Math 221 - Linear Algebra
Oxford College of Emory University
Spring 2014

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Office Hours: To be announced on Blackboard.

Course Content:

This course is designed to introduce the student to the basic notions of linear algebra. Topics include matrices, systems of linear equations, vector spaces, inner products, bases, linear transformations, eigenvalues, eigenvectors, and applications of these topics.

Course Objectives:

At the end of the course the student should:

- Use Gaussian Elimination to solve systems of linear equations and identify those with one solution, no solution, or an infinite number of solutions.
- Perform operations with matrices and demonstrate comprehension of the fundamental properties of matrices and its operations.
- Demonstrate comprehension of fundamental definitions used in the study of linear algebra such as vector spaces, span of a vector space, basis of a vector space, subspaces, linear transformations, etc.
- Know what an inner product is and its properties.
- Obtain the characteristic polynomial, eigenvalues, eigenvectors, diagonalization, and a basis for each eigenspace for a given square matrix.
- Know about some application of linear algebra to other areas.

Text:

Elementary Linear Algebra: Applications Version, Edition 10 by Howard Anton & Chris Rorres.

During the first part of the course, you are required to read the book before coming to class, and working on a few selected problems. Hopefully that will help you develop the good habit of reading the text ahead of time.

Any additional material needed for this class will be provided in class or via Blackboard at https://classes.emory.edu/.

Homework:

Homework problems from each section that we cover in the text will be provided on Blackboard. Although the homework will not be collected, a timely completion of these assignments is crucial to success in this course in addition to serving as an excellent preparation for the tests, quizzes and problem sets.

Grading Policy:

Students' grades are determined by performance on problem sets, quizzes, class participation, projects, tests, and a comprehensive final exam. All tests will be administered during class time, unless special circumstances require otherwise.

Class participation	60
Projects/Problem Sets/Quizzes	200
3 Tests	510
Final	230
Total	1000

Maximum grade cuts are as follows:

A	B	C	D	F
900 – 1000	800 – 899	700 – 799	600 – 699	0 – 590

Plus/minus grades may be assigned for percentages near the maximum grade cuts. Also, I reserve the right to amend, append, or otherwise make changes to the plan for the course.

Class participation:

Your participation grade will be assigned somewhat arbitrarily, but mostly generously. I hope that class will be active and interesting, specially in the first part of the course. Be prepared and involved and it will generally be a lot of fun. You are allowed three unexcused absences, and for each unexcused absence in excess of three I will deduct 8% of your "class participation" grade. I reserve the right to decide what is and what is not an excused absence.

The following are examples of behavior that will be counted as equivalent to an unexcused absence: rude behavior, nodding off, any sight or sound of your cellphone, surfing the internet on your computer, being late to class, leaving the room during class, unwillingness to participate in the assignments, etc. Hopefully breaks should not be needed to go to the bathroom, to answer your phone, etc. If such a break is needed, I expect an explanation.

Students are responsible for all material covered in class and any changes to the syllabus that may be announced. Any conflicts between the course schedule and religious holidays are to be negotiated in advance with me.

Projects/Problem Sets/Quizzes:

Due at the BEGINNING of class on the date indicated on the assignments. The problem sets will consist primarily of the assigned homework problems, but I may add additional questions from other sources. **You are allowed to receive help from anyone/anything to complete**

these assignments. However, you must be actively engaged in the process of completing the assigned problems. Simply copying the work of another student and submitting it as your own will result in zero credit. **All work is expected to be neatly written, and points will be deducted for a lack of organization, illegible or sloppy work, and the inappropriate use of mathematical notation, even if answers found are correct**.

An undetermined number of quizzes will be given throughout the semester. Quizzes need not be announced ahead of time. **There is no provision for making up a quiz. You will receive a zero on any missed quiz.** Grades on quizzes are treated identically to those on problem sets.

Projects will be announced with at least a week in advance.

Tests:

The Oxford Honor Code applies to all tests and is an **individual effort** on all portions (except when announced otherwise).

⋆ Thursday, February 13th. ⋆ Thursday, March 20th. ⋆ Thursday, April 24th.

Final Exam:

Comprehensive with no exemptions. **Make sure to check your final exam schedule before making any trip arrangements**.

Technology:

Although you are encouraged to use technology while doing your homework, in general no technology will be allowed in class, specially smart-phones. Unless stated otherwise, the use of smart-phones, calculators and other technology are prohibited during an assessment for grade, and it will result in an honor code violation.

Expectations:

They're high! I expect that you will read the text (several times) and attempt all the assigned homework (and more). I welcome your comments, criticisms, and suggestions. Please feel free to stop by my office or e-mail me with any concerns or questions that you may have.

Good luck and I hope this will be an enjoyable experience for all of you!

Honor Code:

The Honor Code of Oxford College applies to all work submitted for credit in this course. To receive credit for work submitted you must place your name on it. By placing your name on such work, you pledge that the work has been done in accordance with the given instructions and that you have witnessed no Honor Code violations in the conduct of the assignment.

Disclaimer:

Student work submitted as part of this course may be reviewed by Oxford College and Emory College faculty and staff for the purposes of improving instruction and enhancing Emory education.

List of Topics

1. Section 1.1: Introduction to Systems of Linear Equations;
2. Section 1.2: Gaussian Elimination
3. Section 1.3: Matrices and Matrix Operations
4. Section 1.4: Inverses; Algebraic Properties of Matrices
5. Section 1.5: Elementary Matrices and a Method for Finding the Inverse of a matrix
6. Section 1.7: Diagonal, Triangular, and Symmetric Matrices
7. Section 2.1: Determinants by Cofactor Expansion
8. Section 2.2: Evaluating Determinants by Row Reduction
9. Section 2.3: Properties of Determinants
10. Section 3.1: Euclidean Vector Spaces (2-space, 3-space, n-space)
11. Section 3.2: Norm and Dot Product

Test 1

12. Section 3.3: Orthogonality
13. Section 3.4: The Geometry of Linear Systems
14. Section 4.1: Real Vector Spaces
15. Section 4.2: Subspaces
16. Section 4.3: Linear Independence
17. Section 4.4: Coordinates and Basis
18. Section 4.5: Dimension
19. Section 4.6: Change of Basis
20. Section 4.7: Row Space, Column Space and Null Space

Test 2

21. Section 4.8: Rank, Nullity and Fundamental Matrix Spaces
22. Section 4.9: Matrix Transformations
23. Section 4.10: Properties of Matrix Transformations
24. Section 5.1: Eigenvalues and Eigenvectors
25. Section 5.2: Diagonalization

26. Section 6.1 Inner Products
27. Section 6.2: Inner Product Spaces
28. Section 6.3: Gram-Schmidt Process
29. Section 6.4: Best Approximation; Least Squares
30. Section 7.1: Orthogonal Matrices
31. Section 7.2: Orthogonal Diagonalization
32. Section 8.1: Linear Transformations (?)
33. Section 8.2: Isomorphism (?)
34. Section 8.2: Composition and Inverse Transformations (?)

Test 3

Proposed Calendar
Math 221
Spring 2014

Monday	Tuesday	Wednesday	Thursday	Friday
Jan 13th	Jan 14th	Jan 15th **1** §1.1 Introduction to Systems of Linear Equations	Jan 16th	Jan 17th **2** §1.2 Gaussian Elimination
Jan 20th *No class Martin Luther King Jr. holiday*	Jan 21st	Jan 22nd **3** §1.3 Matrices and Matrix Operations	Jan 23rd	Jan 24th **4** §1.4 Inverses; Algebraic Properties of Matrices
Jan 27th **5** §1.5 Elementary Matrices and a Method for Finding the Inverse of a matrix	Jan 28th	Jan 29th **6** §1.7 Diagonal, Triangular, and Symmetric Matrices	Jan 30th	Jan 31st **7** §2.1 Determinants by Cofactor Expansion
Feb 3rd **8** §2.2 Evaluating Determinants by Row Reduction	Feb 4th	Feb 5th **9** §2.3 Properties of Determinants	Feb 6th	Feb 7th **10** §3.1 Euclidean Vector Spaces (2-space, 3-space, n-space)

Monday	Tuesday	Wednesday	Thursday	Friday
Feb 10th **11** §3.2 Norm and Dot Product	Feb 11th	Feb 12th **12** Review Test 1	Feb 13th **Test 1**	Feb 14th **13** §3.3 Orthogonality
Feb 17th **14** §3.4 The Geometry of Linear Systems	Feb 18th	Feb 19th **15** §4.1 Real Vector Spaces	Feb 20th	Feb 21st **16** §4.2 Subspaces
Feb 24th **17** §4.2 Subspaces	Feb 25th	Feb 26th **18** §4.3 Linear Independence	Feb 27th	Feb 28th **19** §4.3 Linear Independence
Mar 3rd **20** §4.4 Coordinates and Basis	Mar 4th	Mar 5th **21** §4.5 Dimension	Mar 6th	Mar 7th **22** **Last day for dropping.** §4.6 Change of Basis
Mar 10th *Spring Break*	Mar 11th *Spring Break*	Mar 12th *Spring Break*	Mar 13th *Spring Break*	Mar 14th *Spring Break*
Mar 17th **23** §4.7 Row Space, Column Space and Null Space	Mar 18th	Mar 19th **24** Review Test 2	Mar 20th **Test 2**	Mar 21st **25** §4.7 Row Space, Column Space and Null Space

Monday	Tuesday	Wednesday	Thursday	Friday
Mar 24th **26** §4.8 Rank, Nullity and Fundamental Matrix Spaces	Mar 25th	Mar 26th **27** §4.9 Matrix Transformations	Mar 27th	Mar 28th **28** §4.10 Properties of Matrix Transformations
Mar 31st **29** §5.1 Eigenvalues and Eigenvectors	Apr 1st	Apr 2nd **30** §5.2 Diagonalization	Apr 3rd	Apr 4th **31** **Freshman withdraw.** §6.1 Inner Products
Apr 7th **32** §6.2 Inner Product Spaces	Apr 8th	Apr 9th **33** §6.3 Gram-Schmidt Process	Apr 10th	Apr 11th **34** §6.4 Best Approximation; Least Squares
Apr 14th **35** §7.1 Orthogonal Matrices	Apr 15th	Apr 16th **36** §7.2 Orthogonal Diagonalization	Apr 17th	Apr 18th **37** TBA
Apr 21st **38** TBA	Apr 22nd	Apr 23rd **39** Review Test 3	Apr 24th **Test 3**	Apr 25th **40** TBA
Apr 28th **41** **Last day of classes.**	Apr 29th *Reading Day*	Apr 30th	May 1st	May 2nd