FSF3953 Markov Chains and Processes 7.5 credits

Markovkedjor och Markovprocesser

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for FSF3953 valid from Spring 2019

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

An advanced level course in stochastic processes and knowledge of basic measure theory.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After having passed the course, the participant is supposed to be able to

- classify Markov chains as irreducible, recurrent or transient, positive or null.
- explain the classical recurrence-transience dichotomy for Markov chains.
- establish that a given Markov chain has a unique invariant distribution.
- explain the central limit theorem for ergodic Markov chains.
- judge whether a given Markov chain is geometrically ergodic using coupling sets and FosterLyapunov drift conditions.
- illustrate the theory by examples from time series analysis and Markov chain Monte Carlo methods.

Course contents

The lectures will cover the following topics.

1. Markov chains: basic definitions
2. Stopping times and the strong Markov property
3. Atomic chains
4. General irreducible chains
5. Feller kernels
6. Ergodic theory and the law of large numbers
7. Central limit theorems and the Poisson equation
8. Geometric ergodicity and Foster-Lyapunov conditions

Disposition

The course consists of four two-week cycles, each comprising two theory lectures (90 min) and one exercise class (90 min). The lectures will cover the following topics.

Course literature

The course is based on lecture notes. Relevant references are, e.g.

Meyn, S. P. and Tweedie, R. L. (2009). Markov Chains and Stochastic Stability. Cambridge University Press, London.

Assmussen, S. (2003). Applied Probability and Queues. Springer, New York.

Examination

- HEM1 - Home assignments, 3.5 credits, grading scale: P, F
- TENM - Oral exam, 4.0 credits, grading scale: P, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

The examination consists in a combination of home assignments and an oral exam.

Other requirements for final grade

Approved assignments and exam.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.