

Homework 6
Com S 311
Due: Dec 8, 11:59 pm

5% bonus for submission by Dec 7 , 11:59 pm

10% Penalty for late submissions: Dec 9, 11:59PM

Note: “Do not grade” option is back. You will receive 20% credit for writing “do not grade”

This HW is on dynamic programming. For each problem, give the recurrence and give an iterative algorithm based on the recurrence. Your algorithm must not be recursive or use memoization. State the run time. Part of the grade depends on the efficiency. Please provide pseudo-code, your pseudo code need not handle array index out of bounds exceptions. Each problem is worth 40 points.

1. Given a set of positive integers $\{x_1, x_2, \dots, x_n\}$ where $x_1 = 1$ and a positive integer W find non-negative integers w_1, \dots, w_n such that

$$\sum_{i=1}^n w_i x_i = W$$

and

$$\sum_{i=1}^n w_i$$

is minimized.

2. Let $U = \{x_1, \dots, x_n\}$ be a set of non-negative integers and T and k be two integers. Give an algorithm that tests whether there is a subset S of U whose size is k and the sum of integers from S equal T .
3. You are in a rectangular maze organized in the form of $M \times N$ cells/locations. You are starting at the upper left corner (grid location: $(1,1)$) and you want to go to the lower right corner (grid location: (M,N)). From any location, you can move either to the right or to the bottom, or go diagonal. I.e., from (i,j) you can move to $(i,j+1)$ or $(i+1,j)$ or to $(i+1,j+1)$. Cost of moving right or down is 2, while the cost of moving diagonally is 3. The grid has several cells that contain diamonds of whose value lies between 1 and 10. I.e, if you land in such cells you gain an amount that is equal to the value of the diamond in the cell.

Once you reach the destination your earnings is the difference between earnings and costs. Give an algorithm that will output the maximum amount that you can earn. Your algorithm need not give the path.

GUIDE LINES:

- Please write your recitation number, time and TA name.
- You must work on the homework problems on your own. You should write the final solutions alone, without consulting any one. Your writing should demonstrate that you understand the proofs completely.
- When proofs are required, you should make them clear and rigorous.
- Any concerns about grading should be made within one week of returning the homework.
- **Please submit your HW via Canvas. If you type your solutions, then please submit pdf version. If you hand-write your solutions, then please scan your solutions and submit a pdf version. Please make sure that the quality of the scan is good, and your hand writing is legible. HW's submitted in incorrect format (non pdf) may incur a penalty of 20%**
- If you hand writing is not legible or the quality of the scan is poor, your homework will not be graded.