Syllabus - Math 242 Fall 2023
Linear Algebra

Professor: Juanita Duque-Rosero (she/her) - juanita@bu.edu.
TF: Ju Tan - jutan@bu.edu.
Course hours: TR 5:00 - 6:15 PM (LSE B01).
Discussion: M 8:00 - 8:50 AM (CAS 204B) or 9:05 - 9:55 AM (CAS 204B) or 10:10 - 11:00 AM (CAS B27) or 11:15 - 12:05 PM (CAS B27) or 12:20 - 1:10 PM (CAS B27).
Office hours: TR 2:15 - 3:15 PM and W 4:00 - 5:00 PM, or by appointment (at CDS 311).
Text: Lay, Lay, and McDonald, Linear Algebra and its Applications, 6th edition.
Course website: Blackboard via `learn.bu.edu`.

Material

This course will cover the basic concepts of systems of linear equations and their solutions. The first half of the course will emphasize computational techniques, with applications to physics, applied mathematics, economics, and engineering. The second half of the course will cover matrices as linear transformations on vector spaces. We will cover Chapters 1-6 and further topics, time permitting.

Teaching Methods and Philosophy

I firmly believe in Federico Ardila's axioms and I encourage you to think about them at every step of your learning process:

Axiom 1 Mathematical potential is equally present in different groups, irrespective of geographic, demographic, and economic boundaries.

Axiom 2 Everyone can have joyful, meaningful, and empowering mathematical experiences.

Axiom 3 Mathematics is a powerful, malleable tool that can be shaped and used differently by various communities to serve their needs.

Axiom 4 Every student deserves to be treated with dignity and respect.

Expectations. These are my expectations for you: treat me, your classmates, and yourself with respect; come to class on time and prepared to learn; actively work and participate in class; and follow BU's academic conduct code. This is what you can expect from me: treat everyone with respect; come to class on time and prepared; do my best to support your class interactions and to help you succeed; and have open channels of communication during class, office hours, or by email.

Grading

The course grade will be based upon the scores on homework, two in-class midterm exams, and a final exam as follows:

- Homework: 20%
- Your weakest midterm: 20%
- Your strongest midterm: 30%
- Final exam: 30%

This grading policy is subject to change, but grades will not decrease as a result of changes. Homework will be due one week after it is assigned (to be submitted on Gradescope). You are welcome to work with others on your homework; please acknowledge your collaborators on the first page of your write-up. Your lowest two homework scores will be dropped.

Computer Packages

Some homework problems will involve computer calculations. I recommend the open- source software package SageMath, which can be either be used in the cloud at http://www.cocalc.com or via a free download from http://www.sagemath.org.

Academic Honesty

Boston University's policies on cheating are spelled out in the BU Academic Conduct Code, available at http://www.bu.edu/academics/resources/academic-conduct-code/. These policies will be followed in this class.

Attendance Policy

You are expected to attend each class and discussion session unless you have a valid reason for being absent. To reflect the importance of attending discussion sessions, you will receive a bonus of 5 points on your final exam if you attend at least 10 discussion sessions during the semester.

Absence Due to Religious Observance

If you must miss class due to religious observance, you will not be penalized for that absence and you will receive a reasonable opportunity to make up any work or examinations that you may miss. Please notify me of absences for religious observance as soon as possible and **before the absence**.

Mental Health and Wellness

The academic environment is challenging, and classes are not the only demanding part of your life. There are a number of resources available to you on campus to support your wellness, including: mental health services at SHS (https://www.bu.edu/shs/behavioral-medicine), which allows you to book initial evaluation appointments online (http://patientconnect.bu.edu/); and Student Wellbeing (https://www.bu.edu/studentwellbeing/). Please make me aware of anything that will hinder your success in this course.

Accommodations

Students with documented disabilities, including learning disabilities, may be entitled to accommodations intended to ensure that they have integrated and equal access to the academic, social, cultural, and recreational programs the university offers. Accommodations may include, but are not limited to, additional time on tests, staggered homework assignments, note-taking assistance. If you believe you should receive accommodations, please contact the Office of Disability & Access Services to discuss your situation. This office can give you a letter that you can share with me outlining the accommodations you should receive. The letter will not contain any information about the reason for the accommodations.

Tentative Course Outline

The following is a tentative outline for the course. This page will be updated irregularly. Please refer to the Blackboard page for updated assignments.

Week	Lecture	Sections in Text	Brief Description	Practice Problems
1	9/5	1.1	Systems of linear equations	1, 3, 11, 15, 19, 37, 39.
	9/7	1.2	Row reduction and Echelon form	1, 3, 9, 15, 21, 33, 35.
2	9/11		Discussion	
	9/12	1.3, 1.4	Vector equations, linear combinations, and matrix equations	1.3 - 3, 5, 11, 15, 25, 29, 33. 1.4 - 3, 5, 11, 13, 19, 25, 35.
	9/14	1.4, 1.5	Solutions to linear systems	1.5 - 5, 7, 11, 19, 25, 31, 43.
3	9/18		Discussion	
	9/19	1.7	Linear independence	1, 5, 9, 13, 19, 23, 25, 35.
	9/21	1.8, 1.9	Linear transformations and matrices	1.8 - 5, 11, 13, 17, 21, 27. 1.9 - 1, 5, 9, 13, 19
4	9/25		Discussion	
	9/26	1.9, 1.10	Onto and one-to-one linear transformations and applications	1.9 - 33, 37. 1.10 - 1, 3.
	9/28	2.1	Matrix operations	1, 5, 9, 17, 19, 29.
5	10/2		Discussion	
	10/3	2.2, 2.3	The inverse of a matrix	2.2 - 3, 5, 7, 9, 13, 39, 41, 45. 2.3 - 5, 11, 17, 21, 23.
	10/5		**Midterm 1**	
6	10/10		Discussion (Substitute a Monday)	
	10/12	2.3, 2.5	The LU factorization	2.5 - 1, 3, 9, 15
7	10/16		Discussion	
	10/17	3.1, 3.2	Determinants	3.1 - 3, 5, 9, 15, 33.
	10/19	3.2	Properties of determinants	1, 5, 9, 13, 21, 25, 27, 33.
8	10/23		Discussion	
	10/24	3.3, 4.1	Cramer's rule, volume, and vector spaces	3.3 - 3, 9, 13, 19. 4.1 - 1, 3.
	10/26	4.1, 4.2	Subspaces and null spaces	4.1 - 9, 13, 15, 29. 4.2 - 1, 5.
9	10/30		Discussion	
	10/31	4.2	Column and row spaces and linear maps	9, 15, 17, 23, 27, 33, 39.
	11/2	4.3	Linear independence and bases	1, 5, 7, 9, 13, 15, 21, 25.
10	11/6		Discussion	
	11/7	4.4	Coordinate systems and coordinate maps	3, 5, 7, 9, 15, 21, 25.
	11/9		**Midterm 2**	
11	11/13		Discussion	
	11/14	4.5	Dimension of a vector space	3, 7, 9, 13, 17, 31.
	11/16	4.6	Change of basis	1, 3, 5, 7, 11, 15.
12	11/20		Discussion	
	11/21	5.1, 5.2	Eigenvectors and eigenvalues and the characteristic equation	5.1 - 3, 7, 11, 15, 17, 25, 31. 5.2 - 1, 3, 9, 15, 21, 25, 29.
	11/23		**No class**	
13	11/27		Discussion	
	11/28	5.2, 5.3	Similarity and diagonalization	5.2 - 31. 5.3 - 1, 5.
	11/30	5.3	Diagonalization	7, 9, 17, 21, 27, 31, 37.
14	12/4		Discussion	
	12/5	6.1, 6.2	Inner products and orthogonality	6.1 - 5, 7, 13, 17. 6.2 - 1, 5.
	12/7	6.2, 6.3	Orthogonal sets and projections	6.2 - 7, 11, 15, 19. 6.3 - 1, 3.
15	12/11		Discussion	
	12/12	6.4	The Gram-Schmidt process	1, 3, 9, 11, 15, 17, 21.
	TBA		**Final Exam**	