Proof-Based Math Readings
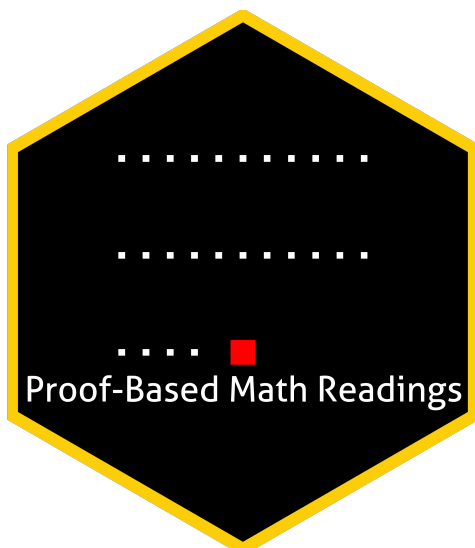# Session: Optimization
2024 Fall

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Click here for the most recent versions of the syllabuses

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Proof-Based Math Readings

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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 *Optimization*.

1 Prerequisites

- CGPA: 3.00/4.00
- 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 from the book.

3 Resources

3.1 Main Book and Main Book's Playlist

A First Course in Optimization Theory by Rangarajan K. Sundaram is our main book because it is well-written and well-structured.

📘 A First Course in Optimization Theory - Rangarajan K. Sundaram (1996)

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 to Basic Analysis I)

▶ Introduction To Metric Spaces - Paige Bright (2023)

4 Reading Schedule

AFCOT is the abbreviation of **A First Course in Optimization Theory - Rangarajan K. Sundaram (1996)**.

📅 **Week 01-02**

📕 AFCOT, Appendix A: Set Theory and Logic: An Introduction
📕 AFCOT, Appendix B: The Real Line
📕 AFCOT, Appendix C: Structures on Vector Spaces
📕 AFCOT, Chapter 1: Mathematical Preliminaries

📅 **Week 03-04**

📕 AFCOT, Chapter 2: Optimization in $\mathbb{R}^n$

📅 **Week 05-06**

📕 AFCOT, Chapter 3: Existence of Solutions: The Weierstrass Theorem
📕 AFCOT, Chapter 4: Unconstrained Optima

📅 **Week 07-08**

📕 AFCOT, Chapter 5: Equality Constraints and the Theorem of Lagrange
📕 AFCOT, Chapter 6: Inequality Constraints and the Theorem of Kuhn and Tucker

📅 **Week 09-10**

📕 AFCOT, Chapter 7: Convex Structures in Optimization Theory
📕 AFCOT, Chapter 8: Quasi-Convexity and Optimization

📅 **Week 11-12**

📕 AFCOT, Chapter 11: Finite-Horizon Dynamic Programming
📕 AFCOT, Chapter 12: Stationary Discounted Dynamic Programming