Department of Economics, USC, Fall 2023
Econ 611, Probability and Statistics

1 Instructor

Instructor

Geert Ridder

E-mail: ridder@usc.edu

Office hours: By appointment, please send me an e-mail message.

TA

TBA

2 Organization of the course

There are two lectures: Tuesday and Thursday, 2-4pm, PST.

There will be weekly assignments that will be graded and will count towards the grade.

The grade for this course will be based on a midterm (1/3) and a final (1/3) and graded assignments (1/3). The date of the midterm will be announced later. The final is Thursday, December 7, 2-4 p.m.

This course has a web site on Blackboard. I will post lecture notes, assignments etc. on the site.

3 Textbook

There is no required textbook for this course. Useful references are

George Casella and Roger L. Berger

Statistical Inference

Duxbury Press, ISBN 0-534-11958-1

Larry Wasserman

All of Statistics

Springer, ISBN 0-387-40272-1

Bradley Efron and Trevor Hastie

Computer Age Statistical Inference: Algorithms, Evidence, and Data Science

Can be viewed at: https://web.stanford.edu/∼hastie/CASI/order.html

I will not follow these books to the letter. These books appeal to different audiences. Casella and Berger is comprehensive and has more material, but some of you may prefer the more direct and concise approach of Wasserman. Efron and Hastie explore the interface between mathematical statistics and data science.

In the probability theory part of the course the level of discussion will be more advanced than in these books. If you need another source besides my lecture notes you may consult

Jeffrey S. Rosenthal

A First Look at Rigorous Probability Theory, Second Edition

World Scientific, ISBN 981-270-370-5

Those of you with a strong math background may find it useful to consult

David Pollard

A User's Guide to Measure Theoretic Probability

Cambridge University Press, ISBN 0-521-00289-3

I will provide a full set of lecture notes that I have posted on Blackboard. The notes will be updated during the course.

4 Brief overview

This course gives an introduction to probability theory and mathematical statistics. This is not a course on data analysis. The goal is to provide the necessary background for subjects that require knowledge of probability and statistics. Obviously, econometrics is such a subject, but economic theory also relies

on probability and statistics, as it often considers behavior under uncertainty. Knowledge of advanced calculus is a prerequisite. I will also use mathematical analysis concepts, and you will have a real advantage in this course if you have taken real analysis. For instance, you should know what open and closed sets of real numbers/vectors are. Some of the distribution theory will use matrix/vector multiplication and some other elementary matrix operations.

The course consists of two parts. The first part gives an introduction to probability theory. I will deviate from the usual rather informal treatment of that subject and introduce it using the mathematical theory of measure and integration. Some knowledge of measure and integration theory is important to understand the asymptotic approximations that are extensively used in econometrics and other fields.

Although the lecture notes give full mathematical proofs in appendices to the lectures, I will skip most of these proofs. I encourage you to study them anyway.

The second part of the course deals with mathematical statistics. The emphasis is on concepts and not on recipes. Probability theory is about the description and analysis of probability models, while mathematical statistics is about learning about a probability model using data generated by that model. By the end of the course you should understand the concepts of sampling and sampling distributions and how these concepts are used in statistical inference, i.e. the learning of features of the assumed probability model.

As a special case we study inference in the linear regression model.

Overview of lectures

1. An introduction to probability theory
2. Random variables and expectation
3. Densities and distributions
4. Independence
5. Conditioning
6. Special probability distributions
7. Sampling and sampling distributions
8. Summarizing sample data
9. Point estimation
10. Hypothesis testing and confidence intervals
11. The linear regression model and its inference

5 Statements

STUDENTS WITH DISABILITIES

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Website for DSP and contact information: (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) ability@usc.edu.

ACADEMIC INTEGRITY

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

EMERGENCY PREPAREDNESS/COURSE CONTINUITY IN A CRISIS

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies. See the university's site on Campus Safety and Emergency Preparedness.