

# Proof-Based Math Readings

## Session: Topology

2023 Winter

**Zeki Akyol\***

Department of Economics

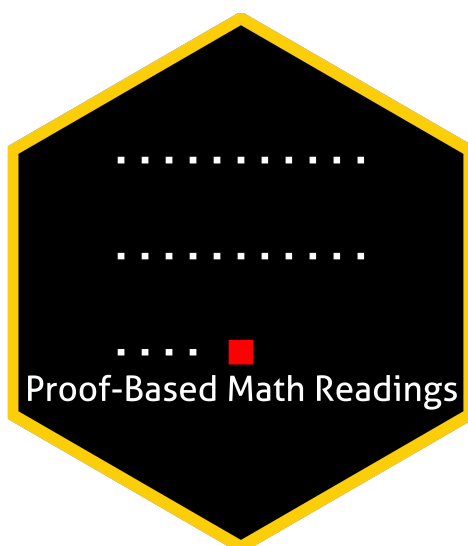
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\*zekiakyol.com

## 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 *Topology*.

## 1 Prerequisites

- CGPA: 3.00/4.00 and Proof and Real Analysis books/playlists listed below.
- Please use our [🔗 Application Form](#) to join our reading group anytime.
- Applicants 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

### 3.1 Main Book and Main Book's Playlist

**Topology (2nd Edition, 2014)** by James Munkres is our main book for this session because it is well-written, well-structured, and has plenty of intuitive figures.

Bruno Zimmermann's playlist is our main playlist because its narrative is just great.

- 📖 Topology - James Munkres (2nd Edition, 2014)
- 🎥 Topology - James Munkres (2nd Edition, 2014, Companion playlist by Bruno Zimmermann, Video 1-15)
- 📖 Topology - James Munkres (2nd Edition, 2014, Solutions for Chapter 1-2 by Dan Whitman)
- 📖 Topology - James Munkres (2nd Edition, 2014, Solutions for Chapter 1-2 by math.solverer)
- 📖 Topology - James Munkres (2nd Edition, 2014, Solutions for Chapter 2-3 by positron0802)
- 📖 Topology - James Munkres (2nd Edition, 2014, Solutions for Chapter 1-2-3-4 by dbFin)

### 3.2 Supplementary

#### 3.2.1 Topology

We use **Schaum's Outline of General Topology** for exercises because it has solutions for all 391 exercises.

- 📖 Schaum's Outline of General Topology - Seymour Lipschutz (2011) → Beginner friendly
- 📖 Topology Without Tears - Sidney A. Morris (2023) → Beginner friendly and open-access
- 🎥 General Topology - Bernard Badzioch (2022)
- 🎥 Topology - Marius Furter (2022)
- 📖 Mathematical Proofs A Transition to Advanced Mathematics - Gary Chartrand, Albert D. Polimeni, Ping Zhang (Chapter 19: Proofs in Topology, 4th Edition, 2018) and Odd-Numbered Exercise Solutions

#### 3.2.2 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)

#### 3.2.3 Real Analysis

- 📖 Basic Analysis I: Introduction to Real Analysis [Volume I] - Jiri Lebl (Version 6.0, 2023)
- 🎥 Real Analysis - Casey Rodriguez (2020, Companion playlist to Basic Analysis I)
- 🎥 Introduction To Metric Spaces - Paige Bright (2023)

## 4 Reading Schedule

TM is the abbreviation of **Topology - James Munkres (2nd Edition, 2014)**.

### Week 01

📅 15 January - 21 January

#### 📖 TM, Chapter 1: Set Theory and Logic

- 1 Fundamental Concepts
- 2 Functions
- 3 Relations
- 4 The Integers and the Real Numbers
- 5 Cartesian Products
- 6 Finite Sets
- 7 Countable and Uncountable Sets
- 8 The Principle of Recursive Definition
- 9 Infinite Sets and the Axiom of Choice
- 10 Well-Ordered Sets
- 11 The Maximum Principle

### Week 02-03-04-05

📅 22 January - 18 February

#### 📖 TM, Chapter 2: Topological Spaces and Continuous Functions

- 12 Topological Spaces
- 13 Basis for a Topology
- 14 The Order Topology
- 15 The Product Topology on  $X \times Y$
- 16 The Subspace Topology
- 17 Closed Sets and Limit Points
- 18 Continuous Functions
- 19 The Product Topology
- 20 The Metric Topology
- 21 The Metric Topology (continued)
- 22 The Quotient Topology

### Week 06-07-08-09

📅 19 February - 10 March

#### 📖 TM, Chapter 3: Connectedness and Compactness

- 23 Connected Spaces
- 24 Connected Subspaces of the Real Line
- 25 Components and Local Connectedness
- 26 Compact Spaces
- 27 Compact Subspaces of the Real Line
- 28 Limit Point Compactness
- 29 Local Compactness

### Week 10-11-12

📅 11 March - 24 March

This chapter is optional.

#### 📖 TM, Chapter 4: Countability and Separation Axioms

- 30 The Countability Axioms
- 31 The Separation Axioms
- 32 Normal Spaces
- 33 The Urysohn Lemma
- 34 The Urysohn Metrization Theorem
- 35 The Tietze Extension Theorem