Instructor information:

Instructor: Dr. Allison H. Moore
Office: Mathematical Sciences Building (MSB) 2151
Office hours: Tuesday 12:00 – 1:00 pm, Wednesday 3:00 – 4:00 pm (subject to change)
Email: amoore@math.ucdavis.edu

Course information:

MAT 22A 002 - Linear Algebra (Mathematics). Term: Fall Quarter, 2017. CRN: 48511
Lectures: MWF 4:10-5:00 pm in Haring Hall 2205

Learning Goals

The purpose of MAT 22A is to introduce students to the fundamental objects and concepts in Linear Algebra, including scalars, vectors, matrices, diagonal matrices, symmetric matrices, inverse matrices, singular & nonsingular matrices, permutation matrices, linear combination, linear dependence & independence, vector spaces, subspaces, the dimension of a vector space, bases of vector spaces, rank, nullity, the four fundamental subspaces associated with a matrix, projections, determinants, permutations and cofactors, and eigenvectors & eigenvalues, and the fundamental operations on these objects including the dot product, matrix multiplication, matrix transpose, Gaussian elimination, Gauss-Jordon elimination, LU decomposition, matrix factorizations, reduction of a matrix to row reduced echelon form (RREF), the solution of systems of linear equations in an arbitrary number of unknowns, the least squares procedure and the Gram-Schmidt procedure.

In MAT 22A a modern, innovative approach is taken in presenting this material. Each new idea is introduced by constructing concrete examples, in which, for example, the student learns to determine key parameters associated with a given matrix, (e.g., its rank and nullity), by applying procedures, (e.g., row reduction) to find the relevant canonical form of the matrix (RREF) from which these parameters can be easily found. Furthermore, this approach provides the student with a constructive proof of each of the key theorems presented in the course. This allows students to learn the theory underlying Linear Algebra by associating facts with procedures they have learned to perform on matrices and vectors, such as reduction to RREF. Thus, this approach gives students an introduction to logic and proof, which is one of the goals of this course.

Students who successfully complete MAT 22A will also have a working knowledge of the computational tool MATLAB and how to use it to compute the solutions to the problems encounter in 22A. Students may obtain this knowledge by having successfully completed Engineering 6 prior to taking 22A or by taking MAT 22AL concurrently with 22A.

Prerequisites:

- Any of the following: ENG 006, EME 005, MAT 022AL (may be taken concurrently)
- Any of the following: C- or better in MAT 016C, C- or better in MAT 017C, C- or better in MAT 021C, C- or better in MAT 021CH.

MAT 22A students are **required** to take 22AL, unless they have taken ENG 6 or have a good knowledge MATLAB and its use in Linear Algebra. If you are enrolled in ENG 6 this quarter, you still need to take MAT 22AL.

Textbook:

The official textbook is *Introduction to Linear Algebra, 5th Edition* by Gilbert Strang; Wellesley Cambridge Press; Search by ISBN on Amazon: 978-0980232714

If you already have a 4th edition textbook, this will work for study purposes. **However**, homework will be assigned from the 5th edition textbook. The problems are different across different versions.

Course website:

The course website can be found within Canvas. Announcements, homework assignments and other documents will be posted to Canvas. Visit: `https://canvas.ucdavis.edu/`

Teaching assistants:

The primary duty of the TAs is to grade homework and to assist in grading exams. They can also help you out with homework and answer questions during their office hours. Disputes over homework grades should be brought to the TAs directly. Disputes over exam grades go through the instructor (Dr. Moore).

Nikitha Muddireddy
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Yuanyuan Xu
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Joshua Parker
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Office: MSB 2131
Office Hours: Tues. 3-4, Fr 5-6 in Calc Room

Grades:

Your grade will be determined by the following:

Homework	16%	100 homework points over the quarter
Midterm 1	27%	Not cumulative
Midterm 2	27%	Not cumulative
Final	30%	Cumulative

You should expect that your letter grade at the end of the semester will be determined by a curve. A typical curve might improve your letter grade over the raw numerical score some, but not much. It is **not** unusual for the mean to correspond with a C or a C^+.

*The instructor reserves the right to offer challenge problems, bonus problems, or extra-credit assignments.

Homework:

Homework is assigned weekly from the textbook, and may also include an additional MATLAB component. Because the class is large and there are only two TAs, more problems will be assigned than will be graded, but you will be expected to complete the entire assignment because it is good practice for the exams. Homework assignments are to be turned into the homework return box, which is located on the ground floor of MSB, around the back of the math department administrative offices. MATLAB assignments may need to be submitted online to the Canvas site.

The homework problems that are graded will be worth approximately 5 points each. Over the fall quarter, there will be about 20 graded problems, with 100 homework points total. Your homework score (out of 100 points) comprises 16% of the overall course grade. (The instructor also reserves the right to offer bonus or extra credit homework problems.)

It is recommended that you begin the homework early. The homework problems will be posted to Canvas and additional problems may appear as the due date nears, so be sure to check often. **No late homework will be accepted.**

Exams:

Midterms will be written during class hours in the usual lecture location. The final exam location will be scheduled by the university at a later date.

Midterm 1	Monday, October 23 at 4:00 PM (in class)
Midterm 2	Monday, November 20 at 4:00 PM (in class)
Final Exam	Tuesday, December 12 at 6:00 PM (location TBD)

Calculators, computing devices, notes and books are prohibited on midterm and final exams. Any exceptional materials to be permitted during midterm exams will be specified and made explicit by the instructor.

Make-up exams will not be given. (If you miss an exam and have a valid, documented excuse, I will use your final exam score to calculate a replacement score for the missed midterm.) **An early final will not be given to accommodate travel plans.** Do not plan to travel during the final exam period.

Academic integrity:

Students are expected to abide by the UC Davis Code of Academic Conduct (`http://sja.ucdavis.edu/cac.html`) on all assignments and exams.

Students with disabilities:

Any student needing academic adjustments or accommodations should contact the Student Disability Center to coordinate the request for an accommodation. Please visit `https://sdc.ucdavis.edu`

for more information. Faculty must provide accommodations for a student with a disability if the student presents a letter enumerating identified accommodations from the SDC.

Lecture Schedule

This is an approximate lecture schedule and is subject to change.

Lecture(s)	Sections	Comments/Topics
1	1.1	Vectors and linear combinations.
2	1.2	Lengths and dot products.
3	1.3	Matrices.
4	2.1	Vectors and linear equations.
5	2.2	The idea of elimination.
6	2.3	Elimination using matrices.
7	2.4	Rules for matrix operations.
8	2.5	Inverse matrices.
9	2.6	Elimination = Factorization: A = LU
10	2.7	Transposes and permutations.
11	3.1	Spaces and vectors.
12	3.2	Nullspace of A: Solving Ax = 0
13		The Rank and the Row Reduced Form
14	3.3	The complete solution to Ax = b
15	3.4	Independence, basis, and dimension.
16	3.5	Dimensions of the Four Subspaces.
17	4.1	Orthogonality of the Four Subspaces.
18	4.2	Projections.
19	4.3	Least squares approximations.
20	4.4	Orthogonal bases and Gram-Schmidt.
21	5.1	The properties of determinants.
22	5.2	Permutations and cofactors.
23	6.1	Introduction to eigenvalues.
24	6.2	Diagonalizing a matrix.
25	6.4	Symmetric matrices.
Time Permitting	6.5	Positive definite matrices.

Disclaimer:

The instructor reserves the right to update the expectations outlined in this syllabus. Any modifications will be uploaded to the Canvas site.