MATH-UA 140: LINEAR ALGEBRA
SYLLABUS - FALL 2015

Instructor: Drew C. Youngren, Clinical Assistant Professor of Mathematics
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Office: Courant Institute (Warren Weaver Hall) Rm. 721
Office Hours: W 11:00am–1:00pm
Lecture:
- Section 001: Silver rm. 508 - TR 1530–1720

Course description: [1] Linear algebra is an area of mathematics devoted to the study of structure-preserving operators on special sets (linear operators on vector spaces). Linear algebra is a cornerstone of any mathematics curriculum for two very important (and related) reasons: 1) The theory of linear algebra is well understood and so a first step in many areas of applied mathematics is to reduce the problem into one in linear algebra. 2) The spaces and operations studied in the subject are commonplace in many different areas of mathematics, science, and engineering.

Over the semester we will study many topics that form a central part of the language of modern science. The successful student will be able to:
- Formulate, solve, apply, and interpret systems of linear equations in several variables;
- Compute with and classify matrices;
- Master the fundamental concepts of abstract vector spaces;
- Decompose linear transformations and analyze their spectra (eigenvectors and eigenvalues);
- Utilize length and orthogonality in each of the above contexts;
- Apply orthogonal projection to optimization (least-squares) problems;
- Explore other topics (as time permits).

The material we take up in this course has applications in physics, chemistry, biology, environmental science, astronomy, economics, statistics, and just about everything else. We want you to leave the course not only with computational ability, but with the ability to use these notions in their natural scientific contexts, and with an appreciation of their mathematical beauty and power.

Textbook:
- Strang, Gilbert. *Introduction to Linear Algebra.* 4th Edition.

Grading: The final grade will be computed with the following weights:

Homework	20%
Quizzes	20%
Midterm Exams	35%
Final Exam	25%

A note on grades of W and I.

You may drop the course in the first three weeks (by Monday, February 10) without it appearing on your transcript. After that, and through the ninth week, you may withdraw and receive a grade of 'W' on your transcript. No withdrawals are granted after the ninth week.

A grade of 'Incomplete' (I) is granted only in the rare circumstances that an emergency prevents a student in good standing from finishing the course in its last few weeks. As per the CAS Bulletin:

> "Students who are ill or have a serious personal problem should see, call, or write to an adviser in the College Advising Center, College of Arts and Science, New York University, Silver Center, 100 Washington Square East, Room 905, New York, NY 10003-6688; 212-998-8130."

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[1]courtesy C. Jankowski

NYU Classes: The chief means of communication for this course will be the course Classes site, accessed through `newclasses.nyu.edu`. Students are expected to check this for up-to-date assignments—including material separate from the text—and announcements.

Homework: Weekly problem sets with a mix of exercises from the text and supplementary problems will be collected. These include more in-depth problems requiring greater abstraction, understanding and/or synthesis of various concepts. In many ways, these constitute the heart of the course; rigor in their completion often yields the greatest understanding.

Quizzes: Short quizzes will be given (almost) weekly. These will generally cover material on the previous week's homework.

When calculating the homework and quiz grades for the semester, the lowest score in each of these areas will be dropped. **N.B.** It is advised that students reserve these "passes" for unexpected absences. In fairness to all students and graders, **late homework will not be accepted.**

Exams: There will be two in-class exams during the semester. See the attached schedule for likely dates.

Final Exam: The final exam will take place on Thursday, December 17 from 4:00pm–5:50pm.

Policy on out-of-sequence exams and missed quizzes

We are only able to accommodate a limited number of out-of-sequence exams due to limited availability of rooms and proctors. For this reason, we may approve out-of-sequence exams in the following cases:

- A documented medical excuse.
- A University sponsored event such as an athletic tournament, a play, or a musical performance. Athletic practices and rehearsals do not fall into this category. Please have your coach, conductor, or other faculty advisor contact your instructor.
- A religious holiday.
- Extreme hardship such as a family emergency.

We will **not** be able to accommodate out-of-sequence exams, quizzes, and finals for purposes of more convenient travel, including already purchased tickets. Please note again the date of the final and plan your summer travel accordingly.

Scheduled out-of-sequence exams and quizzes (those not arising from emergencies) must be taken before the actual exam. Makeups must occur within one week of the regularly scheduled exam or quiz, otherwise a zero score will be given.

If you require additional accommodations as determined by the Center for Student Disabilities, please let your instructor know as soon as possible.

Technology: Technology can play an important role in the learning of mathematics, and as such, graphing and scientific calculators are permitted for class and homework, though they will not be required. Calculators will not be permitted on tests and quizzes, and thus it is emphasized that students learn not to rely on them.

Academic Honesty: Guidelines regarding cheating and plagiarism are laid out in the College of Arts and Sciences guidelines and will be adhered to strictly. Collaboration is permitted, in fact encouraged, for home and class assignments; however, all submitted assignments must be written up independently and represent the student's own work and understanding.

Below is a proposed schedule for covering topics and assignments during the semester. All are subject to change as the semester progresses.

Day	M/W	T/Th	Sections	Topic	Due	Note
1	9/2/2015	9/3/2015	§1.1–2	Introduction, Vectors		
2	9/9/2015	9/8/2015	§1.3	Dot Product, Length		
3	9/14/2015	9/10/2015	§2.1–2	CounterExamples, Boolean Algebra	HW1	
4	9/16/2015	9/15/2015	§2.3–4	Lists, Factorials		Q1
5	9/21/2015	9/17/2015	§2.5	Sets, Quantifiers	HW2	
6	9/23/2015	9/22/2015	§2.6–7	More Sets		Q2
7	9/28/2015	9/24/2015	§3.1	Combinatorial Proofs	HW3	
8	9/30/2015	9/29/2015	§3.2–3	Equivalence Relations		Q3
9	10/5/2015	10/1/2015	§3.4	Complete Solutions	HW4	
10	10/7/2015	10/6/2015		MIDTERM EXAM 1 (through 3.3)		
11	10/13/2015	10/8/2015	§3.5	Independence/Dimension		
12	10/14/2015	10/15/2015	§3.6–§4.1	The Four Subspaces	HW5	
13	10/19/2015	10/20/2015	§4.2	Smallest Counterexample		Q4
14	10/21/2015	10/22/2015	§4.3–4	Projections/Least Squares	HW6	
15	10/26/2015	10/27/2015	§4.5	Orthogonal Bases		Q5
16	10/28/2015	10/29/2015	§5.1	The Determinant	HW7	
17	11/2/2015	11/3/2015	§5.2/3	Permutations, Cofactors, Volumes		Q6
18	11/4/2015	11/5/2015	§6.1	Eigendingen		
19	11/9/2015	11/10/2015	§6.2	Diagonalization	HW8	
20	11/11/2015	11/12/2015	§6.4–6	Symmetry and Similarity		Q7
21	11/16/2015	11/17/2015	§6.7	SVD	HW9	
22	11/18/2015	11/19/2015		MIDTERM EXAM 2 (through 6.6)		
23	11/23/2015	11/24/2015	§7.1	Linear Transformations		
24	11/30/2015	12/1/2015	§7.2	Change of Basis	HW10	
25	12/2/2015	12/3/2015	§8–§10	Applications/Select Topics		Q8
26	12/7/2015	12/8/2015			HW11	
27	12/9/2015	12/10/2015				Q9
28	12/14/2015	12/15/2015			HW12	
				FINAL EXAM		