

# Finite Geometry — Summer 2019

## Instructors

Anurag Bishnoi and Tibor Szabó.

## Course webpage

<http://discretemath.imp.fu-berlin.de/DMIII-2019/>

## Schedule

**Lectures:** Tuesdays 14:15–15:45 (Arnimallee 6, SR 09), and 16:15–17:45 (Arnimallee 3 SR 19).

**Exercises:** Every alternate Tuesday from 14:15–15:45, starting from 23rd April 2019.

## Homework

A new homework assignment will be posted every two weeks. There will be 7 exercise sheets in total. You are asked to form a pair with a classmate. Solutions should be submitted in class, before the start of the Tuesday exercise session every odd week starting from the third week. Late homework will not be accepted.

## Topics of the course

Over the course of this semester, we shall cover the following topics:

- *Finite affine and projective spaces:* basic theory of abstract planes, latin squares, ovals and hyperovals, blocking sets, Kakeya and Nikodym sets
- *Spectral methods:* strongly regular graphs, Moore graphs, eigenvalues of graphs, Hoffman's bound, expander mixing lemma
- *More finite geometries:* generalized quadrangles, abstract polar spaces, quadrics, generalized polygons

## Literature

Recommended texts:

- Simeon Ball, *Finite Geometry and Combinatorial Applications*

- Bart De Bruyn, *An introduction to Incidence Geometry*
- G Eric Moorhouse, *Incidence Geometry*
- Chris Godsil and Gordon Royle, *Algebraic Graph Theory*

Further reading:

- P. Dembowski, *Finite Geometries*
- J. . W. P. Hirschfeld and J. Thas, *Projective Geometries over Finite Fields*
- A. Beutelspacher and U. Rosenbaum, *Projective Geometry: From Foundations to Applications*

## Prerequisites

Students should be familiar with basic graph theory and combinatorics, linear algebra, and finite fields.

## Aktive Teilnehme

You are asked to form homework pairs and in fact strongly encouraged to think about/work on the problems in study groups with your classmates. Each exercise sheet will consist of around 6 exercises, and as a pair you clearly mark 3 exercises that you want to be graded. When submitted, each solution should indicate who from the pair was the writer of the particular solution. For the active participation credit you need to be the scribe of at least 7 submitted exercises. You also need to receive at least 60% of the points and present the solutions of at least two exercises at the blackboard.

## Final exam

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/October. 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.