Course syllabus

Simulering av processer i försörjningskedjor
Simulation of Supply Chain Systems

MION41, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED I
Date of Decision: 2023-04-14

General Information

Elective Compulsory for: MLOG2
Elective for: I5-pr, I5-lf, M5-lp, M5-prr
Language of instruction: The course will be given in English on demand

Aim

The course has the overarching theme of simulation and aims to provide further knowledge in deterministic and stochastic modelling of operational and managerial business problems.

Concrete goals in the course

- in-depth studies in quantitative methods for simulation of industrial processes and logistic system.
- practice and development of the ability to manage (formulate and solve) an process in simulation project.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to use queuing theory/Markovian theory and methodology for discrete event simulation modelling, to analyse, and solve business problems relating to operational and managerial decisions.

For the simulation section of the course this means:

- to get in-depth understanding for the principles of discrete event simulation modelling, and the opportunities and limitations that this technique offers
- to be able to use a commercial software (Extend Sim) to create a simulation model and use this to analyse discrete event systems and processes
- to be able to correctly use statistical methods to analyse input to, and output from simulation models, and to interpret the generated results. This involves the choice and fitting of distribution functions, as well as using various types of hypothesis testing methods
- understand how to generate random numbers
- understand how to generate random variates
- use discrete event simulation methodology for analysis of business processes in a wide sense.
- compare alternative system configurations

For the theoretical section of the course this means:

- to be able to formulate relevant business problems Markov chains/Markovprocesses as queuing or networks.
- to calculate steady state probabilities for Markovian systems
- to be able to interpret the solutions and results and place them in a business context

Competences and skills
For a passing grade the student must

have the skills and abilities to independently perform statistically correct input and output analysis of relevant data. The student should have skills in building simulation models from complex real life production systems. Moreover, the student should be able to analytically analyze simple production systems by using Markov theory. Concrete areas and model types that the student should master include:

- Steps in a simulation study
- Using commercial simulation software
- Empirical distributions vs. parametric distributions
- Techniques for assessing sample independence
- Histograms, probability plots and quantile plots
- Chi-square tests
- Kolmogorov-Smirnov tests
- Linear congruential generators
- Inverse transform
- Generation of random variates
- Transient and steady state behaviour of a stochastic process
- Terminating vs. non terminating systems
- Confidence intervals
- Objectives of simulation in manufacturing
- Markov chains
- Markov processes

Contents

The simulation section of the course examines Markovian theory as an analytical tool for analysing stochastic systems. To deal with more complex systems, a commercial software for discrete event simulation (Extend) is used. The developed models are used for analysing and improving production processes, and flow of materials and information. In order to arrive at a relevant simulation model, various types of stochastic events and processes must be characterised by appropriate distribution functions. Moreover, the output data from the simulation model must be analysed statistically in a correct way. Another important aspect is how to verify and validate the model to assure that it is relevant and that the results can be trusted. The content also includes, generation of random variables and variates. The mandatory project assignments are structured around a case studies dealing with the analysis of business processes using simulation models. The objective is to provide an understanding for the strengths and weaknesses with discrete event simulation models as a tool for process analysis. Each project group reports their assignment work and the obtained results in a well structured technical reports.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Partly individual assignments in simulation, partly a group exam as an assignment, and partly an individual exam. The final grade depends on the performance of these parts.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Admission requirements:

- A Basic Course in Mathematical Statistics

The number of participants is limited to: No
The course overlaps following course/s: MIO240, MION15, MION40, EITN95

Reading list

- Laguna M. and J. Marklund, Business Process Modeling, Simulation and Design, CRC Press (latest edition).
- Additional handouts.

Contact and other information

Course coordinator: Johan Marklund, johan.marklund@iml.lth.se
Course homepage: http://www.pm.lth.se