Chapter 2. Systems of Linear Equations

2.1 Introduction;

consistent, backward substitution, forward substitution

2.2 Direct Methods for solving linear systems;

Gaussian elimination method, REF, RREF

2.3 Spanning sets and Linear Independence

Definitions, determine spans, linearly independence

2.4 Applications

Network problem, electrical circuit problem

Chapter 3. Matrices

3.1 Matrix operations

Addition, subtraction, scalar multiplication, matrix multiplication, Applications

3.2 Matrix Algebra

Properties, transpose, symmetric matrices

3.3 The inverse of a matrix

Def, Inverse of 2 by 2 matrix, transpose and inverse, elementary matrices,

Factorization of matrix into elementary matrices, inverse matrix of 3 by 3 matrix

Fundamental theorem of invertible matrices; version I

3.4 LU factorization

How to factor A into LU, solving a system using LU factorization

3.5 Subspaces, Basis, Dimension, and Rank

Definitions of all these, subspaces associated with matrices, The rank theorem

Fundamental theorem of invertible matrices; version II

3.6 Linear transformation

Definition, standard matrix representation, homogeneous coordinate system, two linear transformations applied

3.7 Applications

Graph theory, adjacency matrix

Chapter 4. Eigenvalues and eigenvectors

4.1 Introduction

Definitions, Check eigenvalue and eigenvector, geometric meaning

4.2 Determinants

Definition, Laplace expansion theorem for determinants, Properties of determinants, Cramer's Rule, Cofactor method for inverse matrix

4.3 Eigenvalues and eigenvectors for n by n matrices

Characteristic polynomial, some properties of eigenvalues and eigenvectors

Fundamental theorem of invertible matrices; version III, higher power of matrix

4.4 Similarity and Diagonalization

Definition, theorem 4.22, diagonalizable or not, high power of a diagonalizable matrix

4.5 & 4.6 Application: Markov Chain, solving a system of first order DE

Chapter 5. Orthogonality

5.1 Orthogonality in $\mathbb{R}^n$

Orthogonal set, Orthogonal basis, linear combination in terms of orthogonal (orthonormal) basis, Orthogonal matrix, Properties of orthogonal matrix,

5.2 Orthogonal Complements and orthogonal projections

Definition, four fundamental subspaces associated with a matrix, orthogonal projections

5.3 Gram Schmidt Process and the QR factorization

Gram Schmidt process, QR factorization, solving a system using QR factorization

7.3 Least Squares Approximation (Application of Orthogonal Projection)

Find the least squares solution of a linear system, application problem

Study tip to prepare well for the final exam

1. Review your past hour exams carefully.

2. Review all problems in review for final thoroughly.

3. Make a sample final and try it!

4. Remember that your final exam score can change your final grade significantly.

(positively or negatively)

Final exam: Wednesday, Dec 11, 1:30-3:30 pm