# 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

- Problem-2 : Longest Common Subsequence
  - 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