Proof-Based Math Readings
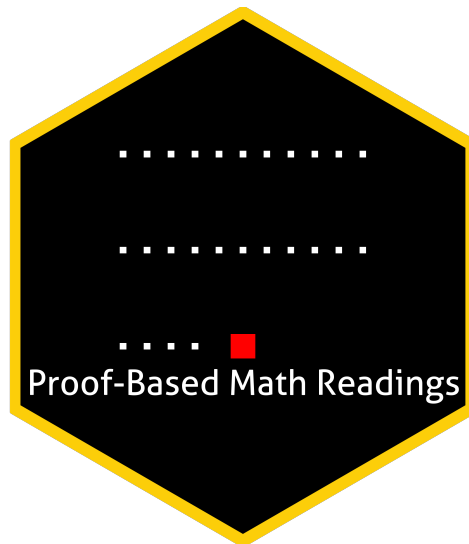# Session: Real Analysis
2023 Fall

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Click here for the most recent versions of the syllabuses

Version: 04 August 2023, 09:52 PM

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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 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 apply by uploading your CV and transcript to this 🔗 Google Form until 23:59, 28 July 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, 30 July 2023.

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 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 Renaulty)
- 📖 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)
- 🔢 Geogebra - Sequences and Series Calculator and Geogebra - Function Graph

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)
- ▶️ Book of Proof - Richard Hammack (3.3 Edition, 2022, Companion playlist by Michael Penn)

4   Reading Schedule

- BAI is the abbreviation of our main book in the previous page.
- 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

Week 03-04   📅 **14 August - 27 August**

- 📖 **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 $\mathbb{R}$
  BAI, Chapter 1.5: Decimal representation of the reals

Week 05-06   📅 **28 August - 10 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
  BAI, Chapter 2.6: More on series

Week 07-08   📅 **11 September - 24 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 09-10   📅 **25 September - 08 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 11-12   📅 **09 October - 22 October**

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