EK103, Computational Linear Algebra
Instructor: Josh Semeter

Lecture 1

- Course Structure
- Motivation to learn linear algebra
- Linear systems of equations
- Geometric viewpoint (vectors, matrices)

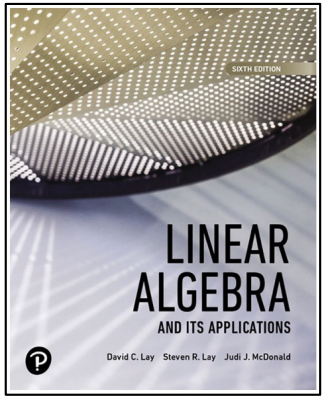
Link to Lecture 1 recording (first 35 minutes only)
Passcode: d.x5B6B%

Instructor: Joshua Semeter, PHO 537 (jls@bu.edu)
GTA: Wei Zhang (wzhang1@bu.edu)
Lecture: Tue/Thu 1:30-3:15, PHO 211
Discussion Session: Fri 8:00-8:50, PHO 211

Web: gradescope.com gradescope Slack

Course Description
This course examines properties of systems of linear equations, vector spaces, linear independence, dimension, linear transformations, matrices, determinants, eigenvalues, and eigenvectors. The concepts and tools you will learn are immensely useful in a wide variety of application domains, including physics, engineering, data science, artificial intelligence, machine learning, and more. Our general approach is to develop a geometric abstraction of concepts using small problems (2 or 3 dimensions), and then to extend to larger problems through Matlab-based computational exercises. Example applications include least-squares fitting, cryptography, image and audio compression, Markov chains, and Google's PageRank algorithm.

Textbook
David C. Lay et al., *Linear Algebra and Its Applications (6th Edition)*
We will follow the textbook fairly closely, focusing on sections listed in the lecture schedule. The book is available to rent direct from publisher for reasonable cost. The 5th edition is also acceptable but the section numbers and contents will be somewhat different.



Software
We will make extensive use of Matlab in this course. Matlab is a highly accessible scripting language, and no prior familiarity with required. You are expected to bring your laptop to lecture. Instructions for download and installation of Matlab are here:
http://www.bu.edu/tech/services/cccs/desktop/distribution/mathsci/matlab/

Discussion session and extra help
Our TA staff will hold a weekly discussion session on **Fridays, 8:00-8:50 in PHO 211.** Other opportunities to get help will be provided through office hours and our Slack channel.

Grading (tentative)
Class participation: 5%, Homework: 20%, Exam1: 20%, Exam2: 25%, Final Exam: 30%
Matlab exercises will be included in the homework portion of the course.

Homework Assignments

Homework assignments will be issued approximately weekly through Slack, and will consist of a combination of Matlab exercises and problems requiring written responses. Collaboration on homework is allowed, but you must turn in your own individually prepared work. Homework will be turned in via upload to Gradescope.

Exams

We will have two mid-term exams, in addition to the final exam. **The midterm exams will on 10/13/2020 and 11/2/2020 during the Lecture period.**

Cheating

Collaboration on exams, or use of resources outside of what is expressly permitted, is considered cheating. Suspected violations will be brought before the BU academic conduct committee. Such cases are incredibly stressful to all involved, and the consequences to your academic career are enormous. So please, follow the rules, and do not cheat. The university's Academic Conduct Code can be reviewed \here:
https://www.bu.edu/academics/policies/academic-conduct-code/

Inclusion

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Accommodations for Students with Documented Disabilities: If you are a student with a disability or believe you might have a disability that requires accommodations, requests for accommodations must be made in a timely fashion to Disability & Access Services, 25 Buick St, Suite 300, Boston, MA 02215; 617-353-3658 (Voice/TTY). Students seeking academic accommodations must submit appropriate medical documentation and comply with the established policies and procedures *http://www.bu.edu/disability/accommodations/*

EK103 Lecture Schedule (tentative)

Week 1 (9/6, 9/8) Sec. 1.1	Course introduction Systems of Linear Equations
Week 2 (9/13, 9/15) Sec 1.2, 1.3	Row Reduction and Echelon Forms Vector Equations
Week 3 (9/20, 9/22) Sec 1.4-1.6	The Matrix Equation Ax=b Solution Sets of Linear Systems Application Examples
Week 4 (9/27, 9/29) Sec 1.6-1.10	Linear Independence Linear Transformations Linear Models in Science and Engineering
Week 5 (10/4, 10/6) Sec 2.1-2.3, 2.5	Matrix Operations The Inverse of a Matrix Matrix Factorization
Week 6 (10/13) Exam 1	**Exam 1 (10/13)**
Week 7 (10/18,10/20) Sec 2.7-2.9	Applications in Computer Graphics Subspaces of R^n Dimensions and Rank
Week 8 (10/25, 10/27) Sec3.1-3.3, 5.1	Determinants and their Properties Area, Volume, Linear transformations Introduction to Eigenvectors and Eigenvalues
Week 9 (11/1, 11/3) Sec 5.1-5.3	Eigenvectors and Eigenvalues The Characteristic Equation Diagonalization
Week 10 (11/8, 11/10) Sec 5.6, 5.8	Discrete Dynamical Systems Iterative Estimates for Eigenvalues
Week 11 (11/15, 11/17) Sec 5.9, 6.1-6.3	Markov Chains Inner Product, Length and Orthogonality Orthogonal Sets Orthogonal Projections; Least Squares
Week 12 (11/22) Exam 2	**Exam 2 (11/22)**
Week 13 (11/29, 12/1) Sec 6.4-6.6	The Gram-Schmidt Process Least Squares Solutions Applications to Linear Models
Week 14 (12/6, 12/8) Sec 7.1, 7.4	Diagonalizations of Symmetric Matrices Singular Value Decomposition Google Page Rank
Date to be announced	**Final Exam**