

390050 DK PhD-L: Advanced Topics in Operations Management

Metaheuristics in Logistics

Course description
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1 General aims

Metaheuristics are high-level algorithmic frameworks that provide guidelines for the design of heuristic optimization algorithms. Research in this field focuses on the development of effective methods for various challenging optimization problems, many of them from the field of logistics. For many logistics optimization problems, metaheuristics are the best, or even the only choice if one wishes to develop state-of-the-art approaches that are able to tackle problems of real-life size and complexity.

This course aims to deepen the participants' knowledge into this challenging research field. In five sessions, the participants will be introduced to the most important methods that have been developed in the literature, and learn how they can be effectively applied. The course will give ample attention to the various pitfalls that “metaheuristicicians” must overcome when developing an effective optimization method. The course will focus on applications in logistics, such as vehicle routing, facility location, production scheduling, ...

2 Evaluation

Evaluation will be based on an assignment prepared by the student. The assignment consists of two parts:

1. A *literature assignment*, in which the student discusses a paper published in the metaheuristics literature
2. A *development assignment*, in which the student develops an actual metaheuristic for a specific optimization problem, tests his/her approach and reports its results

Both assignments are presented by the student in a single presentation of about 30 minutes (depending on the number of students).

3 Topics

1. Introduction

Optimization principles, a primer on complexity theory, metaheuristics terminology and basic principles, a taxonomy of metaheuristics, the component-based view on metaheuristics

2. Local search metaheuristics

Various types of metaheuristics based on local search (iterated local search, tabu search, variable neighborhood search, ...)

3. Constructive and population-based metaheuristics

Constructive metaheuristics (GRASP, pilot method, ant colony optimization, ...)

Population-based metaheuristics (evolutionary algorithms)

4. Matheuristics and other advanced topics

Combinations of exact methods and metaheuristics

5. Designing and testing metaheuristics

Metaheuristic “engineering”: how to develop and test an effective metaheuristic for a given problem

4 Further reading

Z. Michalewicz and D.B. Fogel. *How to solve it: Modern Heuristics*. New York: Springer, 2000.

E-G. Talbi. *Metaheuristics: from design to implementation*. John Wiley & Sons, 2009.

K. Sörensen and F. Glover. “Metaheuristics.” *Encyclopedia of operations research* 3rd ed. New York, NY: Springer (2013).

K. Sörensen “Metaheuristics—the metaphor exposed.” *International Transactions in Operational Research* (2013).

5 Contact

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