MSc Applied Mathematics
Stochastic Operations Research

Richard Boucherie
Stochastic Operations Research: Team

http://www.utwente.nl/ewi/sor/staff/
Operations Research: The World


Models and Methods for Optimization in Industry, Business, or Services

A New View of Analytics and Operations Research

Analytics to optimize scheduling processes

Stochastic Operations Research 20150106
Stochastic Operations Research: Application Areas

Optimal decisions in a random environment

- Planning of transportation systems
- (Internet) security
- Design of web search engines
- Pirate detection
- Design of health care systems
- Maintenance strategies
- Analysis of wifi systems
- Asset Wide Optimization
Operations Research: Embedding

- Computer Science
- Management Science
- Electrical Engineering
- Civil Engineering
- Mathematics

- Twente Graduate School programme:
  Industrial Engineering and Operations Research
Operations Research: Mathematical Tools

- Discrete Optimization
- Continuous Optimization
- Scheduling
- Optimization Modeling
  - Stochastic Processes
  - Queueing Theory
  - Markov Decision Theory
- Networks of Queues
- Game Theory
- Capita Selecta Operations Research (Seminar)
- YOUR SELECTION OF COURSES

- Probability Theory
- Markov chains
- Discrete Event Simulation
Operations Research: Program Overview

1st year: 60 EC course load with focus on *discrete* and *stochastic* optimization models and applications

2nd year: 20 EC traineeship
40 EC MSc thesis

Dual programme
Stochastic Operations Research: Traineeship & Thesis

Traineeship
- companies inside NL and universities abroad (Australia, Germany, Italy, USA, ...)
- often combined with MSc

MSc thesis
- possible in internal projects (~ 20%)
- or external with company (~ 80%)

PDEng

PhD
Stochastic Operations Research: Seminars & Organisation

MSc seminar
- Monthly, by students, graduation projects, Thursday lunch

OR seminar
- Weekly, by staff, overview of theory, Tuesday lunch

Take-in: Richard Boucherie

Mentor: staff member

LinkedIn: overview alumni + jobs (work in progress)
Stochastic Operations Research: Projects
Completed:

MSc: http://www.utwente.nl/ewi/sor/graduates/MSc/

BSc: http://www.utwente.nl/ewi/sor/graduates/BSc/

New:

http://www.utwente.nl/ewi/sor/education/graduationprojects/
Het kan écht: betere zorg voor minder geld

Logistieke verbeteringen gaan hand in hand met kwaliteitsverbeteringen: patiënten die minder vaak naar het ziekenhuis hoeven, minder lang hoeven te wachten en kunnen rekenen op meer aandacht van verpleegkundigen en artsen.

De logistieke kwaliteitsverbeteringen leveren bovendien nog eens een bonus van 3 tot 3.5 miljard euro op: bijna een kwart van de totale ziekenhuisbegroting!

Kortom: betere zorg voor minder geld!
Do popular nodes connect to each other?

- **Left:** negative correlations (Internet, WWW)
- **Right:** positive correlations (social networks)


Current estimators are uninformative. We develop new probabilistic techniques and statistical theory for network analysis.

Which nodes are most important or central?

Many centrality measures but their analytical properties are largely unknown.

We analyze PageRank in random graphs using coupling with weighted branching processes.
Random walks in the positive orthant

- Exact analysis
  - Characterize random walks with tractable invariant measures
- Bounds on performance
  - Error bounds through (non-)linear optimization
- Opportunities for collaboration in TW:
  - Solutions of systems of difference equations
  - Representations of invariant measure
  - Optimization…
Stochastic Operations Research: Team
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