Statistics 900: Probability Theory and Combinatorial Optimization

Professor J. Michael Steele

Prerequisites: This course is designed for Ph. D. students with an interest in probability theory and its applications. It is expected that students will have had a graduate course in probability at the level of Statistics 530.

Course Plan: The course will begin with selected topics from the text. After developing some basic background, it will focus on more sophisticated concentration inequalities and their applications. Here is a partial (and tentative) list of topics.

- Probability and Random Graphs
  - Erdoős's "Probabilistic Method"
  - Concentration Inequalities: First Pass — Hoeffding-Azuma
  - Lovasz Local Lemma and Applications
  - FKG inequalities and the BK inequalites
- Probability and Euclidean Optimization Problems
  - The Traveling Salesman Problem and the Beardwood Halton Hammersley Theorem
  - Subadddivite Euclidian Functionals and their applications
  - Subadditive Ergodic Theory and applications
- The Objective Method
  - Aldous's Theory of the Poisson Weighted Infinite Trees
  - Applications to Matching in Complete Graphs and Binary Graphs
- The Transportation Method
  - Kantorovich Problem and its applications
  - Optimal Coupling
- Deeper Look at Concentration Inequalities
  - Marton's Information Theory Approach
  - Log Sobolev Methods
  - Elementary Gaussian Concentration

Texts: *Probability Theory and Combinatorial Optimzation*, J.M. Steele, (SIAM, 1997). Please see the book's web page for more details about the text.

Homework: Regular homework will be assigned and solutions will be provided, but homework will be self-graded.

Grading: Grades are based on a midterm (30%) and a final exam (70%)

Auditors: Auditors are welcome.

Office Hours: Monday 2:30- 3:30 Wednesday 3:00-4:00. (Please see webpage for contact information)