MATH 524: Linear Algebra
Fall 2008 (TR 11-12:15, EBA 258)

Overview:
Linear algebra is concerned with functions, equations, and transformations that are *linear*. This is a very special, simple case. By insisting on this restriction, very powerful tools can be developed that would not be available without it This allows compicated coupled systems to sometimes be decoupled, which greatly simplifies their solution.

This course is more abstract than MATH 254; this allows for deeper understanding and more powerful tools.

Learning Objectives:
Students will memorize (and state upon request) all relevant definitions and theorems, including proofs where necessary. They will determine whether or not specific examples are covered under these general results. They will emulate these proofs in similar contexts. They will demonstrate (with examples and non-examples) the subtle interactions among these results. These are the primary objectives of the course.

Students will calculate a wide variety of useful objects: eigenvalues, diagonalized matrices, change-of-basis matrices, subspaces, inner products, etc. They will apply these objects to solve a wide variety of problems: differential equations, difference equations, markov chains, least squares, etc. These are the secondary objectives of the course.

Textbook:
Applied Linear Algebra: The Decoupling Principle (2nd ed.), by Lorenzo Sadun, ISBN13 978-0-8218-4441-0
Students are expected to read the text; it is quite brief and easy to understand. We will cover all the material through the middle of Chapter 8, omitting only section 6.9. Students are expected to solve all of the exercises (solutions to the starred ones appear in the back). Homework will not be collected, and will rarely be discussed in class due to time constraints – please bring homework questions to office hours, or ask via email.
Solving exercises is the MAIN mechanism by which students learn the material.

Attendance:
Students are expected to attend every class. Makeup exams are not given under any circumstances; each student's lowest exam grade is dropped, to account for unexpected eventualities. Under extraordinary circumstances (e.g. hospitalization), a second exam grade might be dropped.

Collaboration:
Students are strongly encouraged to study together, to solve exercises together, and to submit explorations together. Exams must be taken without assistance, however.

Computer Software:
There is no requirement to use a computer algebra system such as MATLAB, Maple, or Mathematica (or the free alternatives Scilab and Maxima). However, such a system makes computations easier and faster, and greatly aids with some of the explorations. Students are strongly encouraged to take the time to get familiar with at least one of them.

Course Mechanics:
There will be eleven brief (30 min.) exams, as marked with $\star$ below. Typically they will cover all material since the previous exam. The final, of course, will be cumulative. Approximate schedule:

Sep. 2	1	Oct. 7	$\star$, 4.6	Nov. 11	holiday
Sep. 4	2.1, 2.2	Oct. 9	4.7, 4.8	Nov. 13	$\star$, 6.6
Sep. 9	$\star$, 2.3	Oct. 14	4.9, 5.1	Nov. 18	6.7, 6.8
Sep. 11	2.4, 2.5	Oct. 16	$\star$, 5.2	Nov. 20	$\star$, 7.1
Sep. 16	$\star$, 3.1	Oct. 21	5.3, 5.4	Nov. 25	7.2, 7.3
Sep. 18	3.2, 3.3	Oct. 23	$\star$, 5.5	Dec. 2	7.4, 7.5
Sep. 23	3.4, 3.5	Oct. 28	5.6, 5.7	Dec. 4	$\star$, 8.1
Sep. 25	$\star$, 4.1	Oct. 30	$\star$, 6.1	Dec. 9	8.2, 8.3
Sep. 30	4.2, 4.3	Nov. 4	6.2, 6.3	Dec. 11	$\star$
Oct. 2	4.4, 4.5	Nov. 6	6.4, 6.5	Dec. 16	FINAL 10:30-12:30

Explorations:
The text contains about a dozen explorations. These are multi-part problems, typically involving a computational experiment. Students must choose one (or more) to complete. The due date is the start of the next chapter (e.g. the exploration following section 5.1 must be submitted by Oct. 30, the day we begin chapter 6). Students are encouraged to collaborate on these – the same grade goes to all. These grades are from 0-5, based not only on correctness but on the writing and overall quality of the mini-project. Students may submit more than one exploration; this will constitute extra credit.

Grading:
The 10 exams (after dropping one) will be worth 7% of the course grade each. 5% of the course grade will be from the exploration. The final exam will be worth 25% of the course grade. Each submitted exam problem (and hence the exam as a whole) will be graded on a scale of 50%-100%: handing in a blank exam is worth 50 points, while missing the same exam earns 0 points. The grading policy is as follows:
A 92-100, B 82-87, C 72-77, D 62-67, $\pm$ as obvious

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