SYLLABUS

MA242 Linear Algebra

Fall 2014

Professor: Steve Rosenberg
Office: MCS 248; phone 3-9556
Office Hours: Monday 11-12, Tuesday/Thursday 2-3 or by appointment
Course Hours: TR 3:30-5 in PSY B55; discussion M 1-2 in MCS B21
Text: Lay, *Linear Algebra and its Applications*, 4th edition
Website: math.bu.edu/people/sr
Course Website: Blackboard via learn.bu.edu
Email: sr@math.bu.edu; Be sure to check your Blackboard regularly for course announcements.

Material: The course will cover the basic concepts of systems of linear equations and their solutions. The first half of the course will emphasize calculational 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 1-5 and further topics if time permits.

Grading: There will be two in-class exams and a final. There will be a brief quiz at the beginning of each discussion section. The in-class exams each count for 20% of the grade, the final counts for 20%, the quizzes count for 10%, and homework counts for 30%. The only acceptable excuses for missing an exam, quiz or homework due date are legal reasons such as jury duty, substantiated illness, family emergency or religious reasons. Unacceptable excuses include oversleeping an exam or having non-refundable plane tickets for the day of an exam. Make-up exams for in-class exams are not given. If you miss an in-class exam for an acceptable reason, your remaining in-class exam will count for 40% of your grade.

Homework: The homework assignments are listed below. Homework will be due one week after it is assigned. Late homework will not be accepted. Since the answers to the odd-numbered problems are in the back of the book, you must give complete answers on all problems to receive credit. I cannot emphasize enough the importance of doing the homework problems – I think it is impossible to do well in the course without keeping up with the homework. You are welcome to work with others on your homework.

Computer packages: Go to the book's website at www.pearsonhighered.com/lay and click on student resources to find introductions to computer algebra packages (*Getting Started with Technology*) such as Maple, Mathematica and Matlab. You can download all data sets to avoid tedious typing in of data by clicking on *Data Sets*. The best versions of Matlab and Mathematica are available if you log onto your BU account at Mugar Library. Smaller but adequate versions of these programs are also available via remote login to the BU server acs5.bu.edu. Some homework problems will involve computer calculations; you can use another system (such as TI-86, TI-85, etc.) if you prefer.

BU Network Access: PC users: You can always log on to your BU account using the PC lab BUCommon@Mugar, located in Mugar library. Once you log on, hit the Start button, then select Run, then enter Matlab or Mathematica. Both programs come with tutorials.

Mac/Linux users: (1) From a hot spot on campus, launch your web browser. This should open up a default site called Boston University Wireless Networking. You'll find two options: the 802.1x is the easiest, and the VPN client is more secure. If you use 802.1x, you'll be asked for your BU account name and Kerebos password. This doesn't always work for me! On the other hand, if you click on the link "Using Wireless with the VPN" at the end of the VPN section, you get to a page where you can download the VPN client. It's easy to install.

2) If you use the VPN client: to connect to the BU network, launch your VPN client by clcking on the VPN icon in the toolbar and selecting Connect VPN, and enter your password when prompted.

If you use the 802.1x network, just select this network.

3) Now open the Terminal program, and type ssh ⟨login name⟩@acs5.bu.edu, then hit enter. Note: The 5 in acs5 is important! If you type ssh ⟨login name⟩@acs.bu.edu, you'll get onto a BU server, but you won't

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have access to Matlab. Don't get put off by warnings you get along the way; just type yes. Then enter your password, hit enter, and you should be on the system. If you get the line TERM = (vt100), just hit enter.

4) Once you're connected to the network, type matlab6, and Matlab should open. Note: if you just type matlab, you get a message asking you to enter various other options. Note: accessing Matlab via the Terminal program probably means you can't do graphics or open help windows. For these fancier functions, you have to use a computer in the acs cluster.

There are many online tutorials for linux/unix.

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

Cell phones and laptops: No use of laptops, cell phones, smart phones, texting, etc. in class.

Outline of Contents

Chapter 1. Linear Equations in Linear Algebra
1.1 Systems of Linear Equations   Hwk: #1,5,8,9,14,19,30,33,34
1.2 Row Reduction and Echelon Forms   Hwk: #1,6,9,16,25,26,33,34
1.3 Vector Equations   Hwk: #1,4,5,8,9,12,27,28,29
1.4 The Matrix Equation $Ax = b$ Hwk: #1,5,7,10,12,13,17,20,26,31,35
1.5 Solution Sets of Linear Systems   Hwk: #1,5,8,11,13,16,18,36
1.6 Applications of Linear Systems Hwk: #3, 4, 12, 14
1.7 Linear Independence Hwk: #1,6,19,20,31,32,40
1.8 Intro to Linear Transformations   Hwk: #1,4,9,11,14,16,19,22,23,25,29
1.9 The Matrix of a Linear Transformation   Hwk: #1,6,7, 24
1.10 Business, Science, Engineering Applications   Hwk: #1,2,11, 12

Chapter 2. Matrix Algebra
2.1 Martix Operations   Hwk: #1,4,5,23,24,28,30,31,33
2.2 Inverse Matrix Hwk: #1,5,7,10bc,12,21,22, 39, 40
2.3 Characterizations of Invertible Matrics   Hwk: #1,5,10,16,26,32
2.7 Computer Graphics   Hwk: #1,3,4,5,8,11,15,16,17,18,21

   Test 1, Thursday, October 16*

Chapter 3. Determinants
3.1 Introduction to Determinants Hwk: #1,2,9,10,15,16,38, 41
3.2 Properties of Determinants   Hwk: #5,11,15,17,19,28, 29
3.3 Cramer's rule, etc.   Hwk: #19,21,23,32

Chapter 4. Vector Spaces
4.1 Vector Spaces and Subspaces Hwk: #1,3,4,5,6,9,11,14,16,19,20,21,27
4.2 Null spaces, etc.   Hwk: #1,5,6,7,16,29,31,33,34,38,39
4.3 Bases   Hwk: #1,8,11,14,33
4.4 Coordinate Systems   Hwk: #1,8,9,12,13,17,21,28,36
4.5 Dimension of a Vector Space Hwk: #1,8,9,12,13,20,21,24,27,29,34
4.7 Change of Basis   Hwk: #1,4,6,9,13,14,17,18
4.9 Applications to Markov Chains Hwk: #1,4,5,7,15

   Test 2, Thursday, November 20*

Chapter 5. Eigenvalues and Eigenvectors
5.1 Eigenvectors and Eigenvalues   Hwk: #1,6,11,22abd,31,37,38

5.2 The Characteristic Equation   Hwk: #1,10,13,20,21,24 30
5.3 Diagonalization   Hwk: #1,6,11,22,23,28,31,33
5.5 Complex Eigenvalues Hwk: #1, 7, 8, 13, 27
5.6 Discrete Dynamical Systems Hwk: #1,3,4,5,9,10,16

Chapter 6. Orthogonality and Least Squares
6.1 Inner Product, etc.   Hwk: #1,4,7,11,14,17,20,30
6.2 Orthogonal Sets   Hwk: #1,8,11,14,17,24,26,27
6.3 Orthogonal Projections Hwk: #1,4,7,11,14,17,25
6.4 Gram-Schmidt Hwk: #1,9,24
6.5 Least-Squares Problems Hwk: #1,3,5,7,10
6.6 Applications to Linear Models Hwk: #1,7,8,10,11

Final Exam: Thursday, December 18, 3-5 pm

*****Warning:** The dates of the in-class exams may be changed.