# Proof-Based Math Readings Session: Optimization\*

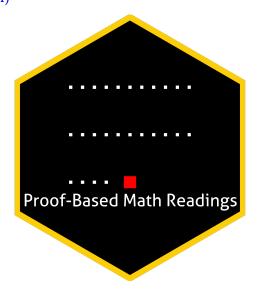
### Zeki Akyol

Department of Economics Istanbul Technical University Click here for the most recent version

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<sup>\*</sup>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 (3.4 Edition, 2025)
- Book of Proof Richard Hammack (3.4 Edition, 2025, Playlist by Jeremy Teitelbaum)
- Book of Proof Richard Hammack (3.4 Edition, 2025, 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).

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  $\mathbb{R}^n$ 

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

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)