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Exercise Set 10

Exercise 10.1. Describe a polynomial-time algorithm which optimally solves any instance of the Traveling Salesman Problem that is the metric closure of a weighted tree.

(4 points)

Exercise 10.2. 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

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

(4 points)

Exercise 10.3. Show that the following problem is NP-complete: Given a graph G and a Hamiltonian cycle C in G, is there a Hamiltonian cycle $C' \neq C$?

(3 points)

Exercise 10.4. Assume $G = (V, E)$ is the complete graph with an Euclidean embedding $\varphi : V \to \mathbb{R}^2$ such that there are no two parallel edges. Show that

(i) An optimum Euclidean tour for G does not intersect itself.

(ii) Given any initial tour T it is possible to construct an intersection free tour T' that is shorter than T in polynomial time by using 2-opt exchanges.

(1+4 points)

Deadline: Thursday, July 9th 14:15, via eCampus. LaTeX submissions are highly encouraged, however, you can also submit a scan (e.g. obtained with a mobile phone). The websites for lecture and exercises can be found at:

`http://www.or.uni-bonn.de/lectures/ss20/appr_ss20_ex.html`

In case of any questions feel free to contact us at approx-ss20@or.uni-bonn.de.