

Course Syllabus (modified on 4 September, 2023): Stochastic Processes BMETE95AM41

Instructor Information:

Instructor: Prof. Károly Simon, office: H 503b

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

Time and Place: Lectures: Thursday 08:15-10:00 at BME H 406 and
Friday 10:15-13:00 at BME H406

The web site of the course:

<http://math.bme.hu/~simonk/StochProc/>

Office Hours: Advertised on the web site of the course.

Language of instruction: English

Attendance requirement: Minimum attendance requirement is 50% of all lectures. Students whose attendance falls below the attendance requirements are ineligible for any further easements and they fail the course.

Text in English:

[Slides of the lectures of the course](#) will be available at:

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

[The course is based on the following book:](#)

[Durrett R. Essentials of Stochastic Processes](#), Second edition, Springer 2012. Students can download it free of charge:

<https://services.math.duke.edu/~rtd/EOSP/EOSP2E.pdf>

[Another fantastic book that we use sometimes is:](#)

[Lawler G.F. Introduction to Stochastic Processes](#), Second edition, Chapman & Hall / CRC 2006

[My favorite book \(below\) will be used as a reference book](#) and it is also available free of charge on the authors web site

[Durrett, R.: Probability: Theory and Examples, 5.a th ed.](#) Cambridge UniversityPress 2017, student can down load it from:

<https://services.math.duke.edu/~rtd/PTE/PTEv5a.pdf>

A very interesting reading but on a higher level:

Levin D.A., Peres Y., Wilmer E.L., *Markov Chains and mixing times*.

Student can download it for free of charge from one of the authors web site:

<http://yuvalperes.com/markovmixing.pdf>

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. The course Probability 1 is the prerequisite for BSc 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:

- The solutions of homework exercises must be submitted at the given time and date and place. There will be 10 series of homework exercises. For each of these 10 series of homework exercises students can get 0, 1 or 2 points. Those who complete at least $\frac{2}{3}$ of the exercises, get 2 points. Those who complete between $\frac{1}{3}$ and $\frac{2}{3}$ get 1 point, and those who complete less than $\frac{1}{3}$ get 0 points. Students who miss the deadline should expect a penalty. Delay of not more than 168 hours results in 50 percentage reduction of points. Those who miss the deadline by not more than 168 hours can hand in their homework assignments only in class in the following week. Those students who miss the deadline of any homework assignment with more than 168 hours, get no grade for that homework assignment and the homework assignments handed in later than 168 hours will not be graded.

- There will be 7 HWETs. This is the 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 or the exercises presented solved together in class.

HWETs: During the semester there will be 7 HWETs. They contain only exercises which are very similar to either some of the homework assignments or some of the exercises presented at lectures. Each of the HWETs will take 30 minutes. The purpose of the HWETs 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 HWETs. However, there is absolutely no way to have a resit HWET (a second attempt of HWET). Maximum 6 points can be scored on an HWET. So, the most successful students can get maximum $5 \times 6 = 30$ points for the HWETs. HWETs will take place:

Friday, **15 September**, 2023, in lecture room H 406 at **12:15-12:45**

Friday, **29 September**, 2023, in lecture room H 406 at **12:15-12:45**

Friday, **6 October**, 2023, in lecture room H 406 at **12:15-12:45**

Friday, **20 October**, 2023, in lecture room H 406 at **12:15-12:45**

Friday, **3 November**, 2023, in lecture room H 406 at **12:15-12:45**

Friday, **17 November**, 2023, in lecture room H 406 at **11:30-12:00**

Friday, **1 December**, 2023, in lecture room H 406 at **12:15-12:45**

There is absolutely no way to write the HWETs at any other times.

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:

- Meet the attendance requirement (at least 50 % attendance at the lectures),
- Minimum 8 points from submitted homework assignments,
- Minimum 12 points from the 5 best HWETs.

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 either some of the homework exercises or some of the exercises presented at lectures.

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**.
- HWETs: 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) Discrete and continuous time Markov chains,
- (2) Martingales,
- (3) Brownian motion.

Professor Károly Simon,

26 July, 2023.