

Proof-Based Math Readings

Session: Real Analysis

2023 Fall

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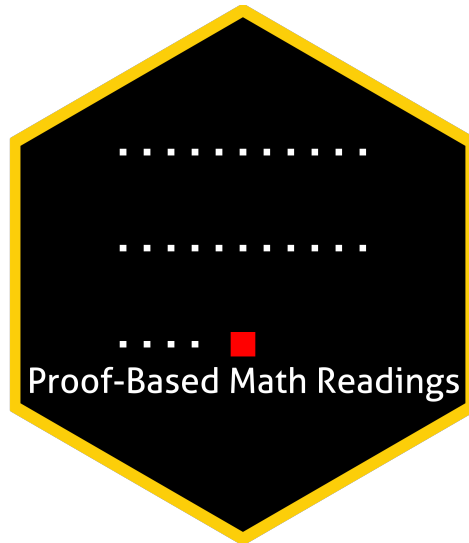
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0 Motivation

- *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 our  **Application Form** to join our reading group anytime.
- People who applied will be informed about their application results within a week via email.

2 Format




- This session will last 12 weeks from 31 July 2023 to 22 October 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 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.

Week 01-02

📅 31 July - 13 August

- 📖 **BAI, List of Notation** (Page 309-312)
- 📖 **BAI, Chapter 0: Introduction**
 - BAI, Chapter 0.1: About this book
 - BAI, Chapter 0.2: About analysis
 - BAI, Chapter 0.3: Basic set theory
- 📖 **BAI, Chapter 1: Real Numbers**
 - BAI, Chapter 1.1: Basic properties
 - BAI, Chapter 1.2: The set of real numbers
 - BAI, Chapter 1.3: Absolute value and bounded functions
 - BAI, Chapter 1.4: Intervals and the size of \mathbb{R}

Week 03-04-05

📅 14 August - 03 September

- 📖 **BAI, Chapter 2: Sequence and Series**
 - BAI, Chapter 2.1: Sequences and limits
 - BAI, Chapter 2.2: Facts about limits of sequences
 - BAI, Chapter 2.3: Limit superior, limit inferior, and Bolzano-Weierstrass
 - BAI, Chapter 2.4: Cauchy sequences
 - BAI, Chapter 2.5: Series

Week 06-07

📅 04 September - 17 September

- 📖 **BAI, Chapter 3: Continuous Functions**
 - BAI, Chapter 3.1: Limits of functions
 - BAI, Chapter 3.2: Continuous functions
 - BAI, Chapter 3.3: Extreme and intermediate value theorems
 - BAI, Chapter 3.4: Uniform continuity

Week 08-09

📅 18 September - 01 October

- 📖 **BAI, Chapter 4: The Derivative**
 - BAI, Chapter 4.1: The derivative
 - BAI, Chapter 4.2: Mean value theorem
 - BAI, Chapter 4.3: Taylor's theorem

Week 10-11

📅 02 October - 15 October

- 📖 **BAI, Chapter 5: The Riemann Integral**
 - BAI, Chapter 5.1: The Riemann integral
 - BAI, Chapter 5.2: Properties of the integral
 - BAI, Chapter 5.3: Fundamental theorem of calculus

Week 12

📅 16 October - 22 October

- 📖 **BAI, Chapter 6: Sequence of Functions**
 - BAI, Chapter 6.1: Pointwise and uniform convergence
 - BAI, Chapter 6.2: Interchange of limits