Matrix Theory

Math 4450.001/5500.001, Spring 2024, TR 11:00-12:20, Lang 211

Professor: Conley, GAB 419, conley@unt.edu

Website: www.math.unt.edu/∼conley. Please note that there will be no Canvas page for this course; homework and announcements will be posted at the course page on my website.

Office Hours: Tuesdays and Thursdays, 2:00-4:00

Text: *Introduction to Linear Algebra*, 6^{th} ed., Gilbert Strang

Prerequisite: Linear Algebra (2700)

Exams: There will be two 100 point midterms, both on Thursdays: Feb. 22 and Apr. 4. There will be a comprehensive 180 point final on Tuesday, May 7, 10:30-12:30. There will be no make-up exams.

Homework: There will be 12 problem sets, worth 10 points each, due Tuesdays, excepting just after exams. They are due at the beginning of class. If you are late to class or your work is messy or unstapled, 1 or 2 points may be deducted. Problem sets will not be accepted after class.

Notes: You may work on the problem sets together with your classmates, but the best way to prepare for the exams is to begin by trying the homework on your own, looking for help only after making a good effort. It is best to work first on scratch paper and then recopy your solutions.

Grading: There are a total of 500 points possible. The letter grade point cut-offs vary from year to year, but are normally no stricter than 80% for an A, 60% for a B, 50% for a C, and 40% for a D. After each exam I will post the cut-offs for that exam, and after Exam 2 I will also post the cut-offs for the total number of points possible up to that point.

Policies:

- Attendance is required. You have 3 free absences. Further unexcused absences may cost 5 points each.
- Phone/laptop use is not permitted in lecture. Visible/audible devices may cost 2 points.
- Exams & quizzes are pen/pencil/paper only. Use of other materials may incur a penalty of up to a zero on the exam/quiz.

Disabled Students: Please let me know of your disability.

Topics: The theme of the course will be matrix decompositions. We will relate each to its applications. Several decompositions are summarized in Appendix 2 of the text. Here are some of them:

- LU, PLU, LPU: solving linear equations via row/column reduction
- $X\Lambda X^{-1}$: eigenvectors, eigenvalues, diagonalization
- $X\Gamma X^{-1}$: generalized eigenspaces, block diagonalization, Jordan form
- QR, KAN: the Gram-Schmidt process and the Iwasawa decomposition
- C^TC: the Cholesky decomposition of positive definite symmetric matrices
- $Q\Lambda Q^{-1}$: diagonalization of symmetric matrices by orthogonal matrices
- QS: the polar decomposition
- $U\Sigma V^T$: the singular value decomposition
- $A^+ = V\Sigma^+U^T$: the pseudo-inverse

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MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1/15	1/16 First lecture	1/17	1/18	1/19
1/22	1/23 Homework 1	1/24	1/25	1/26
1/29	1/30 Homework 2	1/31	2/1	2/2
2/5	2/6 Homework 3	2/7	2/8	2/9
2/12	2/13 Homework 4	2/14	2/15	2/16
2/19	2/20 Homework 5	2/21	2/22 EXAM 1	2/23
2/26	2/27	2/28	2/29	3/1
3/4	3/5 Homework 6	3/6	3/7	3/8
3/11 Spring Break	3/12	3/13	3/14	3/15
3/18	3/19 Homework 7	3/20	3/21	3/22
3/25	3/26 Homework 8	3/27	3/28	3/29
4/1	4/2 Homework 9	4/3	4/4 EXAM 2	4/5
4/8	4/9	4/10	4/11	4/12
4/15	4/16 Homework 10	4/17	4/18	4/19
4/22	4/23 Homework 11	4/24	4/25	4/26
4/29	4/30	5/1	5/2 Homework 12	5/3 Reading Day
5/6	5/7 Final Exam: 10:30	5/8	5/9	5/10