Introduction to Performance Modelling

2025 - 2026

Is part of the next programmes:

- M0012004 Master of Computer Science: Software Engineering
- M0012005 Master of Computer Science: Data Science and Artificial Intelligence
- M0012006 Master of Computer Science: Computer Networks
- M0032004 Master of Mathematics: Financial and Applied Mathematics
- M0048004 Master of Computer Science: Software Engineering
- M0048005 Master of Computer Science: Data Science and Artificial Intelligence
- M0048006 Master of Computer Science: Computer Networks
- M0090004 Master of Teaching in Science and Technology: Computer Science
- U0001008 Courses open to exchange students in Sciences
- U0001008 Courses open to exchange students in Sciences

Course Code:	2001WETSMT
Study Domain:	Computer Science

Semester:	1E SEM
Contact Hours:	45
Credits:	6
Study Load (hours):	168
Contract Restrictions:	No contract restriction
Language of Instructions:	ENG
Lecturer(s):	T Benny Van Houdt
Examperiod:	exam in the 1st semester

1. Prerequisites *

speaking and writing of:

- English

reading and comprehending of:

- English

specific prerequisites for this course

This course introduces various fundamental concepts to develop stochastic models used to make design decisions in communication systems. These include the Bernoulli/Poisson process, Markov chains, Erlang loss models, etc. Some elementary knowledge of probability theory is recommended.

2. Learning outcomes *

- The students become acquainted with some elementary modeling techniques, such as the Bernoulli/Poisson process, Markov chains and queueing theory. The main focus lies on understanding the practical relevance of various mathematical results and techniques.
- The students must be able to identify suitable problem situations where the proposed techniques are viable as a solution technique, both within and outside the area of communication systems. Developing this ability is the main purpose of the exercise sessions.

3. Course contents *

This course introduces various fundamental concepts when developing stochastic models, such as the Bernoulli/Poisson process, Markov chains, Erlang loss models, etc. A table of contents of the course notes is given below:

CONTINUOUS-TIME MARKOV CHAINS
1 De nition and Basic Properties
2 Limiting Behavior
3 Uniformization and Embedded Markov Chain
4 Birth-and-Death Markov Chains
5 PASTA Property
6 Exercises

APPLICATIONS
1 Some Fundamental Queueing Systems
1.1 The M/M/1 queue
1.2 The M/M/1 queue
1.3 Insensitivity
2 Dimensioning the Plain Old Telephone System
2.1 Erlang B Formula (M/M/C/C queue)
2.2 Engset Formula
2.3 Erlang C Formula (M/M/C/C+Q queue)
3 Jackson Networks
4 Bianchi's 802.11 Model
4.1 802.11 DCF Operation
4.2 A Markovian Model for the 802.11 Saturation Throughput
4.2.1 Packet Transmission Probability
4.2.2 Throughput
5 Blocking Probability in an OPS/OBS Switching Element
6 Exercises

4. International dimension *

- This course stimulates international and intercultural competences.
- Students use course materials in a foreign language.

5. Teaching method and planned learning activities

5.1 Used teaching methods *

Class contact teaching

- Lectures
- Practice sessions

Personal work

- Exercises
- **Directed self-study**

5.2 Planned learning activities and teaching methods

Lectures take place on campus. Video recordings for students that cannot attend class are available on BB. The lectures are not recorded.
Tentative schedule:

Week 1-2: Bernoulli and Poisson process
Week 3-6: DTMCs
Week 7-8: CTMCs
Week 9-13: Applications

Additionally there are 10 exercise sessions that contain both theoretical exercises as well as small programming assignments (in MATLAB).

5.3 Facilities for working students *

Others

Video recordings for students that cannot attend class are available on BB. The lectures are not recorded.

6. Assessment method and criteria *

6.1 Used assessment methods *

Examination

- Written examination without oral presentation

6.2 Assessment criteria *

The exam is either
- An open book exam consisting of exercises only.
- A closed book exam where half of the points correspond to theoretical questions and half correspond to exercises.

Every student can choose between an open or closed book exam.

7. Study material

7.1 Required reading *

Detailed English course notes are available for the students and can be bought at
- Cursusdienst UAntwerpen:https://cursussen.uantwerpen.be
- Universitas: http://www.cursusdienst.be

A free .pdf file of the notes is also available on BB.

7.2 Optional reading

The following study material can be studied voluntarily :

Not available.

8. Contact information *

For questions and remarks, please contact Benny Van Houdt in room G222 or via BBCU (after making an appointment by email).

9. Tutoring

For questions Benny Van Houdt can be contacted (G222, CMI) or the assistant supporting the exercise classes.