Proof-Based Math Readings
Session: Optimization
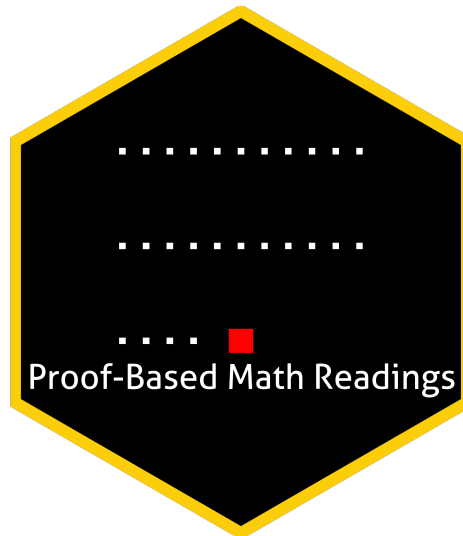## 2025 Spring

Zeki Akyol[*]
Department of Economics
Istanbul Technical University
Click here for the most recent versions of the syllabuses

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Proof-Based Math Readings

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[*]zekiakyol.com

0 Motivation

- *Proof-Based Math Readings* is a free, independent online reading group where we study the mathematics required for economics master's and PhD programs through an intuitive approach. Active since May 2023.
- This session of the reading group is on *Optimization.*

1 Prerequisites

- Proof Techniques 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.
- Members read the main book and discuss the topics/exercises in the Proof-Based Math Readings Discord 🎮.

3 Resources

3.1 Main Book and Main Book's Playlist

A First Course in Optimization Theory - Rangarajan K. Sundaram (1996) is our main book because it is well-written and well-structured.

- 📖 A First Course in Optimization Theory - Rangarajan K. Sundaram (1996)
- 📖 A First Course in Optimization Theory - Rangarajan K. Sundaram (1996, Solutions by Frederick Robinson)
- 📖 A First Course in Optimization Theory - Rangarajan K. Sundaram (1996, Solutions by Paolo Pin)

3.2 Supplementary

3.2.1 Optimization

- ▶️ Foundations for Optimization - Mark Walker (2020)
- ▶️ Optimization - Mark Walker (2020)

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

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

📖 **AFCOT**   **Week 01-02** 📅

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

📖 **AFCOT**   **Week 03-04** 📅

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

📖 **AFCOT**   **Week 05-06** 📅

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

📖 **AFCOT**   **Week 07-08-09** 📅

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

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📖 **AFCOT**   **Week 10-11-12** 📅

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

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5   Further Readings (Optional)

📖 Optimization by Vector Space Methods - David G. Luenberger (1997)
▶️ Optimization by Vector Space Methods - David G. Luenberger (1997, Playlist by Peter Galbacs)