Programme Research and Management

Programme director: Prof. dr N.M. van Dijk
Department: Quantitative Economics (KE)
METIS-code: uva/fee/res/or/prog
JEL-classification: C4
VSNU-scores: Quality: 3, Productivity: 2, Relevance: 3, Viability: 2

Members of the research group and research in FTEs

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Programme design

The general research mission of the Programme can be formulated as threefold
(i) The development and continuation of fundamental theoretical research in the areas of deterministic and stochastic operations research.
(ii) The application and development of scientific research in these fields for technological and infrastructure applications.
(iii) The dissemination of general insights and scientific results from the field of Operations Research for daily-life non-technical logistical situations.

Accordingly, three lines of research and associated activities are distinguished:

I Fundamental Theoretical Research

In this category in turn three directions of research are followed:

1.1 Combinatorial Optimisation specialised to:
- Generalisations of the Travelling Salesman Problems such as Peripatetic Salesman Problem;
- Steiner Tree Problems on Graphs and Generalisations as multiweighted problems;
- Degree constrained trees and problems with criteria as bottleneck, minimum deviation, and partial sum;
- Linear Assignment Problems

This research is focused on both exact and heuristic methods. The heuristic methods are of most interest from a practical point of view, as in many cases a nearly optimal solution is also sufficient. Special interest has been developed for the numerical implementation of algorithms.

1.2 Queuing Network Analysis
Stochastic service networks naturally arise in manufacturing (production lines), computer science (computer networks), telecommunications (long distance, satellite and mobile communications) and transportation (railway systems, traffic lights). The research themes are:

- the development of closed form (exact) expressions for stochastic service networks, most notably product form expressions for queuing networks;
- the development of simple insights in when and when not a stochastic network has this so-called product form steady state distribution.
- simple performance bounds for networks that are non-solvable due to practical phenomena such as finite capacity constraints, job-priorities or breakdowns.

1.3 Markov Chain Analysis

1.3.1 Error Bound Analysis for Approximate Markov Chain Modelling

- As practical systems that arise in manufacturing, telecommunications and computer networking are often non-solvable for the reasons mentioned, based on the insights and results above, approximations and bounds have to be developed. The error introduced by such approximations or bounds is of practical interest. To this end a technique has been developed to provide analytical error bounds. The application and extension of this technique remains a continuing research interest for a variety of situations. Particular research problems are:
  - error bounds for non-exponential stochastic networks;
  - error bounds for the truncation of Markov chains;
  - error bounds for sensitivity analysis.

1.3.2 Continuous time and large Markov Chain Modelling

- Continuous time Markov Chain Models are known to provide a powerful tool for the description and modelling for a variety of applied fields. Unfortunately, for computational purposes these systems are generally hard if not impossible to handle, as the state spaces are usually far too large. Different methods to overcome this intractability are of ongoing research, such as by aggregation methods and uniformization.

II Fundamental Applied Research

This concerns queuing network and Markov chain modelling for a number of applied technical fields in order to obtain computationally attractive results. Most notably:

- Telecommunications (mobile communications, long-distance communications)
- Transportation Networks (Public transportation, Railways)
- Inventory systems and Reliability Networks

III Practical Research for Daily-life Logistics (Operations Management)

This concerns the application of insights and techniques from Operations Research for a number of practical logistical environments such as in:

- Administrative and Production Logistics
- Health care and hospitals
- Call Centers

Resources and funding

The programme received a very modest amount of funding (less than € 3800,-) from the research institute RESAM in 2003. The money was mostly spent on costs related to conference visits by programme members. Clearly this amount was not enough to even let all the researchers visit a conference abroad once. Additional conference visits and other activities had to be sponsored by external funding (‘3rde geldstroom activiteiten’).

Program Evaluation

As evaluated by the research visitation in 2002 with a low score for its viability, the programme appeared to be quite vulnerable (such as due to a temporary half-time reduction of the program
leader) which had resulted in a strong reduction of research activities over the last few years. It also suffered from a total lack of Ph.D.’s.

Most curiously and incorrectly, also the production and quality were evaluated as poor and weak, while in the given time-period (1995-2000) it appeared to be by far the highest of all programmes within the FEE (in both the category of all refereed journals and of A,B-journals), as also (partially) confirmed by the position of the programme leader at the 2003 top-40 list of Dutch economists.

This evaluation resulted in three objectives:

- the completions and development of Ph.D.’s
- more research interaction among the members
- a more balanced production over the programme members

The first steps in each of these directions has been set during 2003 such as

- a Ph.D. completion in 2003 (see dissertations)
- a Ph.D. completion in 2004 and in 2005 (old Ph.D. students)
- one extra Ph.D. position (co-financed by the Dutch Railways)
- and, last but not least, research involvements of almost all members (V.d. Wal, C. Duin, A. Volgenant, V. Dijk) as well as interactions (see reports Van Dijk & Van der Sluis; Duin, Haijema and Van Dijk; Haijema and Van der Wal; Al-Ibrahim, Duin and Van der Sluis; Duin and Volgenant).

The threefold objectives and categories of research of the program design as described above remain standing with the following activities over 2003.

**Fundamental theoretical research**

1.1 See To Appear: Volgenant (3x)
   - See To Appear: Volgenant & Duin (2x)
1.2 See Refereed: Van der Wal (3x)
1.3 See To Appear: Van Dijk and Miyazawa
   - See Report: Van Dijk and Sladky

**Fundamental applied research**

   - See reports: Duin and Van der Sluis (2x)
   - See reports: Van Dijk and Van der Sluis
   - See reports: Van der Wal (2x)

**Practical research**

   - See reports: Haijema, Duin and Van Dijk
   - See report: Haijema and Van der Wal
   - See popular publications: Van Dijk (2x)
   - See organisation: Van Dijk

**Key Publications**


**Forthcoming**


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**Publications in numbers**

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<td>c) book chapters</td>
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**Dissertations**


**Academic publications (excluding publications in/of books) – refereed**


**Academic publications (excluding publications in/of books) – non-refereed**


**Academic publications (working- and discussion papers)**


**Popular publications**


**Contributions to academic conferences, workshops and seminars**


**Other lectures on research**


**Organisational contributions to conferences, workshops and seminars**

Dijk, N.M. van (2003, 30 September). Seminar Integraal Voorraadbeheer, in co-operation with Vereniging van Logistiek Adviseurs (VeLa), Zoetermeer.

Dijk, N.M. van & Sluis, E. van der (2003, 10 October). Themeday for highschool (VWO) mathematics teachers, Universiteit van Amsterdam.

Dijk, N.M. van (2003, 30 October). Workshop Wachtlijst Simulatie voor Ziekenhuizen in co-operation with the Ministry of Health, Welfare and Sport (Ministerie van Volksgezondheid, Welzijn en Sport (VWS)), Universiteit van Amsterdam.

**Participation in academic networks & fellowships**

Dijk, N.M. van (2003). Member LNMB (Landelijk Netwerk Mathematische Besliskunde)

Volgenant, A. (2003). Member LNMB (Landelijk Netwerk Mathematische Besliskunde)

Wal, J. van der (2003). Member LNMB (Landelijk Netwerk Mathematische Besliskunde)

**Editor or member of editorial board**


**Referee activities**


**Membership of academic committees (incl. Ph.D. committees outside the FEE)**
