

Math 313/513: Computational Linear Algebra
Spring 2012
Tuesday, Thursday 3pm – 4:30pm, DRL 3C4

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Main text: *Introduction to Linear Algebra*, Gilbert Strang, Fourth Edition

Course web pages: <http://www.math.upenn.edu/~jjau/math313> and **Blackboard**

Course description: This introductory course on linear algebra emphasizes computational and practical aspects. The main objective is to acquaint you with linear problems and some techniques and algorithms for solving them, both by hand and on a computer. The core material we will cover is:

- vectors and vector operations
- matrices, linear equations, row reduction/Gaussian elimination
- matrix operations: multiplication, inverse, transpose
- vector spaces, null space, column space, row space
- linear independence, span, basis, dimension
- determinants, their geometric meaning, methods of computation
- orthogonal projection, Gram–Schmidt algorithm
- least-squares problems
- eigenvalues and eigenvectors, diagonalization
- symmetric matrices
- matrix decompositions: LU, QR, SVD

Many of the concepts will be supplemented with applications, such as:

- probability, stochastic processes, and Markov chains
- image compression using the SVD
- principal component analysis
- Google’s PageRank algorithm
- other applications to computer science, engineering, and natural sciences

Math 313 vs. 513: These courses share a lecture. Homework and exam problems for Math 313 will be a subset of those for 513.

Attendance: To be successful in this course, you should plan to be present for all class meetings. Please let me know as soon as possible about any absences.

Blackboard and course web page: Homework and exam scores, as well as new assignments, will be posted on Blackboard. The course web page has links to important resources, such as MATLAB tutorials.

Homework: I will assign homework regularly, to be collected and graded. Collaboration on home-

work assignments is encouraged, but any work you turn in must be your own. Some assignments will need to be sent to the grader electronically. (Warning: you will not receive credit for any code that the grader cannot run.) Your lowest two homework scores will not count toward your grade.

Programming: Writing code in MATLAB (or the open source alternative, Octave) will be a significant portion of this course. Many homework assignments will involve programming. Any code you turn in must be your own work; copying is strictly prohibited! You need to understand what your code is doing. If you have little or no prior programming experience, you must be willing to learn as you go (and I encourage you to contact me to let me know).

MATLAB is available in on-campus computer labs, though you may wish to consider purchasing your own copy, or using the free program Octave.

Exams: There will be two midterm exams and one final exam. The schedule is given below. Please let me know immediately if you have a conflict with any of these dates. For each exam, you will be allowed a one-page 8.5 x 11 inch sheet, both sides, of your own hand-written notes. No calculators, books, or other notes.

- Midterm exam 1: Thursday, February 23rd, in class
- Midterm exam 2: Thursday, April 5th, in class
- Final exam: Wednesday May 2nd, 12pm – 2pm, location TBD

Missed/late work: Late homework assignments will always count as zero; missed exams will count as zero, except for reasons such as serious illness or family emergency, or a pre-arranged absence. Written notification from a dean may be required, and your grade will be based on your performance on the final exam or a makeup exam (based on my discretion). Remember, your lowest two homework scores will be dropped.

Grades: Your grade for the course will be determined based on the following factors:

- Homework: 20 %
- Midterm exams: 25 % each
- Final exam: 30 %

Course grades will generally be assigned by the standard “90–100 is an A, etc. rule”, but I reserve the right to deviate from this, particularly if your final exam grade differs substantially from the prior grade. I will not allow changes to your score on a homework assignment or exam more than two weeks past the due date.

Academic honesty: You are not allowed to have any outside help (people, books, unauthorized notes, calculators, phones, etc.) during exams. Penn’s Code of Academic Integrity will be strictly enforced. Cheating on homework or exams (copying/sharing work with other students, etc.) will result in a score of zero on that work and referral to the Office of Student Conduct. *Please do not share your code with anyone.*

Students with disabilities: Any student requiring special accommodations is encouraged to contact me and the Office of Student Disabilities Services as soon as possible.