Pennsylvania State University
Spring Semester 2011
MATH 220: Matrices

Course Information

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The Latest Version of This Document

This document is subject to revision during the semester. The latest version of
this document is available on-line at

http://www.math.psu.edu/simpson/courses/math220/.

Course Description

Systems of linear equations; matrix algebra; eigenvalues and eigenvectors; orthogonality and least squares, symmetric matrices and quadratic forms.

Prerequisite

MATH 110 or MATH 140.

Textbook

Linear Algebra and its Applications, Updated Third Edition, by David Lay,
published by Pearson/Addison Wesley.

Calculators

The use of calculators will not be permitted on exams. Calculators may be used
(but are not required) on homework assignments.

Midterm Exam

A 75-minute evening exam will be held on **Tuesday, March 1, 2011, from
6:30 to 7:45 PM.**

Conflict and Makeup Midterm Exams

Only students with official University conflicts will be allowed to schedule the
conflict midterm exam. Only students with a valid, documented excuse will be
permitted to schedule the makeup exam with no penalty. Students without a
valid, documented excuse may be allowed to take a makeup exam, but they will
receive a mandatory 20-point deduction on their scores.

The conflict midterm exam will be 5:05 PM to 6:20 PM on Tuesday, March 1, 2011. Students taking the conflict exam will not be allowed to leave the examination room until 6:25 PM. Any student who leaves the room before 6:25 PM will receive a score of zero on the exam and will not be allowed to retake it. You must sign up for the conflict exam in class, with your instructor, on a pink form. You are responsible for knowing the room and time of the conflict exam. This information is on the top of the pink form. Note that your instructor must turn in the pink form 48 hours prior to the examination date. If you have not signed up with your instructor, you will not be allowed to take the conflict exam.

For the makeup exam, you must sign up with your instructor, on a yellow form, as soon as possible following the regular exam date.

Final Exam

A comprehensive final exam, covering the entire content of the course, will be given. The final exam period is Monday May 2 through Friday May 6. **Students must not plan to leave University Park before Saturday, May 7.**

Conflict and Makeup Final Exams

For the final exam, notification of conflicts is given on the student's final exam schedule on e-Lion. A student must take action to request a conflict exam through e-Lion during the period February 14 through March 6, 2011. Note that the conflict final exam is scheduled by the Registrar's office, not by the Department of Mathematics.

Students who miss both the regular and the conflict final exams due to a valid and documented reason, such as illness, may be allowed to take a makeup final exam. If a student does not have a valid reason, a 30-point penalty will be imposed. All such makeup exams must be scheduled through the instructor, and students must contact the instructor within 24 hours of the final exam.

Grading Policy

Grades will be assigned on the basis of 350 points distributed as follows:

    100 points for homework and quizzes,
    100 points for the midterm exam,
    150 points for the final exam.

Final grades will be assigned as follows:

    A 325–350   A− 315–324   B+ 304–314   B 290–303
    B− 280-289   C+ 269-279   C 245-268   D 210-244   F 0–209

Note that we do not use a "curve" in this course. Grades will be based exclusively on homework, quizzes, the midterm exam, and the final exam. There is no "extra-credit" work for this course.

Math Center and Tutors

Free mathematics tutoring is available at Penn State Learning

http://www.PennStateLearning.psu.edu

located in 7 Sparks Building. If you need additional help, you may consult the list of private tutors maintained by the undergraduate office. Students are expected to pay for their tutoring session. The Private Tutor List is available through the home page of the Undergraduate Program of the Department of Mathematics at http://www.math.psu.edu/ug/. This web site is also a good source of general information about undergraduate mathematics courses, evening exam schedules, office hours of instructors, etc.

Academic Integrity

All Penn State and Eberly College of Science policies regarding academic integrity apply to this course. For details see

http://www.science.psu.edu/academic/Integrity/.

Questions, Problems, Comments

If you have questions or concerns about a grade or course-related issue regarding MATH 220, please consult your instructor first. If this does not result in a satisfactory solution, please consult the course coordinator, Stephen G. Simpson, simpson@math.psu.edu. If you still cannot resolve the problem, please consult the Associate Head For Undergraduate Studies, James Sellers, sellersj@math.psu.edu.

Course Outline (tentative, subject to revision)

Sections of the textbook are indicated. Dates and number of class periods are in parentheses.

I. LINEAR EQUATIONS IN LINEAR ALGEBRA

1.1. Systems of Linear Equations (1.5, January 11 & 13)
1.2. Row Reduction and Echelon Forms (1.5, January 13 & 18)
1.3. Vector Equations (1.5, January 20 & 25)
1.4. The Matrix Equation $Ax = b$ (1, January 25 & 27)
1.5. Solution Sets of Linear Systems (1, January 27 & February 1)
1.7. Linear independence (1, February 1 & 3)
1.8. Introduction to Linear Transformations (1, February 3 & 8)
1.9. The Matrix of a Linear Transformation (1, February 8 & 10)

II. MATRIX ALGEBRA

    2.1. Matrix Operations (1, February 10 & 15)
    2.2. The Inverse of a Matrix (1, February 15 & 17)
    2.3. Characterizations of Invertible Matrices (1, February 17 & 22)
    2.8. Linear Subspaces (1.5, February 22 & 24)

REVIEW FOR MIDTERM EXAM (March 1)

MIDTERM EXAM (March 1)

    2.9. Dimension and Rank (1.5, March 3 & 15)

III. DETERMINANTS

    3.1. Introduction to Determinants (1, March 15 & 17)
    3.2. Properties of Determinants (1, March 17 & 22)

IV. EIGENPROBLEMS

    5.1. Eigenvalues and Eigenvectors (2, March 22 & 24 & 29)
    5.2. The Characteristic Equation (1, March 29 & 31)
    5.3. Diagonalization (1, March 31 & April 5)

V. ORTHOGONALITY AND LEAST-SQUARES

    6.1. Inner Product, Length, and Orthogonality (0.5, April 5)
    6.2. Orthogonal Sets (1, April 7)
    6.3. Orthogonal Projections (1, April 12)
    6.4. The Gram-Schmidt Process, no QR Factorization (1, April 14)
    6.5. Least-Squares Problems, Example 1 from 6.6 (1, April 19)

VI. SYMMETRIC MATRICES

    7.1. Diagonalization of Symmetric matrices, Spectral Theorem (1, April 21)
    7.2. Quadratic Forms (1, April 26)

REVIEW FOR FINAL EXAM (April 28)

FINAL EXAM (Final Exam Week, May 2–6)