Proof-Based Math Readings
Session: Linear Algebra
2024 Spring

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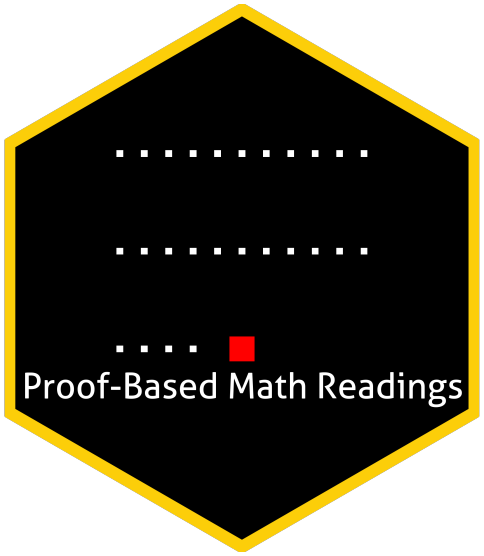

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0 Motivation

- *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 *Linear Algebra*.
- This session is dedicated to Sheldon Axler's lovely cat, Moon, who passed away in August 2023.

1 Prerequisites

- CGPA: 3.00/4.00
- Book of Proof - Richard Hammack (3.3 Edition, 2022)
- Linear Algebra - Gilbert Strang (2005)
- 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

Linear Algebra Done Right by Sheldon Axler is our main book for this session because it is well-written, well-structured, and open-access.

Robert Won's playlist is our main playlist because his narrative is just great.

- Linear Algebra Done Right - Sheldon Axler (4th Edition, 2024, Errata-free version)
- Linear Algebra Done Right - Sheldon Axler (4th Edition, 2024, Companion playlist by Robert Won)
- Linear Algebra Done Right - Sheldon Axler (4th Edition, 2024, Companion playlist by Sheldon Axler)
- Linear Algebra Done Right - Sheldon Axler (3rd Edition, 2015, Solutions by linearalgebras)
- Linear Algebra Done Right - Sheldon Axler (3rd Edition, 2015, Solutions by jubnoske08)
- Linear Algebra Done Right - Sheldon Axler (3rd Edition, 2015, Solutions by solverer.com)

3.2 Supplementary

3.2.1 Linear Algebra

- Essence of Linear Algebra - 3Blue1Brown (2023)
- Linear Algebra Done Right - Sheldon Axler (3rd Edition, 2015, Companion playlist by Jason Morton)
- Linear Algebra Done Right - Sheldon Axler (3rd Edition, 2015, Companion playlist by Felix Leditzky)
- Mathematical Proofs A Transition to Advanced Mathematics - Gary Chartrand, Albert D. Polimeni, Ping Zhang (Chapter 17: Proofs in Linear Algebra, 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, Chapter 1-12)
- Book of Proof - Richard Hammack (3.3 Edition, 2022, Companion playlist by Michael Penn, Chapter 1-14)

4 Reading Schedule

- **LADR** is the abbreviation of **Linear Algebra Done Right - Sheldon Axler (4th Edition, 2024)**.

LADR, Chapter 1: Vector Spaces — **Week 01**

1A: $\mathbf{R}^n$ and $\mathbf{C}^n$
1B: Definition of Vector Space
1C: Subspaces

LADR, Chapter 2: Finite-Dimensional Vector Spaces — **Week 02-03**

2A: Span and Linear Independence
2B: Bases
2C: Dimension

LADR, Chapter 3: Linear Maps — **Week 04-05-06**

3A: Vector Space of Linear Maps
3B: Null Spaces and Ranges
3C: Matrices
3D: Invertibility and Isomorphisms
3E: Products and Quotients of Vector Spaces

LADR, Chapter 5: Eigenvalues and Eigenvectors — **Week 07-08**

5A: Invariant Subspaces
5B: The Minimal Polynomial
5C: Upper-Triangular Matrices
5D: Diagonalizable Operators

LADR, Chapter 6: Inner Product Spaces — **Week 09-10**

6A: Inner Products and Norms
6B: Orthonormal Bases
6C: Orthogonal Complements and Minimization Problems

LADR, Chapter 7: Operators on Inner Product Spaces — **Week 11-12**

7A: Self-Adjoint and Normal Operators
7B: Spectral Theorem
7C: Positive Operators
7D: Isometries, Unitary Operators, and Matrix Factorization
7E: Singular Value Decomposition
7F: Consequences of Singular Value Decomposition