

# Proof-Based Math Readings

## Session: Large Sample Theory

2024 Summer

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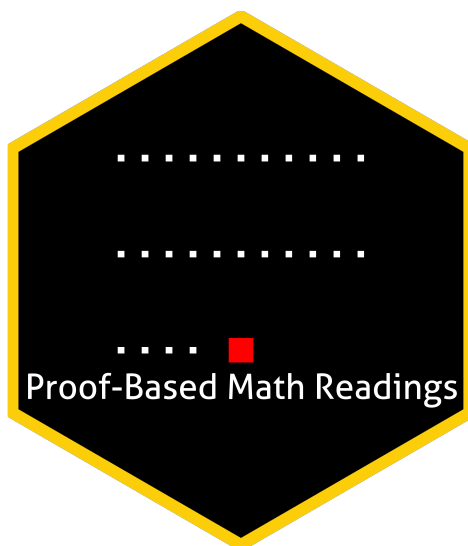
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## 0 Motivation

- *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 and Real Analysis books/playlists listed below.
- Please use the  **Application Form** to join our reading group anytime.
- Applicants are informed about their application results within a week via email.







## 2 Format

- This session takes 12 weeks.
- We discuss the topics/exercises that we struggle with at  **Proof-Based Math Readings [Discord]**.
- We do not have face-to-face/online meetings due to the size of the group.
- 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** 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 to read
-  **Elements of Large-Sample Theory - E. L. Lehmann (1999, Errata)**
-  A Course in Large Sample Theory - Thomas S. Ferguson (2002) → Harder to read
-  **A Course in Large Sample Theory - Thomas S. Ferguson (2002, Errata)**
-  **Large Sample Theory - Jingyi Jessica Li (Playlist, 2021)**
-  **Large Sample Theory - Jingyi Jessica Li (Notes, 2021)**

### 3.2 Supplementary



#### 3.2.1 Proof

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

#### 3.2.2 Real Analysis

-  **Basic Analysis I: Introduction to Real Analysis [Volume I] - Jiri Lebl (Version 6.0, 2023)**
-  **Real Analysis - Casey Rodriguez (2020, Companion playlist)**
-  **Introduction To Metric Spaces - Paige Bright (2023)**


#### 3.2.3 Large-Sample Theory

-  **Notes for a Graduate-Level Course in Asymptotics for Statisticians - David R. Hunter (2024)**
-  **Asymptotic Theory for Econometricians - Halbert White (Revised Edition, 2000)**

## 4 Reading Schedule


- ELST is the abbreviation of **E**lements of **L**arge-**S**ample **T**heory - E. L. Lehmann (1999).

### ELST, Chapter 1: Mathematical Background

Week 01-02 


The concept of limit  
Embedding sequences  
Infinite series  
Order relations and rates of convergence  
Continuity  
Distributions

### ELST, Chapter 2: Convergence in Probability and in Law

Week 03-04-05-06 


Convergence in probability  
Applications  
Convergence in law  
The central limit theorem  
Taylor's theorem and the delta method  
Uniform convergence  
The CLT for independent non-identical random variables  
Central limit theorem for dependent variables

### ELST, Chapter 3: Performance of Statistical Tests

Week 07-08-09 

Critical values  
Comparing two treatments  
Power and sample size  
Comparison of tests: Relative efficiency  
Robustness

### ELST, Chapter 4: Estimation

Week 10-11-12 

Confidence intervals  
Accuracy of point estimators  
Comparing estimators  
Sampling from a finite population