9/9/2019

SYLLABUS

STAT/SURV 410, Sec. 0701: Introduction to Probability

Prof. Eric Slud **MW 5-6:15pm, MTH 0303, Fall 2019**

Course Description: This course is a solid introduction to the formulation and manipulation of probability models, leading up to proofs of limit theorems: the law of large numbers and the central limit theorem. It is a gateway course to serious study of mathematical statistics and graduate-level applied statistics. Key topics characterizing this course as opposed to more elementary introductions to Probability include joint distributions and change-of-variable formulas for them; conditional expectation and its applications; and the formal proofs of limit theorems.

Instructor: **Prof. Eric Slud**, 2314 Kirwan Hall (Math Building), ×5-5469, `evs@math.umd.edu`
Office hours M 11, W10 or by appointment.

Textbook: Sheldon Ross, **A First Course in Probability**, 10th ed., Pearson

We will cover Chapters 1-8, and some of Chapter 10 on Simulation as time permits.

Course Policies: The class will adhere to the **university policies** on course conduct, attendance, grading, academic integrity, and disability support.

Homeworks should be handed in as hard-copy in-class, except for possible occasional due-dates on Fridays when you may submit them electronically, via email, in pdf format. A percentage deduction (at least 15%) of the overall HW score will generally be made for late papers. Some of the problems will have answers in the back of the book, and some will be similar to problems that can be found in the 9th or earlier editions of the book. You may of course use such information as aids, but your submitted HW solutions must show all work, self-contained, to get full credit.

Course requirements & grading: Graded homework sets (one every 2 weeks, 5 altogether) together will count fpr 20% of the course grade; (2 or 3) 20-minute quizzes in-class that will together count 10%; 2 tests will count 20% each; and a final exam will count 30%.

Tentative Test dates: In-Class Test 1 on Chapters 1-4: Monday, October 7; In-Class Test 2 on Chapters 5-7, Wednesday November 20.

Final Exam will be in-class 4-6pm on Saturday, December 14.

Course Schedule, Fall 2019

Date	Topics
08/26/19	(Begin Ch. 1) introduction on notions of probability; counting principle; permutations and combinations
08/28/19	examples of counting problems; combinatorial proof of binomial theorem; multinomial coefficients
09/04/19	(Begin Ch. 2) Sample Spaces, Events, Probability Axioms; Discrete probability models
09/09/19	Gambling-game probabilities (equiprobable sample spaces); countable additivity
09/11/19	(Ch. 3) Conditional probability, Bayes formula; independent events
09/16/19	Joint independence; games with multiple (maybe infinite) stages. (Begin Ch. 4) Discrete random variables
09/18/19	Probability mass & distribution functions; expectation of discrete r.v. Bernoulli, binomial, geometric, negative binomial random variables
09/23/19	Expectation of function of random variable; mean, variance
09/25/19	Properties of expectation; moments; distribution of function of r.v.
10/02/19	Distribution of function of random variable; examples of mass function calculations; expectation of sums of 2 or more random variables
10/07/19	Properties of distribution functions; Limits of distributions, Poisson rv's; Origins of common discrete probability distributions.
10/09/19	In-Class Test 1, covering Chapters 1-4.
10/14/19	(Begin Ch. 5) Continuous random variables. Density, distribution function, expectation and variance. Uniform random variable.
10/16/19	Properties of expectation, expectation of function of random variable. Exponential & Weibull random variables; hazard rates.
10/21/19	Densities defined from calculus: Gamma, Beta, Cauchy, Normal. Mean and variance formulas.

10/23/19	Normal as limit of Binomial (DeMoivre-Laplace limit theorem). Distribution of function of continuous random variable.
10/28/19	(Ch. 10, 1 lecture) Uniform as building-block of computer-generated random variables. Simulations. Idea of gambling-game simulations.
10/30/19	(Begin Ch. 6) Joint distribution of random variables. Joint prob. mass functions and densities. Independent random variables.
11/04/19	Sums of independent random variables: convolution; properties of specific density types: binomial, negative binomial, normal, Gamma
11/06/19	Change of Variable formula for joint densities. Distributional calculations via change of variables.
11/11/19	Conditional densities and expectations; discrete & continuous examples.
11/13/19	Expectations of sums. General properties of expectations, in discrete, continuous and mixed cases.
11/18/19	Covariances, correlations, moments. Moment generating functions.
11/20/19	In-class Test 2, covering Chapters 5-7.
11/25/19	Multivariate normal distribution. Linear combinations of normal variables. Normality and independence. Joint density of sample mean & variance.
12/02/19	(Begin Ch. 8) Chebychev-Markov Inequality and (Weak) Law of Large Numbers.
12/04/19	Convergence in Distribution. Continuity Theorem (Lemma 3.1, p. 398) and Central Limit Theorem.
12/09/19	Consequences of Limit Theorems. Simulation illustrations. Definition of convergence with probability 1.
12/11/19	EXAM REVIEW, tentatively 5-6:30pm Wednesday 12/11.