

Homework Assignment 4

CS 430 Introduction to Algorithms
Spring Semester, 2017

Due: Wednesday, March 1, 2017

1. Problem 16-1 on pages 446–447, adding
 - (d)
 - i. As given on page 447, but use dynamic programming in its recursive formulation
 - ii. As given on page 447, but use dynamic programming in its iterative formulation
 - iii. Analyze the time required.
 - (e) Suppose that, in part (d), we add the restriction that each denomination can be used just once. Modify your algorithm to determine *if* making change for n cents is possible.
2. Coins of various values are placed on the cells of an $n \times m$ chess board. Let the upper left corner cell be $(1, 1)$ and the lower right cell be (n, m) ; cell (i, j) has coins valued at c_{ij} . A robot starts at cell $(0, 0)$ and can move only to the right or down on the board.
 - (a) Give a dynamic programming algorithm expressed recursively without memoization to determine the path the robot should follow to maximize the total value of the coins collected as the robot wanders on the board. Analyze the time required.
 - (b) Give the algorithm iteratively with memoization. Analyze the time required.
3. Consider a weighted form of the activity selection problem of CLRS3 section 16.1 in which each of the n activities is weighted by its importance (the weight is unrelated to the starting and finishing times and to the duration). We want to choose a subset of non-conflicting activities with the highest total weight.
 - (a) Prove that the heuristic of choosing the earliest finishing time does not always result in an optimal schedule.
 - (b) Give an $O(n^2)$ algorithm to compute an optimal schedule.