CE100 Algorithms and Programming II

Matrix Chain Order / LCS

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## Week-6 (Matrix Chain Order / LCS)

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## Matrix Chain Order / Longest Common Subsequence

## Outline

* Elements of Dynamic Programming
  + Optimal Substructure
  + Overlapping Subproblems
* Recursive Matrix Chain Order Memoization
  + Top-Down Approach
  + RMC
  + MemoizedMatrixChain
    - LookupC
  + Dynamic Programming vs Memoization Summary
* Dynamic Programming
  + Problem-2 : Longest Common Subsequence
    - Definitions
    - LCS Problem
    - Notations
    - Optimal Substructure of LCS
      * Proof Case-1
      * Proof Case-2
      * Proof Case-3
    - A recursive solution to subproblems (inefficient)
    - Computing the length of and LCS
      * LCS Data Structure for DP
      * Bottom-Up Computation
    - Constructing and LCS
      * PRINT-LCS
      * Back-pointer space optimization for LCS length
* Most Common Dynamic Programming Interview Questions
  + Problem-1: Longest Increasing Subsequence
    - https://www.geeksforgeeks.org/longest-increasing-subsequence-dp-3/
    - https://en.wikipedia.org/wiki/Longest\_increasing\_subsequence#:~:text=In%20computer%20science%2C%20the%20longest,not%20necessarily%20contiguous%2C%20or%20unique.
    - https://www.youtube.com/watch?v=22s1xxRvy28&ab\_channel=StableSort
* Problem-2: Edit Distance
  + https://www.geeksforgeeks.org/edit-distance-dp-5/
  + https://www.youtube.com/watch?v=tU2f2JwHmfQ&feature=youtu.be&ab\_channel=PrepForTech
  + Recursive
    - https://www.youtube.com/watch?v=8Q2IEIY2pDU&ab\_channel=BenLangmead
  + DP
    - https://www.youtube.com/watch?v=0KzWq118UNI&ab\_channel=BenLangmead
    - https://www.youtube.com/watch?v=eAVGRWSryGo&ab\_channel=BenLangmead
* Problem-3: Partition a set into two subsets such that the difference of subset sums is minimum
  + https://www.geeksforgeeks.org/partition-a-set-into-two-subsets-such-that-the-difference-of-subset-sums-is-minimum/
* Problem-4: Count number of ways to cover a distance
  + https://www.geeksforgeeks.org/count-number-of-ways-to-cover-a-distance/
* Problem-5: Find the longest path in a matrix with given constraints
  + https://www.geeksforgeeks.org/find-the-longest-path-in-a-matrix-with-given-constraints/
* Problem-6: Subset Sum Problem
  + https://www.geeksforgeeks.org/subset-sum-problem-dp-25/
* Problem-7: Optimal Strategy for a Game
  + https://www.geeksforgeeks.org/optimal-strategy-for-a-game-dp-31/
* Problem-8: 0-1 Knapsack Problem
  + https://www.geeksforgeeks.org/0-1-knapsack-problem-dp-10/
* Problem-9: Boolean Parenthesization Problem
  + https://www.geeksforgeeks.org/boolean-parenthesization-problem-dp-37/
* Problem-10: Shortest Common Supersequence
  + https://www.geeksforgeeks.org/shortest-common-supersequence/
  + https://en.wikipedia.org/wiki/Shortest\_common\_supersequence\_problem
* Problem-11: Partition Problem
  + https://www.geeksforgeeks.org/partition-problem-dp-18/
* Problem-12: Cutting a Rod
  + https://www.geeksforgeeks.org/cutting-a-rod-dp-13/
* Problem-13: Coin Change
  + https://www.geeksforgeeks.org/coin-change-dp-7/
* Problem-14: Word Break Problem
  + https://www.geeksforgeeks.org/word-break-problem-dp-32/
* Problem-15: Maximum Product Cutting
  + https://www.geeksforgeeks.org/maximum-product-cutting-dp-36/
* Problem-16: Dice Throw
  + https://www.geeksforgeeks.org/dice-throw-dp-30/
* Problem-17: Box Stacking Problem
  + https://www.geeksforgeeks.org/box-stacking-problem-dp-22/
* Problem-18: Egg Dropping Puzzle
  + https://www.geeksforgeeks.org/egg-dropping-puzzle-dp-11/

## References

TODO