Abstract Linear Algebra - Math 115a - Lecture 4

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Fall 2010

1 Coordinates

Time: 1pm MWF for lectures and 1pm TR for discussion.
Place: `MS 5147`.
E-mail: `antieau@math.ucla.edu`.
Phone: `310-825-3068`.
Office hours: 2:00-3:30pm MW in my office, `MS 6617D`.
TA: Daniel Ram (`danielram@math.ucla.edu`).
TA office hours: to be announced.

2 Catalogue description

Lecture, three hours; discussion, two hours. Requisite: course 33A. Techniques of proof, abstract vector spaces, linear transformations, and matrices; determinants; inner product spaces; eigenvector theory. P/NP or letter grading.

3 Book

Book: *Linear Algebra* by Friedberg, *et. al.*, fourth edition [from the UCLA store, new is $129.25, and used is $97].

Note that the version in the bookstore is a special version printed for UCLA. It contains additional chapters taken from *Mathematical Thinking* by D'Angelo and West. These chapters will be required for the class. But, the UCLA version of *Linear Algebra* **is not** required specifically, nor is any particular edition preferred. Instead, you may buy older editions of **both** *Linear Algebra* and *Mathematical Thinking*. For instance, used copies of *Mathematical Thinking* begin at $7.64 on Amazon, while used older editions of *Linear Algebra* begin at $1.93.

4 Grading

Grading: 20% homework, 20% midterm 1, 20% midterm 2, 40% final. If you should miss a midterm due to *documented* illness or other emergency, the remaining midterm will count for 25% and the final for 55% of the grade. This class will use the myUCLA gradebook facility.

Requests for a re-grading will only be considered within 14 calendar days of the due date of the original assignment or midterm, and no later than the day before the final. All such requests must be directed to the instructor; the TA is not allowed to make changes to grades.

There will be 9 homework assignments. They are each due at the beginning of the class period the day they are due. Late work will not be accepted. The lowest homework score will be dropped at the end of the class. Homework will be returned in discussion section.

A grade of 'F' will be assigned to any student who misses the final. Incompletes are reserved for those who have completed all of the work of the class, including both midterms, but who for a legitimate, documented reason miss the final.

5 General principles

5.1 What it means to learn this material

This class is more than another matrix algebra class. It is an introduction to the methods and practices of modern higher mathematics. It will no longer be sufficient to memorize rules for completing problems. From this point forward, exams measure your creative application of the theorems and definitions in the class. Memorizing these are necessary, but the only way to ensure success in the class and the exam is to practice writing proofs. And then, to practice more. This should include editing and re-writing the proofs in your homework.

5.2 Office hours

Please come to office hours.

5.3 Boredom

Boredom is not encouraged. Please see me if you want to do more work.

5.4 Electronics

Use of electronic devices is discouraged during class. If everyone is respectful, I will not say more than this. But, if these devices become a distraction in any way, then they will be disallowed entirely.

6 Course outline

- **Week 1** (a very short week!) [*09/23-09/24*] - vector spaces (section 1.2).

- **Week 2** [*09/27-10/01*] - subspaces, linear combinations, systems of linear equations, linear (in)dependence, bases, and dimensions (sections 1.3-1.6).

- **Week 3** [*10/04-10/08*] - bases, dimensions, linear transformations, null spaces, and ranges (sections 1.6, 2.1).

- **Week 4** [*10/11-10/15*] - linear transformations, null spaces, ranges, and matrix representations (sections 2.1-2.2). **Midterm 1 on Friday**.

- **Week 5** [*10/18-10/22*] - matrix representations, composition of linear transformations and matrix multiplication, invertibility and isomorphisms (sections 2.3-2.4).

- **Week 6** [*10/25-10/29*] - invertibility and isomorphisms, change of coordinate matrices, important facts about determinants (sections 2.4-2.5, 4.4).

- **Week 7** [*11/01-11/05*] - eigenvalues, eigenvectors, and diagonalizability (sections 5.1-5.2).

- **Week 8** [*11/08-11/12*] - diagonalizability (section 5.2). **Midterm 2 on Friday**.

- **Week 9** [*11/15-11/19*] - inner products and norms, Gram-Schmidt orthogonalization, and orthogonal complements (sections 6.1-6.2).

- **Week 10** (a short week) [*11/22-11/24*] - adjoints of linear operators, normal and self-adjoint operators (sections 6.3-6.4).

- **Week 11** [*11/29-12/03*] - normal and self-adjoint operators, review (section 6.4).

- **Week 12** [*12/10*] - **Final examination**, 11:30am–2:30pm.

7   Important dates

- *23 September*: **First discussion section meeting (!!!).**

- *24 September*: First lecture.

- *27 September*: Homework 1 due.

- *1 October*: Homework 2 due.

- *8 October*: Homework 3 due.

- *15 October*: **Midterm 1**.

- *22 October*: Homework 4 due.

- *29 October*: Homework 5 due.

- *5 November*: Homework 6 due.

- *11 November*: No discussion section; Veteran's Day.

- *12 November*: **Midterm 2**.

- *19 November*: Homework 7 due.

- *24 November*: Homework 8 due.

- *3 December*: Homework 9 due.

- *10 December*: **Final examination**, `11:30am-2:30pm`.