Approximation Algorithms
Summer term 2009

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Exercise Set 11

Exercise 1:
Consider the EUCLIDIAN TSP, i.e. all nodes are embedded into $\mathbb{R}^2$ and the edge lengths are equal to the Euclidian distance of the vertices they connect.

(i) Prove that in an optimal solution of the problem no two edges cross each other.

(ii) Find a class of instances for which the quality of the MST heuristic is arbitrarily close to the guaranteed factor of 2.

(3+3 Points)

Exercise 2:
Show that the 2-OPT algorithm has an approximation guarantee of $\frac{3}{2}$ on graphs which have edge lengths 1 or 2.

(4 Points)

Exercise 3:
Describe an exact algorithm for the TSP. If the vertices are numbered from 1 to n we denote by $\gamma(A, x)$ the length of a shortest 1-x-path P with $V(P) = A \cup \{1\}$ for all $A \subseteq \{2, \ldots, n\}$ and $x \in A$. The idea is to compute all these numbers. What running time can be achieved in contrast to the naive enumeration of all tours?

(5 Points)

Please return the exercises until Tuesday, **July 7nd, at 2:15 pm**.