

Fall Semester, 2002-03

Math 743: Matrix Theory for Graduate Students

Instructor: R.A. Brualdi (725 Van Vleck Hall, brualdi@math.wisc.edu)

Office Hours: I am around a lot. Stop in as you wish (or send me email).

Prerequisite: Solid knowledge of undergraduate linear algebra & matrix theory.

Textbook: None required. The following books are on reserve in the Kleene Mathematics Library:

1. Matrix Analysis, Horn and Johnson, Cambr. Press. QA188 H66 1990
2. Topics in Matrix Analysis, Horn and Johnson, Cambr. Press. QA188 H664
3. Elements of Matrix Theory, M.L. Mehta, Hinustan Publ. Co, QA188 M44
4. Theory of Matrices, Gantmacher, Chelsea Pub. Co. QA263 G353
5. Combinatorial Matrix Theory, Brualdi and Ryser, Cambr. Press. QA188 B78
6. Matrices of Sign-Solvable Linear Systems, Brualdi and Shader, Cambr. Press. QA188 B79 1995
7. Numerical Linear Algebra, Trefethen and Bau, SIAM. QA184 T74 1997

Course Description: I plan a broad and eclectic coverage of mostly classical parts of matrix theory taken from:

1. Jordan Canonical Form.
2. Special Determinant Formulas and Special Determinants.
3. Special Matrix Classes: normal matrices, hermitean and symmetric matrices, positive semi-definite matrices.
4. Perron-Frobenius theory of nonnegative matrices, doubly-stochastic matrices and vector majorization.

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5. Qualitative classes of real matrices, sign-solvability.
6. Eigenvalue and singular-value theory and inequalities, determinant inequalities, matrix Norms.
7. Special Matrix Constructions: tensor product, rth compound, Hadamard product; matrix linear equations.
8. Matrix functions like e.g. the matrix exponential function.

Sprinkled throughout the course may be a few combinatorial applications or interpretations or insights.

Grades: Based on class participation and occasional exercises, possibly a 30 minute class presentation.

RAB (August 30, 2002)