The Probabilistic Method
Summer 2020

Lecturers
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Course webpage `http://discretemath.imp.fu-berlin.de/DMIII-2020/`

Whiteboard site `https://mycampus.imp.fu-berlin.de/portal/site/`
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Schedule   There will be one or two lectures each week, taking place on
Tuesdays and Thursdays from 10:30 to 12:00. The lectures will take place on
the Cisco Webex Meetings platform, with the link to the meeting available
on the Whiteboard site.
The exercise sessions will be scheduled at the beginning of the semester.

Topics of the course   The probabilistic method and its applications in
combinatorics, geometry and theoretical computer science. (Linearity of
expectation, method of alterations, second moment method, Lovász Local
Lemma, correlation and concentration inequalities, pseudorandomness and
random graphs)

Prerequisite   basic combinatorics and graph theory, probability, linear al-
gebra, calculus

Final   The grade for the course is based solely on the final oral exam, which
will be scheduled later in the semester. The final is a closed-book/closed-
notes exam, you must learn everything that was presented and be familiar

with how to apply the learned methods. In order to succeed, it is absolutely necessary to actively follow the lecture throughout the semester, immediately revise the new material, and try to solve the exercises. There will be two different types of tasks on the final:

- Lexical knowledge: Definitions, statements and proofs of theorems
- Problem solving: applying the encountered theorems and methods to solve exercises (some of these will be from the homework sheets, some you have never seen before)

Attending lectures   Each week, the slides for the lectures will be posted to the course website a few days in advance. There may be missing details of proofs, which would be filled in during lectures. Still, you are encouraged to take a quick look through them beforehand, to get some idea of what the lecture will cover. Best practice would be to try to fill in the gaps yourself!

During the lecture, the slides will be shared in the meeting. You may also like to have them open separately in another window, should you need to refer back to something from earlier. When there are gaps in the slides, these will be filled in during the lecture, and the final annotated slides will later be made available on the website.

From a technical perspective, when joining the Webex meeting, we would be happy for you to share your video, so that we can all see one another and recreate a classroom-like setting. However, we do ask that you mute your microphones, to avoid background noise and interference. You can then unmute yourself if you would like to ask something, or are answering a question posed by the lecturer. The chat function can also be used for these purposes.

Problem sheets   There will be an exercise sheet posted to the course website every two weeks, and you will have one to two weeks to solve the problems. While you are welcome to work on the problems with your classmates, you will be expected to submit solutions to all the problems individually. These should be uploaded to the Whiteboard course site.

Exercise sessions   You will be divided into two smaller groups for the exercise sessions, which will take place every two weeks after your solutions to the problem sheets are due. During these meetings, you will have the opportunity to ask any questions you may have, present and discuss your homework solutions, and explore further topics related to the course.

When presenting solutions, you will be able to share a document in the meeting so that your classmates can follow along. This could simply be the

solution you submit, but you may also wish to prepare a separate document if you would like to present the solution in a different way.

Aktive Teilnahme To obtain the aktive Teilnahme credit, you should obtain at least 60% of the available points on the problem sheets, and present at least 3 solutions in the exercise classes. We also expect you be active participants in these seessions, and in particular to ask questions if anything is unclear.

Literature We will mostly be following the text below.

- N. Alon, J. H. Spencer: The Probabilistic Method

For additional reading, these books are also recommended.

- B. Bollobás: Random Graphs

- S. Janson, T. Łuczak and A. Ruciński: Random Graphs

- M. Molloy and B. Reed, Graph Colouring and the Probabilistic Method