Math 43503/53903: Numerical Linear Algebra **Spring 2025**

Prerequisite: MATH 30803 (Linear Algebra) or 30903 (Abstract Linear Algebra)

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Office Hours: MWF 10:00 – 10:50am and by appointment, or just stopping by...

Text: Golub & Van Loan, *Matrix Computations*, 4^{th} Ed.

Mater1al covered: Much of chapters 1–7 of the text and my online notes

Grading on a 90/80/70/60 scale based on the following

Two 1-hour exams (100 points each, dates: approx 2/21 and 4/11)	200
Take home final exam (given approx 1 week before reading day)	100
In class final exam	100
Homework	100
Programs	100
Drop lowest *exam* score	
Total	500

Notes

→ The final is on Wednesday, May 7, 8:00 - 10:00am, same room as lectures.

→ We will be using the Matlab© programming language; it is available in the General Access Computing Labs (and therefore at vlab.uark.edu). The university also has a site-license for Matlab; you can install it on your machine: https://its.uark.edu/software-equipment/get-software/matlab-get-started.php.

→ Programming assignments are to be turned in both electronically (emailed) and on paper (so that I can mark it up).

→ **Inclement weather:** We will have class if the University is open, but a test will automatically be rescheduled to the next class meeting if on that day the Fayetteville public schools are closed due to weather.

→ **Academic Integrity:** *As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals through programs of study and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail.*

Each University of Arkansas student is required to be familiar with and abide by the University's 'Academic Integrity Policy' which may be found at http://provost.uark.edu/ Students with questions about how these policies apply to a particular course or assignment should immediately contact their instructor.

Goals

We will be surveying some of the fundamental linear algebraic aspects of the discipline of *scientific computation*. Scientific computing deals with the solution of mathematically formulated problems from engineering and the sciences.

The tools of the discipline consist of *hardware* (calculators, cell phones, pc's, workstations, graphics cards, FPGAs, super-computers, networks, etc.), *software* (c, fortran, java, python, maple, julia, matlab, SAS, R, etc.) and, of course, the *methods* for solving the mathematical problems (Gaussian elimination, Newtons method, finite elements, etc.).

Numerical methods are the mathematical algorithms which are coded in software and run on hardware. We will be surveying some of the most basic and important problems in applied linear algebra and investigating methods for their solution on computers.

We are interested in the methods and in *the development* of (the math and the ideas behind) the methods. In particular, I hope that you accomplish the following:

- → Develop an understanding of how we represent numbers on a computer and what this means for solving problems.
- → Develop an understanding of the difference between easy and hard problems and good and bad methods.
- → Develop good methods for solving systems of linear equations.
- → Develop good methods for solving linear least squares problems.
- → Develop an understanding of the main difficulties in solving the algebraic eigenvalue problem.
- → Develop some methods for solving the algebraic eigenvalue problem, including subspace iteration and the QR algorithm.
- → Gain experience implementing many of the above methods in the Matlab programming language.