
M346 (92153)

Applied Linear Algebra, Summer 2012

Course syllabus (last revised: 06/28/2012)

Instructor: Ravi Srinivasan

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Office: RLM 11.164

Office hours: MTWThF 11:30-12:30

Lecture: MTWThF 10-11:30, ETC 2.114

Class website: <http://www.ma.utexas.edu/users/rav/M346/>

Required texts:

(1) ``Applied Linear Algebra: The Decoupling Principle (2nd ed.)'' by L. Sadun (ISBN 0821844415);

(2) ``Linear Algebra Done Wrong'' by S. Treil

(<http://www.math.brown.edu/~treil/papers/LADW/book.pdf>)

Prerequisites and degree relevance:

A grade of C or better in M341 (or M311) or M340L, or consent of the instructor.

Course description and content:

This is an advanced undergraduate course on linear algebra directed at students in the natural and social sciences and at engineering students. The emphasis in this course is both on theoretical considerations (with rigorous proofs of results) and on problem solving. Topics include vector spaces, linear transformations and matrix representation, spectral theory (both discrete and continuous), diagonalization of linear operators, inner products and duality, Hermitian (i.e., self-adjoint) and unitary operators, the Fourier transform, and applications to differential equations, probability theory, network analysis, and statistics.

Notice:

The University of Texas provides appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-6441 TTY. If you plan on using accommodations, you need to notify your instructors early in the semester.

Important dates:

Fri., Jun. 01, 2012 -- Last day of official add/drop period

Tue., Jun. 05, 2012 -- Last day to drop a course for possible refund (can only Q-drop after this date)

Mon., Jun. 20, 2012 -- Last day to change status to or from a pass/fail basis

Grading:

Grades will be determined from weekly homework/quizzes, midterms, and the final exam (see below). Course grades will be computed on a +/- basis according to a scheme at least as generous as this (rounded to the closest integer):

A : 92-100
A-: 90-91
B+: 88-89
B : 82-87
B-: 80-81
C+: 78-79
C : 72-77
C-: 70-71
D+: 68-69
D : 62-67
D-: 60-61
F : < 60

1. Homework: 20%

Homework assignments will be posted on the class website, and will be due approximately every other lecture. Late homework will *not* be accepted. The purpose of the HW is to learn the material and you are encouraged to discuss and work together on these problems, including during office hours. Learn to correctly and consistently derive the answer (without a calculator) in order to better prepare for exams. Do not restrict yourself to HW problems, but use them as a basis for trying other questions as well. Only a select set of questions will be graded, and you will get a minimal amount of credit simply for handing in your complete HW solutions.

The *three* lowest HW grades will be dropped to allow for missed lectures, illness, emergencies, etc. Even if you do not hand in HW solutions, make sure to complete the assigned problems in order to prepare for exams.

2. Midterm exams: 40%

There will be two 75-minute midterms given in regular class times on the following dates (subject to change):

2a. Midterm #1: 20%

Tuesday, Jun. 12, 2012

2b. Midterm #2 (not comprehensive): 20%

Friday, Jun. 22, 2012

3. Final exam (comprehensive): 40%

Friday, Jul. 06, 9am-12pm (officially assigned date/time), TBA

Exam policy:

A valid photo ID must be available to be checked at all exams. Calculators, books, and notes are not permitted during quizzes, midterms, and the final exam.

Make-up exams ****will not**** be given so please remember the appropriate exam dates. In extraordinary circumstances ONLY, the final exam score will compensate for a missing midterm exam. This includes illness, observance of a religious holiday, or a university-related absence ***with two weeks advance notice.*** Proper documentation (such as a doctor's note) is required in all cases.

Some tips:

- Ask questions: In lecture, office hours, and by e-mail. Don't be shy--if you have a question it's likely someone else does as well. Class participation makes lectures more interesting and fun for both you and me.
- Do the homework: No one can learn mathematics without working examples themselves. The most important driver of success in virtually every math course is doing practice exercises carefully and completely.
- Read the text: To get the most benefit from the lectures and problem sessions, you should read relevant sections of the text as they are covered in class. The supplementary texts listed can also be useful references at particular times in the course.
- Come to office hours: Office hours offer valuable opportunities to reinforce concepts, clarify confusing issues, work more examples, and get individualized feedback.
- Study together: You are encouraged to study together with your peers enrolled in the class. Get to know your classmates, and make arrangements to share notes in case you miss class due to illness.
- Learn to work problems without a calculator: You may use a calculator on homework problems but not during quizzes or exams. In any case, a calculator will not be useful for the vast majority of problems encountered during the semester.
- Be honest: Any academic dishonesty will be severely penalized.

Tentative course calendar (subject to change):

===== PART I: Basis, finite-dimensional linear operators, and eigenvalues =====

--Week 01--

Topics: Introduction (1.1), vector spaces (2.1), matrix operations (Appendix A), basis and dimension (2.2)

Th 05/31 First lecture

Fr 06/01 HW1 due

--Week 02--

Topics: Properties and change of basis (2.3-2.4), linear transformations and matrix representation (3.1-3.2), basis and operators (3.3), subspaces (3.5), eigenvalues and eigenvectors (4.1-4.2), characteristic polynomials (4.3)

Mo 06/04
Tu 06/05 HW2 due
We 06/06
Th 06/07 HW3 due
Fr 06/08

===== PART II: Diagonalizability and applications, inner-product spaces =====

--Week 03--

Topics: Complex eigenvalues (4.4), diagonalizability (4.5), Jordan canonical form (4.9), trace and determinant (4.6), first-order difference equations (5.1), matrix exponentials (4.7), systems of first-order ODE (5.2)

Mo 06/11 HW4 due
Tu 06/12 ****MIDTERM #1**** (on Part I)
We 06/13
Th 06/14 HW5 due
Fr 06/15

--Week 04--

Topics: Stability and asymptotic behavior (5.5), Markov chains (5.6), applications in network science, inner-product spaces (6.1-6.2)

Mo 06/18 HW6 due
Tu 06/19
We 06/20 HW7 due
Th 06/21 HW8 due
Fr 06/22 ****MIDTERM #2**** (on Part II)

===== PART III: Self-adjoint operators, spectral theory, and Fourier series =====

--Week 05--

Topics: Projections (6.6), Gram-Schmidt procedure (6.4-6.5), least-squares (6.7), adjoints and self-adjoint operators (7.1-7.2), normal operators, isometries (7.4), positive operators, singular value decomposition

Mo 06/25
Tu 06/26 HW9 due
We 06/27
Th 06/28 HW10 due
Fr 06/29

--Week 06--

Topics: Infinite-dimensional spaces and square-integrable functions (3.4, 6.8), Fourier series (6.9, 8.5, 8.7)

Mo 07/02 HW11 due
Tu 07/03 HW12 due
We 07/04 --Independence day--
Th 07/05 HW13 due, last lecture
Fr 07/06 ****FINAL EXAM**** 9am-12pm, ETC 2.114
