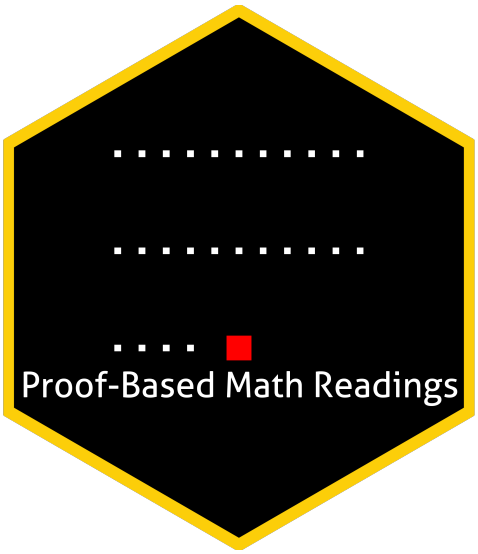
Proof-Based Math Readings
Session: Proof Techniques
2023 Summer

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

Version: 24 August 2023, 12:29 PM

Table of contents



*zekiakyol.com

0 Motivation

- *Proof-Based Math Readings* is an independent online reading group where we study mathematics required in economics master's/PhD programs using an intuitive approach.
- This first session of the reading group is on *Proof Techniques*.

1 Prerequisites

- CGPA: 3.00/4.00
- Please apply by uploading your CV and transcript to this Google Form until 23:59, 04 June 2023.
  Please upload your CV and transcript as **NameSurname.pdf**, not **CV.pdf**.
  Students who applied will be informed about their application results via email at 10:00, 06 June 2023.

2 Format

- This session will last 6 weeks from 12 June 2023 to 23 July 2023.
- 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 size of the group.
- Members are expected to read the chapters, and watch the chapter videos from the book's playlist.

3 Resources [All are open-access]

3.1 Main Book and Main Book's Playlist

Book of Proof by Richard Hammack is our main book because it is a well-written and well-structured pedagogical masterpiece. It is also open-access and provides detailed solutions for odd-numbered exercises at the end of the book.

Jeremy Teitelbaum's playlist on Book of Proof is our main playlist because his narrative is just great.

- Book of Proof - Richard Hammack (3.3 Edition, 2022)
- Book of Proof - Richard Hammack (3.3 Edition, 2022, Companion playlist by Jeremy Teitelbaum, Chapter 1-12)

3.2 Supplementary

3.2.1 Proof

In case we need to watch a proof topic from another instructor, we have 2 additional companion playlists.
Because our main playlist does not cover Chapter 13-14, we will cover theese chapters from Penn's playlist.

- Book of Proof - Richard Hammack (3.3 Edition, 2022, Companion playlist by Michael Penn, Chapter 1-14)
- Book of Proof - Richard Hammack (3.3 Edition, 2022, Companion playlist by Valerie Hower, Chapter 1-12)
- Book of Proof - Richard Hammack (3.3 Edition, 2022, Companion workbook by Justin Wright)

3.2.2 Calculus

In case we need to remember a topic from calculus, we can use these playlists.

- Essence of Calculus - 3Blue1Brown (2023)
- Single Variable Calculus - David Jerison (2006)
- Multi Variable Calculus - Denis Auroux (2007)

4 Reading Schedule

I recommend this study routine:

1) We read the chapter from the main book.
2) We watch the main playlist of the chapter.
3) We solve odd-numbered exercises and check their solutions at the end of the main book.
4) We solve even-numbered exercises in the main book.
5) If we cannot solve/understand an exercise, we can discuss the exercise in our Discord server.
6) We move on to the next chapter of the main book.

Week 01 — **12 June - 18 June**

- Book of Proof, Chapter 1: Sets
- Book of Proof, Chapter 2: Logic
- Book of Proof, Chapter 3: Counting

Week 02 — **19 June - 25 June**

- Book of Proof, Chapter 4: Direct Proof
- Book of Proof, Chapter 5: Contrapositive Proof
- Book of Proof, Chapter 6: Proof by Contradiction

Week 03 — **26 June - 02 July**

- Book of Proof, Chapter 7: Proving Non-Conditional Statements
- Book of Proof, Chapter 8: Proofs Involving Sets
- Book of Proof, Chapter 9: Disproof
- Book of Proof, Chapter 10: Mathematical Induction

Week 04 — **03 July - 09 July**

- Book of Proof, Chapter 11: Relations
- Book of Proof, Chapter 12: Functions

Week 05-06 — **10 July - 23 July**

These two chapters are essential for real analysis, so they are more challenging than the previous ones. We first read Chapter 14, then Chapter 13.

- Book of Proof, Chapter 14: Cardinality of Sets
- Book of Proof, Chapter 13: Proofs in Calculus

5 Further Readings & Playlists (Optional)

If we want to solve more problems after this session, the following resources will be extremely helpful.

- Mathematical Proofs A Transition to Advanced Mathematics - Gary Chartrand, Albert D. Polimeni, Ping Zhang (**Chapter 0-14**, 4th Edition, 2018).
- Basic Analysis I: Introduction to Real Analysis [Volume I] - Jiri Lebl (**Chapter 0**, Version 6.0, 2023)
- Real Analysis - Casey Rodriguez (**Video 1-2**, 2020, Companion playlist to Basic Analysis I)