18.997 - Probabilistic Methods in Combinatorics

Spring 2011

The probabilistic method is one of the most powerful and widely used tools in combinatorics and theoretical computer science. The essence of the approach is the following: in order to prove the existence of a combinatorial structure with certain properties, we construct an appropriate probability space and show that a randomly chosen element of this space has the desired properties with positive probability.

This course will provide an introduction to the probabilistic method, with a focus on methodology. We will illustrate the main ideas by exploring how these methods can be applied to various combinatorial problems.

Some topics which will be covered are the following:

- Linearity of expectation
- The second moment method
- The Lovasz local lemma
- Correlation inequalities
- Martingales
- Large deviation inequalities
- Janson and Talagrand inequalities
- Pseudo-randomness
- Dependent random choice

Instructor: Jacob Fox, 2-363c, fox@math.mit.edu

Time and place: TR 11-12:30, 2-105

Textbook: The Probabilistic Method, by N. Alon and J. H. Spencer, 3rd Edition, Wiley, 2008.

Grades: No exams; grades will be based on 6 problem sets.