Proof-Based Math Readings Session: Linear Algebra

2024 Spring

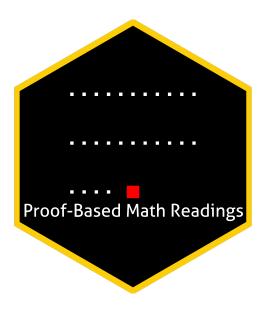
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0 Motivation

- 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 **O** 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.

- Linear Algebra Done Right Sheldon Axler (4th Edition, 2024)
- Linear Algebra Done Right Sheldon Axler (4th Edition, 2024, Errata)
- ▶ 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 Robert Won)
- ► 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 🛱 25 March - 31 March

 $1A: \mathbf{R}^{n} \text{ and } \mathbf{C}^{n}$

1B: Definition of Vector Space

1C: Subspaces

■ LADR, Chapter 2: Finite-Dimensional Vector Spaces

Week 02-03 **=** 01 April - 14 April

2A: Span and Linear Independence

2B: Bases 2C: Dimension

■ LADR, Chapter 3: Linear Maps

Week 04-05-06 **=** 15 April - 05 May

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 **=** 06 May - 19 May

5A: Invariant Subspaces

5B: The Minimal Polynomial

5C: Upper-Triangular Matrices

 ${f 5D}$: Diagonalizable Operators

■ LADR, Chapter 6: Inner Product Spaces

Week 09-10 **= 20** May - 02 June

6A: Inner Products and Norms

6B: Orthonormal Bases

6C: Orthogonal Complements and Minimization Problems

E LADR, Chapter 7: Operators on Inner Product Spaces

Week 11-12 **= 03** June - 16 June

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