

Modern Theory of Markov Chains

Time and location

- Tuesdays 11:00–13:00, from February 4 till June 17, 2014
- Room 204 (*with some exceptions*) of the Minnaert building (Leuvenlaan 4, Utrecht)
The exceptions are April 22, May 6, and May 20, on which we meet at room 022.

Description

How many times do we need to shuffle a deck of n cards in order to make them evenly mixed? Will a population of bacteria survive or eventually go extinct? Will a particle jumping randomly from one place to another eventually return to its original whereabouts? How quickly does a Monte Carlo simulation converge (if at all)? Motivated by modern applications and guided by examples, we develop the basic theory of Markov chains and familiarize ourselves with various mathematical techniques invented to analyze them.

This course is a part of the master's program Stochastics and Financial Mathematics, but the local students from Utrecht are also welcome.

Pre-requisites

Working knowledge of basic concepts of probability theory (at a level covered by a first course in probability) is required. Mathematical maturity and computer skills are desirable.

Literature

- Textbook: D. A. Levin, Y. Peres and E. L. Wilmer, *Markov Chains and Mixing Times*, American Mathematical Society, 2008.
Electronic version available at <http://pages.uoregon.edu/dlevin/MARKOV/>
- Handouts

Other references:

- Rick Durrett, *Probability: Theory and Examples*, Cambridge University Press, 2010.
- Geoffrey Grimmett, *Probability on Graphs*, Cambridge University Press, 2010.
- Olle Häggström, *Finite Markov Chains and Algorithmic Applications*, Cambridge University Press, 2002.
- Torgny Lindvall, *Lectures on the Coupling Method*, Dover, 2002.

Course webpage

<http://www.staff.science.uu.nl/~taati001/markov/>

Instructor

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Evaluation

- Assignments and active participation (50%)
- Project and/or presentation (50%)