

# CAAM 440 · APPLIED MATRIX ANALYSIS

Spring 2012 · Rice University

- Lectures: MWF 2PM, Duncan Hall 1070
- Web Site: <http://www.caam.rice.edu/~caam440>
- Instructor: Mark Embree ([embree@rice.edu](mailto:embree@rice.edu))  
Abercrombie 101/Duncan Hall 3019; (713) 348-6160
- Office Hours: Wednesday 11AM–12PM, Thursday 1:00–2:30PM, or by appointment (in Abercrombie 101)
- Prerequisite: Undergraduate matrix theory (e.g., CAAM 335, MATH 354, or MATH 355)
- Manifesto: A first course in Matrix Analysis develops fundamental concepts relating to subspaces and spectral theory, but many applications and extensions of these ideas fall beyond the course's scope. CAAM 440 seeks to redress this omission. We shall delve deeply into important applicable and theoretical topics such as eigenvalue perturbation theory, nonnegative and stochastic matrices, matrix pencils, functions of matrices, and ergodic theory. These concepts will be illustrated with applications drawn from dynamical systems, control theory, Markov chains, statistics, and social network analysis.
- Grading: Standard problem sets: 50%  
Pledged problem sets: 50%
- Participation: Please contribute to the classroom environment by asking questions and participating in discussions. Your interaction will be considered when assigning borderline grades, as will improving performance throughout the course of the semester.
- Standard problem sets: A problem set will be assigned most weeks, usually due by 5PM on the assigned day. These exercises will require proofs of general results and analysis of illustrative examples. Mathematically rigorous solutions are expected; strive for clarity and elegance. Some problems will require a modest amount of MATLAB programming.
- You are encouraged to collaborate on the standard problem sets, *but your write-up must be your independent work*. Transcribed solutions and copied code are unacceptable.
- Late policy: You may submit two standard problem sets one class period late with no penalty. Subsequent late assignments will be penalized 25%. No work will be accepted more than one class period late without prior arrangement or a written excuse.
- Pledged problem sets: Three assignments will be designated as *pledged problem sets*. These must be completed with only the aid of class notes and limited other specified resources. You may not use outside sources: other students, other books, the web, etc. Pledged problem sets *may not* be turned in late without prior arrangement or written excuse.
- Recommended Texts: Meyer, *Matrix Analysis and Applied Linear Algebra*, SIAM, 2000  
Horn & Johnson, *Matrix Analysis*, Cambridge, 1985  
Horn & Johnson, *Topics in Matrix Analysis*, Cambridge, 1991  
These texts are available at the reserve desk as the Fondren Library. They are useful references that justify the investment. However, we will not follow either book slavishly; students can purchase these as their resources and interests permit.
- Supplemental Resources: Bhatia, *Matrix Analysis*, Springer, 1997  
Dym, *Linear Algebra in Action*, AMS, 2007  
Gantmacher, *Theory of Matrices* (2 volumes), Chelsea, 1959  
Lancaster and Tismenetsky, *Theory of Matrices*, 2nd ed., Academic Press, 1985  
Lax, *Linear Algebra with Applications*, Wiley, 1997  
Trefethen & Embree, *Spectra and Pseudospectra*, Princeton, 2005

*Any student with a disability requiring accommodation in this course is encouraged to contact the instructor during the first week of class, and also to contact Disability Support Services in the Ley Student Center.*