

College of Computing and Information Technology



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Course: Computing Algorithms (CS312)
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Sheet 5

1. Consider a country having monetary coins of values (2,3,7).
 - a. Using dynamic programming, write an algorithm that finds the number of ways to construct an amount N .
 - b. What is the complexity of your algorithm?
 - c. Show the dynamic programming table for an input of $N=10$. For $N=10$ the solution is 3: (2,2,2,2,2) (2,2,3,3) (3,7).
2. Consider the 0/1 knapsack problem. Given N objects where each object is specified by a weight and a profit, you are to put the objects in a bag of capacity C such that the sum of weights of the items in the bag does not exceed C and the profits of the items is maximized. Note that *you can not use* an item type more than once.
 - a. Using dynamic programming, write an algorithm that finds the maximum total value according to the above constraints.
 - b. What is the complexity of your algorithm?
 - c. Show the dynamic programming table for the following data:
 $W = \{ 2, 7, 1 \}$, $P = \{ 3, 15, 2 \}$ and $C=8$.
3. Given two positive integers X and Y , write a function to calculate X power Y using dynamic programming.
4. Given N numbers and a number T , write a dynamic programming algorithm that checks if there is a subset of numbers in N that sum up to T .
5. Consider the Longest Common Subsequence (LCS) problem. You are given two strings A and B and you are to return the longest common subsequence in A and B . A subsequence of a string is defined to be the initial string with 0 or more characters removed. For example if $A="MOHAMED"$, $B="AHMED"$, the length of the LCS of A and B is 4 ("HMED" or "AMED")
 - a. Using dynamic programming, write an algorithm that finds the length of the LCS of two given strings A and B .
 - b. What is the complexity of your algorithm?
 - c. Show the dynamic programming table for $A="MOHAMED"$ and $B="AHMED"$.