

CE100 Algorithms and Programming II

Week-6 (Matrix Chain Order / LCS)

Spring Semester, 2021-2022

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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

- Definitions
 - LCS Problem
 - Notations
 - Optimal Substructure of LCS
 - Proof Case-1
 - Proof Case-2
 - Proof Case-3
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- 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

- 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 computer science%2C the longest,not necessarily contiguous%2C or unique.
 - 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