Course Description

Maura Mezzetti

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Instructor

Instructor	Maura Mezzetti
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Website	https://sites.google.com/site/mezzettimaura/
Office Hours	Via teams on request or Room P2-S58: Tuesday 11:00-13.30 and 16:00-17:30 I will always be available
Teaching Assistant	Stylianos Daskalinas stylianosdaskalinas@gmail.com
Course Website	http://www.economia.uniroma2.it/

Teams Class

MEZZETTI-8010848-STATISTICS 2025-2026

Course Objectives

The course is designed to provide an in-depth knowledge of the main aspects of statistical inference (point estimation and hypothesis testing), both from a conceptual and a technical point of view. Optimality principles are discussed for the main procedures, based on the properties of estimators and on the likelihood principle. The implications of such concepts are analyzed both within the finite sample case and in the asymptotic setting. Principles and techniques discussed in the course are fundamental to the development and analysis of statistical models in econometrics.

Program

The course is an introduction to the fundamental principles and tools of statistical inference, i.e. how to draw conclusions from data subject to random variation. Topics include: random sampling; principles of data reduction; point estimation; hypothesis testing; confidence intervals.
In Particular:

- Brief review of probability
- Random samples and asymptotic methods
  - Sampling and sums of random variables
  - Laws of large numbers and central limit theorem
- Principles of Data Reduction: Sufficiency
- The Likelihood Principle: the Likelihood Function.

Program

- Point Estimation
  - Methods of Finding Estimators: Methods of Moments, Maximum Likelihood Estimators.
  - Finite Sample Properties: Unbiasedness and Efficiency.
  - Asymptotic Properties: Asymptotic Unbiasedness, Consistency and Efficiency.
  - Fisher Information and the Cramer-Rao theorem.
- Hypothesis Testing
  - Methods of Finding Tests: Neyman Pearson lemma
  - Large sample tests: Likelihood Ratio Tests, Score Test, Wald Test
  - Methods of Evaluating Tests: the Power Function, Most Powerful Tests.
  - The p-value.
- Special topics (if time permits)
  - Robustness
  - Notes on Bayesian Inference
  - Non Parametric Inference: Kolmogorov-Smirnov Test

Course Materials: Text Book

Required: G. Casella, R.L. Berger. Statistical inference. Cengage Learning, 2021.

Suggested:
- K. Knight. Mathematical statistics. Chapman Hall/CRC (2000).
- N. Mukhopadhyay. Probability and Statistical Inference, Dekker-CRC Press (2000).

Introductory readings:
- T. H. Wonnacott and R. J. Wonnacott. Statistics: Discovering Its Power. John Wiley Sons; International Ed edition (1982).
- A. Mood, F. Graybill and D. Boes. Introduction to the theory of statistics, McGraw-Hill (1974).

Course Materials: Course Website

- http://www.economia.uniroma2.it/
- You can find
  - Lecture slides
  - Exercises suggested
  - Past Exams
  - Tutorials slides

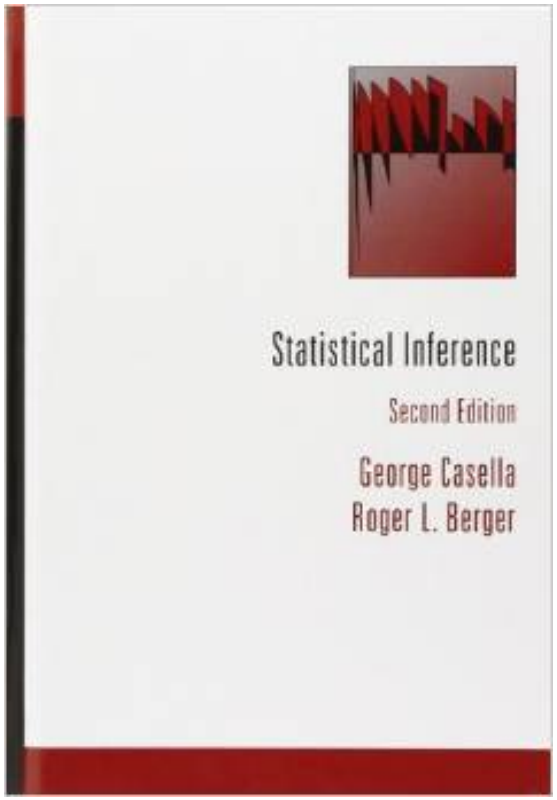
Strongly suggested: JOIN TEAMS

Course Materials: Course Website

- SLIDES are always posted in advanced
- Section: HOMEWORKS: Every week exercised will be posted: STRONGLY encouraged to SOLVE in advance (No grading)

Text Book

Strongly Suggested to use the book to prepare the exam, website materials consist only on notes, that cannot replace the book!
`Casella_Berger_Statistical_Inference.pdf`



Use of Matlab

- Some exercises will be solved using Matlab (the use during class is encouraged)

Detailed Program

September			
Monday	15th	9-11	Course Introduction and Brief review of probability
Tuesday	16th	9-11	Property of Random Sample
Wednesday	17th	9-11	Property of Random Sample
Monday	22nd	9-11	Exercise Matlab: Random Sample
Tuesday	23rd	9-11	Introduction to Inference and Sufficiency
Wednesday	24th	9-11	Inference and Point Estimation
Thursday	25th	9-11	Tutorials
Monday	29th	9-11	Methods of Evaluating Estimators
October			
Tuesday	30th	9-11	MOM Maximum Likelihood Estimators
Wednesday	1st	9-11	Maximum Likelihood Estimators
Thursday	2nd	9-11	Tutorials
Monday	6th	9-11	Fisher Information and Cram´er-Rao Bound
Tuesday	7th	9-11	Comparison among estimators and optimality results
Wednesday	8th	9-11	Exercises on point estimation
Thursday	9th	9-11	Tutorials
Monday	13th	9-11	Confidence Intervals
Tuesday	14th	9-11	Hypothesis Testing: Methods of Finding Tests
Wednesday	15th	9-11	Neyman-Pearson Lemma
Thursday	16th	9-11	Tutorials
Monday	20th	9-11	Large-Sample Inference
Tuesday	21th	9-11	Review of all the theory
Wednesday	22nd	9-11	Simulation of Exam
Thursday	23rd	9-11	Tutorials

Evaluation

- **Final Exam** will be written, will consist on exercises and open-ended questions on theory, covering all the program. Score will up to 30. *Only in the winter Session:* maximum 2 points can be added solving one homework assignments and by taking one or more surprise multiple choice tests during the class.
- **In case of Covid Emergence** Exam will be online and an oral exam is required
- **Assignments**
  1. Due October 13th

Evaluation

There are no different assessment method/exam program between attending and non attending students, but attendance is strongly recommended.

In MaterialeDidattico/PastExams you can find some examples of past exam, NOTICE: the more recent the test, the higher the probability that the difficulty level matches whose of future tests.

Exam Rules

- In order to take an exam, students MUST register on-line via the web-site http://delphi.uniroma2.it. Students who are not registered for the scheduled exam are not admitted to the exam.
- Grades cannot be "frozen" by postponing registration to a future exam date: BELATED REGISTRATION OF GRADES IS NOT ALLOWED!
- In the case of failure the failing grade will not be recorded and the DELPHI system will display *ritirato* - (withdrawn)
- Requests to negotiate or change a grade will not be considered.

Zero tolerance policy in relation to cheating in examinations.

- Any act of academic dishonesty will result in a failing grade. This failing grade may be registered in the student's record, implying that it will affect the grade point average . Some examples of academic dishonesty include (but are not limited to!!!):
  1. use of mobile phone, cellular, tablets during the exam
  2. use of textbooks, classnotes or any other unauthorized materials during the exam;
  3. access unauthorized computing and communication devices during the exam (mobile phones, smartwatches etc...);
  4. collaboration and communication with other students during the exam;
  5. looking at other student's papers during the exam;
  6. taking the exam for someone else or having someone take the exam for you;
  7. obtaining exam questions in advance through illicit means, etc...
- Please note that claiming *ignorance* of these rules will not be

Advices for Students:

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- **Don't Get Lost** Ask questions in class. If something isn't clear to you, it probably isn't clear to others either. Most questions arise when the instructor has not made a connection clear or has accidentally omitted an important point. Your question may give the instructor a chance to explain more clearly.
- If you have difficulty with problems, ask for help from the instructor or a TA. By then it may be too late.
- **Office Hours** They are there for your benefit. Take advantage of them!