

OPM 662 (OPM 6620) Business Analytics: Capacity Optimization

The course Business Analytics: Capacity Optimization focuses on data-driven decision systems support for the design and management of operational systems, with a particular emphasis on capacity planning and optimization. The course introduces core concepts and tools of prescriptive analytics grounded in Operations Research.

Students learn how to formulate strategic, tactical and operational decision problems as linear programming (LP) and mixed-integer linear programming (MILP) models, with a strong focus on capacity allocation, utilization, and constraints in real-world systems. These optimization models are implemented, analyzed, and solved using standard prescriptive analytics tools.

In addition, the course introduces heuristic and approximation methods to address the complexity of large-scale capacity and scheduling problems commonly encountered in practice. To account for uncertainty in operational environments, data-driven and stochastic modeling approaches are also covered. Throughout the course, students apply the methods to realistic case studies and assignments, both individually and in groups, gaining hands-on experience in modeling, solving, and interpreting capacity optimization problems that incorporate different types of variability.

Learning Goals

- Students are able to structure and analyze operational decision problems in the context of capacity optimization in operations systems. They can formulate these problems as linear and mixed-integer linear programming models and implement them using Pythonbased optimization tools (e.g., DCOplex or equivalent modeling environments) and standard solvers to derive optimal or near-optimal capacity allocation and scheduling decisions.
- Students are able to apply appropriate modeling strategies to handle real-world complexity in capacity-constrained systems, including aggregation, relaxation, decomposition, and heuristic approaches. They understand how to incorporate uncertainty and variability using data-driven and stochastic modeling techniques.
- In addition, students are able to interpret optimization results, perform sensitivity analyses, and translate model results into actionable managerial insights for capacity planning, utilization, and operational decision-making.

General Information



Lecturer	Prof. Dr. Raik Stolletz
Course Format	Integrated (lectures, exercises, self-study)
Credit Points	6 ECTS
Language	English
Grading	Assignments and presentations, Programming exam or oral exam
Term	Spring Semester
Range of Application	M.Sc. MMM, M.Sc. Bus. Edu., M.Sc. Bus. Inf., M.Sc. Bus. Math., M.Sc. Econ., M.Sc. MMFACT, M.Sc. MMOSCM



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Prerequisites:

- Basic knowledge in Python (OPM 560 or IS 557 or "Schlüsselqualifikation1: Programmierkurs Python" - Angebot der WIM) **and** knowledge in modelling in operations (OPM 561 or OPM 501).
- In exceptional cases and by prior agreement, other modules may also be accepted as prerequisites.

Recommended prerequisites:

The course assumes a basic knowledge in mathematics (including linear programming).

Registration/Enrolment

The course requires a registration through Portal2. More information can be found there.

Detailed Agenda

I Model building, implementation and numerical tests

- Formulate and implement algebraic models
- Conduct sensitivity analysis
- Interpret solutions and generate insights

II Workforce planning

- Assignment problems
- Shift and tour scheduling problems

III Planning with stochastic variability

- Optimizing under uncertainty
- Interpretation of solutions

IV Solving real world problems

- Aggregation, decomposition
- Multi-objective optimization
- Evaluation of algorithms
- Guest lecture by business analytics professionals

Literature

- Williams, H. P. (2013). Model building in mathematical programming. John Wiley & Sons.
- McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc."

Journal papers will be announced during the lecture.