Math 536 Combinatorics II, Spring 2017

Meeting time and location: MW 2:30-3:45p in MSC E406

Instructor:	Hao Huang
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Office hours:	MW 1:30–2:30.
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Textbook

Most of the topics covered in this course appear in the books listed below, especially the first one.

- N. Alon and J. Spencer, *The Probabilistic Method*, 3rd or 4th edition, Wiley.
- S. Janson, T. Luczak and A. Ruciński, *Random Graphs*, Wiley 2000.
- B. Bollobás, *Random Graphs*, second edition, Cambridge University Press 2001.

Course Goal

The purpose of this one-semester-long course is to provide a fairly complete and rigorous treatment of the fundamental theory and the applications of probabilistic methods in combinatorics, and hence it serves as a good first course for graduate students and higher level undergraduate students in mathematics, computer science, or engineering that are interested in combinatorial or graph theory. The prerequisites for this course are MATH 250 (Foundations of Mathematics), MATH 361–362 (Probability & Statistics), or equivalent courses. This means good comprehension of probability and the ability to understand and write a rigorous mathematical proof.

For some of the applications mentioned in this class, backgrounds in graph theory, algorithms, and complexity theory will be very helpful. But I will assume no knowledge of these.

Upon completion of this course, the students can expect to be able to apply probabilistic reasoning to various problems. Below is a tentative list of topics that will be covered in this course.

- Linearity of Expectation.
- Alterations.
- The second moment method.
- The Lovász Local Lemma.
- Correlation Inequalities.
- Random Graphs.
- Martingales.
- De-randomization.
- Entropy.

These probabilistic techniques are used for a wide array of applications, not just in combinatorics and graph theory, but also in discrete geometry, number theory, algorithms, and information theory. This include some classical results like graphs of high girth and high chromatic number, Erdős-Ko-Rado, Turán's Theorem, Brégman's Theorem, crossing numbers, sum-free subsets, and many other more recent development.

Grading and Homework

During the semester, there will be homework assignments. Students are required to submit their solutions to get a final grade.

The homework assignments will be posted and updated on the class webpage, and announced in the classes or sent by emails. Collaboration is allowed, but every student must write their own solution independently. ****Please note that no late homework will be accepted or credited.****.

Honor Code

All students must adhere to the provisions of the Honor Code. See the following:

`http://catalog.college.emory.edu/academic/policy/honor_code.html`

Accessibility

The Department of Mathematics and Computer Science at Emory supports equal access for students with disabilities. Any students needing special accommodations due to a disability should speak with someone in the Office of Disability Services and arrangements will be made.