

# Chapter 4:

## Advanced Design and Analysis Techniques

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# 1 Dynamic Programming

Dynamic programming applies when the subproblems overlap. We typically apply dynamic programming to *optimization problems*.

When developing a dynamic programming algorithm, we follow a sequence of four steps:

1. Characterize the structure of an optimal solution.
2. Recursively define the value of an optimal solution
3. Compute the value of an optimal solution, typically in a bottom-up fashion.
4. Construct an optimal solution from computed information.

## 1.1 Rod Cutting

The *rod cutting problem* is the following: Given a rod of length  $n$  inches and a table of prices  $p_i$  according to the length  $i$ , determine the maximum revenue  $r_n$  obtainable by cutting the rod and selling them.

length $i$	1	2	3	4	5	6	7	8	9	10
price $p_i$	1	5	8	9	10	17	17	20	24	30