

Design and Analysis of Algorithms

Quiz 3

Oct 22, 2004

1. [30] What is the best way to multiply a chain of matrices with dimensions that are 10×20 , 20×12 , 12×4 , and 4×60 . Show your work.
2. (a) [20] Consider a knapsack that can contain at most 20 lbs. Consider five items, each with a weight w_i and a value v_i . Let $w_1 = 9$, $w_2 = 5$, $w_3 = 7$, $w_4 = 12$, $w_5 = 3$ and $v_1 = 4$, $v_2 = 4$, $v_3 = 8$, $v_4 = 5$, and $v_5 = 1$. Solve the fractional knapsack problem (i.e., fill the knapsack with fractions of items to maximize the value of its contents subject to its weight constraint).
 - (b) [10] Which of the following algorithmic techniques did you use to solve the fractional knapsack problem.
 - i. Divide and Conquer.
 - ii. Greedy.
 - iii. Dynamic Programming.
3. State whether the following are True or False with justification.
 - (a) [10] Memoization is the basis for a top-down alternative to the bottom-up version of dynamic programming. (No need for justification for this question.)
 - (b) [20] Suppose we are given n activities with start and finish times $[s_i, f_i)$ for $i = 1, 2, \dots, n$. We would like to find a set S of non-overlapping activities maximizing $\sum_{i \in S} w_i$, where w_i represents the weight of activity i . Consider the following greedy algorithm: insert into S the activity of maximum weight w_i , remove all activities that overlap with activity i and repeat. This algorithm always provides an optimal solution to this weighted activity selection problem.
 - (c) [10] Data compression using Huffman codes for the string
aaaabaaaa
would result in a bit string with 11 bits.