

Proof-Based Math Readings

Session: Proof Techniques

2023 Summer

Zeki Akyol*

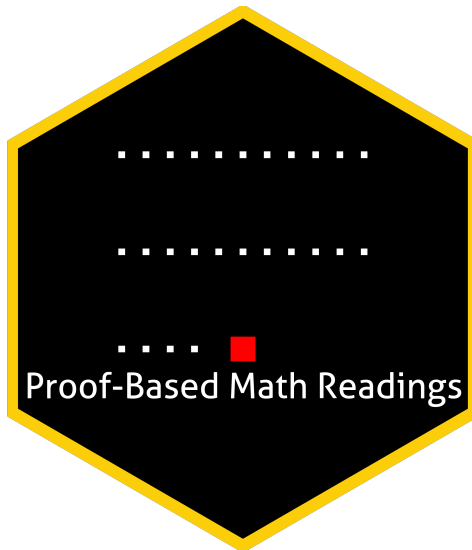
Department of Economics
Istanbul Technical University

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Table of contents

0	Motivation	2
1	Prerequisites	2
2	Format	2
3	Resources [All are open-access]	2
3.1	Main Book and Main Book's Playlist	2
3.2	Supplementary	2
3.2.1	Proof	2
3.2.2	Calculus	2
4	Reading Schedule	3
5	Further Readings (Optional)	3



*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 *Proof Techniques*.

1 Prerequisites

- CGPA: 3.00/4.00.
- Please use the  [Application Form](#) to join our reading group anytime.
- Applicants are informed about their application results within a week via email.

2 Format

- This session takes 6 weeks.
- We discuss the topics/exercises that we struggle with at  [Proof-Based Math Readings \[Discord\]](#).
- We do not have face-to-face/online meetings due to the 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 (3.3 Edition, 2022) 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 two additional companion playlists. Because our main playlist does not cover Chapter 13-14, we cover these chapters from Michael 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 \(2007\)](#)



[Sequences and Series Calculator - Geogebra](#)



[Function Graph - Geogebra](#)

4 Reading Schedule

I recommend the following study routine below:

- 1) Read a chapter from the book.
- 2) Watch the playlist of the chapter.
- 3) Solve odd-numbered exercises and check their solutions at the end of the book.
- 4) Solve even-numbered exercises in the book.
- 5) If you cannot solve/understand an exercise, discuss the exercise in our Discord server.
- 6) Move on to the next chapter of the book.

Book of Proof

Week 01 

Chapter 1: Sets
Chapter 2: Logic
Chapter 3: Counting

Book of Proof

Week 02 


Chapter 4: Direct Proof
Chapter 5: Contrapositive Proof
Chapter 6: Proof by Contradiction

Book of Proof

Week 03 


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

Book of Proof

Week 04 

Chapter 11: Relations
Chapter 12: Functions



Book of Proof

Week 05-06 

We first read Chapter 14, then Chapter 13. These chapters are more challenging than the previous ones.
Chapter 14: Cardinality of Sets
Chapter 13: Proofs in Calculus

5 Further Readings (Optional)

We can use the following book to solve more problems. Although the book is not open-access, its official slides are.

-  Mathematical Proofs A Transition to Advanced Mathematics - Gary Chartrand, Albert D. Polimeni, Ping Zhang (**Chapter 0-14**, 4th Edition, 2018)
-  [Mathematical Proofs A Transition to Advanced Mathematics - Gary Chartrand, Albert D. Polimeni, Ping Zhang \(**Chapter 0-14**, 4th Edition, 2018, Slides\)](#)

You can check out our Real Analysis syllabus at github.com/zekiakyol/proof-based-math-readings