Minor Operations Analytics 2017-2018
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Data Analytics

Doel vak
This course teaches the students the importance of data analysis as the process of transforming data into useful information in order to support decision making. It equips the students with the tools, techniques and common practices used in the field of data analytics, including how to obtain, manipulate, explore, model, and present data.

Inhoud vak
Data analytics is a booming term that is used for the use of large amounts of data to gain knowledge, to optimize operations, and to explore markets. An example is the use of real-time traffic data to analyze vehicle movements, to predict congestions, to find the fastest route, and to schedule maintenance operations. Underlying data analytics is a series of methods and tools that include querying databases, using multivariate statistics, and visualizing high-dimensional data. This course will address theoretical and practical aspects in a number of selected topics relating to data analytics.

The following approaches to data analysis will be covered:
• Exploring data
• Preprocessing
• Statistics
• Regression
• Beyond regression
• Classification
• Clustering
• Importing data
• Missing data and outliers
• Validation

We will use flipped classroom approach, in which most of the time will be devoted to in-class working on assignments, helping your fellow students, and discussing suitable approaches.

Onderwijsvorm
Lectures, computer assignments, student presentations

Toetsvorm
Written exam – individual assessment
Individual assignments – individual assessment
Team assignments – team assessment
Participation and attendance – individual assessment
Literatuur
D.T. Larose, Discovering Knowledge in Data: An Introduction to Data Mining, 2nd Edition, Wiley
Extra documents (articles, data sets, weblinks, etc.) will be provided through Canvas

Vereiste voorkennis
Basic course in statistics

Aanbevolen voorkennis
Elementary computer skills, handling spreadsheets or programming

Overige informatie
For doing the in-class work of this course, you are strongly recommended to bring a laptop with internet connection. This may be a Windows, Mac OS or Linux computer, at your choice. It is convenient when you have some of the programs that you can operate (e.g., Excel, SPSS, Matlab, R, etc.) available on this laptop.

Integrative Practice Lab

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Doel vak
Learn how to model a business problem in such a way that:
- the resulting models are simple enough to allow for analyses and optimization and
- are close enough to reality to make the results practically relevant.
Deepening the understanding of optimization methods through hands on application.
Practice the communication with - and the presentation of results to - business owners.

Inhoud vak
An essential part of the Operations Analytics program is to expose the students to actually apply the knowledge they have on modelling and optimization techniques using the computer. During the course, students work together in small groups on selected cases that originate from practice.
At the start, it is not clear how optimization techniques can be used to improve the business process that is central in the case. Nor is it clear which optimization techniques should be chosen.
Interpreting the business process and modelling it in a way that selected optimization techniques can be applied successfully is central in “solving” the cases.
**Onderwijsvorm**

Group discussions on (intermediate) reports of the groups, with input from both the students from other groups as well as from the teacher, also giving directions for next steps in the research, are combined with background information by the teacher on models and techniques that could be relevant for the cases at hand.

**Toetsvorm**

Research reports – team assessment
Oral examination – individual assessment

**Literatuur**

Dedicated articles and background information on the problems that are studied in the cases.

**Vereiste voorkennis**

Knowledge and skills acquired in other four courses of the minor Operations Analytics or in an a similar curriculum. Experience with a computer language like R or Python.

**Internship Minor Operations Analytics**

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**Doel vak**

Academic Skills
- Ability to examine and understand problems from different perspectives;
- Ability to put forward well-founded, substantiated points of view, both in spoken and written format;
- Ability to apply acquired knowledge to other problems and in other contexts.

Research Skills
- Ability to translate practically relevant problems into (academically) relevant research questions;
- Ability to design and execute a project using a systematic, analytical approach in a real business environment (of profit or not-for-profit organizations).

Knowledge
- Have specialized, in-depth knowledge and insights about the minor theme;
- Ability to make connections between theories, models, and concepts of that specific minor theme/ discipline.

Bridging Theory and Practice
- Ability to apply theoretical knowledge in a specific organizational context;
• Ability to formulate relevant recommendations for practice based on your knowledge acquired;
• Have a better understanding of what the expectations of the academic and professional field are in terms of knowledge and skills needed;
• Have awareness of the various career opportunities the field offers.

Social Skills
• Have a better understanding of roles and needs of different types of stakeholders that you need to interact with as a professional;
• Ability to work well in a team and reflect on your own role in the team.

Self-awareness
• Ability to reflect on your own responsibilities as well as others;
• Ability to reflect on your personal development;
• Ability receive and are able to deal with feedback from others.

Inhoud vak
Increasingly organizations and maybe even your future employer are looking for experience as well as academic credentials. The School recommends doing an internship, because it is an excellent way to apply the knowledge and (academic) skills which you acquired during your studies. Your most important learning goal as a student-intern is to familiarize yourself with professional and market-related skills in a real and new organizational environment. With the job market becoming increasingly competitive, gaining relevant experience will give you a good start into your professional career.

Companies offer a wide range of internships in various disciplines. What is crucial in obtaining approval for your internship and eventually obtaining your study credits, is that there is a clearly defined project that allows you to fulfill the learning objectives. Also, the project needs to allow for an individual assessment.

Finally, note that in order to obtain your internship credits, your internship has to be pre-approved by the minor coordinator and supervised by a School member that is assigned to you by either the minor coordinator.

Onderwijsvorm
On-site Internship

Toetsvorm
Written report – Individual assessment

Literatuur
Literature relevant to the theme of the minor and internship should be used to develop a solution to the problem that is investigated with the internship project.

Vereiste voorkennis
No other requirements than the ones for this minor

Aanbevolen voorkennis
Courses related to the minor
Overige informatie

IMPORTANT:

• Subscription to the internship through VUnet is not possible.

• CONTACT THE MINOR COORDINATOR as soon as you have an INITIAL proposal for the internship. Approval of the minor coordinator is essential in order to be able to do a minor internship.

• The general internship manual will be available through VUnet (including more details on a time plan and practical matters). CAREFULLY READ THE MANUAL ON VUNET (go to Services > Degree programme > Internship, or Serviceplein > Opleidingsprogrmma > Stage). The manual will provide more insights in what is exactly expected in terms of your internship proposal, the concrete requirements, and the related time line of activities.

• After completing the internship the subscription to the course as well as the registration of the result will be done by the back office.

Operations Analysis

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Doel vak

Upon completion of this course, the students will have learned the following.

Academic:
To analyze and solve operations management problems through a variety of models and concepts.
Professional skills and quantitative methods
To apply tools to direct, design, deliver and develop processes, products and services using quantitative decision models
Social
To analyze and develop solutions for stylized case problems in teams
Link to practice
To relate to the practice of analyzing and managing processes and operations through guest lectures from professionals

Inhoud vak

Operations management is the process of managing people and resources to create a product or a service. This course provides the student with analytical and quantitative methods to support the operations function and the decision making process in an organization. We will focus on a number of topics at a strategic, tactical and operational level that are in reality closely related. We will analyze and solve key issues arising
in operations management, such as facility layout and location, aggregate planning, project scheduling, operations scheduling and controlling. We will also investigate the applicability of the studied techniques by developing solutions for case studies and through guest lectures from practitioners.

Onderwijsvorm
Lectures and Tutorials

Toetsvorm
Written exam – individual assessment
Case assignment – team assessment

Literatuur
A selection of additional papers that will be made available via Canvas.

Supply Chain Dynamics

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Doel vak
Academic:
In this course students will learn to understand and simulate dynamics in supply chains using management games and system dynamics simulation.
Professional:
This course provides students hands-on experience with dealing with supply chain issues in realistic game settings, gain an understanding of how behavioural issues interact with rational decision-making in a supply chain and with modelling real life situations in a dynamic fashion.
Quantitative methods:
The students will apply quantitative (dynamic) simulation to understand core operations decisions in a supply chain. We will particularly pay attention to system dynamics.
Social:
In this course students work in teams on complex operations decision problems. They will learn how to deal with conflicting interests and problems they need to solve as a team.
Link to practice:
In this course we study and mimic realistic settings that relate to decision-making in operations practice.

Inhoud vak
After successfully completing this course you are able to analyze operations decision making using behavioral and system dynamics lenses.
More specifically you will:
• Understand and be able to analyse and model operations management problems using system dynamics;
• Gain experience in dealing with actual operations and supply chain problems using management games;
• Gain in-depth insight into how behavioural aspects influence decision making in game settings.

Onderwijsvorm
Lectures and Tutorials

Literatuur
Other literature (via Canvas).

Aanbevolen voorkennis

Transport and Distribution Planning

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Doel vak
The learning outcomes of the course on Transport and Distribution Planning are the following:

Academic skills
In this course, the students learn the challenges faced when optimizing Transport and Distribution plans. Such plans often require the use of heuristics to be efficiently established. The course addresses the most important and powerful optimization techniques known, with emphasis on those techniques that work well for real-life planning.

Quantitative methods
The students learn how to distinguish heuristics in terms of efficiency, solution quality and other quantitative aspects.

Professional skills
The students will become able to solve challenging practical problems, which are within the realm of professionals only.

Social skills
In this course, the students work in teams. They learn how to combine different skills, backgrounds and interests to solve challenging and complex problems.

Link to practice
The lecturers have a sound practical record, complementing their extensive academic achievements. A representative choice of illustrative problem domains from practice is therefore guaranteed, as well as a good understanding on how to bridge the gap between theory and practice. Furthermore, the optimization techniques taught are among the best used in practice.

Inhoud vak
• Heuristics form an indispensable tool for everyone working in operations management, and in the planning of Transport and Distribution in particular.
• Problems arising from practice are often too hard to solve exactly and heuristics are relatively simple methods that may provide feasible solutions of good quality.
• The course covers two areas: the first is about heuristic ideas applicable to general problems and the second is focused on the application of heuristics to Transport and Distribution problems. This field, of so-called routing problems, is so rich that virtually all published heuristic ideas have been applied to it.
• The course is further divided into three parts, each of which first covers general problems and then focuses on routing.
• These three parts are:
  • Classical heuristics to construct a feasible solution
  • Improvement heuristics based on structured local search
  • Heuristics aiming at escaping local optima
Regardless of the part being addressed attention is paid to:
• Meta-heuristics, i.e., general ideas applicable to a large variety of domains
• Complexity analysis
• Whether a performance guarantee can be given and how to prove it
• Ways to benchmark and empirically assess quality

Onderwijsvorm
Lectures
Tutorials

Toetsvorm
Written exam – Individual assessment
(Interim) Assignment(s) – Group assessment

Literatuur
complemented with slides and additional notes to be provided

Vereiste voorkennis
A quantitative background with some affinity with computer programming

Aanbevolen voorkennis
Applied mathematics, econometrics, engineering, business administration, computer or data science, management sciences, or any quantitative study

Doelgroep
Both BA/IE students with an interest in optimization and OR/AM students with an interest in computer implementations can participate, since they
will work together in teams combining knowledge and skills.

**Overige informatie**
The students will experience optimization techniques. We will make as much use of the language R as possible to express the optimization algorithms addressed in the course. R is used through the minor, therefore learning it will be useful for several courses, and you may find it useful in your careers as well.