

EE 441 Course Syllabus – Fall 2012

Linear Algebra

Instructor:

Michael J. Neely (EEB 520, mjneely@usc.edu, 213-740-3505)

Office Hours: Mon 11-12, Tu/Th 11-12:30.

When contacting me by email, please put “441” or “EE 441” in the subject.

Teaching Assistant:

Hao Huang (EEB 535, haoh@usc.edu, 213-740-4682)

Office Hours: Tues 4-6pm.

Class Location and Time:

Lecture: KAP 158, Tu/Th 9:30-10:50am

Discussion: KAP 163, Friday 10-10:50am

Textbook:

Linear Algebra and its Applications (4th edition) by G. Strang. For supplementary material, some nice notes are on the following webpage:

<https://www.math.lsu.edu/~verrill/teaching/linearalgebra/linalg/>

Grading:

There will be problem sets (roughly one every week), a small project, two midterms, and a final, to be weighted in an overall score as follows: Homeworks (15%), Project (5%), Midterm 1 (25%), Midterm 2 (25%), Final (30%). The following minimum letter grades are guaranteed to students with a final score that is within the specified intervals: 85-100 A, 70-85 B, 55-70 C. The above thresholds may be adjusted at the end of the semester at the discretion of the instructor. Any such adjustments will be in favor of a higher letter grade.

Class Participation:

Class participation is strongly encouraged. There may be group work, project presentations, and brief random quizzes given for a small amount of extra credit. All students are required to attend office hours at least once during the semester.

Exam Dates:

- Midterm 1: Thurs. Oct. 11, 9:30-11am.
- Midterm 2: Thurs. Nov. 15, 9:30-11am.
- Final: Thurs. Dec. 13, 11am-1pm.

No Class

- Tues. Sept. 4 (no class — I will be at the ITW conference in Switzerland).
- Thurs. Nov 22 (no class — Thanksgiving).

Statement for Students with Disabilities:

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.-5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity:

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.

Course Topics — These dates and topics are subject to change

- Aug. 28, 30: Matrix and Vector Algebra, Systems of equations, Gaussian Elimination
- Sep. 4: Out of town (no class)
- Sep. 6: Elementary Matrix Interpretations of Gaussian Elimination, Inverses
- Sep. 11, 13: Inverses and Transposes, Vector Spaces, Linear Independence
- Sep. 18, 20: Span, Column Space, Row Space, Null Space
- Sep. 25, 27: Basis, Dimension
- Oct. 2, 4: General Vector Spaces, Applications to Coding, Fourier
- Oct. 9: Orthogonality, Oct. 11: MIDTERM 1
- Oct. 16, 18: Gram-Schmidt, Projections
- Oct. 23, 25: Determinants
- Oct. 20, Nov. 1: Eigenvalues/Vectors
- Nov. 6, 8: Eigenvectors, Dynamic Systems Applications
- Nov. 13 Symmetry, Nov. 15: MIDTERM 2
- Nov. 20, 22: Positive Definite, Singular Values
- Nov. 27, 29: Linear Programming, Applications to Networks, Wireless
- Dec. 4, 6: Applications to Networks, Wireless
- FINAL EXAM: Thurs. Dec 13 (11am-1pm, location TBA)

Project Ideas

Students are encouraged to work in teams of 2 on a project related to linear algebra. Projects will be presented at the beginning of lecture, starting on the 4th lecture and from then on throughout the course. You can volunteer a topic and date, or you will be assigned one. The presentation should be 3-10 minutes, and should be accompanied by a 1-2 page writeup. Projects are equivalent to 1 problem set, and, after you have explored various options and finalized your topic, it should take about a week to work on. Below are some example topics (you can find more by searching the web):

- Computer program for $Ax = b$ and/or matrix inversion in binary field.
- Graph games (see link below):
<https://www.math.lsu.edu/~verrill/teaching/linearalgebra/linalg/linalg7.html#game>
- Difference equations and the Fibonacci sequence.
- Powers of matrices and diagonalization.
- Parity check matrices, parity check codes, erasure codes.
- What is linear programming? Small examples and vertex solutions.
- Eigenvalues and linear (or linearized) ODEs and/or difference equations.
- Markov chains, Steady state equation $\vec{\pi} = \vec{\pi}P$.
- Google pagerank.
- Program for finding eigenvalues/vectors.
- Least squares problems. Learning through least-squares training.
- Singular value decomposition (SVD) and wireless beamforming.
- SVD and image compression.
- Game theory. Payoff Matrix.
- Images through linear maps, rotations.
- Faster-than- N^3 Gaussian elimination.

If you have an opportunity to make a connection between your project and what we have studied in class, please make that connection explicit in both your presentation and your writeup. Learning is about making connections, and this will help you learn. It will also demonstrate to me that you have learned, and will make your project more accessible to everyone in the class. If there are two methods for doing something, one related to what we have seen in class, and one not, please do it both ways and explain the advantages and/or disadvantages.