



Algorithms and Data Structures – Conditional Course

Winter Term 2026/27

Exercise Sheet 11

Due: Wednesday, 20 January 2027, 12:00

Exercise 1: Rod Cutting

(8 Points)

You are given a wooden rod of length n and an array p of prices, where $p[i]$ is the selling price of a rod of length $i \in \{1, \dots, n\}$. Find the maximum total selling price obtainable by cutting the rod into integer-length pieces and selling them at these prices. For example, if $n = 5$ and

$$p[1] = 5, \quad p[2] = 8, \quad p[3] = 16, \quad p[4] = 19, \quad p[5] = 25,$$

the maximum revenue is 26, obtained with two pieces of length 1 and one of length 3.

- (a) Let $OPT(n)$ denote the maximum revenue for a rod of length $n \geq 0$. Give a recurrence for $OPT(n)$, as for the Fibonacci numbers. Do not forget a base case. (4 Points)
- (b) Give an efficient algorithm for this problem. What is its running time? (4 Points)

Exercise 2: Bit Strings without Consecutive Ones

(12 Points)

Given $n \geq 1$, count the bit strings of length n that contain no two consecutive ones. For example, for $n = 3$ the answer is 5: 000, 001, 010, 100, 101.

- (a) Give an algorithm that solves this problem in $\mathcal{O}(n)$ time. Explain the running time. (7 Points)
- (b) Implement your solution using the template `DP.py`. Apply it to $n = 10, 20, 50$ and include the results in your submission or in `experience.txt`. (5 Points)