

Discrete Mathematics II

Winter 2013-2014

Instructor: Juanjo Rué
Office: Arnimallee 3, 204
Phone: 838 - 75383
E-mail: jrue@zedat.fu-berlin.de

Place: Arnimallee 6, SR 032 Seminarraum

Lectures: Tuesday and Wednesday, 08:00-10:00

Problems: Tuesday 12:00-14:00

Office Hours: Tuesday 10:00-12:00 in the instructor's office. Meetings can be also arranged by appointment.

Topics of the course

- Graph theory: planarity and graph minors, connectivity, matchings, colouring, Hamiltonicity, flows.
- Extremal Combinatorics: set systems, forbidden substructures, Regularity Lemma, Roth's Theorem, Ramsey Theory.
- Methods in Discrete Mathematics: probabilistic, algebraic, enumerative.

Requirement for active participation at the exercises

- There will be 13+1 sheets of exercises.
- You should try to solve and write up all exercises for yourself, because you will find some of them on the final exam. Each week submit solutions for *two* exercises, those you would want to be corrected.
- For the signature on the exercises you must achieve 60% of the total score (for each exercise the same score will be given).
- You will usually have two weeks to think about each sheet, except the first one. The new exercise sheet will normally be placed on the web shortly after the end of the Wednesday lecture. You should submit your solutions until the end of the appropriate Tuesday lecture. It is not possible to submit the solutions later.
- It would be great if you thought about and discussed the exercises in small groups. You are encouraged to submit your solutions in pairs. At the beginning of each solution note the name of the person who wrote it up; every student must write up at least *nine* times.
- Furthermore, each student must present at least *once* a correct solution at the board.

In conclusion, for the exercise session credit you need to full each of the following:

- achieving at least 60% of the point value of $2 \times 13 = 26$ homework problems,
- writing up the solutions yourself at least nine times (besides writing the name of the two authors, on each solution you should state who the scribe was),
- presenting at least once a correct solution at the board.

Final: the grade for the course is based solely on the final exam. The final takes place on **February 19th from 8:00 to 10:00**. The make-up final exam will be on **March 26th from 8:00 to 10:00**. There will be three different type of exercises at the final:

- Definitions, statement and proofs of theorems: you should know all the material presented at the lecture.
- Problems from the exercise sheets: you should know how to solve all homework exercises.
- New problems: you should be able to apply the encountered theorems and methods to solve exercises you have possibly never seen.

Bibliography: Very specific bibliography and some papers will be linked in the webpage as soon as they appear in the lectures. Some books that could help during the course are the following ones: *Matoušek, Nešetřil: Invitation to Discrete Mathematics* (basic reference), *Bollobás: Combinatorics*, *van Lint, Wilson: A course in Combinatorics*, *Lovász: Combinatorial Problems and Exercises*.

In each part we have we have the following references:

- Part 1 (Graph Theory): the basic reference in this part is *West: Introduction to Graph Theory*. We will follow it in many of the lectures. We will use also the book *Diestel: graph theory* (both in English and German), which can be downloaded from the author's webpage.
- Part 2 (Extremal Combinatorics): we will use at certain points *Jukna, Extremal Combinatorics* and also *Diestel: Graph Theory*.
- Part 3 (Methods in Discrete Mathematics): the classical reference for probabilistic methods in *Alon, Spencer: The Probabilistic Method*. We will also use *Flajolet, Sedgewick: Analytic Combinatorics* (which can be downloaded from the webpage of the first author) for enumerative methods.