Introduction to Probability
Statistics W4105
Fall 2015

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Prerequisites. This is a master's level class. A solid grounding in calculus (including multivariable calculus) and linear algebra is minimally presupposed; of course, more mathematics is even better. Potential students without such grounding will have too tough a time and should take preparatory mathematics classes and/or a more elementary statistics class.

Description. Probability is the foundation on which statistics is built. The purposes of this course are 1) to introduce you to probability and 2) prepare you to take a sequel course on statistical inference (Statistics 4107).

We shall begin by covering the basic axioms of probability and using these in some simple settings. Then we will take up the idea of independence and conditional probability. Following we shall consider random variables, and the properties first of univariate discrete and continuous distributions. When we look at two or more variables, additional considerations arise, such as the relationship between the variables—conditional distributions and marginal distributions. Following these basics, we will then take up some ways of summarizing distributions, e.g., expectations and variances and, in summarizing relationships among variables, covariance and correlation. We then take up some of the more important distributions in statistics. In particular, for the discrete case, we will study the Bernoulli and binomial distributions and the generalization to the multinomial distribution, also the Poisson distribution. For continuous distributions, we take up the univariate and bivariate normal, the Gamma and the Beta distribution. In statistical applications, sums of independent random variables (for example, a sample average is such a sum, divided by sample size) are extremely important and characterizing the properties of these in large samples justifies many of the ways in which we make inferences in statistics. Thus, we take up the properties of these sums in large samples, focusing on stating laws of large numbers and also a simple central limit theorem.

Grading. There will be about 4 or 5 homeworks (20%), a midterm (35%), and a cumulative final (45%). Makeup exams are not given. The final examination will be given at the time set by the registrar's office; this time is typically announced at the end of October/beginning of November.

Required Text DeGroot, M. and Schervish, M. *Probability and Statistics, Fourth Edition.* Addison-Wesley.
Helpful note: if you can locate an international edition (try Abe Books web site), you might save some money.