Syllabus for MA 322 - Matrix Algebra and its Applications (Fall 2005)

Updated information can be found on the web page of the course at
http://www.ms.uky.edu/~uwenagel/MATRIX-F05/matrix-f05.html

Basic Information

Time and Place: 1:00-1:50 pm MWF, CB 243

Students are expected to attend all lectures.

Instructor: Uwe Nagel, POT 763, 257-6793, uwenagel@ms.uky.edu and www.ms.uky.edu/~uwenagel.

Office Hours: 3:00-3:50 pm MWF in POT 763, or by appointment.
You can also consult me by email.

Exams: There will be two midterms and one final exam.

- Exam 1 (CB 243, September 26, 1:00-1:50 pm)
- Exam 2 (CB 243, October 31, 1:00-1:50 pm)
- Final exam (CB 243, December 14, 1:00-3:00 pm).

All exams are cumulative in the sense that students are expected to know also the material that has been on previous exams.

Material

Textbook: *Linear algebra and its applications* (3rd edition) by David C. Lay, ISBN 0-321-28713-4.

Matrix algebra has its roots in the study of simultaneous linear equations in several variables. The development of systematic methods to find and to discuss the solutions of linear equations has lead to fundamental concepts and methods such as matrix, Gaussian elimination, vector space, dimension, linear transformation, determinant, eigenvalue, inner product. The goal of the course is to become very familiar with all these objects.
Ideas, methods, and the language of matrix algebra are widely used in all areas of mathematics and most other sciences. The course will basically cover Chapters 1-7 of the textbook.

Tentative Schedule

- Aug 24: *1.1 Systems of linear equations*

- Aug 26: *1.2 Row reductions and echelon forms*
- Aug 29: *1.3 Vector equations*
- Aug 31: *1.4 The equation $Ax = b$*
- Sept 2: *1.5 Solution sets of linear systems*
- Sept 5: *1.6 Linear independence*
- Sept 7: *1.7 Introduction to linear transformations*
- Sept 9: *1.8 The matrix of a linear transformation*
- Sept 12: *2.1 Matrix operations*
- Sept 14: *2.2 The inverse of a matrix*
- Sept 16: *2.3 Characterizations of invertible matrices*
- Sept 19: *2.5 LU factorization*
- Sept 21: *Review*
- Sept 23: *Review*
- Sept 26: **First Midterm**
- Sept 28: *3.1 Introduction to determinants*
- Sept 30: *3.2 Properties of determinants*
- Oct 3: *3.3 Cramer's rule, volume, and linear transformations*
- Oct 5: *4.1 Vector spaces and subspaces*
- Oct 10: *4.2 Null spaces, columns spaces, and linear transformations*
- Oct 12: *4.3 Linearly independent sets and bases*
- Oct 14: *4.4 Coordinate systems*
- Oct 17: *4.5 The dimension of a vector space*
- Oct 19: *4.6 The rank of a matrix*
- Oct 21: *4.7 Change of basis*
- Oct 24: *4.8 Difference equations*
- Oct 26: *Review*
- Oct 28: *Review*
- Oct 31: **Second Midterm**
- Nov 2: *5.1 Eigenvectors and eigenvalues*
- Nov 4: *5.2 The characteristic equation*
- Nov 7: *5.3 Diagonalization*
- Nov 9: *5.4 Eigenvalues and linear transformations*
- Nov 11: *5.5 Complex eigenvalues*
- Nov 14: *6.1 Inner products*
- Nov 16: *6.2 Orthogonal sets*
- Nov 18: *6.3 Orthogonal projections*
- Nov 21: *6.4 The Gram-Schmidt algorithm*
- Nov 23: *6.5 Least-squares problems*
- Nov 28: *7.1 Diagonalization of symmetric matrices*
- Nov 30: *7.2 Quadratic forms*
- Dec 2: *Quadratic forms, continued*
- Dec 5: *Review*
- Dec 7: *Review*
- Dec 9: *Review*
- Dec 14 ***Final Exam***

Homework and Quizzes

A short quizz will be given during the last 10 minutes of each Friday lecture beginning September 2, except during exam weeks. Make-up quizzes will not be given without an excused absence.

Homework problems will be regularly assigned using a web-based homework system (WHS). Each student has an individual, **Personal Version** of the web-based homework assignments which he or she is expected to work on and to submit the answers on the web. For each problem set there is also a **Common Version** of problems similar to the personal version. Everyone gets the same common version. Problems on the common version are the ones most likely to be discussed in class. Credit is only given for correct solutions of problems appearing in the student's **Personal** Version according to the following rules:

- A student can submit answers to an assignment any number of times. The system maintains a complete record of all submissions.
- A student receives credit for a problem if he or she submits the correct answer before the homework set expiration date passes.
- Until the expiration date the homework system will inform students whether their submitted answer to a problem is correct. After the expiration date the system will also provide the expected answer.

This homework system is reached at http://www.mathclass.org. There are links which provide information. Accounts already exist for pre-registered students. Your initial login and password is your student number. **Please change your login immediately to your complete email address and change your password to whatever you prefer.** You may also use a non-university email address. Students who are not pre-registered will need to follow the initial instructions at the "For Students" link to get started. Subsequent sections of the "For Students" link describe how to use the system. If you have problems with your account, there will be student staff in the Mathskeller to help you. The Mathskeller is room 65 in the basement of the White Hall Classroom Building. A schedule can be found at http://www.mathskeller.com/.

I strongly recommend to approach the homework assigments via the following rules.

- Start on an assignment as early as possible.
- Print out copies of your personal and of the common assignments (it is free in the Mathskeller, the student staff will show you how to do so) and put them in a notebook.
- Get together with classmates to work on the problems via the printouts.
- Write down the solutions in your notebook and only thereafter enter your solutions on the webpage. **Only correct solutions to the *personal* version of the homework assignment give you homework credit!**
- Bring the notebook with you when going to office hours.
- Bring copies of the common problems to class, they are the ones that are most likely to be discussed.

You are encouraged to discuss homework problems and the course material with each other. However, when it comes time for you to write up or enter the solutions, I expect you to do this completely on your own. It would be the best for your understanding if you put aside your notes from the discussions with your classmates and wrote up the solutions entirely from scratch. Working together on the exams, of course, is expressly forbidden.

Grades

There is a total of 450 points in the course which is distributed as follows:

Attendance	25 points
Homework	50 points
Quizzes	50 points
First Midterm	100 points
Second Midterm	100 points
Final Exam	125 points

In this model an A requires at least 405 points (90% or more), B at least 360 (80% or more), C at least 315 (70% or more), D at least 270 (60% or more), E for anything else.