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Exercise Set 12

Exercise 12.1. Describe a polynomial-time algorithm which optimally solves any instance of the TRAVELING SALESMAN PROBLEM that is the metric closure of a weighted tree.

Exercise 12.2. Let c_0 be the value of an optimal solution of an instance of the METRIC TSP and c_1 the cost of a second-shortest tour (note that this tour might have the same cost as the first one). Show that

$$\frac{c_1 - c_0}{c_0} \leq \frac{2}{n}.$$

Exercise 12.3. Show that the following problem is NP-complete: Given a graph G and a Hamiltonian cycle C in G, is there a Hamiltonian cycle $C' \neq C$?

Exercise 12.4. Let $V \subset \mathbb{R}^2$ be an instance of the EUCLIDEAN TSP and let T be a tour for V. Prove that for any line segment l of length s not containing any point of V, there is a tour for V whose length exceeds the length of T by at most $3s$ and which crosses l at most twice.

Deadline: Tuesday, July 2$^{\text{nd}}$, before the lecture. The websites for lecture and exercises can be found at:

`http://www.or.uni-bonn.de/lectures/ss19/appr_ss19_ex.html`

In case of any questions feel free to contact me at rockel@or.uni-bonn.de.