

Course Syllabus (modified July 13, 2016): Markov Processes and Martingales

BMETE95MM07

Instructor Information:

Instructor: Prof. Károly Simon, office: H 507

www.math.bme.hu/~simonk, simonk@math.bme.hu

Time and Place: Lectures: Wednesday 08:15-09:45 BME H 46 and practical classes: Thursday 12:15-13:45 BME H 46.

The web site of the course:

<http://www.math.bme.hu/~simonk/mm>

Office Hours: Monday 13:00-13:50 in the office: H 507.

Language of instruction: English

Attendance and Class Participation: University policy dictates that students must participate in at least 70% of practical classes.

Text in English:

Slides of the lectures of the course will be available at:

<http://www.math.bme.hu/~simonk/mm>

Durrett, R.: Probability: Theory and Examples, 4th ed. Cambridge University Press 2010,

Lindvall, T.: Lectures on the Coupling Method. Dover Publications, Inc., Mineola, NY, 2002.

Norris, J. R.: Markov chains. Cambridge University Press, Cambridge, 1998. [click here](#) for the pdf format available on the author's web site

Resnick, S.: Adventures in Stochastic Processes. Birkhuser Boston, 1992.

Rosenblatt, M.: Markov processes. Structure and Asymptotic Behavior. Springer-Verlag, New York-Heidelberg, 1971.

Williams, D.: Probability with Martingales. Cambridge University Press, 1991

Part of the material is available also in Hungarian:

Karlin, S.; Taylor, H. M.: Sztochasztikus folyamatok. Gondolat Kiadó, 1985 Budapest

Prerequisites: No prerequisites for MSc and PhD students.

Grading policy:

Homework exercises will regularly be assigned on the web site of the course. Solving the homework exercises is considered the most important part of the completion of the course. Therefore students will demonstrate in three different ways that they are capable of solving the homework exercises:

- Homework exercises must be submitted and will be graded. For any of the 10 series of homework exercises students can get 0,1 or 2 points. Those who complete at least $2/3$ of a series get 2 points. Those who complete between $1/3$ and $2/3$ get 1 point, and those who complete less than $1/3$ of a series of homework exercises get 0 points. So, those students who complete at least $2/3$ of each of the homework assignments get 20 points altogether. Students who miss the deadline should expect a penalty. Delay of less than 168 hours results in 50 percentage reduction of points. Those students who miss the deadline of any homework assignment with at least 168 hours, get no grade for that homework assignment.
- There will be 7 HFEDs. This is the Hungarian acronym for a special test defined with details below.
- Half of the total number of points that a student can get on the exam is given for solving exercises, which are similar to some of the homework exercises.

HFEDs: During the semester there will be 7 HFEDs. They contain only homework exercises and each of them will take 30 minutes. The date and time of these HFEDs will be advertised on the web site of the course, at least one week before each of the HFED. The purpose of the

HFEDs is to check if the students worked out the homework problems alone and thoroughly understand them. We consider only the 5 best out of the 7 HFEDs. However, there is absolutely no way to have a re-sit HFED (a second attempt of HFED). Maximum 6 points can be scored on an HFED. So, the most successful students can get maximum $5 \times 6 = 30$ points for the HFEDs.

The requirements for the signature: It is a specialty of Hungarian universities that to complete the semester successfully (to get a signature as we say in Hungary) student must meet a minimal requirement on every course. This is called the requirement for the signature. This simply means that the student work related to the course requirements during the semester was considered satisfactory and the student can proceed to the exam. Those who do not get the signature, failed the course, and they are not even allowed to take the exam.

The requirement for the signature of this course are:

- Minimum 8 points from submitted homework assignments,
- Minimum 12 points from the 5 best HFEDs.

Those who meet these requirements can proceed to the exam.

The exam consists of two 90-90 minute parts. Both parts are written exams. Maximum 25-25 points can be scored on both parts of the exam.

- The theoretical part of the exam: consists of questions like definitions, theorems, and proofs.
- Exercises part of the exam: consists of exercises which are very similar to some of the homework exercises.

The total number of points which are counted when the grade is computed:

- Submitted homework assignments 10 series, maximum 2 points for each. This means **maximum 20 points**.

- HFEDs: the best five each worth maximum 6 points. That is **maximum 30 points**.
- Exercises part of the exam. **Maximum 25 points**.
- The theoretical part of the exam: **Maximum 25 points**.

The minimum requirement for the exam: The total number of points scored on the exam must be at least 20 points. Those who get less than 20 points on the exam failed the exam.

Grading Scale:

Fail (1)	less than 40	%
Pass (2)	from 40	%
Satisfactory (3)	from 55	%
Good (4)	from 70	%
Excellent (5)	from 85	%

Topics:

- (1) Martingales
- (2) Markov chains
- (3) Renewal processes
- (4) Point processes
- (5) Discrete state Markov processes

Prof. Károly Simon,

July 13, 2016.