Proof-Based Math Readings
Session: Real Analysis
2023 Fall

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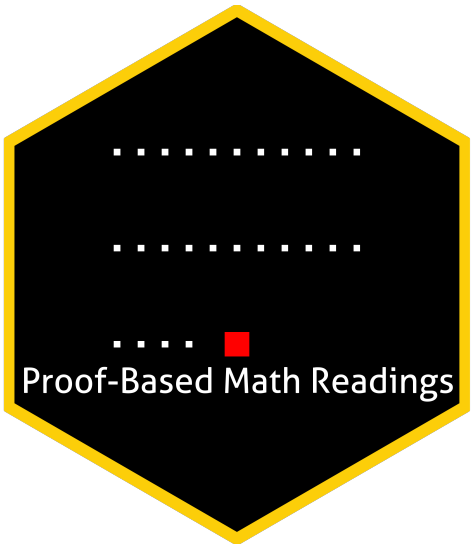

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0 Motivation

- *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.
- 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, 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