Problem Set 3:

Divide and Conquer II and *Dynamic Programming I*

Due: Thursday, January 30, 2014, at the beginning of class

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1. How would you modify Strassen's algorithm to multiply n x n matrices in which n is not an exact power of 2? Show that the resulting algorithm runs in time $\Theta(n^{\lg 7})$.

2. Consider a modification of the rod-cutting problem in which, in addition to a price p_i for each rod, each cut incurs a fixed cost of c. The revenue associated with a solution is now the sum of the prices of the pieces minus the costs of making the cuts. Give a bottom-up dynamic programming algorithm to solve this modified problem.

3. The Fibonacci numbers are defined by recurrence (3.22) in the text (page 59).
   a. Give an O(n)-time dynamic programming algorithm to compute the nth Fibonacci number.
   b. How many vertices and edges are in the subproblem graph for Fibonacci?

4. Describe the subproblem graph for matrix-chain multiplication with an input chain of length n. How many vertices does it have (using θ notation)? How many edges does it have (using θ notation), and which edges are they?