# Minor in Operations Analytics

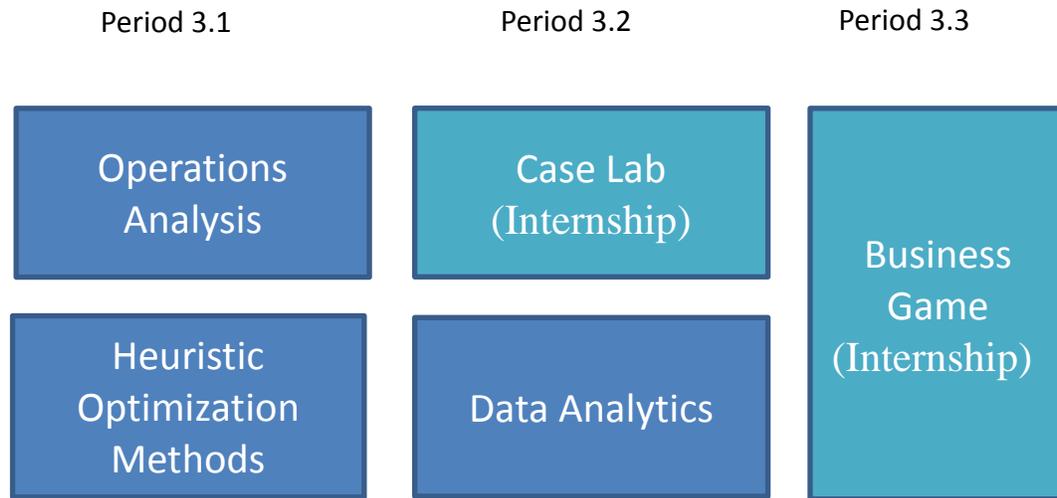**The minor for quantitative decision making in business**

The Department of Econometrics and Operations Research of the Vrije Universiteit Amsterdam offers this minor in collaboration with the department of Information, Logistics and Innovation in the fall semester (September-January) starting in the academic year 2016-2017. Real-life challenges in business operations by applying mathematical analytical methods and techniques from Operations Research and Operations Management are at the core of this minor. A selection of courses and business cases will allow students to explore the spectrum of Operations Analytics skills: identify problems requiring managerial action; translate managerial decisions into mathematical models; make appropriate abstractions; select and analyze relevant (big) data; apply, design and program algorithms for solving the resulting mathematical problems; drawing managerial conclusions taking into account behavioral aspects.

The students. The minor is aimed at a mixture of students from Econometrics and Operations Research (EOR) and students from Business Administration (BA) with a strong quantitative interest. However, any student in the Netherlands and abroad with an interest in applying mathematics in a business environment should be interested in this minor. Specifically, students from all over the world in Applied Mathematics (AM), and Industrial Engineering (IE) are more than welcome to join.

The program. The 30 ects program is entirely taught in English. It consists of three courses a case lab and a business game of 6 ects each. A course Operational Analysis offers models and concepts to analyze operations management problems occurring in a variety of industries. A course Heuristic Methods focusses on practice oriented algorithm design. In a Data Analytics course the challenges of extracting useful information from big data to support decision making in business environments will play a central role. The tools developed in these courses will be applied to challenging and significant business cases in the rest of the program. The Case Lab will draw from a rich variety of business settings, such as supply chain management, revenue management (e.g. in airline industry), marketing, work force planning and health care. The Business Game will simulate the whole process of managerial decision making in a practical business situation. The experience offered by these case studies will be greatly magnified by the aimed mixture of backgrounds of the participating students.

Internship. For students of the program there is the opportunity to do an internship. Such an internship of 12 ects will replace the case lab and the business game. The internship will in general be at a company and will be concluded with a report written by the student. A few talented students may be offered the option to do a research and teaching internship within the participating departments. The internship always has to be approved by the coordinator of the minor Prof. Dr. Leen Stougie.

**The schedule.** The program is schematically given in the following picture. Details of the courses and the internship as well as the entrance requirements are given below.

|  Period 3.1  |  Period 3.2  |  Period 3.3  |
|---|---|---|
| Operations Analysis | Case Lab (Internship) | Business Game (Internship) |
| Heuristic Optimization Methods | Data Analytics |  |

All courses are 6 ects. There is a choice between doing the case oriented courses (Case Lab and Business Game) or doing an Internship of 12 ects.

**Entry requirements.** We aim at a mixture of students of different backgrounds but we expect every student to have completed the mathematics courses in his or her bachelor programme, preferably with good notes. Basic knowledge of optimization algorithms is helpful but certainly not required.

**The lecturers.** The lectures will be given by internationally renowned lecturers from the departments of Econometrics and Operations Research and Information, Logistics and Innovation. The foundations of Operations Analytics on mathematical modelling, data analysis and the design and analysis of algorithms is core business of the Operations Research group at the VU. Next to researchers on the methodological mathematical aspects of Operations Research, the group hosts professors who share their position at the VU with a key position in the consultancy industry. They will share with the students their broad experience in both the practical and the mathematical side of OR-applications in Business Processes.

The application of advanced Operations Research techniques is one of the most prominent pillars of the Logistics research group. The minor aligns well with the 3 main research tracks within the Logistics research group being (i) performance benchmarking and best practices, (ii) network planning and redesign and (iii) supply chain coordination and incentive alignment. As such, insights from ongoing research will be integrated in the lectures and case discussions by lecturers in Logistics from the VU.

For further information on the minor, please contact the coordinator Prof. Dr. Leen Stougie, Department of Econometrics and Operations Research, Faculty of Economics and Business Administration, Vrije Universiteit Amsterdam, e-mail l.stougie@vu.nl

## A Short Description of the courses:

In the courses the material will at places be diversified, to honor the different backgrounds of participating students.

| Courses | Objectives | Examination |
|---|---|---|
| Operations Analysis (3.1; 6ects) Dr. Roberto Roberti (VU) | Practical problem solving in business processes starts with a careful analysis. This course teaches how to analyze operations management problems by applying a variety of models and concepts. It furnishes the students with tools to direct, design, deliver and develop processes, products and services using quantitative decision models | Exam and reports on assignments |
| Heuristic Optimization Methods (3.1; 6ects) Prof. Dr. Joaquim Gromicho (VU, Ortec), Prof. Dr. Daniele Vigo (VU, Univ. of Bologna and chairman of VeRoLog) | Many real-life optimization problems arising in business are too complicated to be solved to optimality. This course therefore gives the student a set of algorithmic solution tools that are generally effectively applicable yet simple to define and design. The student gets insight into when heuristics need to be applied and learn how to distinguish and select heuristics in terms of efficiency, expected solution quality and the ability to accommodate different aspects of a problem. | Exam and reports on assignments |
| Data Analytics (3.2; 6ects) Dr. Reinout Heijungs (VU) | Data is usually unstructured. This course teaches 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. | Exam and reports on assignments |
| Case Lab (3.2; 6ects) Prof. Dr. Gerrit Timmer (VU, Ortec) | Hands on applications of business problems will deepen the understanding of the applicability optimization methods. Students learn how to model a business problem in such a way that the resulting models are on the one hand simple enough to allow for analyses and optimization and on the other hand close enough to reality to make the results practically relevant. Practicing presentation of results in word and in reports is an important part of the case. Cases will differ every year and will be selected for example from the airline industry, public transport, marketing, work force planning and health care. | Research report and oral exam |
| Business Game (3.3; 6ects) Prof. Dr. Sander de Leeuw (VU and Nottingham Business School) | Utilizing the knowledge acquired in this minor for decision making in a business process is challenged through realistic game settings. An Operations/Supply Chain Management game mimics decision-making in practice adequately. By working in teams, competing with each other, students also learn to look at management and team decisions through behavioural lenses and how to deal with conflicting interests. | Research report and game performance (individual and team assessment) |
| Internship (3.2 – 3.3; 12ects) All members of the Operations Research group and of the Logistics group | The internship may be chosen to replace the Case Lab in 3.2 and the Business Game in 3.3. The internship will usually be in a company or other non-academic organisation. Such an internship is meant to give the student insight into the way practitioners work on problems in industry from an analytic point of view. Also a few academic internships will be offered within the departments of EOR and Logistics for talented students who wish to pursue an academic career. | Report on the internship |
| Colloquium (3.1 – 3.2) | The colloquium consists of bi-weekly lunch seminars in which research staff and international speakers present recent developments in the field. | Voluntary presence |