



LUND
UNIVERSITY

Faculty of Science

MASC03, Mathematical Statistics: Markov Processes, 7.5 credits

Matematisk statistik: Markovprocesser, 7,5 högskolepoäng
First Cycle / Grundnivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2007-06-14 and was last revised on 2007-06-14. The revised syllabus applies from 2007-07-01, autumn semester 2007.

General Information

The course is an elective course for first-cycle studies for a Bachelor of Science in Mathematics/Master of Science in Mathematical Statistics.

Language of instruction: Swedish

Main field of studies

Mathematics

Depth of study relative to the degree requirements

G2F, First cycle, has at least 60 credits in first-cycle course/s as entry requirements

Learning outcomes

The aim of the course is that students on completion of the course should have acquired the following knowledge and skills:

Knowledge and understanding

On completion of the course, the students are expected to:

- explain the Markov property and the intensity concept, as well as the concepts of recurrence, communication, stationary distribution, and how they relate to each other,
- perform calculations of stationary distributions and absorption times for discrete Markov chains and processes,
- explain the suitability of the Poisson process as a model for rare events and perform calculations of probabilities using the properties of the Poisson process in one and several dimensions.

Competence and skills

On completion of the course, the students are expected to:

- construct a model graph for a Markov chain or process describing a given system, and use the model for studying the system,
- in connection with problem solving, show ability to integrate knowledge from the different parts of the course,
- read and interpret easier literature with elements of Markov models and their applications.

Judgement and approach

On completion of the course, the students are expected to:

- identify problems that can be solved using Markov models, and choose an appropriate method,
- use knowledge of Markov models in other courses, as transfer concepts, tools, and knowledge between different courses where Markov models are used.

Course content

- Markov chains: model graphs, Markov property, transition probabilities, persistent and transient states, positive and null persistent states, communication, existence and uniqueness of stationary distribution, and calculation thereof, absorption times.
- Poisson process: Law of small numbers, counting processes, event distance, non-homogeneous processes, diluting and super positioning, processes on general spaces.
- Markov processes: transition intensities, time dynamic, existence and uniqueness of stationary distribution, and calculation thereof, birth-death processes, absorption times.
- Introduction to renewal theory and regenerative processes.

Course design

Teaching consists of lectures, exercises and computer exercises. Participation in computer exercises and with this integrated teaching is compulsory.

Assessment

The examination consists of a written exam followed by an oral exam. Students who fail the regular exam are offered a re-examination shortly afterwards.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.

For a passing grade on the entire course a passing grade on the written and oral exam and participation in compulsory parts are required. The grade is formed by weighing together the results on the parts which are included the examination.

Entry requirements

For admission to the course knowledge equivalent to the courses MASA01, Mathematical Statistics: Basic Course, 15 credits and MASC01, Mathematical Statistics: Probability Theory, 7.5 credits is required.

Subcourses in MASC03, Mathematical Statistics: Markov Processes

Applies from H15

- 0703 Laboratory Work part 1, 0,5 hp
Grading scale: Fail, Pass
- 0704 Laboratory Work part 2, 0,5 hp
Grading scale: Fail, Pass
- 0705 Exam, 6,5 hp
Grading scale: Fail, Pass, Pass with distinction

Applies from V08

- 0701 Exam, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction
- 0702 Computer Exercises, 0,0 hp
Grading scale: Fail, Pass