Exercises:
Rigorous mathematical proofs/arguments are expected if not stated otherwise. You are allowed to work in groups of two.

Homepage of the Lecture: [http://www.zib.de/ws17_Optimierung_II](http://www.zib.de/ws17_Optimierung_II)
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**Exercise 12.1** 6 Points
Give an example of a digraph $D = (V, A)$ with weights $c \in \mathbb{R}^A$ that violates Bellman’s Principle of Optimality (Lemma 13.4 (b)). What happens if you run Dijkstra’s algorithm starting at some vertex $s \in V$, and what happens if you run the Moore-Bellman-Ford Algorithm?

**Exercise 12.2** 6 Points
Calculate a shortest $s, t$-path using Dijkstra’s algorithm on the graph shown in Figure 1.

![Figure 1: Example Graph](image-url)
Exercise 12.3 8 Points

Let $D = (V, A)$ be an acyclic digraph with weights $c \in \mathbb{R}^4$ and $s, t \in V$. Show how to find a shortest $s, t$-path in linear time (in the number of vertices and arcs). (Hint: Use Bellman’s Principle of Optimality together with recursion)