Proof-Based Math Readings
Session: Optimization
2025 Spring

Zeki Akyol*
Department of Economics
Istanbul Technical University
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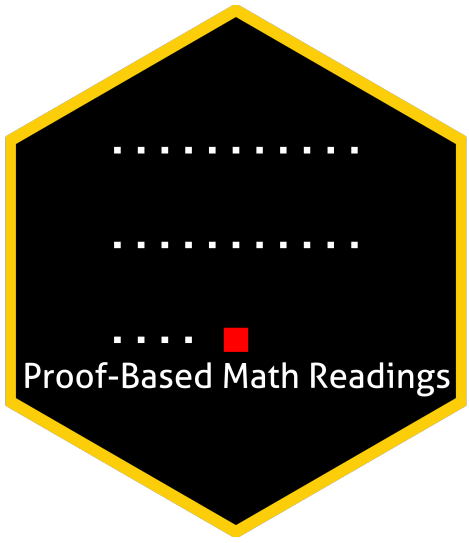

*zekiakyol.com

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. 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.
- We discuss the topics and exercises at Proof-Based Math Readings [Discord].
- 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 - 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

AFCOT **Week 10-11-12**

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

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)