Numerical Linear Algebra

Math 625-001

Spring 2020

This is the web page **http://math.cos.gmu.edu/~wanner/courses/m625s20/index.html**
It will be updated regularly and always contain the latest information on the course.

General Information:

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Office hours:	MW 4pm-5pm, and by appointment

Lectures:	W 7:20pm-10:00pm, Exploratory Hall 4106
Prerequisites:	Sufficient recall of undergraduate linear algebra and computer literacy including familiarity with Matlab.
Textbook:	*Numerical Linear Algebra* by L.N. Trefethen and D. Bau (SIAM, 1997).

Important Links:

- Detailed syllabus
- Homework assignments
- Relevant official GMU policies

Syllabus:

This course covers theory and development of numerical algorithms for the solution of a variety of matrix problems. These include linear systems, least squares problems, eigenvalue problems, and the singular value decomposition. Both direct and iterative methods are covered, as well as analysis of sensitivity to rounding errors. A more detailed syllabus can be found here. It will be updated weekly.

Homework Assignments:

Homework problems will be assigned once a week and posted on the homework page as well as on Blackboard. Some of these assignments will be graded and count towards your homework score. While the remaining ones do not have to be handed in, I do advise everyone strongly to study them and write out the solutions properly. I will post detailed solutions on Blackboard and will go through many of the homework problems in the following class. You will not benefit from this if you have not made a serious attempt at solving the problems.

Matlab:

The software package Matlab will be used throughout the course. Matlab is a computing environment with programming capability, good graphics, and powerful library functions. It is available on campus on the Mason cluster and several Unix computer labs. Alternatively, a PC or Macintosh version can be purchased at the bookstore. Many Matlab tutorials are available:

- A very good tutorial by Kermit Sigmon, University of Florida, in Postscript format. There is also an HTML version of this tutorial.
- The official Getting Started with Matlab guide from Mathworks in PDF format.
- You should also take a look at the tutorials of my colleague E. Sander.

Also, the manual which comes with the PC version is very complete. Further information on Matlab can be found here and here.

Grading Policy:

Your final grade in the course will be determined from your performance in the homework assignments, a comprehensive final exam, and two numerical projects that will be given during the semester (dates to be announced). Weights for these items will be distributed approximately according to the following schedule:

Homework	**Numerical Project 1**	**Numerical Project 2**	**Final Exam**
60%	10%	10%	20%

The assignment of your course grade is based on the total course score. The following grading scale may serve as a guideline, although changes are possible:

Score above	90%	80%	70%	60%	otherwise
Letter grade	A	B	C	D	F

Thomas Wanner, January 6, 2020.

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The following table contains the schedule for the course. It will basically cover Chapters I through V of the textbook, as well as parts of Chapter VI. This page will be updated regularly throughout the semester.

Week	Date		Lectures
1	01/22	Review of Matrices and Linear Maps	Lectures 1, 2
2	01/29	Norms, Singular Value Decomposition	Lectures 3, 4
3	02/05	Singular Value Decomposition, Projectors	Lectures 5, 6
4	02/12	QR factorizations, Gram-Schmidt Method	Lectures 7, 8, 9
5	02/19	Householder Triangularization, Least Squares	Lectures 9, 10, 11
6	02/26	Conditioning	Lectures 12, 13
7	03/04	Stability	Lectures 14, 15
8	03/11	**No class! (Spring Break)**	
9	03/18	Stability of Specific Algorithms	Lectures 16, 17
10	03/25	Gaussian Elimination	Lectures 20, 21, 22
11	04/01	Cholesky Factorization, Eigenvalue Problems	Lectures 23, 24, 25
12	04/08	First Eigenvalue Algorithms	Lectures 26, 27, 28
13	04/15	QR Algorithm for Eigenvalues	Lectures 29, 30
14	04/22	Further Eigenvalue Algorithms, SVD Computation	Lectures 30, 31, 32
15	04/29	Iterative Methods, Arnoldi & Lanczos Iterations	Lectures 32, 33, 34, 36
16	05/06	**Final Exam**	**7:30pm-10:15pm**

Thomas Wanner, January 6, 2020.

Relevant George Mason
Official University Policies

The following policies apply to all courses at George Mason University:

1. It is expected that each student will conduct himself or herself within the guidelines of the Honor Code. All academic work should be done with the level of honesty and integrity that this University demands.
2. You are responsible for the accuracy of your own schedule. Check Patriot Web regularly to verify that you are registered for the classes that you think you are. A student who is not registered may not continue to attend class. Faculty are not permitted to grade work of students who do not appear on the official class roster.
3. You are responsible for knowing the last days to drop and add this class.
4. Once the add and drop deadlines have passed, instructors do not have the authority to approve any requests from students to add or drop/withdraw late. It is NOT permissible to drop the class and leave it at that. It needs approval. Late adds (up until the last day of classes) must be reviewed and approved by the department chair of the course being offered. They will be approved only in the case of a documented university error (such as a problem with Financial Aid being processed). All student requests for withdrawals and retroactive adds (after the last day of classes) must be reviewed by the student's academic dean. In the case of students whose major is in COS, this is the office of Undergraduate Academic Affairs in Enterprise.
5. Instructors are required to give the final exam at the time and place published in the Schedule of Classes, as set by the Registrar. It cannot be changed. You need to plan vacation (make plane reservations, etc.) around these published dates.
6. Once final grades have been recorded, instructors cannot accept any work to change that course grade. Grade changes can only be approved when they are due to a calculation or recording error on the part of the instructor.
7. An IN (incomplete) grade is a very special grade that can only be applied for in writing. It can only be given in cases in which a student is passing a course and has a very limited amount of work left to complete the course.
8. Federal law (a law known as FERPA) requires the protection of privacy of student information. Therefore, no instructor on campus can speak about a student's record with anyone other than the student. The record includes how a student is doing in a course, whether a student has attended class, information about grades, whether a paper has been turned in. Anything. This prohibition includes parents, siblings, and spouses, anyone.
