Advanced Analysis of Algorithms

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1. Chained matrix multiplication.
   (a) Main ideas.
   (b) Brute-force bound.

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

   (c) Optimal substructure.
   (d) Extracting the solution.
2. Discussion on DP and optimal substructure.
3. Optimal binary search trees.
   (a) A set of ordered keys.
   (b) Binary search tree definition.
   (c) Depth. Also called level.
   (d) Searching a binary tree.
   (e) Search time for a node = depth of node +1.
   (f) We want to minimize the expected search time of the binary tree.
   (g) Let key_i have search probability p_i. Let c_i be the number of comparisons to find key_i. Then we want to minimize $\sum_{i=1}^{n} c_i \cdot p_i$.
   (h) The binary search tree problem.
   (i) Example from book.
   (j) Brute-force.
   (k) Formulation of recurrence.
   (l) Running time and space complexities.
4. Complete Floyd-Warshall.
5. Discussion on Traveling Salesman problem.