



**DUTCH NETWORK ON THE
MATHEMATICS OF
OPERATIONS RESEARCH
(LNMB)**

**MASTER AND PhD PROGRAMME IN
OPERATIONS RESEARCH**

Information Guide 2009/2010

June 2009

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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 25 courses for Master and PhD students. This year seven Master courses and nine 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 2009/2010 consists of the following courses.

Master courses:

Fall 2009:

- Introduction to Stochastic Processes
- Continuous Optimization
- Discrete Optimization
- Heuristic Methods in Operations Research

Spring 2010:

- Advanced linear programming
- Scheduling
- Queueing theory

PhD courses:

Trimester 1:

- Stochastic Models for Telecommunication Systems
- Randomized Algorithms
- Combinatorial Optimization 2a

Trimester 2:

- Combinatorial Optimization 2b
- Noncooperative games
- Markov Decision Processes

Trimester 3:

- Operations Research and Health Care
- Advanced Queueing Theory
- OR-Games

Besides information about the LNMB courses, this guide contains:

- Organizational 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 35th Lunteren Conference on the Mathematics of Operations Research. This conference will be held 12 - 14th January 2010.

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

Lodewijk Kallenberg,
Scientific director LNMB
June, 2009.

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 98 members and 144 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 consists of a biennial cycle and in each cycle 18 courses are offered. 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 or 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 application form in the back of this information guide and sending them to the LNMB's secretarial office (for the address: see the inside of the information guide's cover). PhD students who participate for the first time in LNMB courses, also have to fill in the form for New PhD Students, which can be found in the back of this guide. The forms are also available at www.lnmb.nl.

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. 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 will receive a *diploma*. Here, 'sufficiently' means total credits of **25 EC**. 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. After consultation with the director, it is possible that credit points from a related PhD network also count as credit points for the LNMB diploma.

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.

Any semester (Fall and Spring) three of 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 or 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.

Application to an LNMB Master course can be done by filling in the application form in the back of this information guide and sending them to the LNMB's secretarial office (for the address: see the inside of the information guide's cover). Master students who participate for the first time in LNMB courses, also have to fill in the form for New Master Students, also in the back of this guide. The forms are also available at www.lnmb.nl

4. PhD courses 2009/2010

During the academic year 2009/2010 nine courses will be taught in three trimesters; each trimester has a duration of nine weeks.

Trimester 1 (September 14 – November 9):

- SMTS (Stochastic Models for Telecommunication Systems)
- RA (Randomized Algorithms)
- CO2a (Combinatorial Optimization 2a)*

Trimester 2 (November 16 – December 14 & January 18 – February 8):

- CO2b (Combinatorial Optimization 2b)*
- NCG (Noncooperative games)
- MDP (Markov Decision Processes)

Trimester 3 (February 15 – March 29, April 12 and 19):

- ORHC (Operations Research and Health Care)
- AQT (Advanced Queueing Theory)
- ORG (OR-Games)

* The courses Combinatorial Optimization 2a and 2b can be followed without knowledge of the courses Combinatorial Optimization 1a and 1b.

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

	<i>Trimester 1</i>	<i>Trimester 2</i>	<i>Trimester 3</i>
10.15 - 11.00	Course SMTS	Course CO2b*	Course ORHC
11.15 - 12.00	Course SMTS	Course CO2b*	Course ORHC
12.00 - 13.00	Lunch break	Lunch break	Lunch break
13.00 - 13.45	Course RA*	Course NCG	Course AQT
14.00 - 14.45	Course RA*	Course NCG	Course AQT
15.00 - 15.45	Course CO2a*	Course MDP	Course ORG
16.00 - 16.45	Course CO2a*	Course MDP	Course ORG

* = in cooperation with EIDMA/DIAMANT

Location

The courses are given in the Uithof (buildings of the Utrecht University), in Room 420 of the Buys Ballot Laboratorium, Princetonlaan 4, Uithof, Utrecht. The participants will receive detailed information about "How to reach the lecture rooms in the Uithof".

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.

Detailed information about the courses

On the next pages detailed information about the courses is given. Anyone interested in these courses is invited to send a completed registration form (see the last pages of this booklet or our website www.lnmb.nl) to the LNMB secretary before September 5 (trimester 1), November 7 (trimester 2) or February 6 (trimester 3).

Course SMTS: "Stochastic Models for Telecommunication Systems"

Time : Monday 10.15 – 12.00 (September 14 – November 9).

Location: Room 420 of the Buys Ballot Laboratorium, Princetonlaan 4, Utrecht (De Uithof).

Lecturers: Prof.dr. R.D. van der Mei (CWI & VU) and Prof.dr. J.L. van den Berg (TNO & UT)

Course description:

The course consists of two synergistic parts.

Part I: stochastic models for telecommunication systems at the packet/burst level

Part II: stochastic models for telecommunication systems at the call/flow level.

Part I:

At the packet/burst level performance aspects of telecommunication networks can be modeled well by using fluid systems - think of packet delays and loss in the buffers of an IP (Internet protocol) based network. Part I of the course treats these fluid models, focusing on single-node queues. The most prominent subjects are: (1) the M/D/1 queue; (2) the /D/1 queue fed by periodic sources; (3) the Anick-Mitra-Sondhi model; (4) general Markov-fluid driven queues; (5) exponential decay of the overflow probability; (6) effective bandwidth; (7) reduction of fluid models to the call level, to enable the application of the results of Part II.

Part II:

Call/flow-level models are used for dimensioning and planning of communication networks. Performance measures of interest are e.g. call blocking probabilities, flow throughputs and file transfer- or document download times.

In part II the following subjects are treated:

- (1) traffic modelling at the call level, and traffic measurements in operational networks;
- (2) performance models for streaming traffic (speech, video), such as the Erlang and Engset models, multi-rate models, call admission policies like trunk reservation, loss networks, etc.;
- (3) performance models for elastic traffic (data), such as the processor-sharing queueing model;
- (4) flow level models for performance evaluation and optimization of Wireless LANs, UMTS/HSDPA and wireless ad-hoc networks;
- (5) "Quality-of-Service aware" dimensioning of data networks.

Literature:

Lecture notes will be provided.

Prerequisites

Basic knowledge of probability at the level: S.M. Ross, Introduction to probability models, 8th edition, Academic Press, 2003 (chapters 1-3).

Examination:

Take home problems.

Address of the lecturers:

Prof.dr. R.D. van der Mei, CWI, P.O. Box 94079, 1090 GB Amsterdam.

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Prof.dr. J.L. van den Berg

TNO ICT, P.O. Box 5050, 2600 GB, Delft

Phone: 015 – 2857031 E-mail: j.l.vandenberg@tno.nl

Course RA: Randomized Algorithms

Time : Monday 13.00 – 14.45 (September 14 – November 9).

Location: Room 420 of the Buys Ballot Laboratorium, Princetonlaan 4, Utrecht (De Uithof).

Lecturers: Dr. R.A. Sitters (VU) and Prof.dr. L. Stougie (VU).

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 are assumed 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.

Address of the lecturers:

Dr.ir. R.A. Sitters, Department of Econometrics and Operations Research

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Faculty of Economics & Business Administration, VU University Amsterdam

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Phone: 020 - 5989391 E-mail: lstougie@feweb.vu.nl

Course CO2a: Combinatorial Optimization 2a

Time : Monday 15.00 – 16.45 (September 14 – November 9).

Location: Room 420 of the Buys Ballot Laboratorium, Princetonlaan 4, Utrecht (De Uithof).

Lecturer: Prof.dr. G.J. Woeginger (TU/e)

Course description:

Combinatorial optimization is the investigation of design and planning problems in which discrete decisions must be made. The field originated in the 1950s with the work of Dantzig et al and Gomory on integer linear programming formulations for routing, scheduling and cutting stock problems. Other applications occur, e.g. in facility location, network and circuit design, and biomolecular systems.

The course gives an introduction into NP-hardness, and discusses approaches for dealing with NP-hard problems, like: approximation techniques; local search; probabilistic analysis; fixed parameterized tractability; exact algorithms.

Literature:

- C.H. Papadimitriou, K. Steiglitz, Combinatorial Optimization: Algorithms and Complexity, Dover, 1998.
- In addition, some papers will be provided.

Prerequisites

- Knowledge of basic linear algebra.

- Knowledge of network flow, linear programming and duality as, e.g., in V. Chvatal, Linear Programming, Freeman, 1983.

Examination:

Take-home problems.

Address of the lecturer:

Prof.dr. G.J. Woeginger, Dept. of Mathematics & Computer Science
Eindhoven University of Technology, P.O. Box 513, 5600 MB Eindhoven
Phone: 040 – 2472415 E-mail: gwoegi@win.tue.nl URL : www.win.tue.nl/~gwoegi

Course CO2b: “Combinatorial Optimization 2b”

Time : Monday 10.15 – 12.00 (November 16 – December 14 & January 18 – February 8).

Location: Room 420 of the Buys Ballot Laboratorium, Princetonlaan 4, Utrecht (De Uithof).

Lecturer: Prof.dr.ir. K.I. Aardal (TUD)

Course description:

In combinatorial optimization we want to maximize or minimize a linear objective function subject to a set of linear constraints and the restriction that a subset of the decision variables can take only integer values.

In combinatorial optimization the variables are typically restricted to the values 0 and 1. Examples of such problems are for instance the traveling salesman problem, various machine scheduling problems, and network design problems.

The first part of the course, taught in the second trimester, treats, among others, the topic of finding good feasible solutions to integer and combinatorial optimization problems. In this part we focus on techniques for finding provably optimal solutions. Below we mention the main topics treated:

- Describing polyhedra by facets; describing polyhedra by extreme points and extreme rays; Minkowski’s and Weyl’s theorems; polyhedral ties between integer and linear programs. Theory of valid inequalities; generating all valid inequalities.
- Strong valid inequalities: inequalities for structured problems.
- Non-standard methods: Lenstra’s algorithm, primal algorithms and test sets; group relaxations.
- Counting integer points in a polytope.
- Computational issues.

Literature:

Selected parts of:

- G.L. Nemhauser and L.A. Wolsey, Integer and Combinatorial Optimization, J. Wiley and Sons Inc., New York, 1988.
- A. Schrijver, Theory of Linear and Integer Programming, J. Wiley and Sons Ltd., Chichester, 1986.
- Handouts.

Prerequisites

- Knowledge of basic linear algebra.
- Knowledge of network flow, linear programming and duality as, e.g., in V. Chvatal, Linear Programming, Freeman, 1983.

Examination:

Take home problems.

Address of the lecturer:

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Course NCG: “Noncooperative games”

Time : Monday 13.00 – 14.45 (November 16 - December 14 & January 18 - February 8).

Location: Room 420 of the Buys Ballot Laboratorium, Princetonlaan 4, Utrecht (De Uithof).

Lecturer: Dr. F. Thuijsman (UM)

Course description:

The course will focus on noncooperative games, one-shot as well as dynamic, in the following order: matrix and bimatrix games, repeated games, specific models of stochastic (Markov) games, evolutionary games. We explore solution concepts like “value” and “optimal strategies” for zero sum games and “equilibrium” for non-zero sum games. In these noncooperative games the players are strategic decision

makers, who cannot make binding agreements to achieve their goals. Instead, threats may be applied to establish stable outcomes. Besides, we explore the concepts of “evolutionary stable strategy” and “replicator dynamics” and their relations with models of population dynamics and with models of “learning”. Several examples will be taken from biological settings.

Literature:

Lecture notes will be provided.

Prerequisites:

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

Examination:

Take home problems.

Address of the lecturer:

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Maastricht University,

P.O. Box 616, 6200 MD Maastricht

Course MDP: “Markov Decision Processes”

Time : Monday 15.00 – 16.45 (November 16 - December 14 & January 18 - February 8).

Location: Room 420 of the Buys Ballot Laboratorium, Princetonlaan 4, Utrecht (De Uithof).

Lecturers: Dr. S. Bhulai (VU) and prof.dr. L.C.M. Kallenberg (UL/UT)

Course description:

The theory of Markov decision processes (MDPs) - also known under the names sequential decision theory, stochastic control or stochastic dynamic programming - studies sequential optimization of stochastic systems by controlling their transition mechanism over time. Each control policy defines a stochastic process and values of objective functions associated with this process. The goal is to select a control policy that optimizes a function of the values generated by the utility functions.

In real life, decisions that are made usually have two types of impact. Firstly, they cost or save resources, such as money or time. Secondly, by influencing the dynamics of the system they have an impact on the future as well. Therefore, the decision with the largest immediate profit may not be good in view of future rewards in many situations. MDPs model this paradigm and can be used to model many important applications in practice. In this course we provide results on the structure and existence of good policies, on methods for the computation of optimal policies, and illustrate them by applications.

Contents of the lectures:

1. Model formulation, policies, optimality criteria, the finite horizon.
2. Discounted rewards: optimality equation and solution methods.
3. Average rewards: optimality equation and solution methods.
4. More sensitive rewards, part 1: Laurent expansion and solution methods.
5. Structural properties.
6. Applications of MDPs.
7. Further topics in MDPs

Literature:

Lecture notes will be provided.

Prerequisites:

- Elementary knowledge of linear programming (e.g. K.G. Murty, Linear programming, Wiley, 1983).
- Elementary knowledge of probability theory (e.g. S.M. Ross, A first course in probability, Macmillan, New York, 1976).
- Elementary knowledge of (numerical) analysis (e.g. Banach space; contracting mappings; Newton’s method; Laurent series).

Examination:

Take home problems.

Addresses of the lecturers:

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Course ORHC: “Operations Research and Health Care”

Time : Monday 10.15 – 12.00 (February 15 – March 29 & April 12 and 19).

Location: Room 420 of the Buys Ballot Laboratorium, Princetonlaan 4, Utrecht (De Uithof).

Lecturers: Dr.ir. E.W. Hans (UT), Prof.dr.J.J. van de Klundert (EUR) and Prof.dr. G.M. Koole (VU)

Course description:

Global and national developments cause the health of populations and individuals to pose new problems for societies and organizations, for which operations research is often useful to provide the answers. As expectations rise and populations age, the burden of health care cost becomes increasingly difficult to carry. We are presented with tough decision problems regarding the efficient, effective and equitable use of scarce resources to improve our precious health.

In this course, we start by overviewing topics, models, and objectives for health care decision making. We subsequently provide an in depth and rigorous mathematical treatment of operations research applications in a variety of prominent domains. Partly, the material will be based on application of advanced methods in e.g. combinatorial optimization or queuing theory, as dealt with in the respective courses. Another part of the course will extend the standard theory, and show how the theory and techniques are extended to deal with health care specific issues.

The course will be organized by topic

- Human resource planning (Rostering, Crew Scheduling)
- Outpatient planning (Queuing, Scheduling)
- Resource Planning & Scheduling (Scheduling, Branch-and-Price, Stochastic Programming),
- Benchmarking (Data Envelopment Analysis, Stochastic Frontier Analysis)
- Health Chain Planning (Supply Chain Planning, Combinatorial Optimization, Queuing)
- Medical decision making (Non Linear Optimization, Markov Decision Modeling)

Literature:

Course reader.

Prerequisites:

Understanding of queuing theory and combinatorial optimization at M.Sc. level.

Examination:

Take home problems.

Addresses of the lecturers:

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Prof.dr. J.J. van de Klundert, Erasmus Medical Centre/Erasmus University, Department Health Care Management

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Prof.dr. G.M. Koole, VU University Amsterdam, De Boelelaan 1081a, 1081 HV Amsterdam

Phone: 020 – 5987755 E-mail: koole@few.vu.nl URL: www.math.vu.nl/~koole

Course AQT: “Advanced Queueing Theory”

Time : Monday 13.00 – 14.45 (February 15 – March 29 & April 12 and 19).

Location: Room 420 of the Buys Ballot Laboratorium, Princetonlaan 4, Utrecht (De Uithof).

Lecturer: Prof.dr. R.J. Boucherie (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 thus be evaluated in terms of queue lengths, sojourn times or blocking probabilities in queueing networks.

Specific topics include (a selection from):

- Networks of queues: product-form distribution, reversibility, output theorem, tandem networks, partial balance, blocking, insensitivity, BCMP networks, mean-value analysis, Norton's theorem, sojourn times.
- Analytical-numerical techniques: transform methods, matrix-analytic method, compensation method.
- Polling systems: cycle times, queue lengths, waiting times, conservation laws, service policies, visit orders.
- Performance optimization: achievable delay performance, discriminatory scheduling, age-based scheduling, size-based scheduling, fairness.

Literature

- F.P. Kelly, Reversibility and Stochastic Networks, Wiley, 1979.
- R. Nelson, Probability, Stochastic Processes and Queueing Theory, Springer, 1995.
- R.W. Wolff, Stochastic Modeling and the Theory of Queues, Prentice-Hall, 1989.

Prerequisites:

- Basic knowledge of probability theory and elementary queueing theory.

Examination:

Take home problems.

Address of the lecturer:

Prof.dr. R.J. Boucherie, Dept. of Applied Mathematics, University of Twente, P.O. Box 217, 7500 AE Enschede
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Course ORG: “OR-Games”

Time : Monday 15.00 – 16.45 (February 15 – March 29 & April 12 and 19).

Location: Room 420 of the Buys Ballot Laboratorium, Princetonlaan 4, Utrecht (De Uithof).

Lecturers: Prof.dr. P.E.M. Borm (UvT) and 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..

Addressess of the lecturers:

Prof. dr. P.E.M. Borm, CentER for Economic Research, Tilburg University, P.O. Box 90153, 5000 LE Tilburg
Phone: 013 – 4663026 E-mail: pemborm@uvt.nl URL: <http://center.uvt.nl/staff/borm>

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 2009/2010

During the academic year 2009/2010 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 2009

- ISP (Introduction to stochastic processes; September 7, 8, 14 and 15)
- CO (Continuous optimization; September 21 – December 7)
- DO (Discrete optimization; September 21 – December 7)
- HEU (Heuristic Methods in Operations Research; September 21 – December 7)

Spring 2010 (February 1 – March 29; April 12, 19 and 26)

- ALP (Advanced linear programming)
- SCH (Scheduling)
- QT (Queueing theory)

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

	<i>Fall 2009*</i>	<i>Spring 2010</i>
10.15 - 11.00	Course CO	Course ALP**
11.15 - 12.00	Course CO	Course ALP**
12.00 - 13.00	Lunch break	Lunch break
13.00 - 13.45	Course DO	Course SCH
14.00 - 14.45	Course DO	Course SCH
15.00 - 15.45	Course HEU	Course QT
16.00 - 16.45	Course HEU	Course QT

* The course ISP is taught on September 7, 8, 14 and 15 (10.15 – 12.00 and 13.00 – 14.45 each day).

** In cooperation with EIDMA/DIAMANT

Location

The courses are given in the Uithof (buildings of the Utrecht University). The participants will receive detailed information about “How to reach the lecture rooms in the Uithof”.

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

On the next pages detailed information about the courses is given. Anyone interested in these courses is invited to send a (copy of the) completed registration form (for the address: see the last pages of this booklet) to the LNMB secretary before August 30 (course ISP), September 10 (other courses Fall semester) or January 22 (Spring semester).

Course ISP: “Introduction to stochastic processes”

Time : Monday 10.15 – 12.00 and 13.00 – 14.45 (September 7, 8, 14 and 15).

Location: Room 611 AB, Mathematical Institute, Budapestlaan 6, Utrecht (Uithof).

Lecturers: Dr. N. Litvak (UT) and dr.ir. W.R.W. Scheinhardt (UT).

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', 9th edition, Academic Press, 2007.

Examination:

Written examination

Prerequisites:

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

Addresses of the lecturers:

Dr. N. Litvak

Department of Applied Mathematics, University of Twente, P.O. Box 217, 7500 AE Enschede

Phone: 053-4893388 E-mail: n.litvak@math.utwente.nl URL: wwwhome.math.utwente.nl/~litvakn

Dr. W.R.W. Scheinhardt

Department of Applied Mathematics, University of Twente, P.O. Box 217, 7500 AE Enschede

Phone: 053-4893832 E-mail: w.r.w.scheinhardt@utwente.nl URL: www.math.utwente.nl/~scheinhardtwrw

Course CO: “Continuous optimization”

Time : Monday 10.15 – 12.00 (September 21 – December 7)
Location: Minnaert Building, Room 211, Leuvenlaan 4, Utrecht (Uithof): September 21 – November 2
AWK (Aardwetenschappen Kleine zaal), Budapestlaan 4, Utrecht (Uithof): November 9 – December 7
Lecturer: Dr. G.J. Still (UT)

Aim:

This 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 and 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:

A written examination on December 22 (re-examination as oral exam).

Remark:

More information and study material is to be found at <http://wwwhome.math.utwente.nl/~stillgj/conopt/index.html>.

Address of the lecturer:

Dr. G.J. Still

Department of Applied Mathematics, University of Twente, P.O. Box 217, 7500 AE Enschede

Phone: 053-4893404 E-mail: g.still@math.utwente.nl URL: <http://wwwhome.math.utwente.nl/~stillgj/conopt/index.html>

Course DO: “Discrete optimization”

Time : Monday 13.00 – 14.45 (September 21 – December 7)
Location: Minnaert Building, Room 211, Leuvenlaan 4, Utrecht (Uithof): September 21 – November 2
AWK (Aardwetenschappen Kleine zaal), Budapestlaan 4, Utrecht (Uithof): November 9 – December 7
Lecturer: Prof.dr. M. Uetz (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:

In Discrete Optimization, as opposed to Continuous Optimization, we deal with objects which are finite or at most countable. An archetypical problem is the notorious traveling salesman problem (find the shortest of a finite number of possible tours), but also linear programming can be seen as a discrete problem (find the 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

- Algorithms & Analysis
- Shortest Path Algorithms
- 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, which 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.
- C.H. Papadimitriou and K. Steiglitz: Combinatorial Optimization; Algorithms and complexity, Prentice-Hall, 1982.
- R.K. Ahuja, T.L. Magnanti and J.B. Orlin: Network Flows, Prentice Hall, 1993.
- T. Cormen, C. Leiserson, R. Rivest and C. Stein: Introduction to Algorithms, 2nd ed., MIT Press, 2001.
- B. Korte and J. Vygen: Combinatorial Optimization - Theory and Algorithms, 4th ed., Springer, 2008.

Prerequisites:

Knowledge of linear algebra and basic graph theory is recommended.

Examination:

Take home problems (40%) and a written exam (60%); re-exam written or oral (depending on amount of students).

Address of the lecturer:

Prof.dr. M. Uetz, Department of Applied Mathematics, University of Twente, P.O. Box 217, 7500 AE Enschede.
Phone: 053-4893420; E-mail: m.uetz@math.utwente.nl; URL: <http://wwwhome.math.utwente.nl/~uetzm/home.html>

Course HEU “Heuristic Methods in Operations Research”

Time : Monday 15.00 – 16.45 (September 21 – December 7)

Location: Room 611 AB, Mathematical Institute, Budapestlaan 6, de Uithof, Utrecht.

Lecturers: Prof.dr. J.L. Hurink (UT) and dr. M. 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 and website

Handouts

Examination:

Oral or written examination and possibly take home problems

Prerequisites:

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

Addresses of the lecturers:

Prof.dr. J.L. Hurink, Department of Applied Mathematics, University of Twente, P.O. Box 217, 7500 AE Enschede.

Phone: 053 – 4893447 E-mail: j.l.hurink@math.utwente.nl URL: www.math.utwente.nl/~hurinkjl

Dr.ir. J.M.J. Schutten, Department OMPL, University of Twente, P.O. Box 217, 7500 AE Enschede.

Phone: 053 – 4894676 E-mail: j.m.j.schutten@utwente.nl URL: www.mb.utwente.nl/ompl/staff/Schutten/

Course ALP: “Advanced linear programming”

Time : Monday 10.15 – 12.00 (February 1 – March 29; April 12, 19 and 26).

Location: To be announced

Lecturer: Prof.dr. L. Stougie (VU)

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; sensitivity 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:

To be announced.

Address of the lecturer:

Prof.dr. L. Stougie, Department of Econometrics and Operations Research
Faculty of Economics & Business Administration, VU University Amsterdam
De Boelelaan 1105, 1081 HV Amsterdam
Phone: 020 - 5989391 E-mail: lstougie@feweb.vu.nl

Course SCH: "Scheduling"

Time : Monday 13.00 – 14.45 (February 1 – March 29; April 12, 19 and 26).

Location: To be announced

Lecturer: Prof.dr. J.L. Hurink (UT)

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 some 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 these problems are hard (NP-hard) and the classical techniques fail in practice. In this course an overview on the most classical scheduling models is given and exact as well as heuristic solution methods are discussed for these models. In detail, the following issues are treated:

- Classification of scheduling models
- Single-machine models and 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):

- Pinedo, Michael L: Planning and Scheduling in Manufacturing and Services; Series: Springer Series in Operations Research and Financial Engineering, 2005, With CD-ROM., Hardcover, ISBN: 0-387-2198-0.
- 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 oral examination.

Address of the lecturer:

Prof.dr. J.L. Hurink, Department of Applied Mathematics, University of Twente, P.O. Box 217, 7500 AE Enschede.
Phone: 053 – 4893447 E-mail: j.l.hurink@math.utwente.nl URL: www.math.utwente.nl/~hurinkjl

Course QT: “Queueing Theory”

Time : Monday 15.00 – 16.45 (February 1 – March 29; April 12, 19 and 26).

Location: To be announced

Lecturers: Prof.dr.ir. I.J.B.F. Adan (TU/e & UvA) and dr. J.A.C. Resing (TU/e).

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/1 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:

To be announced.

Addresses of the lecturers:

Prof.dr.ir. I.J.B.F. Adan

Mathematics & Computer Science, Eindhoven University of Technology, P.O. Box 513, 5600 MB Eindhoven.

Phone: 040 – 2472932; E-mail: iadan@win.tue.nl; URL: www.win.tue.nl/~iadan

Dr. J.A.C. Resing

Mathematics & Computer Science, Eindhoven University of Technology, P.O. Box 513, 5600 MB Eindhoven.

Phone: 040 – 2472984; E-mail: j.a.c.resing@tue.nl; URL: www.win.tue.nl/~resing

6. Financial regulations

LNMB

The following arrangements hold.

1. Only PhD students who are preparing their thesis under supervision of a member of the LNMB (see the list in paragraph 12 of this booklet) are considered for financial aid.
2. The LNMB does not pay the PhD students directly; the payment will be done afterwards to the administration of the university of the PhD student. In order to receive the payment, a form has to be submitted. These forms are available at the LNMB secretary.
3. Reimbursements are intended for education activities such as courses and workshops.
For participation in courses, 50% of the price of a second class train return ticket between the university location and Utrecht is reimbursed.
For participation in the Lunteren conference and workshops supported by the LNMB, the same arrangement for the travelling costs holds; furthermore, there can be given a compensation for lodging with a maximum of 50 euro per conference or workshop.
4. The other expenses will be accounted to the PhD students or their universities.

NWO

NWO provides grants for research. There are grants for working visits and for attending conferences. Information about these grants can be requested from NWO, phone: 070 - 3440624 (Grant Program Office).

NUFFIC

The Netherlands has cultural accords with various countries, which include arrangements for scientific co-operation and exchange. Scientific staff can obtain, under special conditions, a grant for short visits to other countries. The money originates from the Ministry OCW (Education, Culture and Science). NUFFIC takes care of the formalities. See also www.nuffic.nl/studie/beursopener.html

OTHER GRANTS

For information about other grants we refer to the administration of your own university. See also www.vsnul.nl

7. LNMB certificated persons (179)

J.M. van den Akker	M.E. Angün	A. Asadi
E.M. Báza	R. Bekker	S. Bhulai
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
G.M. te Brake	R.C.M. Brekelmans	M.P. de Brito Peirera Maduro
J.J.J. van de Broek	J. Bruin	G. Budai
A. Bump	D. Chaerani	S.K. Cheung
T.J.M. Coenen	M.B. Combé	U. Corbacioglu
M. Cremers	F.C.A.M. Cruijssen	Q. Deng
A.B. Dieker	E.B. Diks	A.M. Dobber
C. Dobre	M.K. Dogru	A.B. Dragut
R. Egorova	C.A. van Eijl	E. Elabwabi
M. Elghami	I. Endrayanto	A. Estevez Fernandez
S.M. Geervliet	J.R.G. van Gellekom	J.-W. Goossens
F.N. Gouweleeuw	R.M.P. Goverde	A. Grigoriev
E.A. Grigorieva	G. Gu	R. de Haan
R. Haijema	C.J.H. Hendriksen	D. den Hertog
W. van den Heuvel	B. Heydenreich	W.B. van den Hout
G.-J.J.J.A.N. van Houtum	D. Huisman	B.G.M. Husslage
L.J.J. van Iersel	V.C. Ivanescu	I.D. Ivanov
B. Jansen	J.B. Jansen	E. Janssen
F.B.S.L.P. Janssen	R.P. Kampstra	B.-E. Klaus
M.J. Kleijn	E. de Klerk	F. Klijn
A.L. Kok	G.M. Koole	J. de Kort
P. Korteweg	A.M.C.A. Koster	M. Koster
S. Kovaleva	A.F. van der Kraaij	M.G.C. van Krieken
B.H.M. Kuijpers	C.M.H. Kuijpers	T. Le Anh
T. Le Duc	R.L.M.J. van Leensel	H.L. Liem
P. Lieshout	O. Listes	J.A. Loeve
R.B. Lok	J.M.W. van Loon	F.J.W. Lutgens
M. Mainegra Hing	M.R.H. Mandjes	H. Mansouri
B. Marchal	N.A.A. Marquinie	P.J.M. Meersmans
M.A. Meertens	F.J.C. van Megen	R.D. van der Mei
G. Mincsovics	D.I. Miretskiy	M. Mnich
R. Nicolai	L. van Norden	R. Núñez Queija
N.J. Olieman	M. Oosten	D. van Ooteghem
G.J.M. Otten	P.Ouwehand	Ö. Özdemir
U. Özen	K. Pak	O. Passchier
J.J. Paulus	L.W.P. Peeters	N. Piersma
P.C. Pop	E. Porras Musalem	S.A. Pot
D. Potthoff	M. Quant	A.J. Quist
J.H. Reijnierse	G. Rennen	D. Romero Morales
D. Roubos	J.H.G.C. Rutten	B. Selçuk
A.Y.D. Siem	B.P. Silalabi	A. Sleptchenko
M. Slikker	E. Smeitink	J. Smeltink
M.A.J. Smith	S.R. Smits	M. Sol
M.J. Soomer	P.F. Spaans	F.C.R. Spieksma
J.M. Spitter	M.H. Streutker	J.F. Sturm †
M. Tennekes	R.H. Teunter	M.J.G. van Uitert
A. Ule	R.J.M. Vaessens	S.G. Vanneste
H.J.J. Verheijen	M. Verloop	A.J. Vermeulen
A.M. Verweij	A.P.A. Vestjens	M. Vieira
I.F.A. Vis	M. Vlasiou	M.H. van der Vlerk
I. Vliegen	A. van Vliet	J.P.A. van Vliet
Y. Volkovich	T. Vredeveld	M.J.C.M. Vromans
M. van Vuuren	X. Wang	M. Wennink
W. van der Weij	R. Wildeman	E.M.M. Winands
R. Yang	Z. Yang	T. Yuan
C.M. Zwaneveld	A.P. Zwart	

8. Structuurschets interne organisatie LNMB (in Dutch)

Vastgesteld in de algemene ledenvergadering van 16 januari 1991, aangepast in de algemene ledenvergadering van 16 januari 2007

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 tweede-fase 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 tweede fase opleidingen.

2. Leden

Lid van het LNMB kunnen zijn hoogleraren of UHD'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 aio's/oio's. De ledenlijst staat vermeld in de brochure. Over toelating van nieuwe leden beslist het Algemeen Bestuur.

3. Algemeen Bestuur

Het Algemeen Bestuur bestaat uit tenminste 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 tenminste 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 zittingstermijn van de secretaris komt overeen met diens aanstelling als Wetenschappelijk Directeur. De voorzitter wordt in functie gekozen.

De leden van het Dagelijks Bestuur, m.u.v. de directeur, hebben een zittingstermijn van 4 jaar. Jaarlijks treedt tenminste één lid af. Aftredende leden zijn éénmaal herkiesbaar.

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 gedragsregels 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.

9. Operations Research Groups at Dutch Universities and CWI

<u>Nr.</u>	<u>Institution</u>	<u>Research Theme</u>	<u>Projectleader(s)</u>
1a.	CWI	Algorithms, Combinatorics and Optimization	Laurent
1b.	CWI	Communication and computer networks	Van der Mei
2.	EUR	Operations Research	Dekker
3.	WUR	Operations Research	Van der Vorst
4a.	UvT	Operations Research	Van Dam
4b.	UvT/RU	Operations Research and game theory	Borm/Tijs
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
8a.	TUD	Interior point methods	Roos
8b.	TUD	Optimization	Aardal
9.	TU/e	Combinatorial optimization and Stochastic OR	Woeginger/Boxma
10.	UvA	Deterministic and Stochastic Operations Research	Van Dijk
11.	UT	Discrete Optimization and Stochastic OR	Boucherie/Uetz
12.	UU	Operations Research	Balder
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)

Algorithms, Combinatorics and Optimization

Leader : Dr. M. Laurent.
Address : Centre for Mathematics and Computer Science, 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. J. Draisma, prof.dr.ir. A.M.H. Gerards, dr. D.C. Gijswilt, dr. F. Horn, dr. M. Laurent, drs. E.J. van Leeuwen, dr. B. Meijer, prof.dr. J.K. Lenstra, F.M. de Oliveira Filho, dr. G. Schaefer, prof.dr. A. Schrijver, prof.dr. L. Stougie, dr. F. Vallentin, S.A. Witzel, dr. D. Wojtczak, .A. Zvesper.

Research themes:

1. Combinatorics and optimization.
2. Algorithmic game theory.

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

Probability and Stochastic Networks

Leader : Prof.dr. R.D. van der Mei.
Address : Centre for Mathematics and Computer Science, Science Park 123, 1098 XG Amsterdam
Phone : 020 - 5924205; 020 - 5924199 (secretary)
Research staff : Prof.dr. J. van den Berg (0.8), dr. K. Dzhaparidze (1.0), drs. R. Egorova (1.0), ir. G.J. Hoekstra (0.4), dr. M.C. van Lieshout (1.0), drs. P.M.D. Lieshout (1.0), prof.dr. R.D. van der Mei (0.8), dr. R. Núñez Queija (0.5), dr. A. Saposznikov (1.0), dr. V. Sidoravicius (1.0), C. Verhoef (1.0), drs. M. Verloop (1.0), drs. W. van der Weij (1.0) and dr. A.P. Zwart (1.0).

Research themes:

1. Performance analysis of 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, dr. W. van der Heuvel, dr. D. Huisman, dr. A. Gabor, prof. dr. ir. U. Kaymak, dr. D.K. Leegwater, dr. M. Mulder, C. Pince MSc, D. Potthoff MSc, M. Pourakbar MSc, M. Retel Helmrich MSc, R. Spliet MSc, W. van Jaarsveld MSc, prof.dr. A.P.M. Wagelmans.

Research themes:

1. Railway operations optimization (Dekker, Huisman, Potthoff, Wagelmans)
2. Maintenance and reliability analysis (Dekker, van Jaarsveld)
3. Vehicle and ship routing under demand uncertainty (Dekker, Gabor, Spliet)
4. Production planning and inventory control (Dekker, Van de Heuvel, Retel-Helmrich, Wagelmans)
5. Service Logistics (Dekker, Gabor, Pince, Pourakbar, van Jaarsveld)
6. Optimalisering (Brinkhuis)
7. Container and intermodal logistics (Dekker, Pourakbar)
8. OR in Health Care (Dekker, Wagelmans)
9. Reverse logistics (Dekker, van de Heuvel, Pince)
10. Location and network problems (Mulder)

Project 3. Wageningen University
Operations Research and Logistics Group

Leader : Prof.dr.ir. J.G.A.J. van der Vorst.
Address : Hollandseweg 1, 6706 KN Wageningen.
Phone : 0317 – 485645.
Research staff : Dr. E.M.T. Hendrix, Ir. G.D.H. Claassen, dr. R. Haijema, drs. K.G.J. Pauls-Worm,
ir. J.C. van Lemmen-Gerdessen, dr. R. Rossi and prof.dr.ir. J.G.A.J. van der Vorst.

Research themes:

1. Supply chain management and design:
 - a. Robust demand-driven Agrifood chain networks;
 - b. Quality controlled logistics in fresh networks.
2. Decision support models:
 - a. OR-models for Agribusiness and food industry
 - b. Ontology's and modelling frameworks for simulation studies.
3. Efficient and effective algorithms:
 - a. Planning algorithm for Agrifood;
 - b. Algorithm for robust design; application of global optimization algorithms.

Project 4a. Tilburg University
Operations Research

Leader : Prof.dr.ir. E.R. van Dam
Address : Department of Econometrics and Operations Research, CentER for Economic Research,
Faculty of Economics and Business Administration, 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. B.W.M. Bettonvil, dr. J.P.C.Blanc,
prof.dr. P.E.M. Borm, dr. R.C.M. Brekelmans, dr.ir. E.R. van Dam, prof.dr.ir. H. Daniels,
prof.dr. F.A. van der Duyn Schouten, 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, dr. E. de Klerk, prof.dr. P.M. Kort,
dr.ir. M.J.P. Peeters, dr. M. Quant, dr. J.H. Reijnierse, prof.dr. J.M. Schumacher, dr. R. Sotirov,
dr. L.W.G. Strijbosch, prof.dr. A.J.J. Talman, prof.dr. S.H. Tijs, and dr. A.M.B. de Waegenaere.

Research themes:

1. Stochastic Operations Research.
2. Deterministic Operations Research.
3. Simulation.
4. Combinatorial mathematics.
5. Cooperative game theory.

Project 4b. Tilburg University
Operations Research and Game theory

Leaders : Prof.dr. P.E.M. Borm and Prof.dr. S.H. Tijs.
Address : Department of Econometrics and Operations Research, CentER for Economic Research,
Faculty of Economics and Business Administration, Tilburg University, P.O. Box 90153,
5000 LE Tilburg.
Phone : 013 - 4663026; 013 - 4662340 (secretary)

Research staff : Prof.dr. P.E.M. Borm, drs. M. Carvalho, drs. B. Ciftci, drs. M. Gerichhausen, drs. S. Grundel, drs. G. van Gulick, prof.dr. H.J.M. Hamers, dr. R. Hendrickx, drs. J. Kleppe, drs. R. Lindelauf, drs. E. Lohmann, prof.dr. H.W. Norde, dr. M. Quant, dr. H. Reijnierse, prof.dr. A.J.J. Talman, prof.dr. S.H. Tijs and dr. M. Voorneveld.

Research themes:

1. Cooperative game theory
2. Non-cooperative game theory
3. Mathematical economics
4. Skill in games
5. 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, prof.dr.ir. S. van Hoesel, prof.dr. R. Müller, dr. H. Röglin 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 Engineerings, Maastricht University, P.O. Box 616, 6200 MD Maastricht.

Phone : 043 - 3883489; 043 - 3883496 (secretary).

Research staff : dr. J.J.M. Derks, drs. J. Heijman, dr. M. Hoffmann, drs. S. Jansen, drs. J.M.H. Karel, dr.ir. J.Kuipers, prof.dr.ir. R.L.M. Peeters, dr. M. Petreczky, dr. G.M. Schoenmakers, dr. F. Thuijsman and dr. R.L. Westra.

Research themes:

1. Strategic optimization in networks (network games, Markov games, gene networks, evolutionary models).
2. Systems biology (signal processing, data mining, pattern recognition) .

Project 6. University of Groningen Operations Research

Leader : Prof.dr. M.H. van der Vlerk.

Address : Faculty of Economics and Business, University of Groningen, P.O. Box 800, 9700 AV Groningen.

Phone : 050 - 3633816; 050 - 3637491 (secretary).

Research staff : Dr. B. Goldengorin, prof.dr. W.K. Klein Haneveld, D. Krushinsky MSc, prof. dr. G. Sierksma, drs. M.H. Streutker, drs. B.G. Talsma, prof.dr. R.H. Tuenter and prof.dr. M.H. van der Vlerk.

Research themes:

1. Decision making under uncertainty and Stochastic programming (Klein Haneveld, Streutker, van der Vlerk)
2. Combinatorial optimization and quantitative logistics (Goldengorin, Krushinsky, Sierksma, Talsma).
3. Reverse logistics, inventory control and forecasting of demand (Teunter)

Project 7. University of Leiden Stochastic Operations Research

Leader : Prof.dr. L.C.M. Kallenberg.

Address : Mathematical Institute, University of Leiden, P.O. Box 9512, 2300 RA Leiden.

Phone : 071 - 5277130.

Research staff : Prof.dr. L.C.M. Kallenberg and dr. F.M. Spieksma.

Research themes:

1. Markov decision chains with applications in queueing networks.
2. Markov games.

Project 8a. Delft University of Technology

Interior point methods

Leader : Prof.dr.ir. C. Roos
Address : Faculty of Electrical Engineering, Mathematics and Computer Science,
Delft University of Technology, Mekelweg 4, 2628 CD Delft
Phone : 015 - 2782530; 015 - 2787486 (secretary)
Research staff : A. Asadi MSc., Guoyong Gu MSc., B.P. Silalahi MSc. and M. Zangiabadi MSc.
Research themes:
1. Interior point methods for linear and non-linear optimization
2. Randomized (approximation) algorithms
3. Robust optimization

Project 8b. Delft University of Technology

Interior point methods

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 : K.I. Aardal, F. von Heymann, D. Sverdlov and F. Vallentin.
Research themes:
1. Integer and combinatorial optimization
2. Semidefinite/convex optimization
3. Harmonic analysis applied to optimization, lattices and optimization

Project 9. Eindhoven University of Technology

Combinatorial optimization; Stochastic Operations Research

Leaders : Prof. dr. G.J. Woeginger and prof.dr.ir. O.J. Boxma
Address : Department of Mathematics and Computer Science, Eindhoven University of
Technology, P.O. Box 513, 5600 MB Eindhoven
Phone : 040 - 2472412 (Woeginger); 040 - 2472858 (Boxma); 040 - 2473130 (secretary)
Research staff : Dr.ir. I.J.B.F. Adan, ir. P. Beekhuizen, drs. R. Bierbooms, ir. M.A.a. Boon, prof.dr.ir. S.C. Borst,
prof.dr.ir. O.J. Boxma, dr. P. Csorba, drs. C.E.J. Eggermont, ir. J.J.J. van den Broek,
drs. J. Bruin, M. Firat MSc., prof.dr.ir. A.M.H. Gerards, dr. H. van der Holst,
dr.ir. C.A.J. Hurkens, dr. M.T.S. Jonckheere, dr. J.C.M. Keijsper, dr. J.S.H. van Leeuwen,
dr. E.J. van Leeuwen, prof.dr. J.K. Lenstra, dr. A. Löpker, M. Mnich MSc.,
dr. R.A. Pendavingh, dr. J.A.C. Resing, dr. S. Shneer, ir. P.M. van de Ven, dr. M. Vlassiou,
prof.dr.ir. J. van der Wal, ir. A.C.C. van Wijk, prof.dr. G.J. Woeginger and ir. S. van Zwam.

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
2. Stochastic operations research
 - 2.1. Random walks and queueing theory
 - 2.2. Performance analysis of computer- and communication systems
 - 2.3. Performance analysis in operations management and logistics
3. 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 : Department of Econometrics, Faculty of Economics and Econometrics,
University of Amsterdam, Roetersstraat 11, 1018 WB Amsterdam.
Phone : 020 - 5254215; 020 - 5254217 (secretary)
Research staff : Drs. A. Al-Ibrahim, Prof.dr. N.M. van Dijk, dr. C.W. Duin, ir. J.A.M. Hontelez, drs. P. Joulstra,
dr. H.J.J. van der Sluis, dr. A. Volgenant and prof.dr.ir. J. van der Wal.

Research themes:

1. Markov decision theory (Al-Ibrahim, van der Wal, van Dijk)
2. Performance analysis of service networks (van Dijk, van der Sluis)
3. Exact and bounding results for queueing networks (van Dijk, van der Sluis)
4. Scheduling algorithms and complexity (Duin, van der Sluis)
5. Traveling salesman problem and variants (Volgenant)
6. Graph theory problems (Duin, Volgenant)
7. Polyhedral methods (Volgenant)
8. Inventory models (van der Sluis, van der Wal)
9. Transportation (Al-Ibrahim, Haijema, van Dijk, van der Wal)
10. Daily life applications of stochastic models (van Dijk, van der Sluis)
11. Healthcare logistics (van Dijk, Hontelez, Joustra, van der Wal)
12. OR and simulation (van Dijk, van der Sluis, van der Wal)
13. 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- 4893402; 053- 4893434 (secretary).
Research staf : J.W.H. van Bloem MSc, ir. M.J. Bomhoff, M.G.C. Bosman MSc, prof.dr. R.J. Boucherie, prof.dr.ir. H.J. Broersma, dr.ir. T.S.H. Driessen, T. van Essen MSc, Y. Feng, ir. J. Goseling, dr. M. de Graaf, R. de Haan MSc., ir. P. Hölzenspies, prof.dr. J.L. Hurink, dr. W. Kern, N. Kortbeek MSc, dr. N. Litvak, dr. B. Manthey, D.I. Miretskiy MSc., dr. J.C.W. van Ommeren, dr.ir. G. Post, X. Qiu, dr.ir. W.R.W. Scheinhardt, dr. G.J. Still, prof.dr. M. Uetz, P. Vanberkel MSc, dr. J.B. Vink-Timmer, Y. Volkovich MSc., J. Wu MSc, M. Zonderland MSc. and A. Zwartjes MSc

Research themes:

1. Discrete Mathematics & Mathematical Programming:
 - 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

Project 12. University of Utrecht

Operations Research

- Leader* : Prof.dr.ir. E.J. Balder
Address : Department of Mathematics, University of Utrecht, Budapestlaan 6, 3508 TA Utrecht.
Phone : 030 - 2531458; 030 - 2531420 (secretary)
Research staff : Prof.dr.ir. E.J. Balder and dr. A. Gnedin.

Research themes:

1. Generalized solutions in game theory, optimal control and mathematical economics
2. Probabilistic methods in combinatorics
3. Search and sorting algorithms

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

Leaders : Prof.dr. L. Stougie and prof.dr. H.C. Tijms

Address : Department of Econometrics and OR, VU University Amsterdam,
De Boelelaan 1105, 1081 HV Amsterdam

Phone : 020 - 5986013

Research staff : Dr. G.J. Franx, dr. J. Gromicho, dr. B. Heidergott, B. Kaynar MSc., dr. D.A. van der Laan,
dr. R.D. Nobel, dr. A.A.N. Ridder, dr. G. Schaefer, dr.ir. R.A. Sitters, prod.dr. L. Stougie,
prof.dr. H.C. Tijms, prof.dr. G.T. Timmer, W. Wolk-Makarewicz MSc. and T. Yuan 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,
De Boelelaan 1081a, 1081 HV Amsterdam

Phone : 020 - 4447755

Research staff : Dr. R. Bekker, dr. S. Bhulai, drs. M. Bijvank, prof.dr. R.D. van der Mei, drs. P. Out, V. Rai MSc.,
drs. A. Roubos, drs. D. Roubos, drs. R. Yang and dr. A.P. Zwart.

Research themes:

1. Performance modeling of communication systems
2. Theory and applications of controlled queuing systems

10. List of PhD Students

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2. Al-Ibrahim, Drs. A., Faculteit Economie en Bedrijfskunde, Universiteit van Amsterdam, Roetersstraat 11, 1018 WB Amsterdam.
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5. Baarsma, Ir. H.E., Mathematics, University of Twente, P.O. Box 217, 7500 AE Enschede.
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6. Beekhuizen, Ir. P., EURANDOM, P.O. Box 513, 5600 MB Eindhoven.
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REGISTRATION FORM PhD COURSES LNMB (TRIMESTER 1)

Personal data

Family name (including titles) :

First name : Male Female

Address department/university :

.....

.....

Telephone nr. :

E-mail :

URL :

Supervisor :

Course registration

I want register for the following courses (tick anyone)

SMTS : Stochastic Models for Telecommunication Systems

RA : Randomized Algorithms

CO2a : Combinatorial Optimization, part 2a

Date: Signature:

Please send this form ultimately September 4, 2009 to:

Secretary LNMB

Ms. W.A. Hasselton – Snijder

Mathematical Institute

University of Leiden

P.O. Box 9512

2300 RA Leiden

REGISTRATION FORM PhD COURSES LNMB (TRIMESTER 2)

Personal data

Family name (including titles) :

First name : Male Female

Address department/university :

.....

.....

Telephone nr. :

E-mail :

URL :

Supervisor :

Course registration

I want register for the following courses (tick anyone)

CO2b : Combinatorial Optimization, part 2b

NCG : Noncooperative Games

MDP : Markov Decision Processes

Date: Signature:

Please send this form ultimately November 6, 2009 to:

Secretary LNMB
Ms. W.A. Hasselton – Snijder
Mathematical Institute
University of Leiden
P.O. Box 9512
2300 RA Leiden

REGISTRATION FORM PhD COURSES LNMB (TRIMESTER 3)

Personal data

Family name (including titles) :

First name : Male Female

Address department/university :

.....

.....

Telephone nr. :

E-mail :

URL :

Supervisor :

Course registration

I want register for the following courses (tick anyone)

ORHC : Operations Research and Health Care

AQT : Advanced Queueing Theory

ORG : OR - Games

Date: Signature:

Please send this form ultimately February 5, 2010 to:

LNMB

c/o Prof.dr. J.L. Hurink

Dept. of Applied Mathematics

University of Twente

P.O. Box 217

7500 AE Enschede.

REGISTRATION FORM MASTER COURSES LNMB (FALL 2009)

Personal data

Family name :

First name :Gender: female / male

Address :

Postal code :

Place :

University :

Education (e.g. Mathematics) :

First year of enrollment :

Student number :

E-mail :

Supervisor Master thesis :

Course registration

I want register for the following courses (tick anyone)

- ISP Introduction to Stochastic Processes
- CO Continuous Optimization
- DO Discrete Optimization
- HEU Heuristic Methods Operations Research

Date: Signature:

Please send this form ultimately August 28 (course ISP) or September 11 (other courses) 2009 to:
Secretary LNMB
Ms. W.A. Hasselton – Snijder
Mathematical Institute
University of Leiden
P.O. Box 9512
2300 RA Leiden

REGISTRATION FORM MASTER COURSES LNMB (SPRING 2010)

Personal data

Family name :

First name :Gender: female / male

Address :

Postal code :

Place :

University :

Education (e.g. Mathematics) :

First year of enrollment :

Student number :

E-mail :

Supervisor Master thesis :

Course registration

I want register for the following courses (tick anyone)

- ALP: Advanced Linear Programming
- SCH: Scheduling
- QT : Queueing Theory

Date: Signature:

Please send this form ultimately January 22, 2010 to:
LNMB
c/o Prof.dr. J.L. Hurink
Dept. of Applied Mathematics
University of Twente
P.O. Box 217
7500 AE Enschede.

REGISTRATION FORM NEW PhD STUDENTS LNMB

Family name (including titles) :

First name :

Male Female

Date of birth :

Place and country of birth :

MSc in which discipline? :

MSc at which university? :

Address present university :

.....
.....

Expiration date as PhD student :

Telephone nr. (office) :

E-mail :

URL :

Supervisor :

Topic dissertation :

Home address :

.....

Date :

Signature :

Please, send this form with a passport photo to:

Secretary LNMB
Ms. W.A. Hasselton – Snijder
Mathematical Institute
University of Leiden
P.O. Box 9512
2300 RA Leiden

REGISTRATION FORM NEW MASTER STUDENTS LNMB

Family name :

First name :

Male Female

Date of birth :

Place and country of birth :

Present university :

Education (e.g. Mathematics) :

First year of enrollment :

Student number :

Address administration faculty :

.....

Address (home) :

Postal code (home) :

Place (home) :

E-mail :

Master Supervisor :

Date :

Signature :

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