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Algorithms and Datastructures
Exercise Sheet 11

Exercise 1: Wood Cutting *(8 Points)*

Given a wooden rod of length n and an array p of prices for selling a rod of some certain length, i.e., for $i \in \{1, \dots, n\}$ we denote the price of a rod of length i by $p[i]$. Your task is to determine the *maximum value obtainable* by cutting up the given rod and selling the pieces according to the prices in p. For example, if the length of the given rod is $n = 5$ and the prices are as given in the following, then the maximum obtainable value is 26, by cutting the rod into two pieces of lengths 1 and one piece of length 3.

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

a) Let $OPT(n)$ be the maximal obtainable value for a rod of size n. Give a recursive formular on how to compute $OPT(n)$. *(4 Points)*

b) Give an algorithm that solves the problem efficiently. What is the runtime of your algorithm? *(4 Points)*

Exercise 2: Bitstrings without consecutive ones *(12 Points)*

Given a positive integer n, we want to compute the number of n-digit bitstrings without consecutive ones (e.g., for $n = 3$ this number is 5, as 000, 001, 010, 100, 101 are the 3-digit bitstrings without consecutive ones).

(a) Give an algorithm which solves this problem in time $\mathcal{O}(n)$. Explain the runtime. *(7 Points)*

(b) Implement your solution. You may use the template `DP.py`. Run your algorithm on the values 10, 20 und 50 and write your results in `erfahrungen.txt`. *(5 Points)*
Hint: For $n = 25$ the correct solution is 196418 and for $n = 30$ the correct solution is 2178309.