Combinatorial Optimization
Winter term 2010/2011

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Exercises 8

Exercise 1:

The Directed Chinese Postman Problem can be formulated as follows:
Given a strongly connected simple digraph G with weights $c : E(G) \to \mathbb{R}_+$, find $f : E(G) \to \mathbb{N}$ such that the graph which contains $f(e)$ copies of each edge $e \in E(G)$ is Eulerian and $\sum_{e \in E(G)} c(e)f(e)$ is minimum.
Show how to solve this problem in polynomial time by reducing it to a Minimum Cost Flow Problem.

(4 points)

Exercise 2:

Let G be an undirected planar graph with weights $c : E(G) \to \mathbb{R}_+$. A set $F \subseteq E(G)$ is called an *odd cover* if the graph which results from G by successively contracting each $e \in F$ is Eulerian.
Show how to find in polynomial time an odd cover F with $c(F)$ minimum.
Hint: Consider the Undirected Chinese Postman Problem in G.

(4 points)

Exercise 3:

Consider the Maximum Weight Cut Problem in planar graphs: Given an undirected planar graph G with weights $c : E(G) \to \mathbb{R}_+$, we look for a maximum weight cut in G. How can this problem be solved in polynomial time?
Hint: Use Exercise 2 and the following fact: A connected undirected graph is bipartite if and only if its planar dual is Eulerian (and vice versa).

Note: For general graphs this problem is NP-hard even for unit weights.

(4 points)

Invitation

The Mentor Group of the Research Institute for Discrete Mathematics will meet on Thursday the 2nd of December at 6:00 pm in the conference room of the Arithmeum. Philipp Ochsendorf presents his Bachelor thesis "Efficient Implementation of a Multi-Section algorithm". All interested students are welcome.

Deadline: Tuesday, December 7th, before the lecture.