



Operations Research

Course Description

Please answer the following questions:

- Do you like using formulas to solve problems?
- Do you like working in groups?
- Do you like solving case studies or if you haven't done that before, would you like to learn it?

If you answered all these questions with “yes”, then this is the perfect course for you. The course “Operations Research” builds on knowledge that you gathered from the course “Operations Management”. It is therefore highly recommended that you complete “Operations Management” prior to this course.

Course Summary

A supply chain spans many partners. For example, Ford had 1,260 suppliers in 2012. The aim of an efficient supply chain management is to optimally align the processes and activities of the partners. The alignment of these processes and activities is complex. They are often subject to several constraints, such as time, space or money.

Supply chain optimization uses different modelling approaches to make decisions in a business context. Based on these modelling approaches, a business analyst first defines the problem and collects data, then formulates a mathematical model to represent the problem and finally solves it to make a recommendation for the management. The overall objective is to come up with an optimal solution, i.e., to minimize costs, to maximize profits, to increase customer satisfaction, to decrease lead times, etc.

With advancing IT systems, companies can easily collect large amounts of data to make these decisions. This so-called “Big Data” opens up many new opportunities to improve supply chain activities. For example, airlines use data from booking systems, social media and customer loyalty programs to optimize ticket prices, baggage fees, in-flight purchases and entertainment programs. Retail companies collect information on individual purchase behavior with bonus programs and point-of-sale scanner systems to manage their inventories. Websites track visitors and make suggestions for future purchases based on the user's profile and a product's current inventory level.

This course aims at teaching tools and methods to analyze data and implement models from operations research to make well-informed decisions. The learning objective is that students become familiar with software packages available to analyze data and with models to solve practice problems. Students will apply the models discussed in class to different problem sets related to supply chain management. The course teaches important skills for solving practice problems and is a good preparation for writing a bachelor thesis or working at a company in a supply chain management department.

Course Administration

Lecture	Monday 10:00 – 11:30 (weekly), Hörsaal VI (Hauptgebäude) 24.04.2017 – 29.05.2017
	Tuesday 10:00 – 11:30 (weekly), Hörsaal G (105 Hörsaalgebäude) 18.04.2017 – 30.05.2017
Discussion session	Wednesday 14:00 – 15:30 (weekly), Hörsaal VI (Hauptgebäude) 19.04.2017 – 31.05.2017



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Faculty office hours Mondays, 14:00 – 15:00

Assignments

There will be weekly homework assignments that will be discussed in the discussion session.

Handouts

There will be class handouts for each lecture, summarizing the main points covered. The handouts are typically available for download from ILIAS at least 24 hours before class.

Grading

The course will count 6 credit points (LP) according to the new examination handbook from 2015. It will count 8 credit points according to the old examination handbook from 2007. The overall grades are determined as follows:

- Exam (70%)
- Case Study (25%)
- Experiment (5%)
- Bonus points

Language

The lectures are taught in English.

Prerequisites

Interest in the field and working knowledge of quantitative approaches in business administration. It is recommended that the course Operations Management is completed prior to this course. Prior knowledge of Excel is recommended, but can be also gained throughout the course with some additional effort.

Literature

Literature will be announced in class

ILIAS https://www.ilias.uni-koeln.de/ilias/goto_uk_crs_2111025.html

Exam June 3, 2017

All students register via the Prüfungsamt.



Course Overview

Introduction

Introduction to operations research

Decision making under uncertainty

Data analysis

Modeling

Excel spreadsheets

Linear programming

Model formulation

Graphical solution

Solution algorithms

Applications

What-if analysis

Changes in objective function, parameters, constraints

Sensitivity analysis

Network optimization

Minimum-cost flow problems

Maximum flow problem

Shortest path problem

Dynamic programming

Solution algorithms

Bellman's principle of optimality

Integer programming

Project management

Facility location planning

Non-linear programming



Monday	Tuesday	Wednesday	Thursday	Friday
April 17	18	19	20	21
	Lecture 1: Introduction to operations research	Lecture 2: Introduction to linear programming		
24	25	26	27	28
Lecture 3: Solution algorithms	Lecture 4: What-if analysis Spreadsheet modeling	Discussion 1: Spreadsheet modeling Introduction to Excel		
May 1	2	3	4	5
<i>Labor Day</i>	Lecture 5: Guest lecture by Dr. Marcel Sieke, Barkawi Management Consultants	Discussion 2: Linear programming Solution methods What-if analysis		
8	9	10	11	12
Lecture 6: Network optimization I	Lecture 7: Network optimization II	Lecture 8: Guest lecture by Milko Teofilov, Capgemini		Feedback sessions
15	16	17	18	19
Lecture 9: Dynamic programming I	Lecture 10: Dynamic programming II	Discussion 3: Transportation problems and network optimization		Feedback sessions
22	23	24	25	26
Lecture 11: Integer programming Facility location planning	Lecture 12: Non-linear programming	Discussion 4: Dynamic programming Facility location planning	<i>Ascension Day</i>	
29	30	31	June 1	2
Lecture 13: Summary Q&A	Lecture 14: Case study presentations	Discussion 5: Case study presentations		

Exam: June 3, 2017