STATISTICS 523:
Advanced Theory of Probability
Spring 2017

Project/Paper: Information and Possible Topics

During Math/Stat 523, Spring quarter 2017, I would like each of you to write a short paper on a subject or topic of your choice in probability. The choice of topic or subject is up to you, but it should have a probability connection. Some potential or possible topics are listed below as possible starting points. I would be glad to talk to you individually (during office hours for example) about possible topics and starting points for your reading. Part of your first homework assignment of the quarter (due on Wednesday, April 5) will be to identify the topic of your project and paper. I will ask that you submit a tentative outline for your paper on Wednesday, May 3.

Paper: Your papers should be written as if you were writing for publication in one of the more theoretical probability journals such as the *Annals of Probability*, *Bernoulli*, the *Electronic Journal of Probability*, or other comparable journal. I will ask that you identify the journal for which you are writing. It is *not* required that you obtain or present new results in your papers (although it is wonderful if you do!), but you *must* write in your own words; see the the discussion in Higham's book on *plagiarism*, pages 104-105. The papers should be done in TeX or LaTeX, and should be between 8 and 15 pages in length, including references. The written papers will be due on Monday, June 5.

References:

• Higham, Nicholas J. (1998). *Handbook of Writing for the Mathematical Sciences*. SIAM.

• Krantz, Steven G. (1997). *A Primer of Mathematical Writing*. American Mathematical Society.

• N.E. Steenrod, P.R. Halmos, M.M. Schiffer, and J. A. Dieudonné (1973). *How to Write Mathematics*. American Mathematical Society.

Some Possible Topics: The following list is meant to be suggestive, and certainly does not exhaust all possible topics. Within any of these general topics you will probably need to narrow the focus of your paper and project.

- Martingale central limit theorems.
- Entropy type central limit theorems.
- Stein's method for proving combinatorial central limit theorems.
- Conditional multiplier central limit theorems: connections to bootstrap sampling.
- Brownian motion: connections with differential equations / Kac's formula.
- Brownian motion: Dyson's Brownian motion.
- Brownian excursion: combinatorial connections.
- Brownian motion: connections with shape constrained estimation.
- Inequalities and methods connected to log-concavity and the Brunn-Minkowski inequalities.
- Concentration of measure and log-Sobolev inequalities.
- Applications of concentration of measure in statistics.
- Stochastic calculus: Tanaka's formula and local time.