Applied Linear Algebra (2210Q)

Spring 2010, Arend Bayer, Section 5

Questions, Comments...

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Class information

COORDINATES: Classes meet Tuesdays and Thursdays 2.00-3:15 in MSB 315. The registrar calls this Section 005, #9849.

PREREQUISITES: 1132, or 1152, or 2142.

TEXT: David C. Lay: *Linear Algebra and Its Applications, 3rd Ed. Update* Available in the bookstore. The first chapter is available at the weblink above.

WEB RESOURCES: The homepage for this course is http://www.math.uconn.edu/~bayer/math2210s10/. The author also has a useful site with review sheets and downloadable data at: http://www.laylinalgebra.com

GRADING: Your grade will be based on two midterm exams, a final exam, homework, and quizzes.

The breakdown of points is:

Midterms	Final	Quizzes	Homework
20% each	30%	25%	5%

Note that this is a lot of weight on the quizzes. In my experience, students who do well in the quizzes do well in the course. It may look like little weight on homework, but the weekly quizzes will in big part be similar to the homework, so you should think of a 30% block depending directly on your weekly homeworks.

EXAMS: The exam dates are already scheduled, so please mark your calendars now (midterms in class on 2/23 and 4/1). All exams (like math itself at this level) are cumulative. No makeups will be given; instead if you have an approved reason for missing an exam, the final will count for the appropriately higher percentage.

QUIZZES: Short quizzes will be given each Thursday (except midterm exam days), covering (a) sections from the previous week (at the level of HW exercises) and (b) the reading assigned for the current week (at the level of True/False excersies). Your lowest two quiz scores will be dropped.

HOMEWORK: Homework for the sections scheduled for a given week are due the following Tuesday. I will not be able to check your homework carefully, but will be looking for completeness of solutions, not just correct answers.

You may find some homework problems to be challenging, leading you to spend lots of time working on them and sometimes get frustrated. This is natural (and it's the same for me when I learn new mathematics). I really encourage you to work together with other students, in person or electronically. It's OK to get significant help from any resource. The only rule is that in the end, you write your own solution in your own words. (Copying someone else's work without credit is plagiarism and will be dealt with according to university policy.)

CONTENT: Linear Algebra is a beautiful and important subject, rich in applications within mathematics and to many other disciplines. This may be the first course for you connecting concrete computations to abstract reasoning. You will have to understand definitions in the abstract, and it may be the first course where you will have to give some proofs. Understanding the notions of vector spaces, linear (in)dependence, dimension, and linear transformations will help you make sense of matrix manipulations at a deeper level, clarifying the underlyng structure.

LEARNING: **The only way to learn mathematics is by doing it!** Do your best on every homework, and get help when you are confused. Come to class prepared with questions. Don't hesitate to seek help, from other students, at the Q Center, in my office hours.

There will not be time to "cover" all material in the lectures so you will need to read and learn some topics on your own from the book.

SCHEDULE: The following is a tentative schedule, that I will update throughout the semester. Generally we will cover three sections per week, which means splitting a section between two lectures.

2210Q LECTURE AND ASSIGNMENT SCHEDULE

Section	Date	Topics	HW Problems
§1.1	1/19	Intro to Linear Alg & Systems of Eqns	1, 2, 3, 10, 12, 13, 15, 16, 21, 24, 25, 31, 32

§1.2	1/21	Row Reduction & Echelon Forms	2, 10, 13, 14, 19, 24, 29, 31
§1.3	1/21	Vector Equations	3, 6, 7, 9, 12, 14, 17, 21, 22, 23, 25
§1.4	1/26	Matrix Equations	1, 4, 7, 9, 11, 13, 17, 19, 22, 23, 25, 31
§1.5	1/28	Solution Sets of Linear Systems	2, 6, 11, 16, 17, 19, 22, 23, 28, 30
§1.7	1/28-2/2	Linear Independence	1, 2, 5, 7, 9, 15, 16, 20, 21, 32, 34
§1.8	2/2	Linear Transformations	2, 4, 8, 9, 13, 15, 17, 21, 27, 31
§1.9	2/4	Matrix of Linear Transformation	1, 2, 3, 13, 15, 20, 23, 26, 32, 36
§2.1	2/9	Matrix Operations and Inverses	2, 5, 7, 10, 15, 18, 22, 27, 28
§2.2	2/11	Inverse of a Matrix	3, 6, 7, 11, 12, 13, 18, 23, 24, 29, 32, 37
§2.3	2/16	Characterizations of Invertible Matrices	1, 3, 5, 8, 11, 13, 15, 16, 22, 26, 35, 40(challenge!)
§2.4	2/16	Partitioned matrices	1, 4, 9, 10, 11, 13, 15, 19
Ch. 1	2/16	Supplementary Exercises	6, 7, 10 ,18, 22, 23
§1.1-2.3	2/18	Catchup & Review Day	
TUESDAY FEBRUARY 23: FIRST MIDTERM EXAM (through §2.3)			
§2.5	~~2/25~~	~~Matrix Factorizations~~	2, 5, 7, 21
§3.1	2/25	Intro to Determinants	4, 8, 11, 20, 21, 31, 32, 37, 39
§3.2	2/25	Properties of Determinants	2, 3, 8, 16, 17, 20, 26, 27, 32, 34, 40
§3.3	3/2	Cramer's Rule & Volumes	4, 5, 6, 13, 16, 22, 23, 26, 29, 30
§4.1	3/2	Vector Space & Subspaces	1, 3, 8, 12, 13, 15, 17, 22, 23, 31, 32
§4.2	3/4	Null Spaces, Column Spaces & Lin. Transf.	3, 6, 11, 14, 17, 19, 21, 24, 25, 32, 33, 34, 36
§4.3	3/16	Bases and Lin Ind. Sets	3, 4, 8, 10, 14, 15, 21, 23, 24, 29, 30, 31

§4.4	3/18	Coordinate Systems	2, 3, 5, 7, 10, 11, 13, 15, 17, 21, 23, 32
§4.5	3/23	Dimension of a VS	1, 4, 8, 11, 14, 21, 23, 26, 28, 29
§4.6	3/23	Rank	2, 5, 7, 10, 13, 19, 24, 27, 28
§4.7	3/25	Change of Basis	1, 3, 5, 7, 9, 11, 13, 15
§1.1-4.7	3/30	Catchup & Review Day	

THURSDAY APRIL 1 SECOND MIDTERM EXAM (through §4.7)

§5.1	4/6	Eigenvectors & Eigenvalues	2, 6, 7, 11, 13, 15, 19, 21, 23, 24, 25, 27, 31
§5.2	4/6	Characteristic Equation	2, 5, 9, 12, 15, 19, 20, 21
§5.3	4/8	Diagonalization	1, 4, 5, 9, 11, 15, 17, 21, 24, 26
§5.4	4/13	Eigenvectors & Linear Transformations	1, 3, 6, 10, 15, 23
§6.1	4/13	Inner Product & Orthogonality	3, 5, 10, 16, 19, 23, 25, 27
§6.2	4/15	Orthogonal Sets	3, 6, 8, 11, 14, 20, 23, 26, 27, 28
§6.3	4/20	Orthogonal Projections	1, 6, 7, 11, 17, 21
§6.4	4/20	Gram-Schmidt Process	1, 3, 7, 9, 17, 19
§6.5	4/20	Least-Squares Problems Skip: Section "Solution of the General Least-Squares Problem"	15, 16, 17abce, 18abcef
§7.1	4/22	Diagonalization of Symmetric Matrices Skip: Section "Spectral Decomposition"	1, 3, 8, 10, 13, 17, 25
§7.2	4/22	Quadratic Forms Skip: Section "Classifying Quadratic Forms"	1, 5, 8, 11, 13
	4/27	PageRank, the Linear Algebra behind Google	No Homework.
§1.1-7.2	4/29	Catchup & Review Day	Do the problems in the Final Study Guide by today.

***TUESDAY* 4th of MAY 1.00-3.00 pm FINAL EXAM IN MSB 311**

News and Updates

4/28: I will have extra office hours on Monday (the day before our final) at 11am-12pm and 3.30pm-4.30pm.

4/23: Please not the remarks above about the parts of sections 6.5-7.2 that we skipped. Please have a look at the Final Study Guide.

Solutions for the 2nd midterm.

4/20: Several updates:

- There will be **no quiz this Thursday (4/22)**. Instead there will be a longer quiz next Tuesday, 4/27, covering the material from 5.4 to 7.2. (It will still count as one quiz, just with a bit more time and covering more material.)

- The midterm scores have been posted on HuskyCT. I used a curve, so please also look at your grade (column "M2-G", which is a GPA-like score, i.e. 3.8 or better is an A, 3.5-3.8 A-, 3.2-3.5 B+ etc.).
- On Thursday, 4/22, we will do the course evaluation, so please bring an HB2 pencil.
- Tuesday, 4/27, will be a special topic about Google and Linear Algebra.

Final: The Final will be on Tuesday, 5/4, from 1pm to 3pm, in MSB 311 (our regular classroom).

3/31: Partial solutions to the practice midterm.

3/30: As a practice midterm, please to Tom Roby's practice midterm from a 2210 section last fall (ignore the "salvage" part in problems 6 and 8), and the additional problem on section 4.7.

3/21: On 3/23, the homework for 4.2, 4.3 and 4.4 will be due.

Update 3/15: The quiz on Thursday, 3/18, will mostly be based on the written homework for 3.3 and 4.1. For the additional question you should know:

- The definitions and properties of Nul A and Col A (in particular the list on page 232).
- The definition of a basis (chapter 4.3 up to page 238).

Also, please leave some comments on the midterm feedback form - thanks!

Update 3/8:

- Homework change: On 3/16, the homework for 3.3 and 4.1 will be due (not yet 4.2).
- The midterm feedback google webform is now online.

Update 3/2: The quiz on Thursday, 3/4, will cover sections 3.1 and 3.2, and true/false type questions related to section 3.3 (Cramer's Rule and the relation of determinants to areas and volumes).

Update 2/25: If you missed that there was Homework due on Tuesday 2/23, you can still turn it in on Tuesday 3/2 for 80% credit.

Update: Partial solutions for the practice midterm.

Homework: On 2/23, only the homework of 2.3 and the supplementary exercises are due. On 3/2, all of 2.4, ~~2.5,~~ 3.1 and 3.2 will be due.

The quiz on 2/18 will cover the homework materials from 2.1 and 2.2. The true/false-type questions will all be on section 2.3. You should know the Invertible Matrix Theorem in and out by then!

A review sheet for the midterm, and a practice midterm. I will post solutions for the non-computational parts of the midterm. You can check your computations by plugging in your solutions into the original equations. Or you can use an Online Row Reducer to check all your steps.

I will have extra office hours this Friday 2/19, 10.30-12.15. You are more than welcome to stop by with questions about the exam. I will be traveling over the weekend and Monday, so this will be the last chance to ask me questions in person. You can of course e-mail me questions as well, but I may not be so prompt in replying; if you e-mail me by Sunday I can promise to reply in time.

I have now set up a HuskyCT section for the course, where you can check all your (homework, quiz and exam) scores. (I won't use it for anything else.)

Solutions to Quizzes, Study Guides, etc.

Final Study Guide (Update: typo in problem no. 6 fixed).
Solutions for the problems in the study guide.

Solutions for the second midterm.

A review sheet, practice midterm and practice midterm solutions for the first midterm.

Solutions for the first midterm.

- Quiz 1: Solutions.
- Quiz 2: Solutions.

- Quiz 3: Solutions.
- Quiz 4: Solutions. **Attention:**Unfortunately there is a mistake in the solution to problem 1, the second entry in the first column should be 13/3 not 5/3.
- Quiz 5: Solutions.
- Quiz 6: Solutions.
- Quiz 7: Solutions.
- Quiz 8: Solutions.
- Quiz 9 (with typos corrected): Solutions.

My homepage