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

A Matheuristic Approach for Solving the Two-Echelon Vehicle Routing Problem

The Two-Echelon Vehicle Routing Problem (2E-VRP) is an extension of the classical VRP, particularly relevant for modern urban logistics systems. In 2E-VRP, goods are transported from a central depot to a set of micro-depots (first echelon) and then delivered from these micro-depots to end customers (second echelon) using smaller, often eco-friendly vehicles. Due to its combinatorial complexity and layered structure, solving the 2E-VRP to optimality remains a challenge. This thesis focuses on modeling the 2E-VRP as a Set Partitioning Problem (SPP), where the objective is to select a set of feasible routes that collectively serve all customers at minimum cost while respecting operational constraints. The core of the approach relies on generating a high-quality route pool for both echelons before solving the SPP using an integer programming solver like Gurobi or CPLEX.
The goal of this thesis is to evaluate and compare different route construction heuristics (such as savings algorithms, nearest neighbor, and regret insertion) for generating this route pool, and to analyze their effect on the quality and solvability of the final set partitioning formulation.

Key project tasks:

- Literature review on relevant fields of study
- Formulate the Two-Echelon VRP as a Set Partitioning Problem
- Implement or adapt multiple heuristic algorithms for generating feasible routes and solve the resulting SPP instances using an exact solver
- Analyze and interpret the results

Requirements:

The thesis is suitable for Master in Management and Technology students with a major in operations and supply chain management. The ability to work independently as well as analytical skills are required. Knowledge of one general-purpose programming language (e.g., Python, Julia) is required. Knowledge of mathematical programming and optimization is preferred.

Earliest begin: As soon as possible

Supervisor: Nicolas Kuttruff

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