RWTH Aachen University **WS 2010/11**
Lehrgebiet Theoretische Informatik Tutorial 8
Kneis—Langer—Sikdar 07.12.2010

Tutorial Exact Algorithms

This tutorial is aimed primarily at practice in dynamic programming. The problems are all polynomial-time solvable.

Exercise T15 Maximum Value Contiguous Subsequence. You are given a sequence $a_1, \ldots, a_n$ of n integers (positive and negative). You are required to find a *contiguous* subsequence for which the sum of the elements in the subsequence is maximized. Design a DP algorithm for this problem that does this in $O(n)$ time. Note that in the absence of negative integers, the answer is trivially the whole sequence.

Exercise T16 Box Stacking. You are given n types of boxes, where the ith box has height h_i and a base of length l_i and width w_i. Assume without loss of generality that $w_i \leq l_i$. You want to create a stack of boxes that is as tall as possible, but you can stack box i above box j iff $l_j > l_i$ and $w_j > w_i$. Design a DP algorithm for this problem.

Homework Assignment H15 (10 Points) Longest Increasing Subsequence. You are given a sequence of n integers $a_1, \ldots, a_n$ and are required to determine a subsequence (not necessarily contiguous) of maximum length such that the integers in the subsequence form a strictly increasing sequence. For example, if the input sequence is $14, 2, 1, 19, 4, 5$, then an optimal subsequence is $1, 4, 5$. Another optimal solution is $2, 4, 5$.

Homework Assignment H16 (10 Points) Building Bridges. Consider a 2-D map with a horizontal river passing through its center. There are n cities on the southern bank with x-coordinates $a_1 < a_2 < \cdots < a_n$ and n cities on the northern bank with x-coordinates $b_1, b_2, \ldots, b_n$. You want to connect city i on the northern bank with city i on the southern bank by building bridges for as many north-south pairs of cities as possible with the restriction that no two bridges must cross. Design a DP algorithm to find out the maximum number of bridges that can be constructed.