Korea Advanced Institute of Science and Technology (KAIST)

Fall Semester 2011, Topics in Mathematics: Probabilistic Methods

This course is a gentle introduction to the probabilistic method, which is one of the most powerful and widely used tools applied in discrete mathematics. One of the major reasons for its rapid development is the important role of randomness in theoretical computer science and in statistical physics.

The basic idea of the probabilistic method can be described as follows: 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 in this space has the desired properties with positive probability.

The course covers basic probabilistic techniques (e.g. the first moment method, the second moment method, the Lovasz Local Lemma, martingales and tight concentration) and their applications (e.g. random graphs).

Instructor
Mihyun Kang
http://www.math.fu-berlin.de/~kang/

Textbook
[AS] N. Alon, J. H. Spencer, The Probabilistic Method, 3rd Edition, John Wiley & Sons, New York, 2008.

Lecture schedule
Tuesday 4:00 PM-6:30PM
Wednesday 4:00 PM-6:30PM
Thursday 4:00 PM-6:30PM

Final exam
Oral Exam

Grading
20% Homework, 80% Exam

Lecture Plan
Sept. 20: The First Moment Method ([AS] Chapter 1-2)
Sept. 21: Alterations ([AS] Chapter 3)
Sept. 22: The Second Moment Method ([AS] Chapter 4)
Sept. 27: The Lovasz Local Lemma ([AS] Chapter 5)
Sept. 28: Martingales and Tight Concentration ([AS] Chapter 7)
Sept. 29: Random Graphs ([AS] Chapter 10-11)