



Empirical Economic Analysis

EC303

Instructor Info —



Alex Hoagland



Monday & Tuesday, 10am – 11:45am. Book a time [here](#).



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Course Info —



Prerequisites: EC101 or EC111; EC102 or EC112



Monday, Wednesday, Friday



3:35–4:25pm



CAS 226

TA Info —



Ji Min Oh



Office Hrs: **TBD**



Location: **TBD**



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Overview

This course is designed to familiarize you with modern statistical theory as well as practical analytical and numerical skills. During the semester, we will:

- Summarize and visualize data in meaningful ways
- Introduce basic probability theory
- Discuss inference in three ways:
 - *Estimation*: how to estimate a population characteristic by a point or an interval using a sample of data
 - *Testing*: how to test statistical hypotheses on population characteristics
 - *Regression*: how to analyze relationships between 2+ economic variables

This course belongs to the theoretically advanced track (EC303-304) of the statistics/econometrics sequence. The emphasis of this class will be jointly divided between understanding statistical theory and applying it to economic data. We will use Stata for numerical applications. No prior preparation in statistics is required, but familiarity with linear algebra and calculus is assumed. This course fulfills a single unit in the [Quantitative Reasoning I](#) BU Hub area.

Material

Required Texts

Jay L. Devore and Kenneth N. Berk, *Modern Mathematical Statistics with Applications*, 2nd edition, 2012, Springer.

Online access to the text is available from Springer Link [here](#) or the BU library.

Course Website

The course website is on Blackboard Learn. Announcements, grades, and other course materials will be posted there. Please check the website frequently, or enable email notifications to be alerted of new material.

Additional References and Materials

An good advanced textbook on the theory used in this course is Casella, G., and R. Berger's *Statistical Inference*, 2nd Edition, 2002. Online Stata resources are available at <http://www.ats.ucla.edu/stat/stata/> (by UCLA IDRE).

Grading Scheme

15%	Problem Sets
50%	2 Midterm Exams, 25% Each
35%	Final Exam

Due dates for problem sets and exam dates can be found on the calendar.

Problem Sets: There will be 6 problem sets, the lowest of which will be dropped. You may absolutely work in groups, but everyone must turn in an original copy, written in their own words and listing group members. I post solutions to problem sets online immediately, so late problem sets will not be accepted. You will use Stata on the problem sets, but do not need to turn in your code.

Exams: There will be 2 midterms (not cumulative) and a final (cumulative). All exams will be in-class and closed-book, and will favor theoretical results over empirical applications. You may bring a simple scientific calculator to use (I cannot provide any myself); cell phones or other electronic materials will not be permitted. Makeup exams will only be given if absence is due to medical reasons (official medical certificate required).

A note on grading: If you have questions on grading (both problem sets and exams), you must contact the TA within a week after you receive your homework or exams. There will be no regrading of exams written in pencil.

FAQs

? Do I have to buy the textbook? What about Stata?

! There is an online version of the textbook available. Stata is available on any campus computer, but if you want to use it from your laptop, you will need to purchase it. Please let me know if you have any issues.

? What will the assignments and exams look like? Where does Stata fit?

! Assignments will be about a 40-60 split between implementing theory (e.g., proofs) and analyzing data (e.g., running regressions, graphing, etc.). Exams will be very similar to the theoretical sections of the homework, but may also ask more descriptive questions about Stata implementation. No Stata code will be tested in this course.

? What will be the most exciting part of this course?

! Hold out for the Bayesian Inference section. That stuff is wild.

? When will I use this in real life?

! Even if you aren't planning on being an econ/stats major, statistics is *everywhere*! Knowing how to visualize, analyze, and present data will do everything from ward you against fake news to help you convince your roommate to do their share (or more!) of the dishes.

Using Stata

The numerical analysis done in this course will use the software Stata. Stata is available for use at any computer on campus, or can be purchased online at <http://www.stata.com/order/new/edu/gradplans/student-pricing/>. For the class you should purchase Stata/IC 15 (\$198 for a perpetual license, \$89 for a one-year license, \$45 for a six-month license) which has no limitations on the size of the data set used and will be very useful in future courses and projects. You will also be using Stata heavily in EC304.

We will start using Stata right away, so students should be sure to buy their copy of Stata within the first week of class. I have posted some tutorials on Stata on the course website; in addition, the TAs for this course will be hosting a crash course in Stata this month (more info on Blackboard).

Respect & Inclusivity

I consider this classroom to be a place where you will be treated with respect, and I promise to ensure that this is obtained for *any* individual, regardless of any characteristic or belief. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Part of that respect includes respect for learning. This is a small class, which typically will require more participation and interaction per student. Many (if not all) of us will be covering these concepts for the first time. I hope that we can foster an environment where we all feel comfortable making mistakes together as we proceed.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact BU's Office of Disability & Access Services at 617-353-3658, aslods@bu.edu, or <https://www.bu.edu/disability/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please e-mail me as soon as possible in order to set up a time to discuss your learning needs.

My Constant Snacking

I am a Type 1 Diabetic, which means I must frequently monitor my blood sugar levels and attempt to keep them under control through a mix of taking insulin and snacking. I will periodically have to eat during class. Please let me know if you have a serious enough allergy that I should avoid bringing a certain kind of food as a snack. If, in a very unlikely scenario, I become lethargic, incoherent, or pass out, help me to eat a snack if possible before calling for other medical attention.

Academic Integrity

I feel very strongly about academic integrity. For this course, Academic Honesty includes

- Submitting original homework that is visibly distinct from your group members' and any online solutions
- Honest behavior in exams
- Fair requests for re-grading or academic leniency

You are expected to be familiar with the University Academic Conduct Code, which you can find at <https://www.bu.edu/academics/policies/academic-conduct-code/>. By turning in an assignment or exam, you are attesting to me that your work is original work that truthfully represents the time and effort applied. Violations of the Code are most serious and will be handled in a manner that fully represents the extent of the Code and that befits the seriousness of its violation. Typically, this will involve losing credit in full for any inauthentic assignment or exam, as well as any reporting to administration I am required to complete.

Tentative Class Schedule

Probability Theory: Glimpsing Data Through Randomness

Chapters 1 through 4

Week 1	Sep 4: Introduction & Data Visualization	Syllabus, Ch. 1.1 — 1.2	
	Sep 6: Methods of Summarizing Data	Ch. 1.3 — 1.4	
Week 2	Sep 9: Math Review	Online Notes	
	Sep 11: Basics of Probability	Ch. 2.1 — 2.2	
	Sep 13: Basics of Probability	Ch. 2.2 — 2.3	
Week 3	Sep 16: Joint and Conditional Probabilities	Ch. 2.4	
	Sep 18: Bayes' Theorem & Independence	Ch. 2.5	
	Sep 20: <u>No class</u>		
Week 4	Sep 23: <u>No class</u>		
	Sep 25: Random Variables and Moments	Ch. 3.1 — 3.2	Problem Set 1 Due
	Sep 27: Expectations & Moments	Ch. 3.3 — 3.4	
Week 5	Sep 30: Special Discrete Distributions	Ch. 3.5, 3.7	
	Oct 2: Continuous Random Variables	Ch. 4.1 — 4.2	
	Oct 4: Special Continuous Distributions	Ch. 4.3 — 4.5	

Sampling & Estimation: Letting the Data Talk

Chapters 5 through 8

Week 6	Oct 7: Transformations of RVs	Ch. 4.7	
	Oct 9: Jointly Distributed RVs	Ch. 5.1	Problem Set 2 Due
	Oct 10: Make-up Class—Midterm 1 Review	Time/Location TBA	
	Oct 11: Midterm 1	<u>Chapters 1 through 4</u>	
Week 7	Oct 14: <u>No class, Columbus Day</u>		
	Oct 15: Correlation & Covariance	Ch. 5.2	
	Oct 16: Conditional Distributions	Ch. 5.3	
	Oct 18: Transformations of Joint Distributions	Ch. 5.4 — 5.5	<i>May become a catch-up day</i>
Week 8	Oct 21: Sampling Statistics	Ch. 6.1	
	Oct 23: Large Sample Theory	Ch. 6.2 (and appendix)	
	Oct 25: Special Sampling Distributions	Ch. 6.1, 6.3, 6.4	

Week 9	Oct 28: Point Estimation I	Ch. 7.1	Problem Set 3 Due
	Oct 30: Estimation Methods	Ch. 7.2	
	Nov 1: Estimation Issues	Ch. 7.3 — 7.4	
Week 10	Nov 4: Confidence Intervals	Ch. 8.1 — 8.2	
	Nov 6: Special Confidence Intervals	Ch. 8.3 — 8.4	
	Nov 8: <u>Catch-up and/or Start Chapter 9</u>		
Testing & Inference: Interpreting the Data			
Chapters 9 through 12			
Week 11	Nov 11: Hypothesis Testing I	Ch. 9.1	Problem Set 4 Due
	Nov 13: Hypothesis Testing III	Ch. 9.2 — 9.3	
	Nov 14: Make-up Class—Midterm 2 Review	Time/Location TBA	
	Nov 15: Midterm 2	<u>Chapters 5 through 8</u>	
Week 12	Nov 18: <i>p</i> -values in Testing	Ch. 9.4 — Ch 9.5	
	Nov 20: Bayesian Inference I	<u>Online Notes</u>	
	Nov 22: Bayesian Inference II	<u>Online Notes</u>	
Week 13	Nov 25: Bayesian Inference III	<u>Online Notes</u>	
	Nov 27: <u>No classes, Thanksgiving</u>		
	Nov 29: <u>No classes, Thanksgiving</u>		
Week 14	Dec 2: Linear Regression	Ch. 12.1 — 12.2	Problem Set 5 Due
	Dec 4: Inferences, Predictions, & Correlations	Ch. 12.3 — 12.5	
	Dec 6: Multiple Regression Analysis	Ch. 12.7 — 12.8	
Week 15	Dec 9: <u>Review and Catch Up</u>		Problem Set 6 Due
	Dec 11: <u>Review and Catch Up</u>		
Week 16	Date, Time, Location: Final Exam	<u>Cumulative</u>	