Colorado State University

Department of Mathematics
College of Natural Sciences

MATH 369-05 Linear Algebra I

Spring 2017

Instructor: Dr. Manuela Girotti; office: Weber 223C
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Time: Mon-Wed-Fri 2pm-2:50pm

Location: Engineering E105

Office hours: Monday 3pm-4pm and Thursday 11am-noon
Weber 008 (basement)

Textbook: *Elementary Linear Algebra*, 11th edition, by H. Anton (Wiley)

Outline: linear systems, matrices, subspaces of Euclidean spaces, linear transformations on Euclidean spaces, eigenvalues, eigenvectors
(see more below)

Homework: you will be required to hand in 10 assignments along the semester. The assignments will be posted on the Canvas website. They reflect the content of the course. No late assignments will be accepted.
Please, submit your assignment with all the papers stapled together and with your name written on the first page. Use a pen (not a pencil!) and write clearly.
Discussions and work group are encouraged, however the final submission has to be personal and show understanding of the material. Grades will be posted on Canvas.

Quizzes: there will be 6 quizzes taken in class. The solution of the quizzes must be personal and independent. They will last 15 minutes each and they will take place on Fridays (see outline table below). Your lowest quiz grade will be dropped from the calculation of your final grade. All the grades will be posted on Canvas.

Midterm exam: there will be one midway test on Friday March 10th, covering the first eight weeks of the course. It will be held in class and it will last 50 minutes. There will be no make-up test.

Final exam: the final examination will cover material from the entire course. It will be a closed-book exam, no notes are allowed.

The final exam is scheduled for **Tuesday May 9th between 11:50am and 1:50pm**. It will be held in class (E105).

If you have time conflicts with other examinations, please notify me as soon as possible.

Grading scheme: your final grade will be built up from the grades coming from assignments, quizzes, midterm and final exams in the following percentage:

10% assignments,

5% quizzes,

25% midterm exam,

60% final exam.

Calculators: unless otherwise stated, basic 4-function calculators and scientific calculators (like Sharp EL 531 and Casio FX 300MS, for example) are permitted in class tests and final examination.

Academic integrity: as in any other course you will attend, you are required to study and act according to the University Policy on Academic Integrity and the Student Conduct Code.

Moreover, bear in mind that the consequences for such misconduct (cheating, etc.) will ultimately fall upon you: this course is a precious opportunity for you to learn something new and valuable. It's an investment on your future. Failing to acquire it will sadly be your loss.

IMPORTANT: note that there is no "100% final exam" option in this course. The term work contributes 40% to the final grade. Therefore, active participation in classes and continuous work on the course material during the semester is essential for success in this course.

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Tentative (and very ambitious) outline of the course

Week	**Section**	**Topic**	**Suggested exercises**
1	1.1, 1.2	- Introduction to Systems of Linear Equations - Gaussian Elimination	Exercise set 1.1: 2, 5, 8, 11, 12, 16, 19, 21 Exercise set 1.2: 5, 7, 9, 11, 19, 26, 32, 35, 43
2	1.3, 1.4, 1.5, 1.6	- Matrices and Matrix Operations - Inverses; Algebraic Properties of Matrices; Elementary Matrices and a Method for Finding A^{-1} - More on Linear systems and Invertible Matrices - Quiz #1	Exercise set 1.3: 1, 10, 15, 25, 26 Exercise set 1.4: 7, 8, 9, 20, 21, 23, 31, 33, 35, 43, 46, 47 Exercise set 1.5: 3, 7, 9, 11, 14, 19, 27, 30 Exercise set 1.6: 1, 2, 13, 19
3	1.7, 1.8, 1.9	- Diagonal, Triangular and Symmetric Matrices - Matrix Transformations - Applications of Linear Systems	Exercise set 1.7: 15, 17, 25, 27, 32, 37, 40, 42 Exercise set 1.8: 3, 5, 9, 11, 15, 17, 21, 27 Exercise set 1.9: 1, 2, 5, 6, 9, 10, 16, 17
4	2.1, 2.2, 2.3	- Determinants by Cofactor Expansion - Evaluating Determinants by Row Reduction - Properties of Determinants; Cramer's Rule	Exercise set 2.1: 3, 5, 6, 9, 10, 16, 17, 19, 22, 23, 34, 38 Exercise set 2.2: 9, 10, 115, 16, 23, 31 Exercise set 2.3: 19, 20, 24, 25, 31, 34

5	3.1, 3.2, 3.3	- Vectors in 2-space, 3-space and n-space - Norm, Dot Product and Distance in $\mathbb{R}^n$ - Orthogonality - Quiz #2	Exercise set 3.1: 5, 7, 9, 13, 15, 16, 23 Exercise set 3.2: 3, 7, 9, 11, 13, 19, 28 Exercise set 3.3: 3, 4, 7, 8, 11, 13, 15, 16, 21, 25, 27, 30, 31
6	3.4, 3.5, 4.1, 4.2	- The Geometry of Linear Systems; Cross Product - Real Vector Spaces - Subspaces	Exercise set 3.4: 2, 5, 9, 13, 17, 21, 25 Exercise set 3.5: 7, 9, 11, 15, 17, 19, 28, 29 Exercise set 4.1: 1, 4, 5, 7, 9, 10, Exercise set 4.2: 1, 4, 6, 7, 12, 14, 19, 22
7	4.3, 4.4, 4.5	- Linear Independence - Coordinates and Basis - Dimension - Quiz #3	Exercise set 4.3: 2, 5, 7, 9, 13, 15, 22 Exercise set 4.4: 2, 3, 10, 15, 17, 21, 25 Exercise set 4.5: 1, 7, 11, 12, 14, 18
8	4.6, 4.7	- Change of Basis - Row Space, Column Space, Null Space - MIDTERM TEST	Exercise set 4.6: 1, 5, 6, 7, 10, 13, 15 Exercise set 4.7: 3, 5, 7, 9, 16, 20, 21
***	***	*** spring break ***	***

9	4.8, 4.9, 4.10, 4.11	- Rank, Nullity and the Fundamental Matrix Spaces - Basic Matrix Transformations in $\mathbb{R}^2$ and $\mathbb{R}^3$; Properties of Matrix Transformations - Applications	Exercise set 4.8: 1, 3, 8, 9, 12, 18, 28 Exercise set 4.9: 1, 3, 5, 9, 11, 13, 17, 21, 25, 27 Exercise set 4.10: 1, 7, 11, 17, 23, 31 Exercise set 4.11: 1, 7, 9, 11, 18, 22
10	5.1, 5.2, 5.3, 5.4, 5.5	- Eigenvalues and Eigenvectors - Diagonalization - Complex Vector Spaces; Applications - Quiz #4	Exercise set 5.1: 5, 7, 8, 15, 19, 21, 23, Exercise set 5.2: 5, 6, 9, 15, 19, 24 Exercise set 5.3: 1, 3, 5, 7, 11, 13, 15, 19, 23,
11	6.1, 6.2, 6.3, 6.4, 6.5	- Inner Products; Angle and Orthogonality in Inner Product Spaces - Gram-Schmidt Process; QR-Decomposition - Best Approximation; Least Squares; Applications	Exercise set 6.1: 1, 3, 7, 9, 11, 13, 17, 21, 23, 27, 29, 33 Exercise set 6.2: 1, 3, 5, 13, 16, 18, 27, 29 Exercise set 6.3: 5, 7, 11, 15, 23, 27, 31, 35, 37 Exercise set 6.4: 1, 3, 7, 15, 23, 25
12	7.1, 7.2, 7.3, 7.4	- Orthogonal Matrices - Orthogonal Diagonalization - Quadratic Forms; Optimization using Quadratic Forms - Quiz #5	Exercise set 7.1: 5, 7, 11, 13, 18, 22 Exercise set 7.2: 7,9, 15, 17, 19, 23 Exercise set 7.3: 1, 3, 5, 9, 11, 13, 19, 20, 21, 27 Exercise set 7.4: 1, 3, 5, 11, 13

13	7.5, 8.1, 8.2, 8.3	- Hermitian, Unitary and Normal Matrices - General Linear Transformations - Composition and Inverse Transformations; Isomorphism	Exercise set 7.5: 1, 7, 9, 13, 27, 30 Exercise set 8.1: 3, 4, 5, 8, 12, 13, 15, 19, Exercise set 8.2: 1, 3, 7, 8, 11, 15, 17, 19, 23, Exercise set 8.3: 1, 2, 3, 7, 11, 15, 17
14	8.4, 8.5	- Matrices for General Linear Transformations - Similarity - Quiz #6	Exercise set 8.4:1, 4, 5, 7, 11, 13 Exercise set 8.5: 3, 7, 11, 15
15		Review & conclusions	

Disclaimer: the instructor reserves the right to make changes to the course outline and course content should this be necessary for academic or other reasons. Every effort will be made to minimize such changes.