem. You should be able to prove it.
   (d) Fixed-length vs. Variable-length code. Prefix (Prefix-free) Code.
   (e) Can you illustrate the execution of the Huffman algorithm?