21-240 Matrix Algebra with Applications
Spring 2012

Course Information

Instructor:	Timothy Blass tblass@andrew.cmu.edu Wean Hall 7115 / 268-5608 (office)
Office Hours:	Tuesday 4:00pm – 6:00pm, or by appointment, WEH 7115
Schedule of Lectures:	MWF 11:30am – 12:20pm, Gates-Hillman Center 4102
Teaching Assistant:	Mikhail Lavrov mlavrov@andrew.cmu.edu Wean Hall 8213 / 268-8755 (office)
Office Hours:	Tuesday and Friday 12:30pm – 1:20pm, Wean Hall 8213
Schedule of Recitations:	Tuesday 10:30am – 11:20am, Wean Hall 4709
Course Website:	Course materials, assignments, and announcements will be available on the Blackboard website: `http://blackboard.andrew.cmu.edu`
Textbook:	*Linear Algebra and Its Applications*, 4th edition, by David C. Lay
Prerequisites:	None.

Learning Objectives

Matrix Algebra, also called Linear Algebra, is one of the fundamental blocks of Mathematics. You are likely to use Matrix Algebra in courses on Physics, Statistics, Computer Science, Engineering, and Economics.

In this course, you will learn how to solve systems of linear equations, how to compute the determinant, eigenvalues, and eigenvectors of a matrix, and how to orthogonalize a set of vectors. You will also learn the definition and basic properties of linear spaces (vector spaces), subspaces, and linear transformations. At the end of the course, you will be able to apply Matrix Algebra results to solve many different types problems.

Course Content

During this course, we will aim to cover the following sections/topics from the textbook:

1.1 Systems of Linear Equations

1.2 Row Reduction and Echelon Forms

1.3 Vector Equations

1.4 The Matrix Equation $A\overline{x} = \overline{b}$

1.5 Solution Sets of Linear Systems

1.6 Applications of Linear Systems

1.7 Linear Independence

1.8 Linear Transformations

1.9 The Matrix of a Linear Transformation

2.1 Matrix Operations

2.2 The Inverse of a Matrix

2.3 Characterizations of Invertible Matrices

2.4 Partitioned Matrices

2.5 Matrix Factorizations

2.6 The Leontief Input-Output Model

3.1 Introduction to Determinants

3.2 Properties of Determinants

4.1 Vector Spaces and Subspaces

4.2 Null Spaces, Column Spaces, and Linear Transformations

4.3 Linearly Independent Sets; Bases

4.4 Coordinate Systems

4.5 Dimension of a Vector Space

4.6 Rank

4.7 Change of Basis

4.9 Applications to Markov Chains

5.1 Eigenvectors and Eigenvalues

5.2 The Characteristic Equation

5.3 Diagonalization

6.1 Inner Product, Length, and Orthogonality

6.2 Orthogonal Sets

6.3 Orthogonal Projections

6.4 Gram-Schmidt Process; QR factorization

6.5 Least-Squares Problems

7.1 Diagonlization of Symmetric Matrices

7.2 Quadratic Forms

7.3 Constrained Optimization

7.4 The Singular Value Decomposition

Attendance

You are required to attend all the lectures and recitations. You are responsible for all of the announcements made in class. Get to know your classmates so that if you do miss class, you can exchange notes.

Homework

Homework is an integral part of the course. Many problems on the midterms and final exam will come from the homework, so it is important for you to complete all of the homework problems.

Homework will comprise 25% of your total grade. Assignments will be posted on Blackboard each Wednesday, and will be due in lecture the following Wednesday. They must be turned in within the first ten minutes of class. **Late homework will not be accepted.**

The two lowest homework scores will be dropped. This policy accounts for missed assignments due to unforeseen circumstances.

Study groups are encouraged, but assignments should be completed individually. You **may not** copy another student's work. The university's policy on cheating and plagiarism can be found at `http://www.cmu.edu/policies/documents/Cheating.html`. Always show your work.

Exams

There will be three non-comprehensive midterm exams and one comprehensive final exam. The midterm exams will be given in class (50 minutes), and each will comprise 15% of your total grade. The final exam will comprise 30% of your total grade.

The tentative dates for the midterms are **Wednesday, February 8**, **Wednesday, March 7**, and **Wednesday, April 11**. The exact date and location for the final exam will not be determined until mid-semester, so **do not** make plans to leave the university prior to the end of the finals period.

Grading Policy

Final grades are based on homework and exam scores with the following weights:

- Homework: 25%
- 3 Midterms: 45%
- Final Exam: 30%

Your letter grade for the course will be based on the following ranges:

$$\begin{aligned} \text{A} &= 90\text{–}100\% \\ \text{B} &= 80\text{–}89\% \\ \text{C} &= 70\text{–}79\% \\ \text{D} &= 60\text{–}69\% \\ \text{R} &= 0\text{–}59\% \end{aligned}$$

The cutoffs maybe lowered slightly, but will not be increased.

Additional Information

Academic Integrity: All CMU academic integrity policies apply to this course. Please take time to review these policies at: `http://www.studentaffairs.cmu.edu/acad_integ/acad_index.htm`

Learning Accommodations: If you anticipate needing learning accommodations in this course, please let me know at the beginning of the term so that we can work out necessary alternative assessment options. Accommodations will require the appropriate medical documentation. See the CMU Disability Services website http://www.cmu.edu/hr/eos/disability/index.html.