Proof-Based Math Readings
Session: Linear Algebra
2024 Spring

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Table of contents

0 Motivation **2**

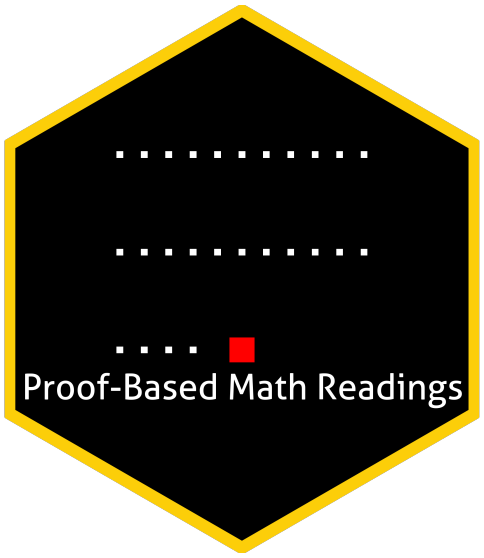
1 Prerequisites **2**

2 Format **2**

3 Resources [All are open-access] **2**
3.1 Main Book and Main Book's Playlist 2
3.2 Supplementary 2
3.2.1 Linear Algebra 2
3.2.2 Proof 2

4 Reading Schedule **3**

5 Further Readings (Optional) **3**



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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.
- Proof resources below and Linear Algebra - Gilbert Strang (2005) are the prerequisites for this session.
- Please use the Application Form to join our reading group.
- Applicants are informed about their application results within a week via email.

2 Format

- This session takes 12 weeks.
- We discuss the topics/exercises that we struggle with at Proof-Based Math Readings [Discord].
- We do 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 - Sheldon Axler (4th Edition, 2024, Errata-free version) 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, Playlist by Robert Won)
- Linear Algebra Done Right - Sheldon Axler (4th Edition, 2024, Playlist by Sheldon Axler)
- Linear Algebra Done Right - Sheldon Axler (4th Edition, 2024, Notes by Robert Won)
- Linear Algebra Done Right - Sheldon Axler (4th Edition, 2024, Solutions by MathwithoutCommentary)
- Linear Algebra Done Right - Sheldon Axler (4th Edition, 2024, Solutions by nehc0)
- 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)

3.2 Supplementary

3.2.1 Linear Algebra

- Essence of Linear Algebra - 3Blue1Brown (2023)
- Linear Algebra Done Right - Sheldon Axler (3rd Edition, 2015, Playlist by Jason Morton)
- Linear Algebra Done Right - Sheldon Axler (3rd Edition, 2015, Playlist by Felix Leditzky)

3.2.2 Proof

- Book of Proof - Richard Hammack (3.3 Edition, 2022)
- Book of Proof - Richard Hammack (3.3 Edition, 2022, Playlist by Jeremy Teitelbaum)
- Book of Proof - Richard Hammack (3.3 Edition, 2022, Playlist by Michael Penn)

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

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

5 Further Readings (Optional)

Matrix Analysis - Roger A. Horn, Charles R. Johnson (2nd Edition, 2013)