

The Probabilistic Method in Combinatorics

MAT 280, Fall 2017, Chaim Even-Zohar

Probabilistic methods are central in modern Combinatorics. In a typical application, a non-constructive proof that a mathematical object with certain properties exists, is given by building an appropriate probability space in which such objects occur with a positive probability.

The goal of the course is to acquaint the students with the main tools in the field. These include: the first and second moments, the local lemma, correlation inequalities, and several measure concentration results. We'll see applications of these techniques in various areas such as Ramsey Theory, Combinatorial Geometry, the Theory of Computing, Algorithms, and more.

We'll follow the standard reference in this area: Noga Alon and Joel Spencer, *The Probabilistic Method*, 3rd edition. We plan to cover in class the main tools presented in Chapters 1–8, and discuss some classical and more recent applications of them.

Prerequisite: undergraduate background in Combinatorics and Probability.