

Algorithms: Assignment #4

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Due: 28 May

Implement the following algorithms in the C or Python programming language and put the described input to the algorithm in order to check the answer. Submit (1) a report containing outputs of the following problems (shown in console) and (2) the codes you have written (screenshots okay). Once you choose a programming language, you should solve the problems using the chosen language. Do not use library functions (e.g., numpy) that can solve the problems directly.

P1) Implement an algorithm of Fibonacci numbers using dynamic programming and get the answers when feeding $n = 5$ and $n = 10$ into the algorithm as inputs (find the n th number), respectively.

[Note that you should store the results we've calculated and return the values when needed.]

P2) Implement a matrix-chain multiplication algorithm using dynamic programming and perform the algorithm for a chain of three matrices containing randomly chosen positive integers whose sizes are 5×3 , 3×7 , and 7×10 , respectively (output should be a matrix of size 5×10). Display your output matrix, optimal chain order, and the minimum number of computations.

[Note that you are required to feed a sequence of dimensions of the matrices into the algorithm (i.e., $\langle 5, 3, 7, 10 \rangle$).]

P3) Implement an algorithm for the fractional knapsack problem by a greedy approach.

- Assume that we have a knapsack with max weight capacity of 16, and our objective is to fill the knapsack with items such that the benefit (value) is maximum. Consider the following items and their associated weight and value:

ITEM	WEIGHT	VALUE
1	6	60
2	10	20
3	3	12
4	5	80
5	1	30
6	3	60

- Sort the items in decreasing order of value/weight, and only the last item in the sorted list need to be broken up as in a greedy approach that the current item is guaranteed to be the optimum one to take. [Note that the last item in the list makes the knapsack of maximum capacity when filling with (fraction of) the item.]
- Display the maximum value and its associated items with their fraction numbers for the problem.