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Exercises

Approximation Algorithms

Spring 2010

Sheet 8

Exercise 1
For the EUCLIDEAN k-TSP problem, we are given points $v_1, \dots, v_n \in \mathbb{Q}^2$ in the plane and a parameter $k \in \{1, \dots, n\}$. The goal is to find a minimum length tour, visiting *at least k nodes*. Here the length is measured using the Euclidean distances. Give a PTAS for this problem (by adapting Arora's algorithm).

Exercise 2
For EUCLIDEAN STEINER TREE, we are given *terminals* $v_1, \dots, v_n \in \mathbb{Q}^2$ in the plane. The goal is to find the cheapest Steiner tree T, spanning all terminals. Here the cost of the tree is measured using the Euclidean distances. For the Steiner tree T one is allowed to add arbitrary points from $\mathbb{Q}^2$ as Steiner nodes in order to make the tree cheaper. Give a PTAS for this problem.
Hint: If might be helpful to answer the following questions.

i) Argue, that the discretization still costs $O(\varepsilon) \cdot OPT$.

ii) Which properties should a *well-rounded* Steiner tree have?

iii) How could suitable table entries for the dynamic program look like? How can you compute them?

iv) How would the patching lemma be for Steiner trees?

v) What about the structure theorem for Steiner tree?