Advanced Analysis of Algorithms

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- 1. Discussion of Homework II and the combinatorial identity from HW 1.
- 2. Optimization and Dynamic Programming.
 - (a) Cite the three principles from the book.
 - (b) Principle of optimality. Regardless of how you reached here
 - (c) Does it hold for all optimization problems? Longest path example from book.
- 3. Chained matrix multiplication.
 - (a) Matrix multiplication $A_{p \times q}$ and $B_{q \times r}$ compatibility.
 - (b) How many multiplications?
 - (c) Use example from CLR 10×100 , 100×5 , 5×50 .
 - (d) Notion of parenthesization. How many for three matrices? Just two. How about five matrices?
 - (e) The matrix-chain multiplication problem (from book).
 - (f) Brute-force bound.

$$P(n) = \begin{cases} 1, & \text{if } n = 1\\ \sum_{k=1}^{n-1} P(k) \cdot P(n-k), & \text{if } n \ge 2 \end{cases}$$

- (g) Optimal substructure.
- (h) Formulate the recurrence. First fix the k. Then minimize across k.
- (i) Example from CLR.
- (j) Analyze time and space complexity.
- (k) Extracting the solution.