Course Description

Linear algebra is a remarkable subject, being both mathematically beautiful and pervasive in practical applications. The central goal is to study systems of linear equations; these generalize the familiar scalar equation $y = mx + b$ to higher dimensions. Major topics include vectors, linear functions, norms and distance, orthogonality, linear independence, the Gram-Schmidt algorithm, matrix multiplication and inverses, QR factorization, and least squares fitting.

The course is intended to emphasize the practical side of linear algebra. As such we will use computers to solve problems over the semester using the Julia language.

The applied focus of the course is an experiment; expect adjustments to the syllabus if needed.

Essential Information

Professor	David Maxwell
Office	Chapman 308C
Email	`damaxwell@alaska.edu`
Phone	474-1196
Web	`damaxwell.github.io`
Required Text	**Introduction to Applied Linear Algebra** , *Boyd and Vandenberghe*, Cambridge University Press

Prerequisites:

The course prerequisite is a C or better in Math 252 (Calculus II).

Student Learning Outcomes

Students will:

- become fluent in linear combinations, bases, and matrix algebra
- apply linear algebra tools to dynamical systems, clustering, and least squares fitting
- understand how QR factorization is used to solve matrix equations, including non-square systems
- use software to solve practical problems using skills from linear algebra

Class Time

There will be three hours of class lecture each week.

Lecture Times

MWF	9:15–10:15	Chapman 106

Office Hours

I will schedule 3 hours a week of formal office hours. Some of these will be held in the Engineering building, but I will be available by Zoom.

Discord
A Discord server has been set up for this class. We will use it as the primary means of group communication.

Communication in Discord will be on-topic, polite and collegial as is suitable for a workplace setting.

As a courtesy to everyone you are communicating with, please sign in to the server with a handle that identifies yourself. As much as I am fond of my dog Frog, a handle of `RedFrog2016` would not be a great user id.

Homework
There will be a homework assignment due roughly every week, usually on Wednesdays. Each week's assignment and due date will be announced in class and will be posted on my web page.

Answers to homework problems will be posted in advance, and homework will be graded solely on completion.

Regarding late homework, I will accept from each student a single late homework with no questions asked. Simply hand in a note indicating you are using your free late homework in place of your actual assignment. You must notify me no later than the time the homework is due that you intend to take advantage of this opportunity, and you must hand in the homework no later than one week after it was due Subsequent late homeworks will be accepted only under extenuating circumstances to be determined at my discretion.

The late homework freebie cannot be used for the first two homework sets, nor can it be used for the final assignment.

Quizzes
There will be a weekly 15 minute quiz on Fridays based on the homework handed in on the previous Wednesday.

Quizzes cannot be made up unless there are extenuating circumstances (e.g. a school sponsored absence, a death in the family, a hospitalization). Your lowest quiz score will be dropped.

Labs
In addition to the more routine homework, there will be about four labs (i.e short projects) covering more in-depth material. More details on the labs will be announced along with your first lab.

Julia
Real-world problems in linear algebra are solved using computer software. We will use the software program Julia (a kind of modern Matlab) on assignments and for the labs. I do not expect that you have any programming experience, and I will provide materials to help you get up to speed.

Math Lab
The Math Lab on the library 5th floor has tutors available at scheduled times throughout the week. The tutors are most experienced at answering calculus questions, but you might find

that some of the tutors (especially the graduate students) would welcome the opportunity to discuss something other than calculus.

Midterms

There will be two in-class midterm exams.

Final Exam

There will be a comprehensive final exam 8am-10am on Friday, May 2.

Evaluation

Course grades will be determined as follows:

Homework	10%
Quizzes	14%
Labs	14%
Midterm 1	18%
Midterm 2	18%
Final	26%

Letter grades will be assigned according to the following scale. This scale is a guarantee; I also reserve the right to lower the thresholds.

A+	97–100%	C+	77–79%	F	≤ 59
A	93–96%	C	73–76%		
A-	90–92%	C-	70–72%		
B+	87–89%	D+	67–69%		
B	83–86%	D	63–66%		
B-	80–82%	D-	60–62%		

Tentative Schedule

The following is a tentative list of the topics to be covered in this class. As we proceed in the course, the course web page will list specific sections to be read for each week.

Week	Topics and Events
1/13 – 1/17	Chapter 1
1/20 – 1/24	Chapter 2 Monday: Holiday
1/27 – 1/31	Chapter 3
2/3 – 2/7	Chapter 4
2/10 – 2/14	Chapter 5
2/17 – 2/21	Chapter 6 First Midterm
2/24 – 2/28	Chapter 7
3/3 – 3/7	Spring Break
3/10 – 3/14	Chapter 8
3/17 – 3/21	Chapter 10
3/24 – 3/28	Chapter 11 Friday: Last day to withdraw with a 'W'
3/31 – 4/4	Eigenvalues Second Midterm
4/7 – 4/11	Chapter 9
4/14 – 4/18	Least Squares
4/21 – 4/25	Least Squares (data fitting)

Rules and Policies

Collaboration
You are encouraged to work together in solving homework problems. But each student must write up his or her own solutions independently. If you receive significant help solving a problem, it is customary to make a note in your homework to give the person who helped you credit.

Makeup Exams
You can make up an exam if certain extenuating circumstances prevent you from taking it and if you inform me in advance. Contact me as soon as possible if you are going to miss an exam.

Attendance
Attendance is not included directly as part of your grade.

Cell Phones
Turn off your cell phone before you come to class.

Disabilities Services
I will work with the Office of Disabilities Services (203 Whitaker, 474-7043) to provide reasonable accommodation to students with disabilities.

Incomplete Grade

Incomplete (I) will only be given in Computer Science, Mathematics or Statistics courses in cases where the student has completed the majority (normally all but the last three weeks) of a course with a grade of C or better, but for personal reasons beyond his/her control has been unable to complete the course during the regular term. Negligence or indifference are not acceptable reasons for the granting of an incomplete grade. (Note: this is essentially the old University policy.)

Late Withdrawals
A withdrawal after the university deadline from a Department of Mathematical Sciences course will normally be granted only in cases where the student is performing satisfactorily (i.e., C or better) in a course, but has exceptional reasons, beyond his/her control, for being unable to complete the course. These exceptional reasons should be detailed in writing to the instructor, department head and dean.

Academic Dishonesty
Academic dishonesty, including cheating and plagiarism, will not be tolerated. It is a violation of the Student Code of Conduct and will be punished according to UAF procedures.

Artificial Intelligence (AI)
These are very, very interesting times. AI is an incredible tool with the potential to both enhance and undermine your education. You are strongly encouraged to have conversations with AI models about the course material. You cannot use AI, however, to author work that you present as your own.

Official UAF Syllabus Addendum

Student protections statement: UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual haras sment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site: https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities/.

Disability services statement: I will work with the Office of Disability Services to provide reasonable accommodation to students with disabilities.

Student Academic Support:

- Speaking Center (907-474-5470, uaf-speakingcenter@alaska.edu, Gruening 507)
- Writing Center (907-474-5314, uaf-writing-center@alaska.edu, Gruening 8th floor)
- UAF Math Services, uafmathstatlab@gmail.com, Chapman Building (for math fee paying students only)
- Developmental Math Lab, Gruening 406

- The Debbie Moses Learning Center at CTC (907-455-2860, 604 Barnette St, Room 120, https://www.ctc.uaf.edu/student-services/student-success-center/)
- For more information and resources, please see the Academic Advising Resource List (https://www.uaf.edu/advising/lr/SKM_364e19011717281.pdf)

Student Resources:

- Disability Services (907-474-5655, uaf-disability-services@alaska.edu, Whitaker 208)
- Student Health & Counseling [6 free counseling sessions] (907-474-7043, https://www.uaf.edu/chc/appointments.php, Whitaker 203)
- Center for Student Rights and Responsibilities (907-474-7317, uaf-studentrights@alaska.edu, Eielson 110)
- Associated Students of the University of Alaska Fairbanks (ASUAF) or ASUAF Student Government (907-474-7355, asuaf.office@alaska.eduasuaf.office@alaska.edu, Wood Center 119)

Nondiscrimination statement: The University of Alaska is an affirmative action/equal opportunity employer and educational institution. The University of Alaska does not discriminate on the basis of race, religion, color, national origin, citizenship, age, sex, physical or mental disability, status as a protected veteran, marital status, changes in marital status, pregnancy, childbirth or related medical conditions, parenthood, sexual orientation, gender identity, political affiliation or belief, genetic information, or other legally protected status. The University's commitment to nondiscrimination, including against sex discrimination, applies to students, employees, and applicants for admission and employment. Contact information, applicable laws, and complaint procedures are included on UA's statement of nondiscrimination available at www.alaska.edu/nondiscrimination. For more information, contact:

UAF Department of Equity and Compliance
1760 Tanana Loop, 355 Duckering Building, Fairbanks, AK 99775
907-474-7300
uaf-deo@alaska.edu