

PROBABILITY THEORY Syllabus

Instructor: Prof. J. Huston McCulloch
Office: 452 Arps Hall. Phone: 2-0382. E-mail mcculloch.2@osu.edu
Office Hours: MW 2:00-3:00 or drop by

Prerequisites: Math 153 or equivalent. Not open to students with credit for Stat 520 or 620. Note that this course is designed for first year PhD grad students, and should more appropriately have a 700 number. Undergrads often find it difficult. In particular, it is not a prequel to Econ 641-642.

Required Text: Casella and Berger, *Statistical Inference*, Duxbury Press, second ed., 2002. (The first, 1990 edition is very similar, but section numbers differ slightly, and a few topics have been added). Readings from Henderson & Quandt, Varian and other material will be provided in class, or available on the class website at www.econ.ohio-state.edu/jhm/econ640/.

Course Objective: To provide Ph.D. students in Economics and related fields a rigorous introduction to the theory of probability, as the first part of the first year econometrics sequence. We will cover most of the material in the first 5 chapters of Casella and Berger, with supplementary lectures on expected utility, risk aversion, portfolio theory, stable distributions, and diffusion processes.

Teaching Assistant: Ms. Yoon Hae Oh will be in charge of grading homework and available during office hours for help with homework. Office Hours TR 9:30-10:30, Arps 469. E-mail oh.171@buckeyemail.osu.edu. Office phone 292-8863.

Grading:	Homework:	20%
	Midterm	40%
	Final	40%

Homework must be handed in on time for full credit, though partial credit will be given for late homework. (By next class = 80%; by last class of quarter = 50%.)

A few of the homework exercises will use Matlab at a basic level.

Outline

Date	Topic	Reading(s)
9/22	Axiomatic Probability Theory	§ 1.1-1.2
9/27	Conditional Prob., Independence, Bayes' Rule, Monty Hall game	1.3-1.4
9/29	Distribution and Density functions: uniform, exponential, Pareto, $N(0,1)$, logistic, Cauchy dists; ordinal probability.	1.5-1.6, 3.3, lecture notes
10/4	Location-scale families, Fns of a RV, RNGs, GOF tests	2.1, 3.5
10/6	Moments, Moment Generating Fn., Delta Method	2.2-2.3, 5.5.4
10/11	Expected Utility, von Neumann - Morgenstern Axioms,	Henderson & Quandt H/O.
10/13	Jensen's Inequality, Risk Aversion, Diminishing Marginal Utility Use and of Ordinal Marginal Utility,"	Thm 4.7.7, McCulloch, "Austrian Theory of the Marginal http://econ.ohio-state.edu/jhm/econ640/
10/18	Pratt-Arrow measures of RA; CRRA, CARA utility fns; Tobin's Theorem	Mas-Colell Micro Thy Ch. 6, Tobin Thm H/O, http://econ.ohio-state.edu/jhm/econ640/
10/20	Chebychev inequality, Leibnitz's Rule, Characteristic Fns.	3.6, 2.4, 2.6
10/25	Midterm (Monday) Through 10/20.	
10/29	Bivariate RV's, independence. Covariance & correlation Cauchy Schwartz Ineq., Convolutions, Stable dists.	4.1-4.2, Thm 5.2, 4.5, 4.7, Stable dist. H/O, http://econ.ohio-state.edu/jhm/econ640/
11/2	Discrete distributions – binomial, geometric, Poisson, inverse binomial, hypergeometric, ergodic frog hop process	3.1-3.2
11/4	Poisson generated processes; exponential, gamma dists.	3.3
11/9	Normal and related distributions – log-normal, χ^2 MV Normal Dist., risk-neutral option pricing	more 3.3 4.5, 4.6
11/10	Diversification, Efficient portfolios, Modigliani/Miller Thm, CAPM	lecture notes

11/15	Law of Iterated Expectations, Martingales, Mixture dists, Bivariate transformations, Jacobian determinant	4.3-4.4, 4.7
11/17-	Random samples – Sample mean and variance. Convergence in probability, Almost sure convergence, Consistency. Law of Large Numbers.	5.1, 5.2, 5.5.1, 5.5.2
11/22	Classic Central Limit Theorem. Normal approx. to sum Generalized CLT, more Stable distributions	5.5.3, Example 3.3.2, Stable H/O cont'd.
11/24	Sampling from normal distribution – χ^2 again, Student t, Snedecor's F	more 3.3, 5.3
11/29	Diffusion Processes, Itô's Lemma, Black/Scholes option pricing	lecture notes, Black & Scholes, "The Pricing of Options and Corp. Liabilities," JPE, 1973, 637-54.
12/1	Order Statistics, Beta Distribution	3.4, 5.4, 7.2.3
12/7	(Monday) 7:30 – 9:18 AM, Scheduled FINAL. (Will try to reschedule to 930.)	

Lighter Reading (not required)

Huff, Darrell. *How to Lie with Statistics*. Norton, 1954.

Ziliak, Stephen T. "Guinnessometrics: The Economic Foundation of 'Student's' t," *Economic Perspectives*, Fall 2008, 199-216.

Heavier Reading (not required)

McCulloch, "The Risk-Neutral Measure and Option Pricing under Log-Stable Uncertainty," 2003, <http://econ.ohio-state.edu/jhm/papers/rnm.pdf>.

Disability Services: Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; <http://www.ods.ohio-state.edu/>.

UNIVERSITY STATEMENT ON ACADEMIC INTEGRITY (ACADEMIC MISCONDUCT)

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's *Code of Student Conduct*, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's *Code of Student Conduct* is never considered an 'excuse' for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

The Committee on Academic Misconduct:
www.oaa.osu.edu/coam/home.html

Ten Suggestions for Preserving Academic Integrity:
www.oaa.osu.edu/coam/ten-suggestions.html

Eight Cardinal Rules of Academic Integrity:
www.northwestern.edu/uacc/8cards.html

Code of Student Conduct:
www.studentaffairs.osu.edu/resource_csc.asp