

Statistics 430: Probability

Spring 2021

Professor:

Jian Ding, *dingjian@wharton.upenn.edu*.

Prerequisite:

The class assumes knowledge of multivariate calculus at the level of Math 114. In particular students are expected to have some familiarity with multiple integrals. From univariate calculus you will certainly need to know integration by parts.

Topics: I expect to cover the following topics.

Quick review of some basic combinatorics including binomial and multinomial coefficients.

Axioms of probability. Inclusion-exclusion principle.

Conditional probability and Bayes formula. Conditional probability as a probability.

Independence and conditional independence.

Random variables as mappings from the sample space to real line. Probability mass functions and densities of discrete and continuous random variables. Expectation of a function of a single random variable or of several random variables. Variance and covariance. Variance of sums of random variables.

Binomial, Poisson, Geometric random variables. Additional discrete random variables.

Poisson approximations and some discussions of the Poisson process.

Normal random variables.

Exponential random variables and Gamma random variables.

Joint distribution of random variables. Conditional and marginal distributions.

Uniform distribution for a single variable and for multiple variables.

Conditional expectation and conditional variance.

Understanding $\mathbb{E}(Y) = \mathbb{E}(\mathbb{E}(Y|X))$ in a variety of contexts.

Sums of independent random variables.

Moment generating functions.

Bivariate normal random variables.

Weak law of large numbers. Central limit theorem.

Textbook:

No required textbook. Lecture notes will be posted. Homework assignments will be posted in pdf files.

Recommended references:

1, Probability textbook by Pitman.

2, Introduction to Probability by David F. Anderson, Timo Seppäläinen and Benedek Valkó.

Graduate Student Teaching Assistant:

TBA.

Office Hours:

Monday 3:30pm - 4:30pm, Tuesday 10:00am -11:45 am and Wednesday 3:30pm-4:30pm.

Undergraduate Teaching Assistants:

TBA.

Grades:

Based on a mixture of homework (50%) and a final exam (50%).

Homework policies:

Homework will typically be assigned on Mondays (due the following Monday at 11:59pm) and Wednesdays (due the following Wednesday at 11:59pm).

Discussions for homework with other people are allowed, with two constraints: (i) you must acknowledge the discussion and provide details when you submit your homework; (ii) you should write up your solutions separately at a time when you are not talking to other people.

If you believe that there has been an error in the grading of any homework you may submit a regrade request within a week of the homework scores being posted.