Math 250: Introductory linear algebra

Section B2, Summer 2020

Instructor: Weihong Xu (wx61@rutgers.edu). Please call me "Weihong".

Class time: MTWTh 12:20 – 2:20 pm EDT

Office hours: TWThF 11:00 –11:30 am EDT

Prerequisites: Math 152 or Math 136.

Technology Policy

Overview: Linear algebra is an extremely useful toolkit and has numerous applications in and outside of mathematics. In this class you will get practice with computations as well as gain conceptual understanding that will enable you to make connections and apply the toolkit in various contexts. Examples of applications from differential equations, data analysis, and more will be discussed.

Learning materials: The official textbook is Spence, Insel, & Friedberg, *Elementary Linear Algebra: A Matrix Approach, 2nd Edition* (ISBN-13: 978-0 13-187141-0), but our class will take a slightly different viewpoint. Lecture notes, recordings, homework solutions, and additional materials will be posted on the course page.

Platforms: We will use Zoom for classes and Canvas for assignment submissions and grade viewing; lecture notes and additional materials will be posted on the course page; everyone will be added to a course team on Microsoft Teams where you can attend office hours and collaborate with each other; exam logistics will be announced later.

Instructions:
1. A Zoom link to join the lectures will be posted on the homepage of our Canvas course site. It will be the same link for every class.
2. Please use your real name on Zoom so I can distinguish you from the Zoom-bombers.
3. Please be on time whenever possible. For security reasons, you will be put a waiting room and I will have to let you in. In order not to disrupt the flow of the class, you may have to wait a little bit before I let you in if you are late.
4. I strongly encourage you to share your webcam during lectures and discussions. Visual feedback is very helpful in communication, and with the webcam on you will feel more present and motivated.
5. A quick start guide for Microsoft Teams.
6. System requirements for Zoom and Microsoft Teams.
7. Technical support for Microsoft Teams.
8. 24/7 Canvas support.

Lecture format: This is a remote synchronous class structured to promote active learning. You are expected to pay close attention and interact with me and your classmates during all class meetings. A lot of time will be spent on workshops where you work on problems in groups. Sometimes I may assign you activities to do before a lecture.

Grading: Final=30%; Homework=20%; Midterm 1=15%; Midterm 2=15%; Workshop=15%; Workshop Participation=5%.

Exams: The exams will be open-book but designed in a way to give a clear advantage to students who do not need to look things up. A few reflective questions will be included. If you require the Office of Disabilities Services for taking exams, please email me your Letter of Accommodations by the end of the first week of classes. Full disability policies and procedures are here.

Homework: There will be 6 homework assignments in total. For due dates see the tentative schedule below. The lowest homework grade will be dropped. Homework must be handwritten (electronic handwriting is allowed) for authentication purposes and submitted on Canvas. Each homework will be graded on the scale of 40, and up to 4 points may be taken off if your solution is hard to read or poorly presented. Homework will be graded by a grader.

Workshops: After each workshop you will be asked to turn in a well-written solution of some problems you worked on during the workshop. They are due the next day at noon. There will be 19 workshops in total, and the lowest 4 workshop grades will be dropped. Workshops must be handwritten (electronic handwriting is allowed) for authentication purposes and submitted on Canvas. Each workshop is graded on a scale of 10, and 1 point may be taken off if your solution is hard to read or poorly presented.

Workshop Participation: During each workshop I will grade your engagement level on a scale of 3 as follows: absent=0; present but unengaged=1; moderately engaged=2; fully engaged=3. The grade is based only on what I see at the times I observe. If you are absent or unengaged during part of the workshop, you may receive a low grade. There will be 19 participation grades, and the lowest 4 will be dropped to accommodate for technical issues and unforeseen circumstances.

Makeups: The exams must be taken during designated times unless there is a truly compelling and documented reason. A good number of homework and workshop grades will be dropped to accommodate for unforeseen circumstances. For this reason, late homework and workshops will NOT be accepted. It is your responsibility to MAKE SURE THAT YOUR SUBMISSIONS ARE SUCCESSFUL AND YOUR FILES ARE LEGIBLE AND COMPLETE. If you have an ongoing issue that require special accommodation, please provide documentations ASAP.

Academic integrity: All Rutgers students are expected to be familiar with and abide by the academic integrity policy. Violations of the policy are taken very seriously. Specific measures will be in place to prevent cheating in online exams. While I encourage collaboration,

you must write homework and workshop solutions IN YOUR OWN WORDS. DO NOT SHARE COMPLETE SOLUTIONS to homework and workshop problems (including posting on Teams or elsewhere) before they are due. YOU WILL RECEIVE NO CREDIT on a homework or workshop if you are found to have copied from whatever source or let others copy your solutions.

How to succeed in this class:
1. This class will be different from what you are used to in that there is greater emphasis on conceptual understanding, which will be seen in lectures, assignments, and exams. If you are used to memorizing standard procedures for standard types of problems, you must do things differently to succeed in this class. Make an effort to really understand. Ask yourself questions. Come to my office hours and discuss with each other. Explaining mathematical ideas to others is often the most effective way to sort out your own confusions and clarify your understanding; you don't know just what it is that you don't understand until you try explaining it to someone else.
2. Beware that this class proceeds at a very fast pace, unlike during regular Fall and Spring semesters, and there will be no time for you to cram before exams. It is very important that you understand each day's material before the next lecture. If you get confused, ask for help IMMEDIATELY!
3. Tips on engaging in meaningful discussions: start by finding out where everyone is, and then ask for or give a hint; discuss the outline of the approach only when necessary.

Tentative schedule:

Lecture	**Topics**	**Dues**
T 5/26	Vector Spaces over $\mathbb{R}$, $\mathbb{C}$ and Their Subspaces	
W 5/27	Span, Linear Dependence and Linear	W1
	Independence of a Set of Vectors;	
	Bases and Dimension of a Vector Space	
Th 5/28	Matrices and Matrix Algebra;	W2
	Partitioned Matrices and Block Multiplication	
F 5/29		W3
M 6/1	Definition of Invertibility of a Matrix;	H1
	Linear Transformations and Their Matrices;	
	Composition and Invertibility of Linear Transformations	
T 6/2	Kernel and Range of Linear Transformations;	W4
	Row and Column Operations on Matrices;	
	Elementary Matrices	
W 6/3	Gaussian Elimination, Echlon Forms, and	W5
	Ranks of Matrices	

Th 6/4	Computing the Inverse of a Matrix;	W6
	LU Decomposition of a Matrix	
F 6/5		W7
M 6/8	**Midterm 1 (in Class)**	H2
T 6/9	The Determinant of a Matrix	
W 6/10	Systems of Linear Equations	W8
Th 6/11 - T 6/16	Eigenvalues and Eigenvectors of a Matrix;	W9 on 6/11
	the Characteristic Polynomial;	W10 on 6/12
	Diagonalization of Matrices and Applications	H3 on 6/15
		W11 on 6/16
W 6/17	Inner Product on a Verctor Space*;	W12
	Orthonormal Bases of a vector space;	
Th 6/18	Unitary Matrices; Gram-Schmit Process;	W13
	QR factorization of Matrices*	
F 6/19		W14
M 6/22	**Midterm 2 (in Class)**	H4
T 6/23	Orthogonal Complement and Projections	
W 6/24	Least Squares Method;	W15
	Solving Inconsistant Systems	
Th 6/25	Adjoint Operator*;	W16
	Diagonalization of Self-adjoint Operators	
F 6/26		W17
M 6/29	Diagonalization of Quadratic Forms*	H5
T 6/30	Spectral Decomposition of	W18
	Self-adjoint Operators	
W 7/1	Catch up	W19
Th 7/2	Review	H6
F 7/3	**Final Exam**	

Note: Topics with a * may be skipped if we fall behind schedule. "W" stands for "workshop"; "H" stands for homework. Everything is due at noon.

Other resources:

1. Student health virtual workshops and resources.

2. Counseling Services.

3. Office for Violence Prevention and Victim Assistance.

Disclaimer: This syllabus is subject to change according to the needs of the class, as deemed appropriate by the instructor. In case of changes, students will be notified in class and a new syllabus will be distributed.