Proof-Based Math Readings
Session: Linear Algebra
2024 Spring

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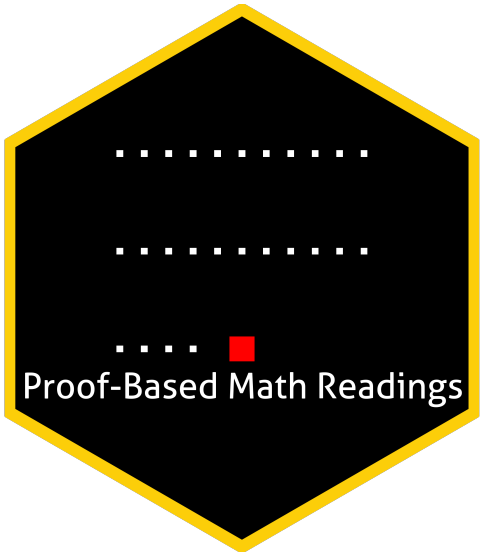

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0 Motivation

- *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*.

1 Prerequisites

- CGPA: 3.00/4.00 and Linear Algebra - Gilbert Strang (2005)
- Please apply by uploading your CV and transcript to this Google Form until 23:59, 10 March 2024.
  Please upload your CV and transcript as **NameSurname.pdf**, not **CV.pdf**.
  Students who applied will be informed about their application results via email at 10:00, 12 March 2024.

2 Format

- This session will last 12 weeks from 25 March 2024 to 16 June 2024.
- 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, open-access, and -most importantly- the author's cat is on the cover photo of the playlist.

- Linear Algebra Done Right - Sheldon Axler (4th Edition, 2023, Forthcoming)
- Linear Algebra Done Right - Sheldon Axler (3rd Edition, 2015, Companion playlist to the book)
- 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)
- Linear Algebra - Elliot Nicholson (2021)
- Mathematical Proofs A Transition to Advanced Mathematics - Gary Chartrand, Albert D. Polimeni, Ping Zhang (Chapter 17 Proof 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, 2023).

LADR, Chapter 1: Vector Spaces — **Week 01** — **25 March - 31 March**

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

LADR, Chapter 2: Finite-Dimensional Vector Spaces — **Week 02** — **01 April - 07 April**

LADR, Chapter 2.A: Span and Linear Independence
LADR, Chapter 2.B: Bases
LADR, Chapter 2.C: Dimension

LADR, Chapter 3: Linear Maps — **Week 03-04-05** — **08 April - 28 April**

LADR, Chapter 3.A: Vector Space of Linear Maps
LADR, Chapter 3.B: Null Spaces and Ranges
LADR, Chapter 3.C: Matrices
LADR, Chapter 3.D: Invertibility and Isomorphism
LADR, Chapter 3.E: Products and Quotients of Vector Spaces
LADR, Chapter 3.F: Duality

LADR, Chapter 4: Polynomials — **Week 06** — **29 April - 05 May**

There is no subsection in this chapter, so we will read the whole chapter.

LADR, Chapter 5: Eigenvalues and Eigenvectors — **Week 07-08** — **06 May - 19 May**

LADR, Chapter 5.A: Invariant Subspaces
LADR, Chapter 5.B: Eigenvectors and Minimal Polynomial
LADR, Chapter 5.C: Upper-Triangular Matrices
LADR, Chapter 5.D: Diagonalizable Operators
LADR, Chapter 5.E: Commuting Operators

LADR, Chapter 6: Inner Product Spaces — **Week 09-10** — **20 May - 02 June**

LADR, Chapter 6.A: Inner Products and Norms
LADR, Chapter 6.B: Orthonormal Bases
LADR, Chapter 6.C: Orthogonal Complements and Minimization Problems

LADR, Chapter 7: Operators on Inner Product Spaces — **Week 11-12** — **03 June - 16 June**

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