OPM 661 (OPM 6610) Business Analytics: Robust Decisions

Business Analytics helps to optimize decisions for the design and management of operations systems and production processes. A major driver of the performance of operations systems is stochastic variability. For example, production systems often operate in an uncertain environment due to uncertain demand, unreliable machines, or random processing capacities.

In order to support robust decisions, we apply analytical solution approaches based on techniques from predictive and prescriptive analytics. The basic concepts of the analysis of Markovian queueing systems are explained in detail and performance evaluation approaches are implemented in Python. To create digital twins of operating systems, simulation techniques are introduced and implemented. This allows to analyze the sensitivity of system parameters on the main performance measures. Advanced topics such as queueing systems with general distributions, heterogeneities, and time-dependent input parameters are covered. Additionally, general managerial insights, for example economies of scale and the value of flexible capacities are discussed. Methods and performance measures of robust planning and optimization are introduced. Students become familiar with concepts and tools for predictive and prescriptive business analytics.

General Information

Lecturer	Prof. Dr. Raik Stolletz
Course Format	Integrated (lectures, exercises, self-study)
Credit Points	8 ECTS
Language	English
Grading	Assignments and presentations, written exam or oral exam
Term	Fall 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

Moreover, we will implement those concepts using the programming language Python to perform sensitivity analyses and to develop managerial insights for stochastic operations systems. During the course the students will work on several case studies and assignments (individual and in groups).

Learning Goals

Students will

- understand the impact of stochastic variability in operations systems
- be familiar with the theory and practice of the analysis of stochastic systems
- implement, adapt and to apply methods and tools from Business Analytics
  e.g. analytical approximations, simulation, and robust planning methods to support managerial decisions

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Version: 25 June 2026

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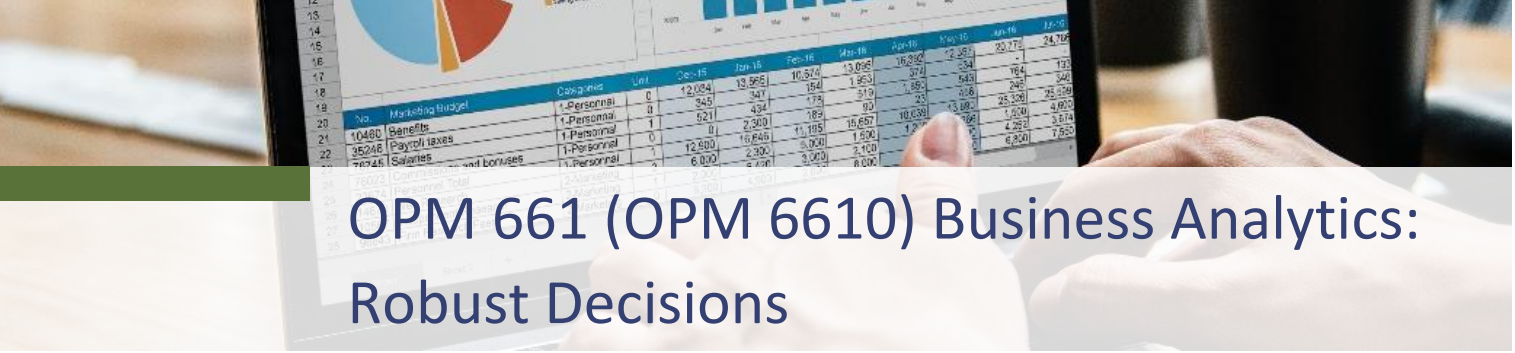

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Prerequisites:

- 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.
- Participants should be familiar with the fundamentals of production and operations management.
- The course further assumes a basic knowledge in mathematics (including linear programming) and in statistics (probability distributions).

Registration/Enrolment

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

Detailed Agenda

I Introduction to performance evaluation

1. Queueing systems, decisions, and applications
2. Performance measures in queues

II Performance analysis of Markovian queueing systems

3. Stochastic processes and Markov chains
4. Birth & death processes and economies of scale

III Impact of variability in queueing

5. Time-dependent analysis of queueing systems
6. Analysis of complex systems and simulation techniques

IV Optimization in queueing

7. Robust planning with scenarios

V Practical insights

8. Predictive and prescriptive analytics with Python
9. Guest lecture

Literature

- Bolch, G., S. Greiner, H. de Meer, and K. S. Trivedi (2006). Queueing networks and Markov chains: modeling and performance evaluation with computer science applications. John Wiley & Sons
- Curry, G. L. and R. M. Feldman (2011). Manufacturing Systems Modeling and Analysis (2 ed.). Springer
- Gross, D., J. F. Shortle, J. M. Thompson, and C. M. Harris (2008). Fundamentals of Queueing Theory (4 ed.). John Wiley & Sons.

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