Proof-Based Math Readings
Session: Topology
2023 Winter

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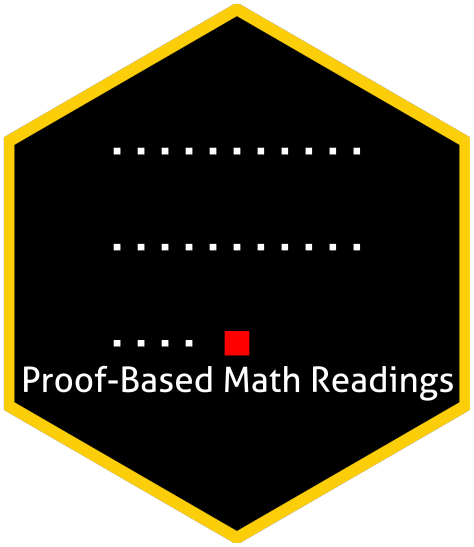

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0 Motivation

- *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 *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