

# Proof-Based Math Readings

## Session: Optimization

### 2024 Fall

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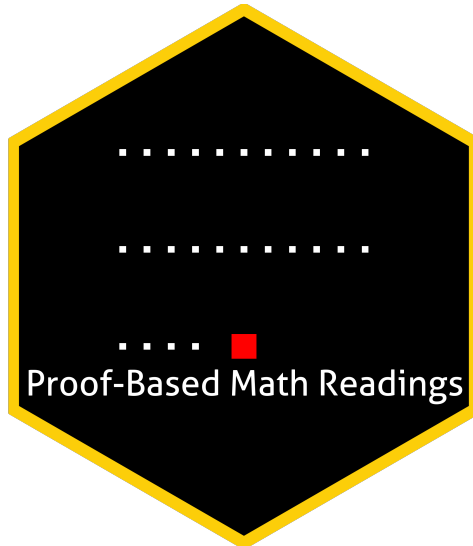
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## 0 Motivation

- *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 *Optimization*.

## 1 Prerequisites

- CGPA: 3.00/4.00
- Please use our  **Application Form** to join our reading group anytime.
- Applicants will be informed about their application results within a week via email.

## 2 Format

- This session will last 12 weeks.
- We will discuss the topics/exercises that we struggle with at  **Proof-Based Math Readings [Discord]**.
- We will not have face-to-face/online meetings due to the size of the group.
- Members are expected to read the chapters from the book's playlist.

## 3 Resources [All are open-access]

### 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 a 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)

 Book of Proof - Richard Hammack (3.3 Edition, 2022, Companion workbook by Justin Wright)

#### 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

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

### 📅 Week 01-02

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

### 📅 Week 03-04

- 📖 AFSOC, Chapter 2: Optimization in  $\mathbb{R}^n$

### 📅 Week 05-06

- 📖 AFSOC, Chapter 3: Existence of Solutions: The Weierstrass Theorem
- 📖 AFSOC, Chapter 4: Unconstrained Optima

### 📅 Week 07-08

- 📖 AFSOC, Chapter 5: Equality Constraints and the Theorem of Lagrange
- 📖 AFSOC, Chapter 6: Inequality Constraints and the Theorem of Kuhn and Tucker

### 📅 Week 09-10

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

### 📅 Week 11-12

- 📖 AFSOC, Chapter 11: Finite-Horizon Dynamic Programming
- 📖 AFSOC, Chapter 12: Stationary Discounted Dynamic Programming