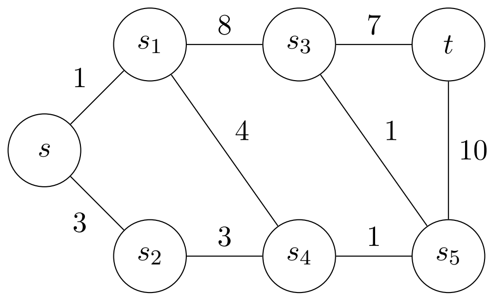
Technische Universität München
Institut für Informatik
Theoretical Computer Science

WS 2017/18

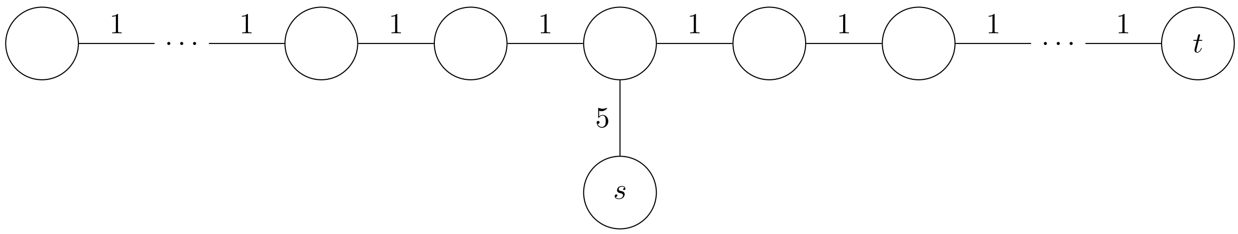
Fundamental Algorithms 12

Exercise 1 (Dijkstra)

Apply Dijkstra's algorithm to the following graph to find the shortest path (and its cost) from s to t. Write down all intermediate steps.



Now, instead consider the following graph. The graph is a (slightly simplified) model of a highway which can be accessed from s and leads, amongst other destinations, to t. Think about what happens when you run Dijkstra on this graph and possible ideas how to improve it, given that the nodes represent locations.



Exercise 2 (HyperDijsktra)

Think about how to define weighted Hypergraphs and how to tweak Dijkstra's Algorithm to work with this generalization.

Exercise 3 (Good Flow)

Suppose you are a logistics engineer for a big manufacturing company. This company assembles its product in a big facility in n different manufacturing steps, for example *preprocessing*, *assembling*, and *packaging* ($n = 3$). The facility is organized as follows. For each processing step i, there are m_i workstations, denoted $w_1^i, \ldots, w_{m_i}^i$. Each workstation w_j^i can process c_{ij} items per day. Further, between the workstations of each step, there is a network of conveyor belts, all of which also have a capacity, specified by a weighted graph. This means that the network between step i and step $i + 1$ has the workstations of either steps, i.e. w_j^i and w_j^{i+1}, as nodes and, potentially, some intermediate conveyor junctions.

Think about how you can apply concepts of the lecture to optimize the productivity of the company, i.e. maximize the output of the workstations in the final step.