GMU CS583 Algorithms Assignment 3

Name: G#:

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1. 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 dynamic-programming algorithm to solve this modified problem. Show the algorithm's running time.

2. Consider a modification of the rod-cutting problem in which the solution should not have more than k pieces. The revenue associated with a solution is now the sum of the prices of the pieces under the restriction that there are at most k pieces.

   Give a dynamic-programming algorithm to solve this modified problem. Show the algorithm's running time.

3. Give an $O(n^2)$-time algorithm to find the longest monotonically increasing subsequence of a sequence of n numbers.

4. Professor Stewart is consulting for the president of a corporation that is planning a company party. The company has a hierarchical structure; that is, the supervisor relation forms a tree rooted at the president. The personnel office has ranked each employee with a conviviality rating, which is a real number.

   In order to make the party fun for all attendees, the president does not want both an employee and his or her immediate supervisor to attend.

   Professor Stewart is given the tree that describes the structure of the corporation, using the left-child, right-sibling representation described in Section 10.4. Each node of the tree holds, in addition to the pointers, the name of an employee and that employees conviviality ranking. Describe an algorithm to make up a guest list that maximizes the sum of the conviviality ratings of the guests. Analyze the running time of your algorithm.