



Linear Algebra

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Lecturer

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Textbook

- **Title:** Linear Algebra and Its Applications
- **Author:** David C. Lay, Steven R. Lay and Judi J. McDonald
- **Edition:** Fifth
- **Publisher:** PEARSON
- **Year:** 2016
- **Chapters:** 1-7, 9

Evaluation

- Mid-term exam
 - Usually 5-7 scores
- Final exam
 - Usually 10 scores
- Assignments
 - Usually 3-5 scores
- This may change, depending on the situation!

Details of the covered topics

- In the following slides, I describe, in details, the covered topics
 - However, we may always have some changes!

Chapter 1

- Linear equations in linear algebra
 - Systems of linear equations
 - Row reduction and echelon forms
 - Vector equations
 - Matrix equation
 - Solution sets of linear systems
 - Homogeneous systems and non-homogeneous systems
 - Linear independence
 - Linear transformations
 - The matrix of a linear transformation

Chapter 2

- Matrix algebra:
 - Matrix operations
 - Inverse of a matrix
 - Characterizations of invertible matrices
 - Partitioned matrices
 - Matrix factorization
 - Subspaces of \mathbb{R}^n
 - Dimension and rank

Chapter 3

- Determinants:
 - Introduction to determinants
 - Properties of determinants
 - Cramer's rule, volume and linear transformation

Chapter 4

- Vector spaces:
 - Vector spaces and subspaces
 - Null spaces, column spaces and linear transformations
 - Linearly independent sets, bases
 - Coordinate systems
 - The dimension of a vector space
 - Rank
 - Change of basis

Chapter 5

- Eigenvalues and eigenvectors
 - Eigenvalues and eigenvectors
 - The characteristic equation
 - Diagonalization
 - Eigenvector and linear transformations
 - Complex eigenvalues
 - Discrete dynamical systems
 - Iterative estimates for eigenvalues

Chapter 6

- Orthogonality and least squares
 - Inner product, length and orthogonality
 - Orthogonal sets
 - Orthogonal projections
 - The Gram-Schmidt process
 - Least squares problems
 - Inner product spaces

Chapter 7

- Symmetric matrices and quadratic forms:
 - Diagonalization of symmetric matrices
 - Quadratic forms
 - Constrained optimization
 - Singular value decomposition (SVD)

Chapter 9

- Optimization
 - Linear programming – geometric method
 - Linear programming – simplex method
 - Duality

Optional materials

- Applications to dimension reduction, latent factors,...
- Linear regression, Moore-Penrose Pseudoinverse
- ...