MATH 3160: Probability (UConn, Fall 2015)

Course schedule (Last updated: August 24, 2015)

This document supplements the information given on our websites: http://homepages.uconn.edu/jpchen/math3160f15/ and http://www.math.uconn.edu/~troby/math3160f15/. Unless otherwise noted, all readings refer to Ross, 9th edition. It is strongly recommended that you read the assigned sections before the indicated lecture. It is essential that you watch the posted videos listed above the day of the lecture.

For a condensed review of the material, refer to the lecture notes by Prof. Richard **Bass**, posted under "Resources" on the Piazza course page. The sections relevant to each class are listed in [square brackets] in the "Readings" column.

Wk	Date	Topic(s)	Readings [Review]	HW
1	T 9/1	Class intro. Counting principle. Permutations.	1.1–1.3	
	Video	Permutations & combinations.		
	R 9/3	Combinations and binomial coefficients: $\binom{n}{k}$. The Binomial Thm. Khayyam-YangHui-Pascal triangle.	1.3–1.4	
2	Video	From binomials to multinomials.		
	T 9/8	Multinomials. The birthday problem. Counting 5-card poker hands.	1.5 [Bass §1]	
	Video	More counting problems.		
	R 9/10	Compositions (aka "# integer solutions of equations"), multistep problems. [End combinatorics.] The probability setup.	1.6–2.2	**HW1 Due**
3	Video	Kolmogorov's axioms of probability.		
	T 9/15	Consequences of the axioms. The inclusion-exclusion identity. Applications to dice and cards.	2.3–2.5; also Bass pp. 5–7	
	Video	Uniform discrete probability problems.		
	R 9/17	Examples: Urn games, the birthday problem, and the matching problem.	2.5 (skip 5o) [Bass §2]	**HW2 Due**
4	Video	Coin flips as independent Bernoulli trials.		
	T 9/22	(Finish) uniform discrete probability problems. Independence of events. Bernoulli trials.	3.4 (up to 4h), Bass §3	
	Video	What is conditional probability?		
	R 9/24	Examples. The multiplication rule. The matching problem revisited. Conditional probability is a probability.	3.2, 3.5 (theo. disc.)	**HW3 Due**
5	Video	Bayes' formula		
	T 9/29	Examples. The Monty Hall problem.	3.3, 3.4 (4i–4ℓ)	
	Video	Gambler's ruin		
	R 10/1	Finish conditional probability. Start discrete random variables. pmf and cdf.	4.1 (skip 1e), 4.2, 4.10 [Bass §4]	**HW4 Due**
6	Video	Random variables and their expectations.		
	T 10/6	Expectation of a discrete rv. Linearity of expectation. Expectation of a function of a rv (LOTUS). Variance & higher moments.	4.3, 4.4, 4.5, 4.9	
	R 10/8	**Midterm exam 1**	**1.1–3.5**	

7	Video	Bernoulli, binomial, geometric, negative binomial.		
	T 10/13	Bernoulli and binomial distributions. The geometric distribution and its memoryless property. The negative binomial distribution. The Banach match problem.	4.5, 4.6 (skip 4.6.2), 4.8.1–2 [Bass §5]	
	Video	Poisson		
	R 10/15	The hypergeometric distribution. The binomial approx to the hypergeometric. The Poisson distribution. Examples. The Poisson approx to the binomial.	4.8.3, 4.7 (skip 4.7.1) [Bass §6]	**HW5 Due**

This is a good time to brush up on multivariable calculus! How do you evaluate $\displaystyle\int_0^\infty e^{-x^2}\,dx$ *?*

8	Video	Discrete, continuous, or neither?		
	T 10/20	Continuous distributions: pdf, cdf, expectation. The uniform distribution.	5.1–3 [Bass §7]	
	Video	Properties of the normal distribution.		
	R 10/22	The normal distribution and the Z-table. The de Moivre-Laplace central limit theorem. Examples. Confidence interval and margin of error in opinion polling.	5.4, 5.4.1, Bass §8–9	**HW6 Due**
9	Video	The exponential distribution and its memoryless property.		
	T 10/27	Examples. The gamma distribution. Connecting with the Poisson process.	4.7, 5.5 (skip 5.5.1) 5.6.1, 9.1	
	Video	Transformation of random variables		
	R 10/29	Examples. How to code the exponential distribution. The Cauchy distribution (and why it is special).	5.7, 5.6.3	**HW7 Due**
10	Video	Joint probability distributions		
	T 11/3	Examples. Marginal and conditional distributions.	6.1, 6.4, 6.5 [Bass §10]	
	Video	(In)dependence of random variables		
	R 11/5	Examples. Buffon's needle problem. Sums of independent rv's. Convolutions.	6.2 (skip 2e, 2g), 6.3.1–6.3.4	**HW8 Due**
11	Video	Order statistics (min and max)		
	T 11/10	Finish sums of independent rv's. Examples on order statistics. Transformation of jointly distributed random variables.	6.6, 6.7	
	R 11/12	**Midterm exam 2**	**4.1–6.2**	
12	Video	The indicator function trick		
	T 11/17	Moments of the number of occurring events. The matching problem revisited. The coupon collector's problem.	7.2–7.3	
	Video	Covariance		
	R 11/19	Covariance. Variance of sums. Correlation.	7.4	**HW9 Due**
13		*Thanksgiving Break*		
14	Video	Conditional expectations.		
	T 12/1	Examples. Adam's & Eve's Laws.	7.5 [Bass §12]	
	Video	Moment generating functions.		
	R 12/3	Examples and applications.	7.7, Bass §13	**HW10 Due**

15	Video	LLN & CLT		
	T 12/8	Markov's ineq., Chebyshev's ineq., and Chernoff bound. Proof of the weak LLN. Strong LLN.	8.2, 8.5	
	Video	Proof of CLT		
	R 12/10	How to use the CLT. Jensen's ineq. Why hedge funds exist. A cautionary tale from the subprime mortgage crisis of 2008.	8.3, 8.4, 8.5 [Bass §14]	**HW11 Due**
16	Check!	**Comprehensive final exam** (with a moderate emphasis on materials covered after Midterm 2)	**Everything discussed**	