

640:250 Introduction to Linear Algebra, Spring 2003, MW4 (1:10-2:30 pm) in ARC 333

Lecturer: Chris Woodward, Assoc Prof in Mathematics

Office and telephone number: Hill 336, 5-2466

Office Hours: M 3:00 - 4:00 pm Hill 336 or by appt.

E-mail: ctw@math.rutgers.edu webpage: math.rutgers.edu/~ctw/250-s03

Text: Spence, Insel & Friedberg *Elementary Linear Algebra: A Matrix Approach*

ISBN # 0-13-716722-9, Prentice-Hall, Upper Saddle River, NJ 07458

Course Web Page: From the Mathematics Department web site (<http://www.math.rutgers.edu>) click on course materials and then Math 250 Linear Algebra. Follow the indicated links from there.

Computer Component of Course: Linear algebra is the most widely-used mathematics tool in engineering, applied science, and statistics. Unlike the one-variable calculus problems that you can solve by hand calculation (or with the aid of a graphing calculator), real linear algebra computations need substantial computer resources. The best software package for this purpose is generally agreed to be MATLAB (although other symbolic computer programs such as MAPLE or MATHEMATICA also have linear algebra capabilities and some graphing calculators can do linear algebra problems with a small number of variables).

The MATLAB sections of Math 250 use the same textbook and syllabus as the regular sections of Math 250. In addition to homework assignments, quizzes, and exams, you will carry out linear algebra calculations using MATLAB in one of the Rutgers computer labs (or on your own computer, if you buy a copy of the Student Edition of MATLAB). You will create a printed writeups of your MATLAB sessions to hand in for grading. **NO PROGRAMMING KNOWLEDGE OF MATLAB IS REQUIRED.**

The MATLAB software package is installed on PC's in all the Rutgers public computer labs (in ARC, Loree, College Avenue, Livingston). Students in the School of Engineering can also use MATLAB in the DSV Lab (Eng B-125/127).

If you want to install MATLAB on your personal computer, the Student Edition (for Windows, Linux or Macintosh) can be purchased directly from the publisher, MathWorks, Inc. by going to their website: www.mathworks.com. It includes documentation and tutorials. Links to MATLAB tutorials and related web sites can be found on the course web page.

Exams, Homework, and Grades: There will be two midterm exams and a final exam (all exams will be closed book). There will be six MATLAB assignments. Each section will have quizzes and graded homework, as determined by the instructor. Your final course grade will be determined on the following 600-point basis:

each midterm exam: 100 points

each MATLAB assignment (required part): 25 points

quizzes and homework: 50 points

final exam: 200 points

NOTE: Each MATLAB assignment has an optional question involving an application of Linear Algebra. These optional questions add up to a maximum of 30 points over the term (more than half the points on one midterm exam).

Roster: Bring a photocopy (with recognizable photo) of your Rutgers I.D. by the third class; this WILL COUNT as the zeroth quiz. Late submissions will get partial credit. List on the sheet your e-mail address/possible major/reason for taking the course.

Attendance is required, although exceptions may be made for students who are sick, etc. I will semi-regularly take attendance.

Academic Honesty: The work you submit should be your own; do not copy other students assignments and exams, or allow your assignments/exams to be copied by others. Students taking make-up exams are responsible for not looking at exams other students have taken, even if they are different versions. Breaking these rules will lead, at the very least, to a grade of zero. Formula sheets and calculators are not allowed in exams.

Syllabus

Lecture	Reading	Topics
1/22	1.1, 1.2	Matrices and Vectors
1/27	1.3	Systems of Linear Equations
1/29	1.4	Elimination
2/3	1.6	Span of a Set of Vectors
2/3	MATLAB Lab #1 due – Matrix and Vector Computations in MATLAB	
2/5	1.7	Linear Dependence and Linear Independence
2/10	1.7, 2.1	Homogeneous Systems, Matrix Multiplication
2/12	2.1	Matrix Algebra
2/17	2.3	Invertibility and Elementary Matrices
2/17	MATLAB Lab #2 due – Linear Equations and Matrix Algebra	
2/19	2.4	Inverse of a Matrix
2/24	2.5	LU Decomposition of a Matrix
2/26	Midterm Exam #1	
3/3	3.1	Determinants; Cofactor Expansions
3/5	3.2	Properties of Determinants
3/5	MATLAB Lab #3 due – LU Decomposition and Determinants	
3/10	4.1	Subspaces
3/12	4.2	Basis and Dimension
3/24	4.3	Column Space and Null Space of a Matrix
3/26	5.1,5.2	Eigenvalues and Eigenvectors
3/26	MATLAB Lab #4 due – Vector Spaces and General Solution to $Ax = b$	
3/31	5.3	Diagonalization of a Matrix
4/2	handout	Complex Numbers
4/7	5.5	Applications of Eigenvalues (Markov Chains)
4/9	Midterm Exam # 2	
4/14	6.1	Geometry of Vectors; Projection onto a Line
4/14	MATLAB Lab #5 due – Eigenvalues and Eigenvectors (due 11/21)	
4/16	6.2	Orthogonal Sets of Vectors; Gram-Schmidt Process
4/21	6.2	Orthogonal Projection; Orthogonal Complements
4/23	6.3	Least Squares; Normal Equations
4/28	6.4, 6.5	Orthogonal Matrices; Diagonalization of Symmetric Matrices
4/28	MATLAB Lab #6 due – Orthonormal Bases and Least Squares Approximations	
4/30	6.5	Spectral Decomposition for Symmetric Matrices Diagonalization of Quadratic Forms
5/5		Catch up and review
Tuesday 5/13	Final Exam	12pm - 3pm, room tba

Section**Homework Problems**

- 1.1 1, 3, 5, 7, 9, 35, 39, 45, 46 (ML #48)
- 1.2 1, 3, 11, 13, 15, 17, 21, 22, 23, 25, 29, 31, 33, 35, 36, 37, 39, 40, 41, 42
- 1.3 1, 3, 5, 7, 9, 11, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 45
- 1.4 1, 3, 5, 7, 9, 13, 15, 19, 21, 25, 27, 29, 31, 35, 44-46, 51-62
- 1.6 1, 3, 5, 9, 11, 13, 15, 17, 19, 21, 23, 25, 31, 35, 42, 45
- 1.7 1, 3, 5, 7, 9, 11, 13, 17, 21, 23, 25, 27, 29, 33, 39, 40, 41

- 2.1 1, 5, 7, 9, 11, 13, 15, 17, 19, 21, 22, 23, 24, 25, 27, 29, 31
- 2.3 1, 3, 5, 7, 11, 13, 15, 21, 29, 31, 33, 41
- 2.4 1, 3, 5, 7, 11, 15, 17, 19, 25, 27, 30
- 2.5 3, 5, 7, 9, 10, 11, 12, 13, 14, 15, 19

- 3.1 1, 3, 5, 7, 9, 11, 14, 15, 17, 19, 21, 25, 31, 33, 37, 39, 41, 43
- 3.2 1, 3, 5, 7, 11, 15, 21, 25, 39-45

- 4.1 1, 3, 5, 9, 11, 13, 15, 19, 21, 23, 25, 27, 29, 31, 33, 36, 37, 38, 42
- 4.2 1, 3, 4, 5, 7, 9, 11, 13, 15, 27, 29
- 4.3 1, 3, 5, 7, 9, 11, 13, 15, 37-42, 47

- 5.1 3, 7, 13, 17, 21, 39, 42, 43, 44, 45, 48
- 5.2 1, 3, 5, 9, 13, 15, 17, 21, 23, 25, 27, 41, 45, 47, 51, 52
- 5.3 1, 3, 7, 9, 11, 13, 15, 17, 19, 23, 25, 27, 29, 33, 35, 37, 39, 45, 51, 52, 53
- 5.5 3, 5, 7, 9, 13, 15, 21, 23

- 6.1 1, 3, 5, 7, 9, 11, 13, 17, 21, 23, 25, 30-35, 49, 52
- 6.2 1, 3, 5, 7, 9, 13, 15, 17, 19, 21, 23, 27
- 6.3 1, 3, 5, 7, 9, 13, 15, 17, 21, 26-35, 42
- 6.4 3, 5, 7, 9, 11, 22
- 6.5 1, 3, 5, 13, 17, 19