Proof-Based Math Readings
Session: Large Sample Theory
2024 Summer

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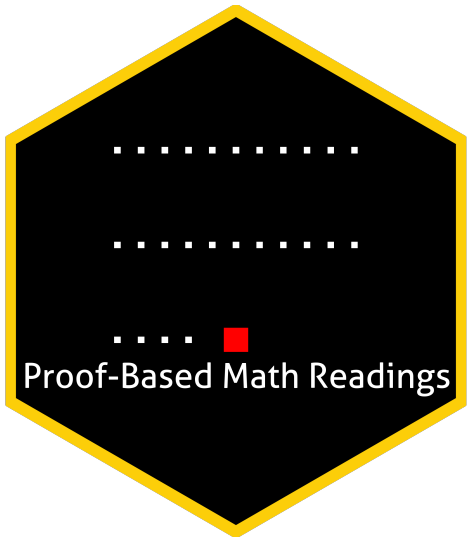

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0 Motivation

- *Proof-Based Math Readings* is a free and independent online reading group where we study mathematics required in economics master's/PhD programs using an intuitive approach.
- This session of the reading group is on *Large Sample Theory*.

1 Prerequisites

- CGPA: 3.00/4.00. Proof Techniques and Real Analysis resources below.
- Please use the Application Form to join our reading group; you will receive a response within a week.

2 Format

- This session takes 12 weeks. We do not have face-to-face/online meetings due to the size of the group.
- We discuss the topics and exercises at Proof-Based Math Readings [Discord].
- Members are expected to read the chapters, and watch the chapter videos from the book's playlist.

3 Resources

3.1 Main Book and Main Book's Playlist

Elements of Large-Sample Theory - E. L. Lehmann (1999) is our main book for this session because it is well-written and well-structured.

Jingyi Jessica Li's playlist is our main playlist because her narrative is just great.

- Elements of Large-Sample Theory - E. L. Lehmann (1999) → Easier but doesn't contain solutions
- Elements of Large-Sample Theory - E. L. Lehmann (1999, Errata)
- A Course in Large Sample Theory - Thomas S. Ferguson (2002) → Harder but contains solutions
- A Course in Large Sample Theory - Thomas S. Ferguson (2002, Errata)
- A Course in Large Sample Theory - Thomas S. Ferguson (2002, Playlist by Jingyi Jessica Li)
- A Course in Large Sample Theory - Thomas S. Ferguson (2002, Notes by Jingyi Jessica Li)

3.2 Supplementary

3.2.1 Large-Sample Theory

- Notes for a Graduate-Level Course in Asymptotics for Statisticians - David R. Hunter (2024)
- Understanding Convergence Concepts: A Visual-Minded and Graphical Simulation-Based Approach - P. Micheaux, B. Liquet (2009)

3.2.2 Proof Techniques

- Book of Proof - Richard Hammack (3.3 Edition, 2022)
- Book of Proof - Richard Hammack (3.3 Edition, 2022, Playlist by Jeremy Teitelbaum)
- Book of Proof - Richard Hammack (3.3 Edition, 2022, Playlist by Michael Penn)

3.2.3 Real Analysis

- Basic Analysis I: Introduction to Real Analysis - Jiri Lebl (Version 6.1, 2024)
- Basic Analysis I: Introduction to Real Analysis - Jiri Lebl (Version 6.1, 2024, Playlist by Casey Rodriguez)
- Introduction To Metric Spaces - Paige Bright (2023)

4 Reading Schedule

- **ELST** is the abbreviation of **Elements of Large-Sample Theory - E. L. Lehmann (1999)**.

ELST, Chapter 1: Mathematical Background — **Week 01-02**

1.1 The concept of limit
1.2 Embedding sequences
1.3 Infinite series
1.4 Order relations and rates of convergence
1.5 Continuity
1.6 Distributions

ELST, Chapter 2: Convergence in Probability and in Law — **Week 03-04-05-06**

2.1 Convergence in probability
2.2 Applications
2.3 Convergence in law
2.4 The central limit theorem
2.5 Taylor's theorem and the delta method
2.6 Uniform convergence
2.7 The CLT for independent non-identical random variables
2.8 Central limit theorem for dependent variables

ELST, Chapter 3: Performance of Statistical Tests — **Week 07-08-09**

3.1 Critical values
3.2 Comparing two treatments
3.3 Power and sample size
3.4 Comparison of tests: Relative efficiency
3.5 Robustness

ELST, Chapter 4: Estimation — **Week 10-11-12**

4.1 Confidence intervals
4.2 Accuracy of point estimators
4.3 Comparing estimators
4.4 Sampling from a finite population

5 Further Readings (Optional)

Asymptotic Theory for Econometricians - Halbert White (Revised Edition, 2000)