Syllabus

COURSE HOME

SYLLABUS

CALENDAR

READINGS

ASSIGNMENTS

EXAMS

STUDY MATERIALS

TOOLS

RELATED RESOURCES

VIDEO LECTURES

Course Meeting Times

Lectures: 3 sessions / week, 1 hour / session

Recitations: 1 session / week, 1 hour / session

Prerequisites

Multivariable Calculus (18.02)

Text

The readings are assigned in: Buy at Amazon Strang, Gilbert. Introduction to Linear Algebra. 4th ed. Wellesley, MA: Wellesley-Cambridge Press, February 2009. ISBN: 9780980232714.

Reading assignments are also provided for the newer edition: *Introduction to Linear Algebra*. 5th ed. Wellesley, MA: Wellesley-Cambridge Press, February 2016. ISBN: 9780980232776.

NOTE: More material on linear algebra (and much more about differential equations) is in Professor Strang's 2014 textbook *Differential Equations and Linear Algebra*. In 2016, the textbook was developed into a series of 55 short videos, *Learn Differential Equations: Up Close with Gilbert Strang and Cleve Moler*.

Goals

The goals for 18.06 are using matrices and also understanding them.

Here are key computations and some of the ideas behind them:

1. Solving Ax = b for square systems by elimination (pivots, multipliers, back substitution, invertibility of A, factorization into A = LU)
2. Complete solution to Ax = b (column space containing b, rank of A, nullspace of A and special solutions to Ax = 0 from row reduced R)
3. Basis and dimension (bases for the four fundamental subspaces)
4. Least squares solutions (closest line by understanding projections)
5. Orthogonalization by Gram-Schmidt (factorization into A = QR)
6. Properties of determinants (leading to the cofactor formula and the sum over all n! permutations, applications to inv(A) and volume)
7. Eigenvalues and eigenvectors (diagonalizing A, computing powers A^k and matrix exponentials to solve difference and differential equations)
8. Symmetric matrices and positive definite matrices (real eigenvalues and orthogonal eigenvectors, tests for x'Ax > 0, applications)
9. Linear transformations and change of basis (connected to the Singular Value Decomposition - orthonormal bases that diagonalize A)
10. Linear algebra in engineering (graphs and networks, Markov matrices, Fourier matrix, Fast Fourier Transform, linear programming)

Homework

The homeworks are essential in learning linear algebra. They are not a test and you are encouraged to talk to other students about difficult problems-after you have found them difficult. Talking about linear algebra is healthy. But you must write your own solutions.

Exams

There will be three one-hour exams at class times and a final exam. The use of calculators or notes is not permitted during the exams.

Grading

ACTIVITIES	PERCENTAGES
Problem sets	15%
Three one-hour exams	45%
Final exam	40%

MATLAB®

Some homework problems will require you to use MATLAB, an important tool for numerical linear algebra. No previous MATLAB experience is required in 18.06. The related resources section has links to information about MATLAB, including a tutorial.