Mathematics 314: Linear Algebra
Fall 2014

Instructor: John Rhodes

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Office Hours: M 2:00–3:00, W 11:00–12:00, F 2:00-3:00, and by appointment.

Web page: http://www.dms.uaf.edu/~jrhodes/M314.html

Prerequisites: Math 201

Credit Hours: 3.0

Texts: Introduction to Linear Algebra, 4th ed., by Gilbert Strang, Wellesley Cambridge Press

Class Meetings: MWF 3:30–4:30, in Gruening 303

Software: MATLAB, available on many public computers across campus, including the Bunnell and Rasmussen labs, and many departmental labs.

Math Lab: Walk-in tutoring available in Chapman 305, for schedule see http://www.uaf.edu/dms/mathlab/

In-class Exams: Monday, October 20; Friday, November 21

Final Exam: 3:15–5:15, Wednesday, Dec. 17

Course overview and goals:

Linear Algebra provides the main framework for the overwhelming majority of modern computations in science and engineering. Its concepts play as important — or arguably even a *more* important — role as those of calculus for formulating and solving a wide range of real-world problems. Majors in mathematics, computer science, physics, chemistry, biology, economics, and all engineering fields will find it a worthwhile (and for some, required) part of their program of study.

As with most areas of mathematics, it is difficult to adequately describe the content informally. The naming of the field as a type of algebra is accurate, since its computations are very algebraic in nature – though of a very elementary nature involving little more than addition and multiplication. Although we extend these basic operations to arrays of numbers, such as *vectors* and *matrices*, good arithmetic skills at about an eight-grade level are sufficient technical background to do well. To be honest, for much of the course the algebraic nature of the material is probably its least interesting aspect.

The concepts of linear algebra, however, are motivated primarily by geometry. For instance, you have probably seen vectors presented as 'arrows' in the plane, or 3-space. We'll use your geometric intuition in 2- and 3-dimensions to understand n-dimensional space for larger n. By the end of the course, you should be comfortable thinking of a 4-dimensional 'hyperplanes' in 6-dimensional space as determining a 2-dimensional plane of perpendicular directions. And more importantly, you will see that such ideas can be useful for solving very down-to-earth problems that might arise in the work of any engineer or scientist.

Since almost all linear algebra problems outside of textbooks are solved using computers, you will also be introduced to the computer software system MATLAB through homework exercises. This is probably the most widely used system for linear algebra computations, and though we will only scratch the surface of its capabilities, it is a valuable tool to begin to learn.

Finally, be warned that the course is highly cumulative, with very simple ideas gradually building a larger conceptual body. Work in the course may be deceptively easy at times, but it is a great mistake to think you can do well by superficial effort. In studying and doing homework, your focus should not be on the mechanics of the computations you are performing, but on general principals and ideas.

Mechanics of the course:

Class meetings will be run as interactive lectures. That means that while I will be presenting material at the board, and you should be taking notes, I will also be asking for suggestions, ideas, and questions about the material as we go along. I don't expect 'correct' answers, but I do expect you to be actively following and participating — that makes the class more interesting for us all.

Class attendance is expected, although I will not formally take roll. If you miss a class, you should get notes from another student. Homework assignments will be given in class, but also posted on the course web page soon after class is over.

Reading the textbook is also essential. The author writes informally, but his presentation is full of conceptual insights that will aid your understanding. You should think of this textbook as giving you another lecture, to solidify what you already heard in class. (Strang's MIT lectures for this course are also free to watch online through the MITOpenCourseWare website.)

Quizzes will be given randomly throughout the semester, roughly once per week. These will typically take 10 minutes and be similar to recent homework. These serve two primary purposes 1) to encourage you to be present in every class and 2) to ensure that you stay current with the homework. If you expect to miss a class, you should talk to me (no e-mail!) in advance about having any potential quiz waived — you must have a good reason and, except in situations I consider to be emergencies, you cannot get retroactive approval.

Homework problems from the text will usually be assigned daily, and collected each **Monday**. I will typically begin each class by asking if there are questions

about the last lecture and its homework assignment. That means you should review notes and make at least an initial attempt on homework problems before the next class meeting, even though problems may not be collected until several days later. While it never hurts to ask, in general I will defer questions about any earlier assignment to my office hours, in order to keep the course moving along.

I encourage you to work with others on the homework, but you must *write up solutions independently*. You will learn nothing from simply copying someone's solution. Even though you may find you can't do every problem, you must make a reasonable attempt on them all. The entire homework assignment will be checked to be sure you have attempted everything. Selected problems will be graded more completely.

Several **MATLAB exercises** will be given on handouts throughout the semester. You will have at least a week to do these, since you must find a time outside of class to use MATLAB in a UAF computer lab. You may work with another student if you wish, provided you write your answers independently. All MATLAB handouts will be graded completely, and collectively form a substantial portion of your grade.

Assignments are due in class on their due date. I will not accept *any* late homework that has not been cleared ahead of time or is not due to a genuine emergency (e.g., a death in the family, unexpected hospitalization).

Missed examinations or due dates that are not approved in advance will result in a zero grade on that exam or assignment. No make-ups will be allowed except in extreme circumstances (e.g., family death, documented illness, etc.). Notifying me by email or a note that you will miss an exam or due date is not sufficient for advance approval; you must speak with me to be excused.

Tutoring is available at no cost, on a walk-in basis, at the Math Lab in Chapman 305. Hours are posted on the web and door. A good way to use the Math Lab is to simply go there to do your homework, so that if any questions come up you can get immediate help.

Calculators will not be allowed on any examinations or quizzes. This will ensure that testing conditions are equal for everyone. I have no strong feelings on whether you use a calculator when doing homework. As long as you are sure you have the skills to do all calculations by hand, it is fine for you to use technology as a time saver.

Auditing of this course will only be allowed for those who agree to attend regularly, as evidenced by completion of midterm exams and most quizzes.

Grades:

Your performance will be evaluated based on 6% quizzes, 7% daily homework, 7% MATLAB exercises, 25% first midterm exam, 25% second midterm exam, 30% final exam.

Course grades will be determined according to the following cutoffs:

$$A \geq 90\%,$$
$$B \geq 80\%,$$
$$C \geq 70\%,$$
$$D \geq 60\%.$$

The top 3 points of each grade range will receive a '+', and the bottom 3 points a '–'.

I reserve the right to move the cutoff points downward if particular exams turn out to be unexpectedly difficult. Note that you are not in competition with your peers – everyone in the class may get an $A+$, or everyone may get an F.

University and Department Policies:

Your work in this course is governed by the UAF Honor Code. The Department of Mathematics and Statistics has specific policies on incompletes, late withdrawals, and early final exams which can be found at

`http://www.dms.uaf.edu/dms/Policies.html`.

If you have any disabilities that I should know about, you should bring them to my attention soon so that we can work with the Office of Disability Services to set up any necessary accommodations.

Tentative Schedule

Week 0-1	Sept 5 – 12	Chapter 1, 2
Week 2	Sept 15 – 19	Chapter 2
Week 3	Sept 22 – 26	Chapter 2
Week 4	Sept 29 – Oct 3	Chapter 3
Week 5	Oct 6 – 10	Chapter 3
Week 6	Oct 13 – 17	Chapter 3
Week 7	Oct 20 – 24	MIDTERM 1, Chapter 4
Week 8	Oct 27 – 31	Chapter 4
Week 9	Nov 3 – 7	Chapter 5
Week 10	Nov 10 – 14	Chapter 5, 6
Week 11	Nov 17 – 21	Chapter 6, MIDTERM 2
Week 12	Nov 24 – 28	Chapter 6
Week 13	Dec 1 – 5	Chapter 6, 7
Week 14	Dec 8 – 12	Chapter 7