MATH 265 | Linear Algebra I

Spring 2019

General Information

Class Time: M – R, 9:00am – 9:50am (265-002)
M – R, 1:00pm – 1:50pm (265-001)

Location: Samuelson 149 (MTR)
Samuelson 138 (W)

Instructor: Dr. Emilie Hancock

Please address me as either Emilie or Dr. Hancock.

Office: Samuelson 218C
Office Hours: MWF 10-11am, MTWR 12-1pm, or by appointment (F2F or virtual)

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Course Description[1]

Linear algebra, the study of multivariate linear systems and transformations, is essential preparation for advanced work in the sciences, statistics, and computing. Linear algebra will introduce you to discrete mathematics, algorithmic thinking, a modicum of abstraction, moderate sophistication in notation, and simple proofs. Linear algebra will help you develop facility with visualization, see connections among mathematical areas, and appreciate the power of abstract thinking.

Technology

Linear algebra is especially useful in helping you learn to use and compare analytical, visual, and numerical perspectives in exploring mathematics. Technology facilitates solving large systems of linear equations quickly and efficiently: "no serious application of linear algebra happens without a computer" (Cowan, 1997). Thus, we will link applications and theory by using technology effectively, both as a tool for solving problems and as an aid to exploring mathematical ideas.

Pedagogy

Every linear algebra course should develop the core topics in an instructional framework that promotes conceptual understanding of fundamental ideas. Linear algebra stresses visualization and geometric interpretations of theoretical ideas in 2- and 3-dimensional spaces. Doing so highlights "algebraic" and "geometric" thinking as contrasting but complementary points of view.

Class activities and course assignments will help you build effective thinking skills: critical thinking, pattern recognition, formulating conjectures, writing, student engagement, creation of examples to illustrate a concept, technology, reading proofs, introduction to construction of proofs, and counterexamples. Problem solving arises in both computational (matrix computations) and theoretical (writing proofs) forms. Course projects will be especially useful in helping you develop written and oral communication skills.

Modeling Applications

Every linear algebra course should incorporate interesting applications, both to highlight the broad usefulness of linear algebra and to help you see the role of the theory in the subject as it is applied. Such applications may also entice those of you majoring in other disciplines to choose a minor or additional major in mathematics ☺. Certain elementary applications and extensions frequently appear in texts and have the reputation of revealing fundamental ideas. Among these, in no particular order, are Markov chains, graph theory, correlation coefficients, cryptology, interpolation, long-term weather prediction, the Fibonacci sequence, difference equations, systems of linear differential equations, network analysis, linear least squares, graph theory, Leslie population models, the power method of approximating the dominant eigenvalue, linear programming, computer graphics, coding theory, spectral decomposition, principal component analysis, discrete and continuous dynamical systems, iterative solutions of linear systems, image processing, and traffic flow. We will hit a subset of these applications this quarter.

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[1] Taken/adapted from Zorn, P. (Ed.). (2015). *2015 CUPM Curriculum Guide to Majors in the Mathematical Sciences*. Mathematical Association of America.

Learning Objectives

Upon successful completion of this course, you will be able to…

- Formulate, solve, apply, and interpret properties of linear systems
- Recognize and use equivalent forms to identify matrices and solve linear systems
- Recognize and use equivalent statements regarding invertible matrices, pivot positions, and solutions of homogeneous systems
- Perform basic matrix operations
- Compute with and recognize properties of particular matrices
- Recognize and use basic properties of subspaces and vector spaces
- Determine a basis and the dimension of a finite-dimensional space
- Translate information between the context of systems of equations, coefficient matrices, and the domain and range of a linear transformation (e.g. conceptions of one-to-one and onto)
- Find the eigenvalues and eigenvectors of a matrix
- Use eigenvalues and eigenvectors to represent a linear transformation
- Solve problems requiring the use of eigenvalues and eigenvectors

Course Materials

Canvas Access for Schedule and Communication

Exam and assignment dates are posted on Canvas. I will update the Canvas course frequently with assignments, handouts, and due dates. The Canvas 'Announcements' tool will be my main form of communication with you.

> Check Canvas daily for schedule updates and course materials.
> Make sure your Canvas settings are adjusted to receive course announcements as they are posted.

Supplies

You need (1) a 3-ring binder for handouts, assignments, and notes, (2) a calculator capable of matrix operations (cell phone calculators are not allowed), and (3) laptop/tablet for access to GeoGebra and WeBWorK

Required Textbook

Alayont, F. & Schlicker, S. (2019). *Linear Algebra and Applications: An Inquiry-Based Approach.*
This free and open-source book is available for download on the course Canvas page.

Additional Resources

The following textbooks are available on hold at the library:

Lay, D., Lay, S., & McDonald, J. (2016). Linear Algebra and its Applications (5th ed.). ISBN: 978-0321982384
Leon, S. (2002). Linear Algebra with Applications (6th ed.). ISBN: 978- 0130337818

Grading Scale

Final grades will be determined based on your weighted percent grade, rounded to the nearest whole percent.

Letter Grade	F	D	D+	C-	C	C+	B-	B	B+	A-	A
Percent Score	0-59	60-66	67-69	70-72	73-76	77-79	80-82	83-86	87-89	90-92	93-100

Method of Evaluation

Overall grades will be determined as a weighted average:

8%	Attendance and Professionalism
20%	Course Assignments
18%	Modeling Lab Reports
12%	Mastery Quizzes
42%	Exams (Two Midterms and a Cumulative Final Exam)

Descriptions of Evaluation Components

Attendance and Professionalism (8%)
Each class period is worth 2 participation points. Your final grade in this evaluation category is calculated using:

$$\frac{Number\ of\ points\ you\ accumulated\ throughout\ the\ quarter}{2 \times (Number\ of\ class\ sessions)}$$

Professionalism
As a member of a peer learning community, a high degree of professionalism is necessary. CWU expects every member of the university community to contribute to an inclusive and respectful classroom culture.

I measure professionalism based on the following criteria:

- Arrive to class on time and stay for the entire class.
- Be present. Focus on learning by being an active participant. Limit side activities and put away cell phones. (If you are anticipating an emergency phone call, just let me know in advance.)
- Come to class prepared. You may need to finish up activities in between classes.
- Bring a positive and energetic attitude every day.
- Respect everyone, treat each other with dignity, and encourage all to participate.
- Participate in group work by asking questions, communicating your understanding to your groupmates, and completing the handouts.
- Present your ideas to the class and ask questions when other students present.
- Use a 3-ring binder to organize and promptly access class handouts, assignments, and notes.

A lack of professional participation will result in a loss of participation points for the day. Severe or repeated lapses in professional judgment may result in disciplinary action up to and including failing the course.

Attendance
Regular attendance is essential for successful completion of this course.

- Each absence will lower your overall score in the 'Attendance and Professionalism' evaluation component by 10%.
- More than 4 absences from this class may result in an automatic course grade of F for the quarter.

Is my absence excused?
Excused absences will not lower your overall grade in this class and are determined on a case-by-case basis. Excused absences are those that are both valid and verifiable, i.e. illness, bereavement, and school-related activities. Documentation is required. Excused absences do not include holiday travel, work, or non-emergency travel delays.

What if I miss class?

- Communicate with me as soon as possible
- Get information about what happened in class, either from me or a peer
- Assignment deadlines will not be adjusted if your absence is unexcused
- If appropriate, send me supporting documentation for an excused absence

Course Assignments (20%)
Late assignments will receive a score of zero. Assignments are the responsibility of each individual, but you are encouraged to work with others.

Pre-Class Assignments
Preview activities are designed for you to complete and submit before class. This work serves to motivate the upcoming topic and prepare you with necessary background information for in-class activities and discussions.

In-Class Activities
I may periodically collect and grade in-class activities, but I will communicate this with you.

Post-Class Homework
The purpose of post-class assignments is for you to practice mathematical communication and reasoning related to important course concepts. Show all of your work (process, not just final product/answer).

Modeling Lab Reports (18%)
Late reports will receive a score of zero. These projects will be started in class and a lab report will be submitted the following week.

Mastery Quizzes (12%)
The purpose of quizzes is for you to master fluency with procedures, facts, vocabulary, and representations. The first quiz attempt will take place in class. Quizzes will cover material since the last quiz or test. No notes allowed and no make-ups of the first quiz attempt unless you have an excused absence. Mastery quizzes are graded Pass/Fail, where 'Pass' means $\geq$ 80% correct.

Quiz Retakes
You may only retake a quiz if you took the first quiz with everyone else in class. You may retake a quiz up to two additional times (3 attempts total), and within 1 week of the first in-class attempt. Quiz retakes during office hours do not need to be scheduled in advance. Bring a laptop or tablet with access to WeBWorK.

Exams (14% each): Midterm 1, Midterm 2, and Cumulative Final
Exams will test your conceptual understanding of key course material, as well as your skills related to problem solving and proof. No notes allowed for in-class exams and no make-ups unless you have an excused absence. Any missed exam which is not excused will be a zero and will certainly affect your grade in the course.

There will be no early final exam or make-ups, so make travel plans accordingly. Your final exam time is:
9AM Section (265-002) Final: Thursday, June 6th, 8am-10am
1PM Section (265-001) Final: Thursday, June 6th, noon-2pm

Academic Honesty and Misconduct
Consult university policies (CWUP 5-90-040(22), CWUR 2-90-040(22), and Student Conduct Code) for student conduct in the classroom, cheating, plagiarism, and other academic expectations. CWU's policies and recommendations for academic misconduct will be followed, leading to disciplinary action up to and including failing the course.

Disability Support Services
Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. Students with disabilities should contact Disability Services to discuss a range of options to removing barriers, including accommodations: Hogue Hall 126, 509.963.2214, DS@cwu.edu

Changes
I reserve the right to amend, adjust, or otherwise modify the syllabus at any time during the course.