

# Proof-Based Math Readings

## Session: Real Analysis

2023 Fall

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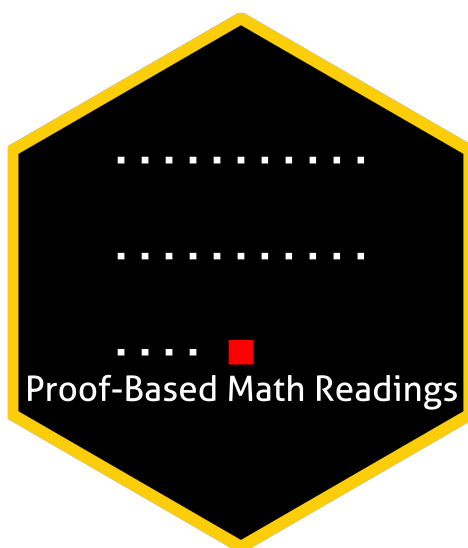
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## 0 Motivation

- *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 13 weeks from 31 July 2023 to 30 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 \(2nd Edition 2016, Playlist by Marc Renault\)](#)
- 📖 [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 \(2007\)](#)
- 📖 [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 \(3.3 Edition, 2022, Companion playlist by Jeremy Teitelbaum, Chapter 1-12\)](#)
- ▶ [Book of Proof - Richard Hammack \(3.3 Edition, 2022, Companion playlist by Michael Penn, Chapter 1-14\)](#)

## 4 Reading Schedule

- **BAI** is the abbreviation of 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 01-02-03-04

📅 31 July - 27 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  $\mathbb{R}$
  - 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 09-10-11

📅 25 September - 15 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
- 📖 **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 12-13

📅 16 October - 30 October

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