

Math 312: Linear Algebra (winter 2009)

Instructor: Tristram Bogart (JEFF 516; phone 513-2422.)

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Lectures: slot 011 in STI 501: Monday 11:30-12:20, Tuesday 1:30-2:20, and Thursday 12:30-1:20.

Tutorial: Monday 1:30-2:30 in JEFF 101, run by James Chou. There will be no tutorial in the first week of classes.

Office Hours: Wednesday and Thursday, 10:00-11:30 in JEFF 516

Textbook: Sheldon Axler, *Linear Algebra Done Right*, Second Edition, Springer, 1997, ISBN 0387982582

Format

This is primarily a lecture-based course. The topics covered in the lectures will roughly match those in the text, but my examples and emphasis will often be different. If you need to miss a class meeting, please arrange to get notes from a classmate. The weekly tutorial will provide an opportunity to review some of the ideas from class.

Homework

To learn almost any part of mathematics, it's essential to spend time solving problems. Accordingly, there will be weekly homework assignments, due at the beginning of class on Thursday. Your best ten problem sets will determine your homework grade. The assignments will be posted on this web page at least one week before they are due. Each assignment will consist of three problems to be handed in. These problems are intended to be challenging and will often require considerable time to solve and to write up careful solutions. You must explain your work in order to obtain full credit; an assertion is not an answer.

Assignments and Solutions

- [Assignment 1](#), due Thursday, January 15. [solutions](#)
- [Assignment 2](#), due Thursday, January 22. [solutions](#)
- [Assignment 3](#), due Thursday, January 29. [solutions](#)
- [Assignment 4](#), due Thursday, February 5. [solutions](#)
- [Assignment 5](#), due Thursday, February 12.

Exams

There will be a midterm during the sixth week of classes. The midterm will consist of two parts, each lasting 50 minutes: the first during the lecture period on **Monday, February 9**, and the second during the tutorial period on the same day. The midterm will be based on the material in Chapters 1-5 of the text.

The final exam will be cumulative, though stressing material from the second half of the course more than the first. The time and place of the final exam will be determined by the registrar during the semester. Calculators and note sheets will not be permitted on either of the exams.

Marking Scheme

Homework	15%
Midterm	30%
Final exam	55%

Disabilities

Students with disabilities who will be taking this course and may need disability-related classroom accommodations are encouraged to make an appointment to see the instructor as soon as possible. Also, stop by the Health, Counseling and Disability Services Office to register for support services.

Academic Integrity

It is the obligation of each student to understand the University's policies regarding academic honesty and to uphold these standards. Students are encouraged to talk about the problems, but should write up the solutions individually. Students should acknowledge the assistance of any books, software, students or professors. In that spirit:

Acknowledgement: This page as well as the lectures are based on those of Gregory G. Smith, who taught this course in previous semesters.

Lecture Schedule

Reading Week

Date	Topic	Read	Notes
Mon, January 5	Vector Spaces	§1.2-3	No tutorial
Tues, January 6	Subspaces	§1.4	
Thurs, January 8	Direct Sums	§1.5	
Mon, January 12	Span, Linear Independence	§2.1	First tutorial
Tues, January 13	Bases	§2.2	
Thurs, January 15	Dimension, Linear Maps	§2.3, 3.1	Assgn. 1 due
Mon, January 19	Null Space and Range	§3.2	
Tues, January 20	Invertibility	§3.4	
Thurs, January 22	Matrix of a Linear Map	§3.3	Assgn. 2 due
Mon, January 26	Polynomials	§4.1-3	
Tues, January 27	Invariant Subspaces	§5.1	
Thurs, January 28	Upper Triangular Matrices	§5.3	Assgn. 3 due
Mon, February 2	Diagonal Matrices	§5.4	
Tues, February 3	More Invariant Subspaces, Review	§5.5	
Thurs, February 5	Inner Products	§6.1	Assgn. 4 due
Mon, February 9	Midterm (during lecture and tutorial)		
Tues, February 10	Norms	§6.2	
Thurs, February 12	Orthonormal Bases	§6.3	Assgn. 5 due
Mon, February 23	Orthogonal Projections	§6.4	
Tues, February 24	Dual Spaces	§6.5	
Thurs, February 26	Adjoint	§6.5	Assgn. 6 due

Mon, March 2	Self-Adjoint and Normal Operators	§7.1	
Tues, March 3	Spectral Theorems	§7.2	
Thurs, March 5	Normal Operators on Real Inner-Product Spaces	§7.3	Assgn. 7 due
Mon, March 9	Postive Operators	§7.4	
Tues, March 10	Isometries	§7.5	
Thurs, March 12	Polar Decomposition	§7.6	Assgn. 8 due
Mon, March 16	Singular-Value Decomposition	§7.6	
Tues, March 17	Generalized Eigenvectors	§8.1	
Thurs, March 19	Characteristic Polynomials	§8.2	Assgn. 9 due
Mon, March 23	Decomposition of Operators	§8.3	
Tues, March 24	Square Roots of Operators	§8.4	
Thurs, March 26	Minimal Polynomials	§8.5	Assgn. 10 due
Mon, March 30	Jordan Canonical Form	§8.6	
Tues, March 31	More Jordan Canonical Form	§8.6	
Thurs, April 2	Review		Assgn. 11 due