Master Thesis Topic:

Sensitivity Analysis for Discrete Ordered Location Problems

Many classical problems in discrete location theory can be formulated within the framework of the Discrete Ordered Median Problem (DOMP). By assigning weights to the sorted allocation costs between facilities and demand points, this model captures a wide range of location objectives (e.g., median, center, and k-centrum problems). Different choices of the weight vector lead to different problem classes and may result in substantially different optimal solutions. While many models and solution methods have been developed for the DOMP, comparatively little attention has been devoted to studying how the set of optimal solutions changes when the weight vector varies. Studying this sensitivity can provide insight into the relationships between different location models and the robustness of the resulting decisions.

Goals of the thesis:

- Identify relevant related **literature** serving as a basis for further investigation.
- Analyze how **changes in the weight vector** affect the set of optimal solutions.
- Focus on **special cases**, for instance k-centrum problems where the sum of the k largest costs is minimized and / or problems with monotone weight vectors.
- Perform **computational experiments** on benchmark instances to illustrate and visualize the sensitivity of the set of optimal solutions.

Prerequisites:

- Knowledge in **discrete optimization / combinatorial optimization**.
- Basic knowledge in **location theory**.
- **Programming skills** (e.g., Python, Julia, or C++) for computational experiments.
- Optional but helpful: some experience with optimization solvers (e.g., Gurobi, CPLEX) or modeling tools.

Supervision:

- Prof. Dr. Stefan Nickel
- Simon Ramoser

Contact:

- If interested, please contact Christiane Weste (christiane.weste@kit.edu).
- For questions regarding the content, please reach out to Simon Ramoser (simon.ramoser@kit.edu).

More on the Ordered Median Problem: https://dol.ior.kit.edu/english/Projects_2151.php
More on our research group: https://dol.ior.kit.edu/english/index.php