MATH 368K: Numerical Methods for Applications

Study guide for Exam #1

Vectors, matrices and norms (Sec 7.1, 7.2)
- -Vector l_p norms, properties
- -Matrix norms, properties
- -Natural matrix norms
- -Eigenvalues/vectors, properties
- -Spectral radius of a matrix
- -Relation b/w spectral radius and natural norms
- -Convergent matrices

Splitting methods for linear systems (7.3, 7.4)
- -Fixed-point formulation, splitting approach
- -Jacobi, Gauss-Seidel and SOR methods
- -General convergence theorem
- -Sufficient conditions for Jacobi, G-S, SOR

Sensitivity of a linear system (7.5, class notes)
- -Condition number of matrix, properties
- -Sensitivity theorem
- -Residual of an approximate solution
- -Residual theorem
- -Idea/goal of pre-conditioning

Gradient methods for linear systems (7.6)
- -Symmetric positive-definite systems
- -Optimization formulation
- -Steepest descent method, properties
- -Conjugate gradient method, properties
- -Implementation of pre-conditioning

Least-squares approx by poly functions (8.1, 8.2)
- -Discrete least-squares problem
- -Normal equations, properties
- -Transformation method for exp, power functions
- -Continuous least-squares problem
- -Normal equations, properties
- -Ill-conditioning of standard poly basis
- -Defn of an orthogonal poly basis
- -Form of normal eqns in an orthog poly basis
- -Gram-Schmidt algo for orthog poly basis

Least-squares approx by trig functions (8.5, 8.6)
- -Continuous least-squares problem
- -Normal equations, properties
- -Orthogonality of std trig basis
- -Connection to Fourier series
- -Discrete least-squares problem
- -Normal equations, properties
- -Discrete orthogonality of std trig basis
- -FFT algo for computing trig poly coeffs
