Algorithms Fall 2016 Homework 1

Due Mon. Sep. 19, in Class

September 12, 2016

Related reading:

Chapter 15

Either typewrite or handwrite your answers clearly. You will lose points if the TA cannot read your handwriting.

Problem 1: (20 points)

Exercise 15.1-3 (page 370)

Make your changes based on the MEMOIZED-CUT-ROD and BOTTOM-UP-CUT-ROD algorithms on pages 365-366, respectively. Explain your changes.

Problem 2: (20 points)

Consider a variation of the longest subsequence (LCS) problem, which we call a *String Similarity Score* (SSS). For two strings s1 and s2, each matching character in a subsequence alignment gives a score of 3, while each character in s1 or s2 that is not matched gives a penalty score of -1. For example, ACGTC and CATGCTC have an SSS of $4 \times 3 - 4 = 8$, since an LCS has length 4 and there are one and three unmatched characters in s1 and s2, respectively. Modify the original LCS dynamic programming algorithm to compute the SSS of two strings *directly*. That is, your algorithm **must not** compute the LCS first and then calculate the SSS from the LCS.

Problem 3: (20 points)

Exercise 15.3-3 (page 389)

Problem 4: (40 points)

Problem 15-2 (page 405)

Give a recursive formula, pseudo code for computing the length of the longest palindrome, correctness justification, and the running time of your algorithm. Also give the pseudo code on how to construct the longest palindrome.