

Proof-Based Math Readings

Session: Real Analysis

2023 Fall

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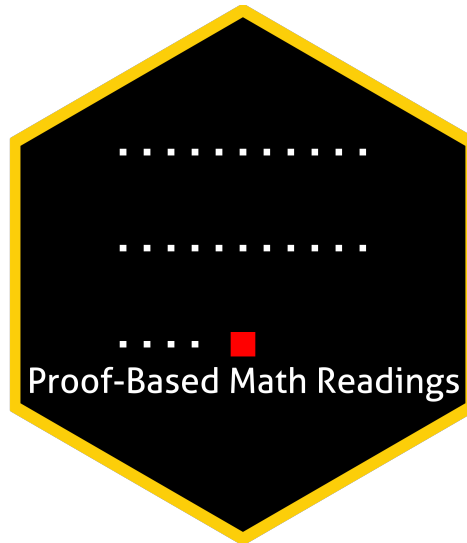
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0 Motivation

- *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 *Real Analysis*.

1 Prerequisites

- CGPA: 3.00/4.00 and **Book of Proof - Richard Hammack (3.3 Edition, 2022)**.
- 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 12 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

Basic Analysis I: Introduction to Real Analysis [Volume I] by Jiri Lebl is our main book for this session because it is well-written, well-structured, and open-access.

Casey Rodriguez's playlist is our main playlist because his narrative is just great.





-  **Basic Analysis I: Introduction to Real Analysis [Volume I] - Jiri Lebl (Version 6.0, 2023)**
-  **Real Analysis - Casey Rodriguez (2020, Companion playlist to the main book)**
-  **Real Analysis - Casey Rodriguez (2020, Companion notes to the main book)**

3.2 Supplementary




3.2.1 Real Analysis

-  **Real Analysis - Michael Penn (2021)**
-  **Real Analysis - Wrath of Math (2023)**
-  **Understanding Analysis - Stephen Abbott (2nd Edition 2016, Playlist by Marc Renault)**
-  **Understanding Analysis - Stephen Abbott (2nd Edition 2016, Solutions by Ulisse Mini, Jesse Liby)**
-  **Introduction To Metric Spaces - Paige Bright (2023)**

3.2.2 Calculus

-  **Essence of Calculus - 3Blue1Brown (2023)**
-   **Single Variable Calculus - David Jerison (2006) and Multi Variable Calculus - Denis Auroux (2007)**
-  **Sequences and Series Calculator - Geogebra and Function Graph - Geogebra**


3.2.3 Proof

-  **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)**
-  **Book of Proof - Richard Hammack (3.3 Edition, 2022, Companion playlist by Michael Penn, Chapter 1-14)**

4 Reading Schedule


- **BAI** is Basic Analysis I: Introduction to Real Analysis [Volume I] - Jiri Lebl (Version 6.0, 2023).
- We use Understanding Analysis - Stephen Abbott (2nd Edition 2016, Solutions) for exercises.

BAI, Chapter 0: Introduction

Week 01 


List of Notation (Page 309-312)
0.1 About this book
0.2 About analysis
0.3 Basic set theory

BAI, Chapter 1: Real Numbers

Week 02 


1.1 Basic properties
1.2 The set of real numbers
1.3 Absolute value and bounded functions
1.4 Intervals and the size of \mathbb{R}

BAI, Chapter 2: Sequence and Series

Week 03-04-05 


2.1 Sequences and limits
2.2 Facts about limits of sequences
2.3 Limit superior, limit inferior, and Bolzano-Weierstrass
2.4 Cauchy sequences
2.5 Series

BAI, Chapter 3: Continuous Functions

Week 06-07-08 


3.1 Limits of functions
3.2 Continuous functions
3.3 Extreme and intermediate value theorems
3.4 Uniform continuity

BAI, Chapter 4: The Derivative

Week 09-10 

4.1 The derivative
4.2 Mean value theorem
4.3 Taylor's theorem

BAI, Chapter 5: The Riemann Integral

Week 11-12 

5.1 The Riemann integral
5.2 Properties of the integral
5.3 Fundamental theorem of calculus