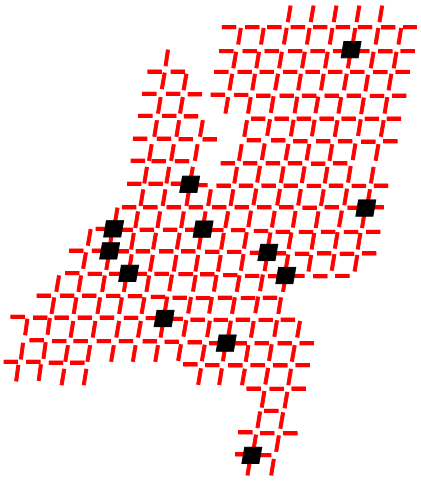

DUTCH NETWORK ON THE MATHEMATICS OF OPERATIONS RESEARCH (LNMB)

MASTER AND PhD PROGRAMME IN OPERATIONS RESEARCH

Information Guide 2014/2015

June 2014

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Preface

The education programme of the LNMB provides high quality teaching in the broad field of interest in the mathematics of operations research, including new interesting areas. The programme consists of 27 courses for Master and PhD students. This year seven Master courses and ten PhD courses are scheduled (the PhD courses have a cycle of two years). It is allowed that Master students attend PhD courses and, vice versa, that PhD students attend Master courses. The lectures are taught in the Uithof buildings of the Utrecht University.

The education programme for the academic year 2014/2015 consists of the following courses.

Master courses:
Fall 2014:
− Introduction to Stochastic Processes;
– Continuous Optimization;
– Discrete Optimization;
– Heuristic Methods in Operations Research.
Spring 2015:
– Advanced Linear Programming;
– Scheduling;
– Queueing Theory.

PhD courses:
Trimester 1:
– Multi-class Queues and Stochastic Network;
– Networks and Polyhedra;
– Convex Analysis for Optimization.
Trimester 2:
– Networks and Semidefinite Programming;
– Algorithmic Methods in Queueing Theory;
– Cooperative Games.
Trimester 3:
– Randomized Algorithms;
– Asymptotic Methods in Queueing Theory;
– Robust Optimization;
– OR-Games.

Besides information about the LNMB courses, this guide contains:
− Organisational and administrative affairs;
− Information about the operations research groups at the Dutch universities;
− Lists of members, PhD students and alumni.

The information is also available via the LNMB website www.lnmb.nl

In addition to the courses, the LNMB organizes the 40th Lunteren Conference on the Mathematics of Operations Research. This conference will be held 13 – 15th January 2015.

The LNMB gladly acknowledges the financial support by the universities. This enables the LNMB to continue its activities.

Johann Hurink,
Scientific director LNMB
June, 2014

1. Dutch Network on the Mathematics of Operations Research (LNMB)

The Dutch Network on the Mathematics of Operations Research (in Dutch: Landelijk Netwerk Mathematische Besliskunde; abbreviated LNMB) is an interuniversity co-operation in which all Dutch universities and the Centre for Mathematics and Computer Science (CWI) in Amsterdam participate. The LNMB has been established in July 1987. From 1987 until 2001 the University of Groningen was its administrator, from 2002 until 2006 the University of Maastricht, and from January 2007 the University of Twente acts as administrator of the LNMB.

The tasks of the LNMB are twofold. Firstly, the LNMB offers courses for PhD and Master students, and is responsible for the annual Lunteren Conference on the Mathematics of Operations Research. Secondly, the LNMB is an organization of full and associate professors in the field of Operations Research. The universities and the CWI are represented in the General Board out of whom an Executive Board is chosen.

The LNMB has 119 members and 173 PhD students. The LNMB courses are also accessible, on payment, to other interested people. An independent judgment by NWO (Netherlands Organization for Scientific Research) has proven that the LNMB graduate education programme is of a high international standard.

2. PhD courses and diploma requirements (general information)

The programme of the LNMB PhD courses is offered in a biennial cycle consisting of 20 courses. The subjects of the courses are in the following areas: Combinatorial Optimization, Stochastic Operations Research, Mathematical Programming, Game Theory and Applications of OR.

The programme is flexible in the sense that new PhD students can start with their programme at the beginning of any trimester. Furthermore, the individual programmes can vary; each student can choose his of her own parts of the education programme. In each trimester a combination of various subjects is taught. In general one can follow each of the courses without any prerequisites of the other courses. The courses take place on Monday in Utrecht.

The courses are intended for PhD students in Operations Research. However, Master students in mathematics, econometrics or computer science who acquired enough prerequisites are also welcome. Further information can be obtained from the director of the LNMB or from the lecturers of the courses. Furthermore, government and/or business employees who want to follow a course may participate. Participants are expected to make exercises (homework) during or at the end of the course to show that they have understood the contents of the course. The credits (including for the attendance of the course) for participants who have passed the exercises successfully have been set at 4 EC per course. In case the courses are only attended (or when the exercises are not passed successfully), the workload is set at 1 EC. At the end of each course the participants receive a certificate with the grade and the credits involved.

The following regulation holds for the course fee. Participants from the departments of the Dutch universities which finance the LNMB don't pay any course fee. Other participants pay for each course a fee of 500 Euro. The director of the LNMB is authorized to grant a reduction of this fee at occurring situations.

Application to a LNMB PhD course can be done by filling in the online application form available at the website http://www.lnmb.nl/pages/courses/. PhD students who participate for the first time in LNMB courses, also have to fill in the form for new PhD Students, which can also be found on the mentioned website.

In addition to the courses, the PhD programme includes the Lunteren Conference on the Mathematics of Operations Research. During this conference prominent - usually foreign - researchers lecture on special topics or on recent research. PhD students can give a so-called PhD presentation. In such a presentation one can present his or her research results. It is preferred to give such a presentation in the 2nd or 3rd year of the PhD period. Attendance in the Lunteren Conference is credited by 1 EC.

PhD students who have sufficiently participated in the LNMB PhD programme and have given a PhD presentation receive a diploma. Here, ‘sufficiently’ means that they have passed at least 6 LNMB PhD courses with success, whereby one of the courses may be replaced by a course of the graduate program GP-OML and whereby in consultation with the supervisor one course may be replaced by a Master course. If PhD courses have already been taken during the Master program, these courses are also taken into consideration for the LNMB diplom and it is mentioned on the diploma that the courses are part of a Master program. Under certain circumstances the supervisor may submit a motivated request to give the diploma to a PhD student although he or she did not meet the requirement of the PhD presentation.

3. Master courses (general information)

From September 2004, the LNMB provides Master courses in Operations Research. These courses are intended for Master students in Mathematics or Econometrics who want to take one or more courses in Operations Research. Usually, the Master thesis adviser will propose or decide that a student will participate in LNMB Master courses.

Due to the small number of Master students in Operations Research at each individual university, a national concentration is efficient and can help to guarantee a qualitatively high education. This is the main purpose of the LNMB Master courses. An additional advantage for the students is the contact with professors and students from other universities. The LNMB Master courses are part of the Dutch Master Programme in Mathematics, which is a coordinated programme of the Departments of Mathematics of the Dutch universities.

In each semester (Fall and Spring) three or four LNMB Master courses are given. The subjects of the courses are taken from the following areas: Mathematical Programming, Combinatorial Optimization and Stochastic Operations Research. The programme is flexible in the sense that new Master students can start with their programme at the beginning of any semester. Furthermore, the individual programmes can vary; each student can choose his of her own courses. The courses take place on Monday in Utrecht.

Although the courses are intended for Master students, PhD students are also welcome. It is up to their thesis adviser to propose or decide that a PhD student will attend such a course. Further information can be obtained from the director of the LNMB.

The students are subjected to an examination that usually will consist of making exercises during the course and also a written or oral examination. The credits for participants who have passed the examination successfully have been set by the LNMB at ***6 EC*** per course. A final decision about the credits and the grade is formally up to the university of the student.

The organisational part of the Master courses is done by the Dutch Master's Degree Programme in Mathematics (Mastermath). Therefore, Master- as wel as PhD students have to register for the Master courses of the LNMB via the website of Mastermath (http://www.mastermath.nl/). Mastermath distribute the results of the Master students to the corresponding universities and the PhD students get a certificate via LNMB.

4. PhD courses 2014/2015

During the academic year 2014/2015 ten courses will be taught in three trimesters; each trimester has a duration of nine weeks. In the 3rd trimester two courses are given in parallel.

Trimester 1: (September 15 – November 10)

- Multi-class Queues and Stochastic Networks (MQSN) — Boucherie/Scheinhardt
- Networks and Polyhedra (NP) — Aardal/ Molinaro
- Convex Analysis for Optimization (CAO) — Brinkhuis

Trimester 2: (November 17 – December 15 & January 19 – February 9)

- Networks and Semidefinite Programming (NSP) — Laurent
- Algorithmic Methods in Queueing Theory (AlQT) — Adan/van Leeuwaarden
- Cooperative games (CG) — Borm

Trimester 3: (February 16 – March 30, April 13 and 20)

- Randomized Algorithms (RA) — Sitters/Stougie
- Asymptotic Methods in Queueing Theory (AsQT) — Borst/Núñez-Queija (parallel)
- Robust Optimization (RO) — den Hertog (parallel)
- OR-Games (ORG) — Hamers

The courses are given on Monday according to the following schedule:

	Trimester 1	*Trimester 2*	*Trimester 3*
10.15 – 11.00	Course MQSN	Course NSP*	Course RA*
11.15 – 12.00	Course MQSN	Course NSP*	Course RA*
12.00 – 13.00	Lunch break	Lunch break	Lunch break
13.00 – 13.45	Course NP*	Course AIQT	Course AGT & ATS
14.00 – 14.45	Course NP*	Course AIQT	Course AGT & ATS
15.00 – 15.45	Course CAO	Course CG	Course SP
16.00 – 16.45	Course CAO	Course CG	Course SP

* = in cooperation with DIAMANT

Location:
The courses are given in the Uithof (buildings of the Utrecht University), in the Mathematical Building, Room 611AB, Budapestlaan, Utrecht; except for one of the courses AGT and ATS (the room will be announced later this year).

Credits:
The credits (including for the attendance of the course) for participants who have passed the exercises successfully are ***4 EC*** per course. In case the courses are only attended (or when the exercises are not passed successfully), then the workload is set at ***1 EC***. At the end of each course the participants receive a *certificate* with the grade and the credits involved.

Registration:
Anyone interested in these courses is invited to fill in the online registration form on the webpage of the LNMB (http://www.lnmb.nl/pages/courses/phdcourses/). For each of the three trimesters a separate form is given. If you are a new PhD student, please also fill in the 'Form for New PhD students' on that webpage.

Course MQSN: "Multi-class Queues and Stochastic Networks"

Time : Monday 10.15 – 12.00 (September 15 – November 10).
Location: Room will be announced later on the LNMB webpage, Utrecht (De Uithof).
Lecturers: Prof.dr. R.J. Boucherie (UT) and Dr.ir. W.R.W. Scheinhardt (UT).

Course description:
Complex stochastic systems, like communication systems, computer networks and manufacturing systems, may often be modeled as queueing networks with multiple nodes and/or multiple classes. The performance of these systems may be evaluated in terms of queue lengths, sojourn times or blocking probabilities. This course focuses on basic queueing networks for which performance measures can be obtained in closed form. First, the course focuses on a class of networks where the equilibrium distribution has a so-called product-form solution. Topics include the output theorem, reversibility, partial balance, quasi reversibility and product-form. Examples include Jackson networks, Kelly-Whittle networks, BCMP networks, loss networks and processor sharing networks. Second, the course considers the sojourn time distribution in simple networks. Third, computation of performance measures often requires effcient algorithms. To this end, Mean Value Analysis and approximation techniques will be studied. Finally, fluid queues will be addressed.

Detailed content:
– reversibility, stationarity, basic queues, output theorem, feedforward networks;
– partial balance, Jackson network, Kelly-Whittle netwerk, arrival theorem;
– quasi-reversibility, customer types, BCMP networks, bandwidth sharing networks;
– blocking, aggregation, decomposition;
– loss networks, insensitivity via supplementary variables;
– sojourn time distribution in networks;
– MVA, AMVA, QNA;
– fluid queues, basic models;
– feedback fluid queues, networks of fluid queues.

Literature:
– R. Nelson, Probability, Stochastic Processes and Queueing Theory, 1995 : Chapter 10;
– F.P. Kelly, Reversibility and Stochastic Networks, Wiley, 1979 (available on-line);
– R.W. Wolff, Stochastic Modeling and the Theory of Queues, Prentice Hall, 1989;
– R.J. Boucherie, N.M. van Dijk (editors), Queueing Networks - A Fundamental Approach, International Series in Operations Research and Management Science Vol 154, Springer, 2011;
– Handouts, slides and references to relevant additional literature will be made available at the lectures.

Prerequisites:
The participants should have followed courses in probability theory, stochastic processes and queueing theory.

Examination:
Take home problems.

Addresses of the lecturers:
Prof.dr. R.J. Boucherie
Dept. of Applied Mathematics, Faculty EEMCS, University of Twente
P.O. Box 217, 7500 AE Enschede
Phone: 053 – 489 3432 E-mail: r.j.boucherie@utwente.nl

Dr.ir. W.R.W. Scheinhardt
Dept. of Applied Mathematics, Faculty EEMCS, University of Twente
P.O. Box 217, 7500 AE Enschede
Phone: 053 – 489 3832 E-mail: w.r.w.scheinhardt@utwente.nl

Course NP: "Networks and Polyhedra"

Time: Monday 13.00 – 14.45 (September 15 – November 10).
Location: Mathematical Building, Room 611AB, Budapestlaan, Utrecht (De Uithof).
Lecturer: Prof.dr.ir. K.I. Aardal (TUD) and Dr. M. Molinaro (TUD).

Course description:
Combinatorial optimization problems are concerned with the efficient allocation of limited resources to meet desired objectives when the values of the variables are restricted to be integral.

Combinatorial problems arise in various applications, e.g. airline crew scheduling, manufacturing, network design, cellular telephone frequency design and optimization problems on graphs.

The course deals with polynomial-time solvable combinatorial optimization problems. Many of these problems are special cases of linear programming problems.

The following subjects are discussed:
– shortest paths and trees;
– polytopes, polyhedra, Farkas' lemma and linear programming;
– matchings and covers in bipartite graphs;
– Menger's theorem, flows and circulations;
– non-bipartite matchings.

Literature:
– lecture notes: A Course in Combinatorial Optimization, A. Schrijver, CWI (chapters 1-5);
– B. Korte and J. Vygen, Combinatorial Optimization, 2e edition, Springer 2001;
– A. Schrijver, Combinatorial Optimization: Polyhedra and efficiency, Volume A: Paths, Flows, Matchings, Springer 2003.

Prerequisites:
Basic knowledge (bachelor level) of linear algebra and graph theory.

Examination:
Take home problems.

Addresses of the lecturers:
Prof.dr.ir. K. Aardal
Faculty EEMCS, Delft University of Technology
P.O. Box 5031, 2600 GA Delft
Phone: 015 – 27 85093/84109 E-mail: k.i.aardal@tudelft.nl

PhD M.C. Molinaro
Faculty EEMCS, Delft University of Technology
P.O. Box 5031, 2600 GA Delft

Course CAO: "Convex Analysis for Optimization"

Time : Monday 15.00 – 16.45 (September 15 – November 10).
Location: Mathematical Building, Room 611AB, Budapestlaan, Utrecht (De Uithof).
Lecturer: Dr. J. Brinkhuis (EUR).

Course description:
Convexity plays an important role in optimization, particularly in nonlinear optimization. Many applications of optimization problems are nonlinear but have the convexity property. For convex optimization an elegant mathematical theory can be developed, including a duality theory and algorithmic aspects.

Key words for the course are: convex sets and functions; separation theorems; subdifferential calculus; polarity; Karush-Kuhn-Tucker theorem; duality; minimax results in game theory; optimal consumption and investment in economics.

Literature:
Lecture notes will be provided. In addition (also as indication for the level):
– M.S. Bazaraa, H.D. Sherali and C.M. Shetty, Nonlinear programming, theory and algorithms, 2nd edition, Wiley, 1993.
– Borwein, J. and A.S. Lewis, Convex analysis and nonlinear optimisation, 2nd edition, Springer-Verlag, New York, 2006.
– R.T. Rockafellar, Convex analysis, Princeton University Press, 1970.

Prerequisites:
Basic knowledge (bachelor level) of analysis and linear algebra.

Examination:
Take home problems.

Address of the lecturer:
Dr. J. Brinkhuis
Dept. of Econometrics, Faculty of Economics, Erasmus University Rotterdam
P.O. Box 1738, 3000 DR Rotterdam
Phone: 010 – 408 1364 E-mail: brinkhuis@few.eur.nl

Course NSP: "Networks and Semidefinite Programming"

Time : Monday 10.15 – 12.00 (November 17 – December 15 & January 19 – February 9).
Location: Mathematical Building, Room 611AB, Budapestlaan, Utrecht (De Uithof).
Lecturer : Prof.dr. M. Laurent (CWI and UvT).

Course description:
Combinatorial optimization problems are concerned with the efficient allocation of limited resources to meet desired objectives when the values of the variables are restricted to be integral. Such problems arise in various applications, e.g., airline crew scheduling, manufacturing, network design, cellular telephone frequency design, and they can often be modeled as optimization problems on graphs. The course deals with several basic combinatorial optimization problems. While these problems are intrinsically hard to solve in general, we will present polynomial-time solvable instances. Algorithms use combinatorial tools, linear and semidefinite programming.

The following subjects are discussed:
– problems, algorithms and running time; basics of semidefinite programming;
– cliques, cocliques and colouring in graphs; Lovász theta number;
– cuts and metrics; multicommodity flows and disjoint paths.

Literature:
– lecture notes: A Course in Combinatorial Optimization, A. Schrijver, CWI (chapters 6,7,9);
– additional lecture notes on chosen topics will be provided;
– A. Schrijver, Combinatorial Optimization: Polyhedra and efficiency, Volumes A, B, and C, Springer 2003.

Prerequisites:
Basic knowledge of linear algebra, graph theory and linear programming.

Examination:
Take home problems.

Address of the lecturer:
Prof.dr. M. Laurent
CWI, P.O. Box 94079, 1090 GB Amsterdam
Phone: 020 – 5924105 E-mail: m.laurent@cwi.nl

Course AIQT: "Algorithmic Methods in Queueing Theory"

Time : Monday 13.00 – 14.45 (November 17 – December 15 & January 19 – February 9).
Location: Mathematical Building, Room 611AB, Budapestlaan, Utrecht (De Uithof).
Lecturer: Prof.dr.ir. I.J.B.F. Adan (TU/e) and Prof.dr. J.S.H. van Leeuwaarden (TU/e).

Course description:
This course focusses on algorithmic aspects of queueing theory, and builds on the basic queueing models treated in the Master course Queueing Theory. Typically, queueing systems can be described by appropriately defined Markov processes. The course starts by treating numerical methods to solve the steady-state and transient behavior of (finitestate) Markov processes. Attention is also devoted to the construction of (error) bounds on the steady-state distribution. Then the course introduces elements that enrich the basic queueing models, such as Markovian arrival processes, and phase-type service times. Inclusion of such elements usually results in multi-dimensional Markov processes on a strip (i.e., one in finite dimension). Techniques to analyse the steady-state distribution of Markov processes on a strip include: spectral expansion, matrix-analytic and generating function techniques for the analysis of G/M/1-type and M/G/1-type Markov processes. Further, the course addresses several techniques to analyse Markov processes with two (or more) infinite dimensions, such as the compensation method, the power series method and the generating function (or boundary value) method. Finally, topics such as the (numerical) inversion of generating functions and Laplace transforms are discussed.

Detailed content:
– direct and iterative methods for the solution of the equilibrium equations;
– Markov processes on a strip;
– G/M/1-type models, M/G/1-type models;
– matrix-analytic methods;
– spectral expansion;
– generating function (or boundary value) method;
– compensation method;
– power series method;
– numerical inversion of generating functions and Laplace transforms.

Literature:
Handouts, slides and references will be made available at the lectures (see webpage).

Prerequisites:
The participants should have followed courses in probability theory, stochastic processes and queueing theory.

Examination:
Take home problems.

Addresses of the lecturers:
Prof.dr.ir. I.J.B.F. Adan
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Phone: 040 – 2472932 E-mail: i.j.b.f.adan@tue.nl

Prof.dr. J.S.H. van Leeuwaarden
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P.O. Box 513, 5600 MB Eindhoven
Phone: 040 – 2472813 E-mail: j.s.h.v.leeuwaarden@tue.nl

Course CG: "Cooperative Games"

Time : Monday 15.00 – 16.45 (November 17 – December 15 & Januari 19 – February 9).
Location: Mathematical Building, Room 611AB, Budapestlaan, Utrecht (De Uithof).
Lecturer: Prof.dr.ir. P.E.M. Borm (UvT).

Course description:
Game theory studies interactive decision situations involving conflict and/or cooperation. In cooperative games binding agreements are allowed and the players may form coalitions. The focus is on the question how to reallocate the resulting joint coalitional payoff among the players in a fair way.

The following subjects are discussed:
– games in characteristic form (TU games);
– shapley value, compromise value and nucleolus;
– core concepts;
– convexity and compromise stability;
– some classes of OR Games: flow games and linear production games.

Literature:
Lecture notes will be provided.
NOT compulsory (just as an indication):
– S.H. Tijs, Introduction to Game Theory, Hindustan Book Agency, India, 2003.

Prerequisites:
– basic knowledge of analysis and linear algebra.

Examination:
Take home problems.

Address of the lecturer:
Prof.dr. P.E.M. Borm
Dept. of Econometrics & Operations Research, Tilburg University
P.O. Box 90153, 5000 LE Tilburg
Phone: 013 – 4663026 E-mail: p.e.m.borm@uvt.nl

Course RA: "Randomized Algorithms"

Time: Monday 10.15 – 12.00 (February 16 – March 30 and April 13 and 20).
Location: Mathematical Building, Room 611AB, Budapestlaan, Utrecht (De Uithof).
Lecturers: Dr. R.A. Sitters (VU and CWI) and Prof.dr. L. Stougie (VU and CWI)

Course description:
The topics are:
– randomized complexity classes; Yao's minimax principle; application of probabilistic bounding techniques;
– the probabilistic method; derandomization; random walks; randomized LP algorithms; on-line algorithms;
– randomization in geometric problems.

Literature:
R. Motwani and P. Raghavan: Randomized Algorithms, Cambridge University Press, New York, 1995, ISBN 0 521 47465 5. The participants have to have this book at their disposal by buying or lending (e.g. from the university library) the book.

Prerequisites:
Elementary knowledge of probability theory.

Examination:
Take home problems.

Addresses of the lecturers:
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Course AsQT: "Asymptotic Methods in Queueing Theory"

Time : Monday 13.00 – 14.45 (February 16 – March 30 and April 13 and 20).
Location: Mathematical Building, Room 611AB, Budapestlaan, Utrecht (De Uithof).
Lecturer: Prof.dr.ir. S.C. Borst (TU/e) and Prof.dr. R. Núñez Queija (UvA/CWI)

Course description:
Exact analysis of complex queueing systems is often out of scope. For many queueing systems it is all but impossible to obtain exact expressions for expected values of performance measures such as queue lengths, waiting times and sojourn time. Also, average values may not even be the most informative measures to describe a system's performace, but one may rather be interested in performance quantiles for example. For such cases a wide range of asymptotic techniques are available that may serve to develop suitable approximations and provide valuable insights. In this course we will discuss several such techniques and illustrate them on more advanced queueing models such as GPS queues, DPS queues, and bandwidth-sharing networks. The following techniques and topics will be discussed.

– Large deviations and tail asymptotics: We discuss several techniques to estimate tail probabilities in queueing systems. We distinguish two intrinsically different scenarios: one in which performance characteristics have light tailed distributions and one with heavy tails. We will explain the fundamental differences between these two scenarios ("conspiracy" versus "disaster" scenarios) and illustrate several analysis techniques that one may resort to in obtaining asymptotically accurate estimates, including analytic asymptotics, probabilistic bounds and coupling arguments.

– Fluid and diffusion limits: For optimization of complex stochastic processes, one may search for simpler versions of the processes that are still accurate enough to design meaningful optimizing control strategies. Fluid and diffusion limits are particularly useful in this context. For the fluid limit, one starts off the stochastic process (for example a queue length process) at an exceptional high level x and monitors it over a long period of time (order x). As the scaling parameter x tends to infinity, the stochastic process can often be shown to satisfy a functional strong law of large numbers, which is commonly referred to as the fluid limit. In applications, the fluid limit may not give sufficient information to design optimal control strategies and one will typically be interested in deviations from the fluid limit. The diffusion limit describes these deviations.

– Perturbation analysis and time-scale separation: analyzing Markovian queueing networks as multi-dimensional Markov processes may be notoriously difficult. One abstraction is to isolate the behavior of a single queue, and capture the influence of other queues in what is called the random environment. The state of the random environment determines the transition laws of the queueing system at hand. As the random environment changes state, the queue can move from one mode of operation to another (for example from lightly loaded conditions to overloaded conditions and back). When the state changes of the random environment occur on a much faster time scale than the queueing dynamics, one obtains a so-called fluid approximation (this is a somewhat different notion than the earlier mentioned fluid limits). On the contrary, if the state changes are extremely slow the limiting process is called a quasi-stationary approximation. This concept of time-scale separation can be formalized using perturbation analysis for Markov processes.

– Heavy traffic: For efficiency, in practice service systems are aimed at being deployed at fairly high loads. As the load on a (queueing) system approaches the critical capacity, typical performance characteristics such as queue lengths and sojourn times grow beyond limits. In the 1960's, Kingman showed that for single-server queues, the queue length process can be scaled such that a meaningful limit is obtained as the critical capacity is approached. In the past half a century, this concept has been extended to much more complex systems and successfully applied in practice, particularly in inventory systems, production facilities, call centers and communication networks. In the course we will discuss the founding principles of heavy traffic theory.

Literature:
Handouts, slides and references to relevant literature will be made available at the lectures.

Prerequisites:
The participants should have followed courses in probability theory, stochastic processes and queueing theory.

Examination:
Take home problems.

Addresess of the lecturers:
Prof.dr.ir. S.C. Borst
Dept. of Mathematics & Computer Science, Eindhoven University of Technology
P.O. Box 513, 5600 MB Eindhoven
Phone: 040 – 2475105 E-mail: sem@win.tue.nl

Prof.dr. R. Núñez Queija
Faculty of Science, University of Amsterdam
P.O. Box 94248, 1090 GE Amsterdam
Phone: 020 – 5255010 E-mail: nunezqueija@uva.nl

Course RO: "Robust Optimization"

Time : Monday 13.00 – 14.45 (February 16 – March 30 and April 13 and 20).
Location: Mathematical Building, Room 611AB, Budapestlaan, Utrecht (De Uithof).
Lecturer: Prof.dr.ir. D. den Hertog (UvT).

Course description:
Optimization problems often contain parameters that are uncertain. The recent methods developed in Robust Optimization try to find solutions that are robust against these uncertainties. The idea is to define a so-called uncertainty region for the uncertain parameters, and then require that the constraints should hold for all parameter values in this uncertainty region. For several optimization problems, and for several choices of the uncertainty region, it has been shown that this so-called robust counterpart problem can be reformulated as tractable optimization problems.

The main topics treated are:

- Uncertain *lineair* optimization (LO) problems:
  - data uncertainty in LO;
  - tractability of robust counterparts;
  - non-affine perturbations;
  - applications in logistics, marketing, finance, engineering, … .
- Uncertain *nonlineair* optimization problems:
  - tractability of robust counterparts;
  - examples.
- Robust adjustable multistage optimization:
  - adjustable robust counterpart;
  - affine decision rules;
  - non-affine decision rules.
- Robust counterpart approximations of scalar chance constraints:
  - how to specify an uncertainty set?;
  - chance constraints;
  - safe tractable approximations.
- Globalized robust counterparts of uncertain problems:
  - motivation and definition of globalized robust counterpart;
  - computational tractability.

Literature:
– handouts;
– selected parts of: A. Ben-Tal, L. El-Ghaoui, A. Nemirovski, Robust Optimization, Princeton Series in Applied Mathematics , 2009.

Prerequisites:
– knowledge of basic linear algebra;
– knowledge of linear programming and duality;
– basic knowledge of convex analysis and non-linear optimization.

Examination:
Take home problems.

Address of the lecturer:
Prof.dr.ir. D. Den Hertog
Tilburg School of Economics and Management , Tilburg University
P.O. Box 90153, 5000 LE Tilburg
Phone: 013 – 4662122 E-mail: d.denhertog@uvt.nl

Course ORG: "OR-Games"

Time: Monday 15.00 – 16.45 (February 16 – March 30 and April 13 and 20).
Location: Mathematical Building, Room 611AB, Budapestlaan, Utrecht (De Uithof).
Lecturers: Prof.dr. H.J.M. Hamers (UvT).

Course description:
The aim of this course is to provide a general overview of the possibilities of analyzing various OR-situations from a game theoretic perspective. A large part of the course is motivated by the idea that joint OR-problems in which various decision makers are involved not only have an optimization aspect in generating e.g. minimal total joint costs but as an allocation aspect in dividing these costs back fairly to the individuals itself.

Global scheme:
– a global survey of relevant notions from both cooperative and non-cooperative game theory;
– applications to bankruptcy, cost sharing, fixed and spanning tree, traveling salesman, Chinese postman, assignment, permutation, scheduling, lot sizing and inventory situations.

Literature:
Course material:
– handouts will be provided during the course;
– further reading: Curiel, I. (1997). Cooperative game theory and applications. Kluwer Academic Publishers.

Prerequisites:
The course is intended to be accessible without specific knowledge of game theory. For this aim the first part of the course will survey the game theoretical concepts that are needed.

Examination:
One final assignment to model and analyze a self-selected OR problem from a game theoretical perspective.

Address of the lecturer:
Prof.dr. H.J.M. Hamers
CentER for Economic Research, Tilburg University
P.O. Box 90153, 5000 LE Tilburg
Phone: 013 – 4662660 E-mail: h.j.m.hamers@uvt.nl URL: http://center.uvt.nl/staff/hamers

5. Master courses 2014/2015

During the academic year 2014/2015 seven courses will be taught in two semesters; each semester has a duration of 12 weeks. The courses are part of the Dutch Master Programme in Mathematics (http://www.mastermath.nl).

Fall 2014:
– ISP (Introduction to stochastic processes; September 8, 9, 15 and 16);
– CO (Continuous optimization; September 22 – December 8);
– DO (Discrete optimization; September 22 – December 8);
– HEU (Heuristic Methods in Operations Research; September 22 – December 8).

Spring 2015 (Febuary 2 – March 30, April 13 and 20, May 11):
– SCH (Scheduling);
– ALP (Advanced linear programming);
– QT (Queueing theory).

The courses are given on Monday according to the following schedule:

	*Fall 2014**	*Spring 2015*
11.00 – 11.45	Course CO	Course SCH
12.00 – 12.45	Course CO	Course SCH
12.45 – 13.15	Lunch break	Lunch break
13.15 – 14.00	Course DO	Course ALP**
14.15 – 15.00	Course DO	Course ALP**
15.15 – 16.00	Course HEU	Course QT
16.15 – 17.00	Course HEU	Course QT

* The course ISP is thaught on September 8, 9, 15 and 16 (10.15 – 12.00 and 13.00 – 14.45 each day).
** In cooperation with DIAMANT

Location:
The courses are given in the Uithof (buildings of the Utrecht University). Detailed information on the location can be found on the website of the Dutch Master Programme in Mathematics (Masthermath): http://www.mastermath.nl/locations.

Credits:
The credits for students who have passed the exercises successfully are 6 EC per course, except the short course ISP (4 EC).

Detailed information about the courses:
The registration and administration of the master courses is done by the Dutch Master Programme in Mathematics.
Anyone interested in these courses is invited to register via http://www.mastermath.nl.

Course ISP: "Introduction to Stochastic Processes"

Time : 10.15 – 12.00 and 13.00 – 14.45 (September 8, 9, 15 and 16).
Location: Utrecht (De Uithof).
Lecturers: PhD S. Kapodistria, (TU/e) and Dr. J.A.C. Resing, (TU/e).

Aim:
To provide an introduction in the basic notions of stochastic processes as applied in stochastic operations research topics like queueing theory and Markov decision processes.

Description:
The following subjects will be treated:
– discrete time Markov chains, including classification of states and long run behaviour and branching processes;
– exponential distribution and Poisson Processes;
– generating functions and Laplace-Stieltjes transforms;
– continuous time Markov chains and birth-and-death processes;
– renewal theory, including renewal theorem, renewal reward processes and regenerative processes.

Literature:
S.M. Ross, "Introduction to probability models", 10th edition, Academic Press, 2010.
The 9th or 8th edition can also be used. Having the book is essential for the course.

Prerequisities:
Knowledge of probability at the level: S.M. Ross, 'Introduction to probability models', 10th edition, Academic Press, 2010 (chapters 1-3).

Examination:
Written examination.

Addresses of the lecturers:
PhD S. Kapodistria
Dept. of Mathematics & Computer Science, Eindhoven University of Technology
P.O. Box 513, 5600 MB Eindhoven
Phone: 040 – 2475825 E-mail: s.kapodistria@tue.nl

Dr. J.A.C. Resing
Dept. of Mathematics & Computer Science, Eindhoven University of Technology
P.O. Box 513, 5600 MB Eindhoven
Phone: 040 – 2472984 E-mail: resing@win.tue.nl

Course CO: "Continuous Optimization"

Time : Monday 11.00 – 12.45 (September 22 – December 8).
Location: Utrecht (De Uithof).
Lecturer: Dr. P.J.C. Dickinson (UT) and Dr. G.J. Still (UT).

Aim:
The course aims to provide an advanced introduction into the basics and methods of nonlinear continuous optimisation (also called nonlinear programming).

Course description:
The course starts with some historical examples and an introduction into convex sets and convex functions. Then, optimality conditions in unconstrained and constrained optimization are discussed with emphasis on convex problems. Duality in convex optimization is the next topic followed by an introduction into the basic algorithms for unconstrained and constrained problems. Finally as a special topic, LP-, Lagrange- and semidefinite-relaxations of integer programs are studied.

Literature:
– lecture notes "Nonlinear Optimization", by E. de Klerk, C. Roos, T. Terlaky;
– Algorithmic Principles of Mathematical Programming" by U. Faigle, W. Kern and G. Still.

Prerequisites:
Basic knowledge of linear algebra and multivariate analysis.

Examination:
Written examination.

Address of the lecturer:
Dr. P.J.C. Dickinson
Dept. of Applied Mathematics, Faculty EEMCS, University of Twente
P.O. Box 217, 7500 AE Enschede
Phone: 053 – 489 4264 E-mail: p.j.c.dickinson@utwente.nl

Dr. G.J. Still
Dept. of Applied Mathematics, Faculty EEMCS, University of Twente
P.O. Box 217, 7500 AE Enschede
Phone: 053 – 489 3404 E-mail: g.j.still@utwente.nl URL: http://wwwhome.math.utwente.nl/~stillgj/

Course DO: "Discrete Optimization"

Time : Monday 13.15 – 15.00 (September 22 – December 8).
Location: Utrecht (Uithof).
Lecturer: Dr. B. Manthey (UT).

Aim:
To provide a solid foundation in Discrete Optimization, with an eye on algorithm design and algorithm analysis, including the basics of computational complexity.

Course description:
The aim of the course is to provide a solid foundation in Discrete Optimization. A particular focus will be given to the design and analysis of algorithms and to computational complexity. Discrete Optimization is about the problem of finding a best solution among a set of feasible solutions. The set of feasible solutions might be astronomically large but is assumed to be discrete (finite or countably infinite), which also constitutes the major difference to Continuous Optimization. A notorious example is the traveling salesman problem, where we are asked to find a shortest tour among all tours that visit every node of a given graph exactly once. Yet another example is linear programming, which can be interpreted as the problem of finding a best among a finite number of vertices of a polyhedron. The course introduces some of the most relevant problems from the area, as well as algorithms to solve them.

The following topics will (most probably) be treated:
− introduction to algorithms & analysis;
− shortest path algorithms;
− minimum spanning trees & matroids;
− maximum flows & minimum cuts;
− minimum cost flows;
− P, NP, coNP, NP-completeness;
− integer linear programming & total unimodularity;
− approximation algorithms;
− primal-dual algorithms;
− inapproximability & approximation schemes.

Literature:
We use a reader with selected chapters from several books listed below. The reader can be purchased in the first lecture. Occasionally additional copies will be distributed (if necessary).
− W.J. Cook, W.H. Cunningham, W.R. Pulleyblank and A. Schrijver, Combinatorial Optimization, Wiley, 1998. ISBN 0-471-55894-X;
− C.H. Papadimitriou and K. Steiglitz, Combinatorial Optimization; Algorithms and Complexity, Prentice-Hall, 1982. ISBN 0-13-152462-3;
− Ahuja, R.K., T.L. Magnanti, and J.B. Orlin, Network Flows, Prentice Hall, 1993. ISBN 0-13-617-549;
− T. Cormen, C. Leiserson, R. Rivest and C. Stein, Introduction to Algorithms, 2nd ed., MIT Press, 2001. ISBN10 0262531968;
− B. Korte and J. Vygen, Combinatorial Optimization - Theory and Algorithms, 4th ed., Springer, 2008. ISBN10 3-540-25684-9.

Prerequisites:
Knowledge of linear algebra and graph theory is advantageous.

Examination:
Take home problems (40%) and a written exam (60%).

Address of the lecturer:
Dr. B. Manthey
Dept. of Applied Mathematics, Faculty EEMCS, University of Twente
P.O. Box 217, 7500 AE Enschede
Phone: 053 – 489 3385 E-mail: b.manthey@utwente.nl

Course HEU "Heuristic Methods in Operations Research"

Time : Monday 15.15 – 17.00 (September 22 – December 8).
Location: Utrecht (De Uithof).
Lecturers: Prof.dr. J.L. Hurink (UT) and Dr. J.M.J. Schutten (UT).

Aim:
This course gives an overview of heuristic solution methods in combinatorial optimization.

Description:
Due to the computational complexity of most of the practical relevant optimization problems, heuristic methods form an important class of solution methods for such problems. In this course we give an overview of different classes of heuristic solution approaches and present examples of their application.

In detail, the following issues are treated:
– sampling based heuristics;
– restricted dynamic programming;
– truncated branch and bound/beam search;

– relaxations/lower bounds;
– evaluation techniques;
– local Search;
– evolutionary methods;
– hierarchical and decentralized approaches.

Literature:
Handouts.

Prerequisities:
Basic knowledge (bachelor level) of analysis, linear algebra and linear programming.

Examination:
Oral examination and take home problems.

Addresses of the lecturers:
Prof.dr. J.L. Hurink
Dept. of Applied Mathematics, Faculty EEMCS, University of Twente
P.O. Box 217, 7500 AE Enschede
Phone: 053 – 489 3447 E-mail: j.l.hurink@utwente.nl URL: www.math.utwente.nl/~hurinkjl

Dr.ir. J.M.J. Schutten
Dept. OMPL, University of Twente
P.O. Box 217, 7500 AE Enschede
Phone: 053 – 489 4676 E-mail:j.m.j.schutten@utwente.nl URL: www.mb.utwente.nl/ompl/staff/Schutten/

Course ALP: "Advanced Linear Programming"

Time : Monday 11.00 – 12.45 (Febuary 2 – March 30, April 13 and 20, May 11).
Location: Utrecht (De Uithof).
Lecturers: Prof.dr. L. Stougie (VU/CWI) and Dr.ir. J.M. van den Akker (UU).

Aim:
To provide insight in theory and development of practical methods for basic and advanced linear programming.

Course description:
Part 1: Basic theory and algorithms of linear optimization:
Linear optimization; polyhedra and polytopes; the simplex algorithm; duality; linear inequalities and Farkas' lemma; sensivity analysis.
Part 2: Advanced linear optimization methods:
The revised simplex method and column generation; Dantzig-Wolfe- and Benders' decomposition; network flow problems; the ellipsoid method; an interior point method; integer programming formulations and solution methods.

Literature:
D. Bertsimas and J.N. Tsitsiklis: Introduction to linear optimisation, Athena Scientific, 1997.

Prerequisites:
Basic knowledge (bachelor level) of linear algebra and graph theory.

Examination:
Written examination.

Addresses of the lecturers:
Prof.dr. L. Stougie
Dept. of Econometrics and Operations Research, VU University Amsterdam
De Boelelaan 1105, 1081 HV Amsterdam
Phone: 020 – 5989391 E-mail: l.stougie@vu.nl

Dr.ir. J.M. van den Akker
Dept. Informatica, Utrecht University
P.O. Box 80089, 3508 TB Utrecht
Phone: 030 – 2533989 E-mail: marjan@cs.uu.nl URL: http://people.cs.uu.nl/marjan/

Course SCH: "Scheduling"

Time : Monday 13.15 – 15.00 (Febuary 2 – March 30, April 13 and 20, May 11).
Location: Utrecht (De Uithof).
Lecturer: Dr. T. Vredeveld (UM).

Aim:
This course gives an introduction into scheduling theory and its applications.

Course description:
The term scheduling represents the assignment of resources over time to perform tasks, jobs or activities. Feasible schedules are compared with respect to a given optimality criterion. Mostly, the optimization problem is combinatorial and very complex. From a computational point of view many of these problems are hard (NP-hard). In this course an overview on the most classical scheduling models is given and exact as well as some optimal and some heuristic solution methods are discussed for these models.

In detail, the following issues are treated:
− classification of scheduling models;
− single-machine models;
− parallel-machines models;
− open shop, flow shop and job shop models;
− timetabling;
− transportation;
− on-line models.

Literature:
– Handout for special subjects.

The following books can be used as background and further information, but do not have to be bought:
– Brucker, Peter: Scheduling Algorithms 4th ed., 2004, Springer Verlag Berlin, Hardcover, ISBN: 3-540-20524-1;
– Pinedo, Michael L: Scheduling: Theory, Algorithms, and Systems, 2nd ed., 2002, Prentice Hall, ISBN: 0-13-028138-7.

Prerequisites:
Basic knowledge (bachelor level) of analysis and linear algebra.

Examination:
Take home problems and an examination (oral or written).

Address of the lecturer:
Dr. T. Vredeveld
School of Business and Economics, Dept. of Quantitative Economics, Maastricht University
P.O. Box 616, 6200 MD Maastricht
Phone: 043 – 3883911 E-mail: t.vredeveld@maastrichtuniversity.nl
URL: http://www.personeel.unimaas.nl/t.vredeveld

Course QT: "Queueing Theory"

Time : Monday 15.15 – 17.00 (Febuary 2 – March 30, April 13 and 20, May 11).
Location: Utrecht (De Uithof).
Lecturers: Dr.ir. W.R.W. Scheinhardt (UT).

Aim:
To provide insight in the theory of queueing models.

Course description:
The following subjects will be treated:
– fundamental queueing relations (Little's law, PASTA property);
– Markovian queues (M/M/1 queue, M/M/c queue, M/E_r/1 queue) ;
– M/G/1 queue and G/M/1o queue;
– mean value technique;
– priority queues;
– variations of the M/G/1 queue;
– insensitive queues (M/G/c/c queue and M/G/infinity queue).

Literature:
Lecture notes of the course "Queueing Theory" (free available: http://www.win.tue.nl/~iadan/queueing.pdf).

Prerequisites:
Basic knowledge of probability at the level: S.M. Ross, Introduction to probability models, 9th edition, Academic Press, 2007 (chapters 1-3).

Examination:
Written examination.

Addresses of the lecturers:
Dr. W.R.W. Scheinhardt
Dept. of Applied Mathematics, Faculty EEMCS, University of Twente
P.O. Box 217, 7500 AE Enschede
Phone: 053 – 489 3832 E-mail: w.r.w.scheinhardt@utwente.nl
URL: www.math.utwente.nl/~scheinhardtwrw

6. LNMB certificated persons (257)

J.J. Aarts
F. Ahmed
J.M. van den Akker
M.E. Angün
A. Asadi
E.S. Badila
N. Baër
E.M. Bázsa
R. Bekker
S. Bhulai
J.J.P.H. Bierbooms
M. Bijvank
H.M. le Blanc
J.M. Bloemhof – Ruwaard
C.A. Boer
K.M.J. de Bontridder
N.K. Boots
S.C. Borst
R.J. Boucherie
Y. Boulaksil
H.W. Bouma
P.C. Bouman
H.C.M. Bossers
A. Braaksma
G.M. te Brake
R.C.M. Brekelmans
M. van Brink
M.P. de Brito Peirera Maduro
J.J.J. van de Broek
J. Bruin
G. Budai
A. Bump
N.C. Büyükkaramikli
M. Calinescu
S. Caner
D. Chaerani
S.K. Cheung
T.J.M. Coenen
H. Cetinay
M.B. Combé
U. Corbacioglu
K. Cornelissen
M. Cremers
F.C.A.M. Cruijssen
G. Csapó
S. Dabia
Q. Deng
A.B. Dieker
E.B. Diks
A.M. Dobber
C. Dobre
M.K. Dogru
T. Dollevoet
J.P. Dorsman
A.B. Dragut
R. Egorova
C.A. van Eijl
E. Elabwabi
M. Elghami
I. Endrayanto
J. Ensinck
J.T. van Essen
A. Estevez Fernandez
L. Evers
Y. Feng
M. Firat
M. Frolkova
J. van der Gaast
O. Gabali
S.M. Geervliet
J.R.G. van Gellekom
K. Glorie
J.-W. Goossens
B. Gorissen
F.N. Gouweleeuw
R.M.P. Goverde
A. Grigoriev
E.A. Grigorieva
G. Gu
R. de Haan
A. Haesel
R. Haijema
C.J.H. Hendriksen
D. den Hertog
W. van den Heuvel
B. Heydenreich
F.J. von Heymann
R.P. Hoeksma
K.M.R. Hoen
W.B. van den Hout
G.-J.J.A.N. van Houtum
D. Huisman
P.J.H. Hulshof
E. van der Hurk
B.G.M. Husslage
L.J.J. van Iersel
V.C. Ivanescu
I.D. Ivanov
W. van Jaarsveld
B. Jansen
J.B. Jansen
M. Jansen
E. Janssen
F.B.S.L.P. Janssen
R.P. Kampstra
A.G. Karaarslan
F.J.P. Karsten
B. Kaynar
B. de Keijzer
O.A. Kilic
B.-E. Klaus
M.J. Kleijn
J. Kleppe
E. de Klerk
F. Klijn
A.L. Kok
G.M. Koole
J. de Kort
N. Kortbeek
P. Korteweg
A.M.C.A. Koster
M. Koster
S. Kovaleva
A.F. van der Kraaij
M.G.C. van Krieken
D. Krushinsky
B.H.M. Kuijpers
C.M.H. Kuijpers
R. Langestraat
T. Le Anh
T. Le Duc
R.L.M.J. van Leensel
S. Li
H.L. Liem
P. Lieshout
O. Listes
J.A. Loeve
E.R.M.A. Lohmann
R.B. Lok
J.M.W. van Loon
F.J.W. Lutgens
M. Mainegra Hing
M.R.H. Mandjes
H. Mansouri
S. Marban
B. Marchal
N.A.A. Marquinie

P.J.M. Meersmans
R.D. van der Mei
D.I. Miretskiy
J. Mulder
R. Núñez Queija
C.D. van Oosterom
P. Out
U. Özen
J.J. Paulus
P.C. Pop
D. Potthoff
M. Quant
J.H. Reijnierse
W. Romeijnders
A. Roubos
J.H.G.C. Rutten
A.Y.D. Siem
M. Slikker
M.A.J. Smith
M.J. Soomer
R. Spliet
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P. Ouwehand
K. Pak
L.W.P. Peeters
E. Porras Musalem
M. Pourakbar
A.J. Quist
G. Rennen
D. Romero Morales
D. Roubos
B. Selçuk
B.P. Silalabi
E. Smeitink
S.R. Smits
P.F. Spaans
J.M. Spitter
J.F. Sturm †
M. Tennekes
M.J.G. van Uitert
R.J.M. Vaessens
E. Vatamidou
C. Verhoef
A.M. Verweij
I.F.A. Vis
I. Vliegen
Y. Volkovich
N.M. van de Vrugt
M. Wennink
R. Wildeman
Z. Yang
A. Zocca
A.P. Zwart

F.J.C. van Megen
G. Mincsovics
M. Mnich
L. van Norden
M. Oosten
G.J.M. Otten
Ö. Özdemir
O. Passchier
N. Piersma
S.A. Pot
X. Qiu
G. Regts
M. Retel Helrich
J.M.M. van Rooij
J. Rutten
D. Sever
A. Sleptchenko
J. Smeltink
M. Sol
F.C.R. Spieksma
M.H. Streutker
Z. Sun
R.H. Teunter
A. Ule
P.T. Vanberkel
E.J.M. van der Veen
M. Verloop
A.P.A. Vestjens
M. Vlasiou
A. van Vliet
T. Vredeveld
M. van Vuuren
W. van der Weij
E.M.M. Winands
T. Yuan
M.E. Zonderland

7. Structuurschets interne organisatie LNMB (in Dutch)

Vastgesteld in de algemene ledenvergadering van 16 januari 1991, aangepast in de algemene ledenvergaderingen van 16 januari 2007, 18 januari 2011 en 17 januari 2012

0. Preambule
De juridische structuur van het LNMB is nog niet vastgelegd, en dat gebeurt ook niet door onderstaande structuurschets. Op dit moment is het niet opportuun om de juridische aspecten volledig uit te werken, dat zal te zijner tijd gebeuren in samenhang met de uitwerking van de structurele financiering. Bovendien is het wenselijk om te wachten tot de discussie over "onderzoekscholen" verder gevorderd is. Wel is het op dit moment noodzakelijk om interne gedragsregels af te spreken, onder meer omdat de hoogleraar-directeur is aangesteld.

1. Het Landelijk Netwerk Mathematische Besliskunde
Het LNMB is een organisatie die een landelijke tweedefase-onderzoekersopleiding in de mathematische besliskunde verzorgt. Door landelijke bundeling van internationaal erkende expertise en door inzet van vooraanstaande onderzoekers uit het buitenland wordt gestreefd naar een opleiding van hoge kwaliteit. Het LNMB streeft naar een goede afstemming van activiteiten met de universitaire instellingen en met andere tweedefaseopleidingen.

2. Leden
Lid van het LNMB kunnen zijn hoogleraren, UHD's en UD's (inclusief emeriti) van de Nederlandse universiteiten of medewerkers van het CWI die actief onderzoeker zijn op een van de deelgebieden van de mathematische besliskunde en betrokken zijn bij de begeleiding van promovendi. Over toelating van nieuwe leden beslist het Algemeen Bestuur.

3. Algemeen Bestuur
Het Algemeen Bestuur bestaat uit ten minste n en ten hoogste $n+m$ leden van het LNMB, waar n = het aantal instellingen waar leden werkzaam zijn en m = het aantal leden van het Dagelijks Bestuur. Het Algemeen Bestuur wordt gekozen door de Ledenvergadering zodanig dat van elk van de n instellingen ten minste één personeelslid lid van het Algemeen Bestuur is. Leden van het Dagelijks Bestuur zijn automatisch lid van het Algemeen Bestuur. De voorzitter wordt in functie gekozen. De Wetenschappelijk Directeur is secretaris. Het Algemeen Bestuur verdeelt onderling de overige functies. Leden van het Algemeen Bestuur die geen lid zijn van het Dagelijks Bestuur treden jaarlijks af, en zijn terstond herkiesbaar. Voor de overige leden van het Algemeen Bestuur geldt het rooster van bestuursmutaties van het Dagelijks Bestuur.
Het Algemeen Bestuur heeft tot taak:
a. het benoemen van nieuwe leden van het LNMB;
b. het benoemen van de Wetenschappelijk Directeur;
c. het toezien op de activiteiten van het Dagelijks Bestuur;
d. het jaarlijks vaststellen van het algemeen en financieel verslag, alsmede van de begroting voor het komende jaar;
e. alles te doen wat de doelstellingen van het LNMB kan bevorderen.

4. Dagelijks Bestuur
Het Dagelijks Bestuur bestaat uit 5 of 6 leden van het LNMB. Het Dagelijks Bestuur wordt gekozen door de Ledenvergadering. Voorzitter en secretaris van het Algemeen Bestuur zijn tevens voorzitter en secretaris van het Dagelijks Bestuur. De leden van het Dagelijks Bestuur, m.u.v. de directeur, hebben een zittingstermijn van 4 jaar. Aftredende leden zijn éénmaal herkiesbaar. De zittingstermijn van de secretaris komt overeen met diens aanstelling als Wetenschappelijk Directeur.
De voorzitter wordt in functie gekozen en heeft een zittingstermijn van 4 jaar als voorzitter.
Het Dagelijks Bestuur heeft tot taak:
a. het vaststellen van het onderwijsprogramma van het LNMB, in het bijzonder de aanwijzing van de docenten;
b. het vaststellen van regels voor de beoordeling van de deelnemende aio's/oio's door de docenten en het vaststellen van slaagregels;
c. het vaststellen van cursusgelden, contributies, vergoedingen etc.;
d. het vaststellen van regelingen voor diploma's, en het afgeven van diploma's aan deelnemers die geslaagd zijn;
e. het jaarlijks uitbrengen van een begroting, ten behoeve van het Algemeen Bestuur;
f. het zorgdragen voor de continuïteit van de activiteiten van het LNMB; inhaken op actuele ontwikkelingen, het veilig stellen van structurele financiering etc.;
g. het adviseren van de Wetenschappelijk Directeur bij diens taakuitoefening;
h. alles te doen wat de doelstellingen van het LNMB kan bevorderen.
Het Dagelijks Bestuur is verantwoording verschuldigd aan het Algemeen Bestuur en aan de Ledenvergadering.

5. Wetenschappelijk Directeur

Het LNMB heeft een Wetenschappelijk Directeur. De functie van Wetenschappelijk Directeur wordt op hoogleraarniveau vervuld. De Wetenschappelijk Directeur wordt benoemd door het Algemeen Bestuur, in samenwerking met de penvoerende instelling. De termijn van de aanstelling wordt eveneens in overleg met de penvoerende instelling vastgelegd.

De Wetenschappelijk Directeur heeft tot taak:

a. het voorbereiden en doen uitvoeren van het onderwijsprogramma;
b. het beslissen omtrent toelating van deelnemers aan het onderwijsprogramma op grond van door het Dagelijks Bestuur vastgestelde regels;
c. het bijhouden van een administratie van deelnemers aan het onderwijsprogramma, en de door hen behaalde resultaten;
d. het toezicht houden op het financieel beheer dat namens het LNMB wordt gevoerd;
e. het voorbereiden van de vergaderingen van het Dagelijks Bestuur, het Algemeen Bestuur en de Ledenvergadering;
f. het opstellen van voorlichtingsmateriaal voor aio's/oio's en andere belangstellenden;
g. het verzorgen van goede contacten met de penvoerende instelling, met deelnemende aio's/oio's en hun promotoren, met docenten, met instellingen die bij het LNMB zijn betrokken en met verwante netwerken.

De Wetenschappelijk Directeur is verantwoording verschuldigd aan het Dagelijks Bestuur.

6. Ledenvergadering

Ieder kalenderjaar, bij voorkeur tijdens de jaarlijkse Lunteren-conferentie, wordt een Ledenvergadering gehouden, waar onder meer aan de orde komen:

a. het algemeen verslag over het afgelopen kalenderjaar;
b. de plannen voor het komende kalenderjaar.

De Ledenvergadering heeft verder tot taak:

c. de benoeming van de leden van het Dagelijks Bestuur en van het Algemeen Bestuur;
d. het vaststellen van de gedragregels die binnen het LNMB worden gehanteerd.

7. Financiën

Voor de periode 1989 – 1993 heeft de Minister van Onderwijs en Wetenschappen het LNMB een startsubsidie toegekend. Daarna hebben de instellingen via een jaarlijkse bijdrage gezorgd voor het voortbestaan van het LNMB. De gelden wordt beheerd door de penvoerende instelling. Betalingen behoeven de goedkeuring van de Wetenschappelijk Directeur, die gehouden is aan regels die door het Dagelijks Bestuur zijn vastgelegd.

8. Slot

In alle gevallen waarin deze regels niet voorzien, beslist het Dagelijks Bestuur.

8. Operations Research Groups at Dutch Universities and CWI

Nr.	Institution	Research Theme	Projectleader(s)
1a.	CWI	Algorithms, Combinatorics and Optimization	Laurent
1b.	CWI	Probability and Stochastic Networks	Van der Mei
2.	EUR	Operations Research	Dekker
3.	WUR	Operations Research	Van der Vorst
4a.	UvT	Operations Research	Van Dam
4b.	UvT	Operations Research and game theory	Borm
5a.	UM	Combinatorial optimization	Van Hoesel
5b.	UM	Game theory and optimization	Thuijsman
6.	RUG	Operations Research	Van der Vlerk
7.	UL	Stochastic Operations Research	Kallenberg
8	TUD	Optimization	Aardal
9.a	TU/e	Combinatorial optimization	Woeginger
9.b	TU/e	Stochastic Operations Research	Boxma
10.	UvA	Deterministic and Stochastic Operations Research	Van Dijk
11.	UT	Discrete Optimization and Stochastic OR	Boucherie/Uetz
12.	UU	Algorithms and Optimization	van den Akker/Bodlaender
13a.	VU	Combinatorial Optimization and Stochastic OR	Stougie/Tijms
13b.	VU	Optimization of business processes	Koole

Project 1a. Centre for Mathematics and Computer Science (CWI)
Networks & Optimization

Leader : Prof.dr.ir. M. Laurent.
Address : Centre for Mathematics and Computer Science (CWI)
Science Park 123, 1098 XG Amsterdam.
Phone : 020 – 5924105 / 020 – 5924189 (secretary).
Research staff : Prof.dr.ir. K.I. Aardal, Prof.dr. K. Apt, Dr. N. Bansal, Dr. S. Burgdorf, Dr. J. Draisma, Prof.dr.ir. A.M.H. Gerards, Dr. D.C. Gijswijt, G. van den Hove, Prof.dr. M. Laurent, Prof.dr. J.K. Lenstra, N. Olver, T. Piovesan, M. Rahn, Prof.dr. G. Schaefer, Prof.dr. A. Schrijver, M. Seminaroti and Dr. R. Sitters.

Research themes:
1. combinatorics and optimization;
2. algorithmic game theory.

Project 1b. Centre for Mathematics and Computer Science (CWI)
Stochastics

Leader : Prof.dr. R.D. van der Mei and Prof.dr. A.P. Zwart.
Address : Centre for Mathematics and Computer Science (CWI)
Science Park 123, 1098 XG Amsterdam.
Phone : 020 – 5924129 / 020 – 5924199 (secretary).
Research staff : Drs. T. Van Barneveld, Prof.dr. J. van den Berg, S. Bethuelsen MSc, D. Bhaumik MSc, Dr. J.W. Bosman, Drs.ir. M. van Buuren, Drs. R. Conijn, Drs. S. Ding, Drs. J.P. Dorsman, Dr. K. Dzhaparidze, Dr. M. Heydenreich, Dr.ir. G.J. Hoekstra, Drs. A. Hristov, Drs. C. Jagtenberg, Drs. B. Kamphorst, Drs. G. Legemaate, Drs. D. Van Leeuwen, Drs. M. Mahfoud, Dr. M.N.M. van Lieshout, Prof.dr. R.D. van der Mei, Prof.dr. R. Nunez-Queija, Drs. M. Onderwater, Drs. D.D. Sierag, Dr. P.J. van der Ven, Drs. P. Vis, Drs. F. Wetzels, Dr. A.W. Zuniga and Prof.dr. A.P. Zwart.

Research themes:
1. performance analysis and communication systems;
2. spatial stochastics and stochastic processes;
3. stochastic geometry.

Project 2. Erasmus University Rotterdam
Operations Research

Leader : Prof.dr.ir. R. Dekker.
Address : Econometric Institute, H11-33, Erasmus University Rotterdam
Postbus 1738, 3000 DR Rotterdam.
Phone : 010 – 4081274 / 010 – 4081264 (secretary).

Research staff : Dr. J. Brinkhuis, Prof.dr.ir. R. Dekker, Z.M. Dehkordi MSc, T. Dollevoet MSc, M. Hekimoglu MSc, Dr. W. van der Heuvel, Dr. D. Huisman, Dr. A. Gabor, K. Glorie MSc, Dr. T. Farenhorst-Yuan, Dr. D.K. Leegwater, I. Louwerse MSc, Dr. M. Mulder, J. Mulder MSc, M. Retel Helmrich MSc, R. Spliet MSc, Dr. T. Tervonen, W. van Jaarsveld MSc, Prof.dr. A.P.M. Wagelmans and G.Yang MSc.

Research themes:

Transportation:

1. railway operations optimization (Dekker, Dollevoet, Huisman, Louwerse, Wagelmans);
2. container and intermodal logistics (Dekker);
3. robust distribution networks (Dekker, Gabor, Mulder, Spliet);
4. design of liner shipping networks (Dekker, Mulder).

Supply chains:

5. production planning and inventory control (Dekker, van de Heuvel, Retel-Helmrich, Wagelmans);
6. service logistics (Dekker, Gabor, Farenhorst-Yuan, Hekimoglu, van Jaarsveld, Yang);
7. coordination in supply chains (Dehkordi, van de Heuvel, Wagelmans);
8. reverse logistics (Dekker, van de Heuvel);
9. location and network problems (Mulder).

Various methods and topics:

10. OR in medical decision making (Glorie, Wagelmans);
11. multi-criteria decision making (Tervonen);
12. optimization (Brinkhuis);
13. maintenance and reliability analysis (Dekker, Farenhorst-Yuan).

Project 3. Wageningen University
Operations Research and Logistics Group

Leader : Prof.dr.ir. J.G.A.J. van der Vorst.

Address : Operations Research and Logistics Group, Wageningen University
Hollandseweg 1, 6706 KN Wageningen.

Phone : 0317 – 485645.

Research staff : A. Banasik MSc, X. Bing MSc, Prof.dr. J.M. Bloemhof-Ruwaard, Ir. G.D.H. Claassen, Dr. F. Cruijssen, Dr. R. Germs , Dr. R. Haijema, Dr. E.M.T. Hendrix, J. Jonkman MSc, Ir. J.C. van Lemmen-Gerdessen, Drs. M. de Keizer, Drs. K.G.J. Pauls-Worm and Prof.dr.ir. J.G.A.J. van der Vorst.

Research themes:

1. quality controlled logistics:
– using advanced product quality information in logistics decision making for improved customer service and less food spoilage;
2. sustainable logistics:
– socio-economic and environmental performance measures, trade-offs to improve overall sustainable performance in agrifood chains;
3. planning and inventory control:
– production and inventory models for perishable products;
– models and algorithms for valorisation and robust design.

Project 4a. Tilburg University
Operations Research

Leader : Dr. R. Sotirov.

Address : Department of Econometrics and Operations Research, CentER for Economic Research, School of Economics and Management, Tilburg University
P.O. Box 90153, 5000 LE Tilburg.

Phone : 013 – 4662430.

Research staff : Prof.dr. H.A. Akkermans, Prof.dr.ir. J. Ashayeri, Dr. J.P.C.Blanc, Prof.dr. P.E.M. Borm, Dr. R.C.M. Brekelmans, Prof.dr.ir. E.R. van Dam, Prof.dr.ir. H. Daniels, Prof.dr. A.M.B. De Waegenaere, Dr. J.C. Engwerda, Prof.dr.ir. H.A. Fleuren, Dr.ing. W.J.H. van Groenendaal, Dr. Gul Gurkan, Prof.dr.ir. W.H. Haemers, Prof.dr. H.J.M. Hamers, Prof.dr.ir. D. den Hertog, Dr. K.J.M. Huisman, Prof.dr. G. Kant, Prof.dr. J.P.C. Kleijnen, Prof.dr. E. de Klerk, Prof.dr. P.M. Kort, Prof.dr. M. Laurent, Dr.ir. M.J.P. Peeters, Dr. M. Quant, Dr. J.H. Reijnierse, Prof.dr. J.M. Schumacher, Dr. R. Sotirov, Prof.dr. A.J.J. Talman and Dr. J. Vera.

Research themes:

1. stochastic operations research and simulation;
2. deterministic operations research;
3. combinatorial mathematics;

4. game theory.

Project 4b. Tilburg University
Operations Research and Game theory

Leaders : Prof.dr. P.E.M. Borm.
Address : Department of Econometrics and Operations Research, CentER for Economic Research, Tilburg School of Economics and Management, Tilburg University
P.O. Box 90153, 5000 LE Tilburg.
Phone : 013 – 4663026 / 013 – 4662340 (secretary).
Research staff : Prof.dr. P.E.M. Borm, Drs. S. Grundel, Prof.dr. H.J.M. Hamers, Dr. R. Hendrickx, Drs. M. Musegaas, Prof.dr. H.W. Norde, Dr. M. Quant, Dr. H. Reijnierse, Drs. O. Selcuk, Drs. T. Suzuki and Prof.dr. A.J.J. Talman.

Research themes:
1. cooperative game theory;
2. non-cooperative game theory;
3. mathematical economics;
4. skill in games;
5. overt and covert network analysis.

Project 5a. Maastricht University
Combinatorial Optimization

Leader : Prof.dr.ir. C.P.M. van Hoesel.
Address : Department of Quantitative Economics, Faculty of Economics, Maastricht University
P.O. Box 616, 6200 MD Maastricht.
Phone : 043 – 3883727 / 043 – 3883835 (secretary).
Research staff : Dr. A. Berger, Dr. A. Grigoriev, Dr. T. Harks, Prof.dr.ir. S. van Hoesel, Prof.dr. R. Müller and Dr. T. Vredeveld.
Research themes:
1. mechanisme design, combinatorial auctions;
2. network optimization;
3. planning and scheduling;
4. approximation;
5. pricing, revenue management;
6. supply chain management.

Project 5b. Maastricht University
Game Theory and Optimization

Leader : Dr. F. Thuijsman.
Address : Department of Knowledge Engineering, Maastricht University
P.O. Box 616, 6200 MD Maastricht.
Phone : 043 – 3883489.
Research staff : I. Arcaya MSc, Dr. P. Bonizzi, M. Clerx MSc, M. Cluitmans MSc, Dr. P.J. Collins, Dr. J.J.M. Derks, Dr. J.M.H. Karel, Dr. S.M. Kelk, Dr.ir. J.Kuipers, Dr.ir. E. de Lange, N. Lekić MSc, Prof.dr.ir. R.L.M. Peeters, Dr. G.M. Schoenmakers, Dr. K. Staňková, Dr. F. Thuijsman, P. Uyttendaele MSc and Dr. R.L. Westra.
Research themes:
1. strategic optimization in networks (network formation games, Markov games, gene networks, phylogenetic networks, evolutionary models);
2. systems biology (signal processing, data mining, pattern recognition, computability).

Project 6. University of Groningen
Operations Research

Leader : Prof.dr. R.H. Teunter.
Address : Faculty of Economics and Business, University of Groningen
P.O. Box 800, 9700 AV Groningen.
Phone : 050 – 3638617 / 050 – 3637020 (secretary).
Research staff : Drs. B. Beemsterboer, Drs. P. Buis, Drs. B. de Jonge, Dr. N. v. Foreest, Prof.dr. W.K. Klein Haneveld, Drs. G. van der Heijde, Drs. K. Karousis, Drs. M. Olde Keizer, Drs. D. Prak, Drs. W. Romeijnders, Prof.dr. K.-J. Roodbergen, Prof.dr. G. Sierksma, Prof.dr. R.H. Teunter, Dr. J. Veldman, Prof.dr. I. Vis, Dr. E. Ursavas, Drs. M. Veenstra, Prof.dr. M.H. van der Vlerk and dr. X. Zhu.

Research themes:
1. service logistics and Maintenance, Forecasting and Inventory control, Game theory (Beemsterboer, de Jonge, Foreest, Karousis, Olde Keizer, Prak, Teunter, Veldman, Zhu);
2. stochastic programming (Klein Haneveld, Romeijnders, van der Vlerk);
3. combinatorial optimization and Quantitative logistics (van der Heijde, Roodbergen, Sierksma);
4. maritime logistics (Buis, Ursavas, Veenstra, Vis).

Project 7. University of Leiden
Stochastic Operations Research

Leader : Dr. F.M. Spieksma.
Address : Mathematical Institute, University of Leiden
P.O. Box 9512, 2300 RA Leiden.
Phone : 071 – 5277128.
Research staff : H. Blok MSc, Drs D. Ertiningsih, L.Smit MSc and Dr. F.M. Spieksma.
Research themes:
1. Markov decision chains with applications in queueing networks;
2. Markov games;
3. stability properties of parametrised collections of Markov processes;
4. inventory control.

Project 8. Delft University of Technology
Optimization

Leader : Prof.dr.ir. K.I. Aardal.
Address : Faculty of Electrical Engineering, Mathematics and Computer Science,
Delft University of Technology
Mekelweg 4, 2628 CD Delft.
Phone : 015 – 2785093 / 015 – 2784109 (secretary).
Research staff : Prof.dr. K.I. Aardal, Dr. F. Vallentin, Dr. D. Gijswijt, Prof.dr.ir. C. Roos, P. van den Berg, T. Janssen, Dr. J.T. van Essen, E. DeCorte, D. de Laat, S. Li and H. Post.
Research themes:
1. integer and combinatorial optimization;
2. semidefinite/convex optimization;
3. harmonic analysis applied to optimization, lattices and optimization;
4. optimization in ambulance planning.

Project 9a. Eindhoven University of Technology
Combinatorial optimization

Leaders : Prof.dr. G.J. Woeginger.
Address : Dept. of Mathematics and Computer Science, Eindhoven University of Technology
P.O. Box 513, 5600 MB Eindhoven.
Phone : 040 – 2472412 (Woeginger) / 040 –2473130 (secretary).
Research staff : Prof.dr. N. Basal, Dr.ir. C.A.J. Hurkens, Dr. J.C.M. Keijsper, Dr. R.A. Pendavingh and Prof.dr. G.J. Woeginger.
Research themes:
1. combinatorial optimization;
1.1. graph and matroid structure theory;
1.2. complexity and approximation;
1.3. enumerative optimization;
1.4. optimization under uncertainty.

Project 9b. Eindhoven University of Technology
Stochastic Operations Research

Leaders : Prof.dr.ir. O.J. Boxma.
Address : Dept. of Mathematics and Computer Science, Eindhoven University of Technology
P.O. Box 513, 5600 MB Eindhoven.
Phone : 040 – 2472858 (Boxma) / 040 – 2473130 (secretary).
Research staff : Prof.dr.ir. I.J.B.F. Adan, S. Badila, G. Bet, Dr.ir. M.A.A. Boon, Prof.dr.ir. S.C. Borst, Prof.dr.ir. O.J. Boxma, F. Cecchi, Drs. J.L. Dorsman, Dr. S. Kapodistria, Prof.dr. J.S.H. van Leeuwaarden, Ir. B.W.J. Mathijsen, Ir. T.M.M. Meyfroyt, Dr. J.A.C. Resing, Ir. J. Sanders, Ir. J. Selen, E. Vatamidou, Dr. M. Vlasiou, and A. Zocca.
Research themes:
1. stochastic operations research;

1.1. random walks and queueing theory;
1.2. performance analysis of computer- and communication systems;
1.3. performance analysis in operations management and logistics;
2. the EURANDOM program on Queueing and Performance Analysis.

Project 10. University of Amsterdam
Deterministic and Stochastic Operations Research

Leader : Prof.dr. N.M. van Dijk.
Address : Dept. of Econometrics, Faculty of Economics and Econometrics, University of Amsterdam
Roetersstraat 11, 1018 WB Amsterdam.
Phone : 020 – 5254215 / 020 – 5254217 (secretary).
Research staff : Prof.dr. N.M. van Dijk, Dr. C.W. Duin and Dr. H.J.J. van der Sluis.
Research themes:
1. Markov decision theory (van Dijk);
2. performance analysis of service networks (van Dijk, van der Sluis);
3. exact and bounding results for queueing networks (van Dijk);
4. scheduling algorithms and complexity (Duin, van der Sluis);
5. graph theory problems (Duin);
6. inventory models (van der Sluis, van der Wal);
7. transportation (van Dijk);
8. daily life applications of stochastic models (van Dijk, van der Sluis);
9. healthcare (van Dijk);
10. OR and simulation (van Dijk, van der Sluis*).*

Project 11. University of Twente
Discrete Optimization and Stochastic Operations Research

Leaders : Prof.dr. R.J. Boucherie and Prof.dr. M. Uetz.
Address : Faculty of Electrical Engineering, Mathematics & Computer Science,
University of Twente
P.O. Box 217, 7500 AE Enschede.
Phone : 053 – 489 3433 (secretary M. Uetz) / 053 – 489 3434 (secretary R. Boucherie).
Research staf : N. Baer MSc, Dr.ir. V. Bakker, I.A. Bikker MSc, Dr. A.V. den Boer,
Prof.dr. R.J. Boucherie, A. Braaksma MSc, S.P.J. van Brummelen MSc, Y. Chen MSc,
Ir. K. Cornelissen, Dr. P.J.C. Dickinson, Prof.dr. N.M. van Dijk, Dr.ir. T.S.H. Driessen,
Dr.ir. J. Goseling, Dr.ir. M. de Graaf, R.P. Hoeksma MSc, Prof.dr. J.L. Hurink, J. de
Jong MSc, Dr. W. Kern, T. van der Klauw MSc, Dr. N. Kortbeek, Dr. N. Litvak,
Dr. B. Manthey, M.A. Mitici MSc, Dr.ir. A. Molderink, Dr. J.C.W. van Ommeren,
Dr.ir. G.F. Post, Dr.ir. W.R.W. Scheinhardt, B. Serbetci MSc, Dr. G.J. Still,
H.A. Toersche MSc, Prof.dr. M. Uetz, Dr. J.B. Timmer and N.M. van de Vrugt MSc.
Research themes:
1. discrete mathematics, mathematical programming and stochastic operations research:
– combinatorial optimization, approximation algorithms, online algorithms, continuous optimization, graph theory, scheduling, timetabling, routing, pricing;
2. game theory:
– cooperative game theory, noncooperative game theory, stochastic game theory, algorithmic game theory, mechanism design;
3. stochastic operations research:
– telecommunication systems, queuing network analysis, large deviations, fluid models, pricing, wireless networks, IP networks;
4. supply chain management:
– manufacturing, scheduling, logistics, inventory models, reliability, maintenance, spare parts planning and control;
5. health care logistics;
6. energy management.

Project 12. University of Utrecht
Algorithms and Optimization

Leaders : Dr.ir. J.M. van den Akker and Dr. H.L. Bodlaender.
Address : Department of Information and Computing Sciences, Utrecht University
Princetonplein 5, 3584 CC Utrecht.
Phone : 030 – 253 3989 / 030 – 253 4409.
Research staff : Dr.ir. J.M. van den Akker, Dr. H.L. Bodlaender, B.M.P. Jansen MSc, Dr. J.A. Hoogeveen, Dr. J. Nederlof and M.E. van Kooten Niekerk MSc.

Research themes:
1. graph and network algorithms;
2. LP-based optimization algorithms;
3. search algorithms;
4. optimization under uncertainty.

Project 13a. VU University Amsterdam
Combinatorial Optimization and Stochastic Operations Research

Leaders : Prof.dr. L. Stougie.
Address : Department of Econometrics and OR, VU University Amsterdam
De Boelelaan 1105, 1081 HV Amsterdam.
Phone : 020 – 5986013.
Research staff : J. Berkhout MSc, Dr. G.J. Franx, Prof.dr. J. Gromicho, Dr. B. Heidergott, Dr. D.A. van der Laan, Dr. R.D. Nobel, Dr. N. Olver, Dr. A.A.N. Ridder, Prof.dr. G. Schaefer, Dr.ir. R.A. Sitters, Dr. S.L. van der Ster, Prof.dr. L. Stougie, Prof.dr. G.T. Timmer and M. van der Ee MSc.

Research themes:
1. combinatorial optimisation;
1.1. algorithms: complexity and approximation;
1.2. algorithmic game theory;
1.3. on-line algorithms;
1.4. computational biology;
2. stochastic operations research;
2.1. Markov decision algorithms for controlled queuing systems;
2.2. analysis and simulation of probabilities for rare events;
2.3. perturbation analysis and simulation techniques;
2.4. numerical algorithms based on Taylor series expansion;
2.5. stochastic programming.

Project 13b. VU University Amsterdam
Optimization of Business Processes

Leader : Prof.dr. G.M. Koole.
Address : Department of Mathematics, VU University Amsterdam
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2. theory and applications of controlled queueing systems.

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