MA304 Abstract Linear Algebra

Instructor Information	Jinwei Yang Home institution: Shanghai Jiao Tong University Email: jinwei2@sjtu.edu.cn Office Hour: To be determined		
Term	June 27, 2022 - July 22, 2022	**Credits**	4 units
Class Hours	Monday through Friday, 120 mins per teaching day		
Discussion Sessions	2.5 hours each week, conducted by teaching assistant(s)		
Total Contact Hours	66 contact hours (1 contact hour = 45 mins, 3000 mins in total)		
Required Texts (with ISBN)	Linear Algebra: A Modern Introduction (4th Edition) By David Poole ISBN-13: 978-1285463247 ISBN-10: 9781285463247		
Prerequisite	Linear Algebra		

Course Overview

This course introduces students to a rigorous and abstract study of linear algebra, which is an extension of introduction to linear algebra course. Topics covered include matrix algebra, vector space, eigenvalues and eigenvectors, orthogonalization, diagonalization, linear transformation, inner product space, and applications.

Learning Outcomes

Upon successful completion of this course, students will be conversant with

- understanding concepts of linear algebra and matrix algebra
- understanding linear independence, span, and basis
- developing problem solving skills, such as solving systems of linear equations using multiple methods
- applying principles of matrix algebra to linear transformation
- understanding examples, theorems, algorithms, and applications

Grading Policy

Three Assignments	30%
Quizzes/Attendance	20%
Middle Exam	25%
Final Exam	25%

Grading Scale is as follows

Number grade	Letter grade	GPA
90-100	A	4.0
85-89	A-	3.7
80-84	B+	3.3
75-79	B	3.0
70-74	B-	2.7
67-69	C+	2.3
65-66	C	2.0
62-64	C-	1.7
60-61	D	1.0
≤59	F (Failure)	0

Class Schedule

Date	Lecture
Day 1	1.0: Introduction: The Racetrack Game 1.1: The Geometry and Algebra of Vectors 1.2: Length and Angle: The Dot Product
Day 2	1.3: Lines and Planes 1.4: Applications 2.0: Introduction: Triviality
Day 3	2.1: Introduction to Systems of Linear Equations 2.2: Direct Methods for Solving Linear Systems
Day 4	2.3: Spanning Sets and Linear Independence 2.4: Applications
Day 5	2.5: Iterative Methods for Solving Linear Systems 3.0: Introduction: Matrices in Action
Day 6	3.1: Matrix Operations 3.2: Matrix Algebra
Day 7	3.3: The Inverse of a Matrix 3.4: The LU Factorization
Day 8	3.5: Subspaces, Basis, Dimension, and Rank 3.6: Introduction to Linear Transformations
Day 9	3.7: Applications 4.0: Introduction: A Dynamical System on Graphs 4.1: Introduction to Eigenvalues and Eigenvectors
Day 10	4.2: Determinants 4.3: Eigenvalues and Eigenvectors of n ×n Matrices
Day 11	Midterm Exam Review
Day 12	**Midterm Exam**
Day 13	4.4: Similarity and Diagonalization 4.5: Iterative Methods for Computing Eigenvalues
Day 14	4.6: Applications and the Perron-Frobenius Theorem 5.0: Introduction: Shadows on a Wall
Day 15	5.1: Orthogonality in $\Re^n$ 5.2: Orthogonal Complements and Orthogonal Projections

Day 16	5.3: The Gram-Schmidt Process and the QR Factorization 5.4: Orthogonal Diagonalization of Symmetric Matrices
Day 17	5.5: Applications 6.0: Introduction: Fibonacci in (Vector) Space 6.1: Vector Spaces and Subspaces
Day 18	6.2: Linear Independence, Basis, and Dimension 6.3: Change of Basis 6.4: Linear Transformations
Day 19	Final Exam Review
Day 20	**Final Exam**