

Assignment 2

Instructions:

- This assignment is equivalent to two assignments.
- Write the code by yourself. **Adopting any unfair means will result in -100%.**
- **Your output should match the sample outputs.**
- Submit the codes in ELMS. Name the files **1.cpp**, **2.cpp**, **3.cpp**, **report.pdf**.
 - **1.cpp** contains the solution to the first problem, **2.cpp** contains the solution to the second problem, and **3.cpp** contains the solution to the third problem.
 - report.pdf contains the recurrence equations of the problems and comparison of the runtimes of naive vs dp algorithms for all the given problems.

Problem 1: Rod cutting problem

Given a rod of length n inches and a table of prices p_i for $i = 1, 2, \dots, n$, determine the maximum profit obtainable by cutting up the rod and selling the pieces. Note that if the price p_n for a rod of length n is large enough, an optimal solution may require no cutting at all.

- Write a recurrence equation for the given problem.
- Determine the maximum profit using naive recursion
- Determine the maximum profit using the tabulation method. Print where to cut the rod pieces.
- Compare the runtime of the naive solution vs the tabulation method solution.

Sample Input	Sample Output
n p_1, p_2, \dots, p_n	
7 1 5 9 7 12 8 16	profit 17 taka $5+2=7$

Problem 2: Longest common subsequence problem

Find the longest common subsequence (LCS) length of given two sequences X (length m) and Y (length n).

- Write a recurrence equation for the given problem.
- Determine the LCS length using naive recursion
- Determine the LCS length using the tabulation method. Print the LCS.
- Compare the runtime of the naive solution vs the tabulation method solution.

Sample Input	Sample Output
X Y	
AXCDAX XDCAXA	LCS length 4

Problem 3: Subset sum problem

Find whether a given integer X is a sum of any subset of a given array $A=\{a_1, \dots, a_n\}$.

- I. Write a recurrence equation for the given problem.
- J. Determine whether X is a sum of any subset of A using naive recursion
- K. Determine whether X is a sum of any subset of A using the tabulation method. If yes, then print the subset.
- L. Compare the runtime of the naive solution vs the tabulation method solution.

Sample Input	Sample Output
n a_1, \dots, a_n X	
5 2 4 6 5 8 15	15 is a subset sum 5 + 6 + 4 = 15