

Constructive Combinatorics — Summer 2015

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Course webpage <http://discretemath.imp.fu-berlin.de/DMIII-2015/>

Course contents In this course we will study extremal constructions for Turán- and Ramsey-type problems in combinatorics. These constructions shall make use of finite fields, projective planes, algebra, and probability. We will also study quasirandomness through graph eigenvalues, as well as applications of the discrete Fourier transform.

Prerequisites Basic extremal graph theory, combinatorics, algebra, probability, and calculus.

Lectures Lectures will take place in Arnimallee 3, SR 119, from 12:30pm to 2:00pm. On odd weeks (weeks starting April 13th, April 27th, May 11th, and so on), there will be lectures on Tuesdays and Wednesdays. Even weeks (weeks starting April 20th, May 4th, May 18th, and so on) will only have lectures on Wednesdays.

Homework A new homework assignment will be posted every two weeks. While you are welcome to work on the problems with your classmates, you will be expected to submit solutions to all the problems individually. Solutions should be submitted to the tutor box of Shagnik Das by 5pm on the Mondays of even weeks.

Übervisions This term we shall be trialling¹ a new “Übervision” system to replace the weekly exercise classes. The class will be divided into small² groups of students, with each group meeting the assistant for two hours every

¹We would be grateful for any feedback on the system and suggestions for improvement at the end of the semester.

²Probably three to four students, depending on the size of the class.

even week. During these meetings, you will get the opportunity to ask any questions you may have, discuss your homework solutions, present selected solutions at the board, and explore further topics related to the course. This new system is intended to both provide you with more detailed feedback and better prepare you for the oral exams at the end of the term.

Aktive Teilnahme Every two weeks you will receive between zero and five points for your written homework and active participation in the Übervision session. In order to receive the Aktive Teilnahme credit for the course, you should obtain at least 60% of the total points available.

Final The grade for the course is based solely on the final exam. There will be oral exams, offered either in July directly after the end of the lectures, or in September. During the exam, you should expect to encounter three different types of exercises:

- Definitions, statements and proofs of theorems.
You should know all the material presented in lectures.
- Homework exercises.
You should be able to solve all the homework exercises.
- New exercises.
You should be able to apply the theorems and methods from the course to solve exercises you have not seen before.

Literature Lecture notes will be provided as the course progresses. The following books also contain interesting material for further reading:

- N. Alon, J. Spencer: The Probabilistic Method
- R. Diestel: Graph Theory
- S. Jukna: Extremal Combinatorics
- D. West: Introduction to Graph Theory