MATH 430 Matrix Analysis

Section 0101 Spring 2011

- Instructor: Dr. Jinglai Shen
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- Lectures: Tue and Thu, 1:00–2:15 pm, at MP 008
- Office hours: Tue and Thu, 12:00–1:00 pm or by appointment
- Course web-page: http://www.math.umbc.edu/~shenj
- Prerequisites: Math 221, 251 and 301
- Text: *Matrix Analysis and Applied Linear Algebra* by Carl D. Meyer, SIAM Press, 2000
- Other books:
  - *Linear Algebra and Its Applications*, by David C. Lay (Math 221 text)
  - *Linear Algebra and Its Applications*, by Gilbert Strang, 4th Edition
- **Tentative exam dates**:
  - Exam I: Thu, Mar. 10 (in class)
  - Exam II: Tue, Apr. 12 (in class)
  - Final Exam: Tue, May 17

  These dates are subject to change.

Course Description and Objectives This course deals with linear equations, matrix algebra, fundamental properties of finite-dimensional vector spaces, linear transformations, as well as their applications. Rigorous mathematical foundation will be developed for linear and matrix algebra. The main topics of the course include: matrix algebra, algebraic and geometric properties of vector spaces, inner products and orthogonality of vector spaces, determinants and their properties, eigensystems and spectrum properties of linear transformations. The linear algebraic and matrix techniques covered in this class will equip you with important tools that you will find useful in a wide range of pure and applied mathematics, like algebra, differential equations, scientific computing, optimization, and statistics, as well as applied areas such as computer science, engineering, and economics.

Homework Weekly homework will be assigned. The homework is usually collected in class on Tuesdays unless a due date change is announced. No late homework will be accepted. Please present your answers neatly and show all your work.

Exams There will be two (2) mid-term exams, and one (1) final exam (see the tentative dates on Page 1). Each mid-term exam mainly focuses on topics covered in the month before the exam, but the final exam will be comprehensive. Please be alerted that calculators and other computing devices are *not* allowed for all the tests.

Grading Policy The grading scheme is as follows:

- homework: 20%
- mid-term exams: 50% (25% each)
- final exam: 30% (the final is comprehensive)

The letter grade will be computed based upon the numerical grade:

$A : \geq 90; \quad B : 89 - 80; \quad C : 79 - 65; \quad D : 64 - 50; \quad F :< 50$

Academic Integrity

- The UMBC Academic Integrity Statement:

  "*By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the Faculty Handbook, or the UMBC Policies section of the UMBC Directory [or for graduate courses, the Graduate School website]* ".

- All work in a homework or an exam must be your own; collaborating on a test is *not* permitted. Discussions with other students on homework problems are allowed, but you should present your own work in the final turn-in; simply copying other people's work is a violation of UMBC's academic integrity code.

- If you wish to contest a graded exam, you must make an appeal within *one week* of the return date to the class. If you must miss an exam due to a prior obligation, you must speak to the instructor *in advance* of the exam. If you must miss an exam due to an unforseen but valid reason (e.g. illness), you must submit a written excuse. Failing to do so may result in loss of substantial points off the top in your make-up.

Some Suggestions

- You are expected to carry out mathematical reasoning (know as proofs), not only mechanical calculation, in this class. Problem solving is critical to learning mathematics. Simply reading definitions, theorems, and examples is far from enough to grasp problem solving skills. You must try your best to work problems out by your own effort.
- Review notes and the textbook before doing homework. Read the scheduled materials before going to class. If you have difficulty in understanding concepts or results, bring them to the class.
- If you have already done your best but sill have questions, either see the instructor or get helps from other sources right away. If you are left behind at certain point, it may take you much more time and effort to catch up.

Tentative Schedule and Topics (the topics and dates in the list are subject to change, depending on class progress)

No.	Week	Topic	Section (Meyer)
1	Jan. 24-Jan. 28	Introduction and review	1.2, 1.3, 2.1-2.5
2	Jan. 31–Feb. 4	Matrix algebra, matrix multiplication	3.2-3.5
3	Feb. 7–Feb. 11	Matrix inverse, Subspaces and fundamental subspaces	3.6-3.7, 4.1-4.2
4	Feb. 14–Feb. 18	Linear independence, basis	4.2-4.3
5	Feb. 21–Feb. 25	Dimension, rank, least squares	4.4-4.6
6	Feb. 28–Mar. 4	Linear transformations, basis change	4.7-4.8
7	Mar. 7–Mar. 11	Norms, inner-products, orthogonality, Exam I	5.1-5.4
8	Mar. 14–Mar. 18	Gram-Schmidt procedure, Unitary and orthogonal matrices	5.5, 5.6
9	Mar. 21–Mar. 25	Spring break (no class)	
10	Mar. 28–Apr. 1	Complementary subspaces, decomposition	5.9-5.11
11	Apr. 4–Apr. 8	Determinants and their properties	6.1-6.2
12	Apr. 11–Apr. 15	Exam II, eigensystems	7.1
13	Apr. 18–Apr. 22	Diagonalization and its application	7.2-7.3
14	Apr. 25–Apr. 29	Normal matrices, positive definiteness	7.5, 7.6
15	May 2–May 6	ODE applications, Jordan structure	7.4, 7.7
16	May 9–May 13	Jordan canonical form, review	7.8