

CS 372/CM 372 - Winter 2006: Course Outline

Numerical Linear Algebra

Instructor: Justin Wan
Classroom: MC 4060

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MWF 11:30am-12:20pm

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Week of Jan 4	C++, basic linear algebra
Week of Jan 9	C++, LU, Cholesky factorization
Week of Jan 16	C++, Tridiagonal, Band matrices
Week of Jan 23	C++, Stability, Pivoting, Conditioning
Week of Jan 30	Least squares problems, Gram-Schmidt orthogonalization
Week of Feb 6	QR factorization, Householder transformation
Week of Feb 13	Givens rotation, Stability and Conditioning Feb 17: midterm
Week of Feb 20	Eigenvalue problems, Schur form, Reduction to Hessenberg or tridiagonal matrices
Week of Feb 27	Rayleigh quotient, Power iteration, Inverse iteration, QR method with shifts
Week of Mar 6	Jacobi, Bisection, Divide-and-Conquer.
Week of Mar 13	Singular value decomposition, Bidiagonalization
Week of Mar 20	Search engine using SVD
Week of Mar 27	Review

- **Text and references:** The following are useful references.
 - *Numerical Linear Algebra* (textbook), L.N. Trefethen and D. Bau III, SIAM, QA184.T74, 1997, (Guelph library).
 - *Applied Numerical Linear Algebra*, J. Demmel, SIAM QA184.D455, 1997, (Guelph library).
 - *Matrix Computations*, G. Golub and C. van Loan, Johns Hopkins, 1985, QA188.G65x.
 - *An Introduction to C++ and Numerical Methods*, J. Ortega and A. Grimshaw, Oxford University Press, 1999, QA297.O778.
- **Programming Languages:** The assignments are generally in C++. Assignments will generally consist of software that is missing some functions. You have to provide these missing modules. It will be assumed that students have an understanding of basic data structures.
- **Assignments:** Must be submitted in class the date the assignment is due.

- **Late Policy:** On the due date of an assignment, the work done to date should be submitted in class; further material may be submitted for one-half credit at the start of the next class.
- **Assignment Marking:** The assignments will consist of programming problems and analytic work. Programming assignments will be "black box" tested by the TA. Please pay careful attention to the assignment specifications!
- **Course Grade:** The course is planned to have four marked assignments, a midterm, and a final examination. The course grade will be made at the discretion of the instructor; the guidelines for this are that the assignments count 35%, midterm 25% and the final exam, 40%. About two thirds of the final examination will consist of perturbations of the assignment questions and the practice questions.
- **Collaboration:** You are encouraged to discuss assignments with other individuals in the class. However, the submitted assignment should be your own work. Note that current School of Computer Science policy is that a mark of -100% can be recorded for the assignment for all parties involved in a case of blatant cheating/copying.
- **Assignment Objectives:** After completing assignments, you will have developed a set of numerical linear algebra routines for solving linear systems, least squares problems, eigenvalue problems, and singular value decomposition.