Statistical Inference (Econ-180.636)

Fall 2025

Lectures: Thursday 1:00 pm – 4:00 pm

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This course is a semester-long introduction to probability theory and statistical inference for graduate students in economics. It is a required course for all Ph.D. students in economics. It introduces basic probability theory and statistical inference, which forms the foundation for later courses in econometrics and plays an important role in modeling the economic behavior studied in micro- and macro-economics.

We will introduce basic concepts and theorems in probability theory and statistics, explore how to use them to understand and model randomness and its distribution in a quantitative model, and discuss ways to conduct statistics inference with random samples in applied works.

In addition to these theoretical tools, there will be some exercises on programming, particularly in the second part of the class when we talk about statistical estimation and inferences. For example, we will simulate artificial random data and see how estimators and test statistics behave. Students are encouraged to complete these programming exercises using Python Jupyter Notebook. A good tutorial for Python can be found at https://datascience.quantecon.org, The material covered in this tutorial should be sufficient for the purpose of this class. Alternatively, students can also hand in their exercises in Matlab which is also a popular language in the field of Economics.

I will provide a handout that summarizes all the materials covered in the lecture. You can find this handout on Canvas. You are recommended to print these handouts beforehand, and bring them with you when attending the lecture. Students are expected to understand all concepts, examples, theorems, and their proof in the lecture notes, except for a few exceptions explicitly stated in the lecture notes. It is also required to have a copy of the following textbook, as it provides extra details for the concepts covered in the lecture.

Recommended reading: *Statistical Inference*, 2nd Edition, by George Casella and Roger Berger.

Other recommended reading: The above book is the only required textbook. For students interested in more advanced topics, I recommend the following references:

- *Introduction to the Mathematical and Statistical Foundations of Econometrics* by Herman Bierens
- *A User's Guide to Measure Theoretic Probability* by David Pollard
- *Asymptotic Statistics* by van der Vaart

The prerequisites for the course are basic statistics, some linear algebra and a solid foundation in calculus. Some understanding of the measure theory and the real analysis is helpful but not required.

Homework: Problem sets will be assigned each week and posted on Canvas. The grade on the two lowest problem sets will be dropped. I encourage you to collaborate on the homework, but everyone must write up his/her own solutions. If the TA finds that two people have identical solutions, then both will receive a grade of zero.

Exams: There will be a midterm and a final exam. The form of the exams, the dates and times are to be determined.

Requirements: Since this is supposed to be a graduate-level class, there will be no classroom attendance requirement. Although I strongly encourage you to attend the lecture, but there is no point to force you to do so if you can study more efficiently by yourself. However, you are required to understand and master all concepts and theories covered in the lecture notes. You should also submit your homework and attend the exams on time.

Grades:

Homework: 20 percent

Midterm Exam: 40 percent

Final Exam: 40 percent

Course Calendar

Date of Class	Material to Cover	Problem Set
28-Aug	Chapter 1: Section 1 - 3	PS1: due on 4-Sep
4-Sep	Chapter 1: Section 4 - 5	PS2: due on 11-Sep
11-Sep	Chapter 2 and Chapter 3: Section 1 - 2	PS3: due on 18-Sep
18-Sep	Chapter 3: Section 3 - 4 and Chapter 4: Section 1 - 4	PS4: due on 25-Sep
25-Sep	Chapter 4: Section 5 - 7	PS5: due on 2-Oct
2-Oct	Chapter 5: Section 1 - 4	PS6: due on 09-Oct
TBD	Midterm Exam: covering Chapter 1 - 4	
09-Oct	Chapter 5: Section 5 - 7	PS7: due on 23-Oct

16-Oct	Fall Break: no class	
23-Oct	Chapter 5: Section 8 - 11	PS8: due on 30-Oct
30-Oct	Chapter 6: Section 1 - 4	PS9: due on 6-Nov
6-Nov	Chapter 6: Section 5 and Chapter 7: Section 1-3	PS10: due on 13-Nov
13-Nov	Chapter 7: Section 4 - 6	PS11: due on 27-Nov
27-Nov	Chapter 8: Section 1 - 4	PS12: due on 4-Dec
4-Dec	Chapter 8: Section 5 - 6	PS13: due on 09-Dec
TBD	Final Exam: covering Chapter 1 - 8	