MATH 314/814: Linear Algebra
UNL, Fall 2015, Section: 002, CRN: 3587/3601
Lecture: T, R, 12:30 pm-1:45 pm, Avery Hall 110

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Web: www.math.unl.edu/~alarios2/courses/2015_fall_M314H/content.shtml

Prerequisites: A grade of "P" or "C" or better in MATH 208 or 208H.

Textbook: Lay, David C.; Lay, Steven R.; McDonald, Judi J. *Linear Algebra and its Applications*, 5^{th} Edition. Pearson/Addison Wesley, 2015. ISBN-13: 978-0-321-98238-4.

ACE Outcome 3: "Use mathematical, computational, statistical, or formal reasoning (including reasoning based on principles of logic) to solve problems, draw inferences, and determine reasonableness." Your instructor will provide examples, you will discuss them in class, and you will practice with numerous homework problems. The exams will test how well you've mastered the material. The final exam will be the primary means of assessing your achievement of ACE Outcome 3.

Contacting me: The best way to contact with me is by email, alarios@unl.edu. Please put [MATH 314] or [MATH 814] somewhere in the title and make sure to include your whole name in your email. Polite, courteous emails are appreciated; see my website for tips on email etiquette. My office is in Avery Hall, room 305. My office hours are M,W,F, 12:30 pm - 1:20 pm. Drop-ins are welcome during these times. If you want to meet at another time, please email me in advance, and we will try to schedule a time to meet.

NOTE: Because of privacy rights, **I cannot discuss grades over email or telephone. Please do not email me asking about your grade. I will not be able to give you any information.** Of course, I am happy to discuss grades in my office.

Description: Fundamental concepts of linear algebra, including properties of matrix arithmetic, systems of linear equations, vector spaces, inner products, determinants, eigenvalues and eigenvectors, and diagonalization.

Motivation: Linear algebra is one of the most fundamental building blocks toward understanding modern science, engineering, mathematics, and computer science. It lies at the core of essentially every scientific discipline, and even has powerful uses in humanities and the arts, such as in computer graphics, linguistics, and audio engineering. The applications of linear algebra are far-reaching, and it has even had impacts in subjects as diverse as artificial intelligence, humanitarian aide, and legal studies. Besides having all these applications, the subject itself contains beautiful mathematics. It is a very visual subject, and many students enjoy this aspect as well.

Much of linear algebra requires very little mathematical background. This can be nice: most math courses you have had up until now continually build on each other, and linear algebra can feel like a nice departure from this. It can also be a little disorienting, since many of the mathematical tools you learned in calculus, for example, are not really employed here, or make only minor appearances. Linear algebra does however require a degree of so-called "mathematical maturity," which mostly means that you should be comfortable working with linear equations, plotting lines on a plane (we will rarely use curves), and translating ideas into mathematical language.

This course is both a careful introduction to linear algebra and its applications, and a transition course from computational courses, like calculus, to more theoretical ones. **You will need to understand definitions and theorems, be able to apply them, and sometimes, prove theorems.** *The material in the course will tend to be more mathematically subtle than that encountered in your previous math courses, and will consequently require a significant effort on your part to master.* The course covers sections from Chapters 1 to 7 of the text: systems of linear equations; matrix algebra, determinants, vector spaces, eigenvalues and eigenvectors, orthogonality, and inner product spaces, and quadratic forms.

Homework: Homework is designed to help students understand the material and to prepare them for exams. Homework assignments will be posted on the website. The suggested exercises represent a minimal assignment. Some students may have to work additional exercises from the text to attain sufficient mastery of the material.

Reading & Exercises: You are expected to **read the appropriate sections of the text before coming to the class** meeting in which the topic is scheduled. You are also expected to work through the indicated exercises after the corresponding material is presented in class, and **before** the next class meeting.

Scheduling: A tentative schedule of assignments and exams is included in this syllabus. These details are presented as a guide. Your instructor may change the dates for each assignment and/or exam, modify the exercise list, and/or add assignments. It is your responsibility to keep track of the course details and schedule for your section.

Collaboration: Collaboration is encouraged in this course. However, copying someone else's work and submitting it as your own is unacceptable. This act of academic dishonesty will be prosecuted in accordance with university policy.

Electronics: You are not allowed to have on your person during exams or quizzes any device that can access the internet or communicate in any way. Cell phones, Apple watches, etc. should be put away in backpacks/purses. Calculators, laptops, tablets, cell phones, and other non-medical electronic devices are not permitted during exams unless otherwise stated. During class, cell phones should be set on vibrate or off. If you need to take a call, send a text message, etc., please quietly leave the classroom to do so, so that you do not distract other students. You are welcome to return to class quietly when you are finished. If you wish to take notes using an electronic device, you must first demonstrate to me that you can type or write fast enough to do so properly, and that you can do it without distracting others, before the privilege to use such devices may be granted. If you are found to be abusing this privilege, you risk forfeiting it.

Grading: Your minimal course grade will be computed as follows.

Homework:	20%	A	90%	–	100%
Midterms:	$2 \times 25\% = 50\%$	B	80%	–	89.99%
Final Exam:	30%	C	70%	–	79.99%
—	—	D	60%	–	69.99%
Total:	100%	F	0%	–	59.99%

Attendance: Daily attendance for class lectures is expected and is extremely important. While attendance is not recorded, missing even one class will put you behind. Note that there is a strong correlation between class absences and poor grades. You are responsible for all material and announcements in class regardless of whether or not you attended. **You are also responsible for making arrangements with another classmate**

to find out what you missed. You should not ask me to go over material you missed (due to tardiness or absences) during office hours or over email.

Make-up exams: Make-up exams will only be given with written evidence of an official university excused absence.

Incompletes: A grade of "incomplete" may be considered if all but a small portion of the class has been successfully completed , but the student in question is prevented from completing the course by a severe, unexpected, and documented event. Students who are simply behind in their work should consider dropping the course.

ADA Statement: Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the **Services for Students with Disabilities (SSD) office**, 132 Canfield Administration, 472-3787 voice or TTY.

Grade Questions: Any questions regarding grading/scoring of homework, exams, or projects must be made within two class days from when they were handed back, or no change in grade will be made.
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Special Dates:

Sept. 4, 2015 (Friday):	Last day to withdraw from this course and not have it appear on your transcript.
Oct. 16, 2015 (Friday):	Last day to change your grade option to or from Pass/No Pass.
Nov. 13, 2015 (Friday):	Last day to drop this course and receive a grade of W. (No permission required.) After this date, you cannot drop.

Departmental Grading Appeals Policy: Students who believe their academic evaluation has been prejudiced or capricious have recourse for appeals to (in order) the instructor, the departmental chair, the departmental appeals committee, and the college appeals committee.

Final Exam Policy: Students are expected to arrange their personal and work schedule to allow them to take the final exam at the scheduled time. No student will be permitted to take the final exam early. The final exam for this course is:
Friday, December 18, 2015, 7:30 am-9:30 am (same classroom).

Disclaimer: While this syllabus was prepared carefully and according to information available at the beginning of the semester, changes may be necessary in the interest of good teaching. Changes to any of the information above will be announced in class and posted on the class web site. This includes in particular possible updates or corrections to the syllabus, and changes of exam dates.

Rough schedule: The following table shows the material expected to be covered and the corresponding tentative problem assignments for each week of the semester. Note that what is shown here is approximate; please be alert for changes throughout the semester.

Week of	Section	Recommended Exercises
August 24	1.1 – Systems of Linear Equations	1, 3, 5, 9, 10, 11, 15, 18, 19, 20, 23, 24, 25, 31
	1.2 – Row Reduction and Echelon Forms	1, 3, 7, 11, 13, 15, 17, 19, 21, 22, 23, 24, 25, 26
	1.3 – Vector Equations	1, 3, 5, 9, 11, 13, 15, 17, 19, 23, 24, 25, 28
August 31	1.4 – The Matrix Equation $A\mathbf{x} = \mathbf{b}$	1, 3, 7, 9, 11, 13, 14, 15, 17–24
	1.5 – Solutions Sets of Linear Equations	2, 5, 6, 7, 9, 11, 12, 13, 15, 16, 20, 23, 24, 25, 40
	Friday, September 4 is the last day to file a drop to remove course from student's record	
September 7	*Monday, September 7 is Labor day*	
	1.6 – Applications of Linear Systems	3(a,b), 7, 14
	1.7 – Linear Independence	1, 3, 5, 7, 9, 13, 14, 15, 17, 19, 21, 22, 23, 24, 28, 32
	1.8 – Introduction to Linear Transforms	1, 2, 3, 5, 7, 9, 11, 13–16, 19, 21, 22, 32, 33, 34
September 14	1.9 – The Matrix of Linear Transformation	1, 5, 7, 13, 15, 17, 22–25
	2.1 – Matrix Operations	1, 3, 5, 7–11, 15, 16, 19, 22, 24
	2.2 – The Inverse of a Matrix	1, 3, 5, 7, 8, 9, 10, 13, 20, 21, 23, 24, 29, 31, 33
September 21	2.3 – Characterizations of Invertible Matrices	1–7(odd), 11, 12, 13, 16, 17, 19, 22, 33, 37
	2.5 – Matrix Factorization	3, 5, 9, 11, 19
	catch up and review	
September 28	**Midterm Exam 1 is Tuesday, September 29**	
	3.1 – Introduction to Determinants	1–13 (odd), 39, 40
	3.2 – Properties of Determinants	1–7, 11, 15, 18, 19, 25, 27, 28
	3.3 – Cramer's Rule, Volume, and Linear Transformations	Read section 3.3, it will help you visualize things
October 5	4.1 – Vector Spaces and Subspaces	1–15, 17, 19, 21, 23, 24, 25, 27
	4.2 – Null Spaces, Column Spaces, and Linear Transformations	1, 2, 3, 5, 7, 11, 12, 15, 17, 19, 20, 21, 25–28, 30, 35
	4.3 – Linearly Independent Sets; Bases	1–15 (odd), 19, 21–25, 31, 32
October 12	4.5 – The Dimension of a Vector Space	1–5, 7–17 (odd), 19, 20, 21, 29, 30, 31
	4.6 – Rank	1, 3, 4, 5–15 (odd), 17, 18, 19, 21, 25, 27–29
	4.7 – Change of Basis	1–9 (odd), 11, 12, 13, 15
	Friday, October 16 is the last day to change to P/NP	
October 19	*October 19–20 (Monday and Tuesday) is Fall Break: No class*	
	4.9 – Applications to Markov Chains	1, 3, 5, 9, 11
October 26	5.1 – Eigenvectors and Eigenvalues	1–15 (odd), 19, 21, 22, 23, 24, 25, 27, 31, 33
	5.2 – The Characteristic Equation	1, 3, 7, 9, 11, 13, 17, 21, 22, 23, 24
	5.3 – Diagonalization	1, 3, 5, 7, 11, 15, 19, 21, 22, 23, 24, 25, 27, 29
November 2	5.4 – Eigenvectors and Linear Transformations	1, 3, 5, 8, 9, 11, 13, 19, 23, 27
	5.6 – Discrete Dynamical Systems	1, 5, 7
	catch up and review	
November 9	**Midterm Exam II is Tuesday, November 10**	
	6.1 – Inner Product, Length, and Orthogonality	1–19 (odd), 20, 25–31
	6.2 – Orthogonal Sets	1, 5, 9, 11, 13, 15, 17, 23, 24, 27–29
	Friday, November 13 is the last day to withdraw from one or more courses	
November 16	6.3 – Orthogonal Projections	1, 5, 7, 11, 13, 15, 21, 22, 23, 24
	6.4 – The Gram-Schmidt Process	1, 5, 11, 15, 17, 18, 19, 22
	This homework is due Tuesday, December 1	
November 23	**Thanksgiving vacation is November 25–November 30**	
	6.5 – Least-Squares Problems	1, 3, 5, 7, 11, 15, 17, 18, 19, 21
	6.6 – Applications to Linear Models	1, 3, 7a, 9
November 30	**The set of problems from 6.5 and 6.6 are due Thursday, December 3**	
	7.1 – Diagonalization of Symmetric Matrices	1–19 (odd), 23, 25, 26, 28, 29, 36
	7.2 – Quadratic Forms	1–13 (odd), 21, 22, 23, 24
December 7	7.3 – Constrained Optimization	1, 3, 5, 9, 11
	7.4 – The Singular Value Decomposition	1, 3, 5, 11
	The set of problems from 7.1 and 7.2 are due Thursday, December 10	
	catch up and review	
	The Final Exam is 7:30 am –9:30 am, Friday, December 18	