At the Chair of **Logistics and Supply Chain Management** of TUM School of Management we are looking for an interested and qualified student to conduct his/her

Master Thesis

on the topic:

The Adaptive Competitive Pickup and Delivery Orienteering Problem for Rebalancing Carsharing Systems: Signaling Selected Nash Equilibria

Carsharing is a fast-growing market in which operations are very costly, as imbalances occur frequently and, thus, fleets have to be rebalanced. Further, the market is getting more competitive, for example, Car2Go and DriveNow offer a similar service in Munich. Whilst the total profit of single instances is fixed, it is unknown whether this profit must be shared with a competitor, in which case it can make sense to evade competition. We therefore model the Competitive Pickup and Delivery Orienteering Problem to rebalance the fleet. Yet, this problem contains more than one Nash equilibrium in many instances. We, thus, consider the Adaptive Competitive Pickup and Delivery Orienteering Problem for Rebalancing Carsharing Systems: Two competitors find profit-maximizing routes through a bipartite graph with metric costs in which all delivery nodes are associated with profits (an implementation exists already). Yet, in such problems we can show that in general more than one Nash equilibrium exists, giving rise to a selection problem. We like to find a route (or a starting point) which can be used to signal to the competitor which route is being used.

Selected research tasks:
- Literature Research on Rebalancing in Carsharing Systems (with a minor focus on competition)
- Literature Research on Game Theory in Operations Research and Transportation Science
- Modeling a starting point selection strategy
- Implementation of a prototype of a decision support system
- Case Study (i.e., with Car2Go and DriveNow data)

Requirements:
The thesis is for Master students of the study-program TUM-BWL (with a major in Supply Chain Management). The ability to work independently as well as analytical skills are required. Knowledge of Linear Programming (understanding LPs + implementation in CPLEX) and at least one programming language (i.e. Java or C) is required. The thesis should be written in German or English.

Begin: as soon as possible

Advisor: Layla Martin

Application: Email with curriculum vitae and transcript of records to logtheses.wi@tum.de