Spring 2012

MA260 – Linear Algebra TTh 11:00 a.m.–12:15 p.m. (W-1-55)

Instructor: Steven Jackson Office: Sci-3-082 Drop-in office hours: TTh 12:30 p.m.-1:30 p.m.; for appointments see below. E-mail: jackson@math.umb.edu Phone: (617) 287-6469 URL: www.math.umb.edu/~jackson/

# **Course Description**

This course is an introduction to the objects and techniques of linear algebra. Topics include systems of linear equations and their solution by Gauss-Jordan elimination, matrices, linear transformations, image and kernel of a linear transformation, linear spaces, bases and linear independence, invariance of dimension, change of coordinates, orthonormal sets, the Gram-Schmidt Process and QR factorization, determinants, eigenvalues, and eigenvectors. See the course calendar for more detailed information.

## Prerequisites

Admission to the course is contingent upon successful completion of MA140 or an equivalent college level calculus course.

## Text

There is one required text for the course: *Linear Algebra with Applications*, Fourth Edition, by Otto Bretscher. In addition, a *Student's Solutions Manual* is available. Both the text and the solutions manual are on reserve in Healey Library.

#### Grading

Course grades are based on weekly quizzes (20%), two in-class tests (20% each), and a cumulative final exam (40%).

## Reading and class preparation

There is a reading assignment associated with each class period. Although it is not generally possible to discuss every topic in class, students are responsible for the entire content of the reading assignment. *Test and exam questions may cover reading material not discussed explicitly in class.* Consequently it is very important to complete the reading assignments on time and to come to class prepared with questions.

## Make-up tests

Tests may be rescheduled only in cases of serious illness, bereavement, or other circumstances of similar gravity. Whenever possible, arrangements for make-up tests must be made *in advance* of the regularly scheduled testing time.

#### Student conduct

Students are required to adhere to the University Policy on Academic Standards and Cheating, to the University Statement on Plagiarism and the Documentation of Written Work, and to the Code of Student Conduct as delineated in the catalog of Undergraduate Programs, pp. 44–45 and 48–52. The Code is available online at the following web site:

http://www.umb.edu/editor\_uploads/images/life\_on\_campus/CSC.pdf

#### Web page and appointments

This syllabus and other course materials are available on-line at

http://www.math.umb.edu/~jackson/classes/s12\_ma260/

If my drop-in office hours are not convenient for you, you may schedule an appointment with me, at least twenty-four hours in advance, by following the appropriate link from the course webpage. If the times listed on the calendar do not suit you, please try to ask your question by e-mail, or contact the Math office for information on other instructors' office hours.

# **Course Calendar**

Homework problems should be done prior to the due date but are not to be handed in. One problem from each assignment will appear on the weekly quiz.

Tuesday, January 24: Introduction.

Thursday, January 26: Systems of linear equations.

Read before class: Section 1.1.

Tuesday, January 31: Gauss-Jordan elimination.

Read before class: Section 1.2.

Do before class: Section 1.1: 1, 3, 5, 9, 11, 13, 17, 21

Thursday, February 2: Solutions of linear systems.

Read before class: Section 1.3.

Tuesday, February 7: Linear transformations and their inverses.

Read before class: Section 2.1.

Do before class: Section 1.2: 1, 3, 5, 7, 25, 27, 45 Section 1.3: 1, 3, 5, 7, 9, 11, 13, 17, 19, 23

Thursday, February 9: Linear transformations in geometry.

Read before class: Section 2.2.

Tuesday, February 14: Matrix products.

Read before class: Section 2.3.

Do before class:

Section 2.1: 1, 3, 5, 9, 11, 13, 17, 19, 45 Section 2.2: 1, 3, 5, 7, 9, 11, 19, 25, 35

Thursday, February 16: Inverses.

Read before class: Section 2.4.

Tuesday, February 21: Images and kernels.

Read before class: Section 3.1.

Do before class:

Section 2.3: 1, 3, 5, 7, 9, 17, 23, 27, 43, 45 Section 2.4: 1, 5, 9, 13, 55, 61, 67, 69, 75

Thursday, February 23: Subspaces. Bases and linear independence.

Read before class: Section 3.2.

Tuesday, February 28: Test 1: Sections 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, and 2.4.

Thursday, March 1: Dimension.

Read before class: Section 3.3.

Tuesday, March 6: Coordinates.

Read before class: Section 3.4.

Do before class:

Section 3.1: 1, 5, 13, 15, 19, 33 Section 3.2: 1, 3, 11, 15, 19, 25 Section 3.3: 23, 25, 29, 31, 33, 36

Thursday, March 8: Abstract linear spaces.

Read before class: Section 4.1.

Tuesday, March 20: Linear transformations and isomorphisms.

Read before class: Section 4.2.

Do before class: Section 3.4: 1, 5, 9, 25, 27, 29, 37

Thursday, March 22: The matrix of a linear transformation.

Read before class: Section 4.3.

Tuesday, March 27: Orthogonal projections and orthonormal bases.

Read before class: Section 5.1.

Do before class:

Section 4.1: 1, 5, 7, 9, 18, 23, 27, 33 Section 4.2: 1, 3, 5, 25, 39, 53 Section 4.3: 1, 7, 21, 27, 55

Thursday, March 29: Gram-Schmidt orthonormalization and QR-factorization. Read before class: Section 5.2.

Tuesday, April 3: Othogonal transformations and orthogonal matrices.

Read before class: Section 5.3.

Do before class: Section 5.1: 3, 5, 9, 15, 17, 27 Section 5.2: 7, 11, 19, 27, 33

Thursday, April 5: Least squares and data fitting.

Read before class: Section 5.4.

Tuesday, April 10: Introduction to determinants.

Read before class: Section 6.1.

Do before class: Section 5.3: 1, 3, 5, 7, 9, 11, 13, 15, 21, 23 Section 5.4: 1, 7, 19, 21, 31, 33

Thursday, April 12: Properties of the determinant.

Read before class: Section 6.2.

**Tuesday, April 17:** Test 2: Sections 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, and 5.4.

Thursday, April 19: Geometric interpretations. Cramer's rule.

Read before class: Section 6.3.

Tuesday, April 24: Dynamical systems and eigenvectors.

Read before class: Section 7.1.

Do before class: Section 6.1: 5, 9, 33, 37, 39, 41 Section 6.2: 3, 5, 11, 13, 15

Section 6.3: 1, 23, 25, 27, 31

Thursday, April 26: Finding eigenvalues.

Read before class: Section 7.2.

Tuesday, May 1: Finding eigenvectors.

Read before class: Section 7.3.

Do before class:

Section 7.1: 1, 5, 15, 19, 25, 27, 29 Section 7.2: 3, 5, 9, 11, 13, 29 Thursday, May 3: Diagonalization.

Read before class: Section 7.4.

**Tuesday, May 8:** Epilog: Non-diagonalizable matrices, similarity, and the Jordan decomposition.

Do before class:

Section 7.3: 3, 5, 7, 13, 17 Section 7.4: 3, 7, 13, 19, 31, 33, 49