MATH2210Q – Applied Linear Algebra

Section 5 (7119) meets Tuesday/Thursday from 11:00 am – 12:15 pm in Monteith 319

Section 6 (7120) meets Tuesday/Thursday from 12:30 pm – 1:45 pm in Monteith 112

Instructor: Ben Lantz

Email: Benjamin.Lantz@uconn.edu

Office: Monteith 405

Office Hours

Monday

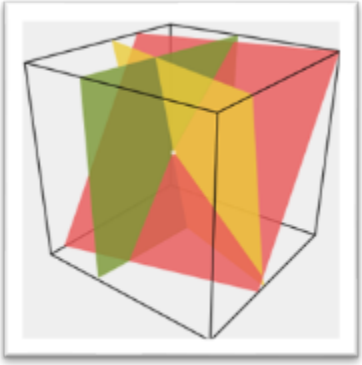
10:00 am - 11:00 am

Tuesdays/Thursdays

9:00 am - 10:15 am

2:00 pm - 3:00 pm

Or by Appointment (contact me via email)



Course Description

Linear Algebra is one of the most useful mathematics courses to take as an undergraduate. The applications of linear algebra stretch into many diverse fields and is used fundamentally today in many disciplines including engineering, computer science, physics, economics, and more.

Linear algebra is often an undergraduate student's first exposure to a math course that explores abstract ideas in depth. This course will act as a bridge to more abstract courses in mathematics and transition away from more computationally focused courses such as the Calculus sequence of courses.

One reason that I enjoy Linear Algebra so much is that we get to tell the same story throughout the whole semester in different ways. We will build connections and see that seemingly completely different topics are remarkably similar. We will constantly

reference the first few weeks of introductory material throughout the whole semester and will build a solid foundation of linear algebra.

In this course we will cover the following broad topics: systems of equations, matrices, determinants, linear transformations on vector spaces, characteristic values and vectors from a computational point of view. The course is an introduction to the techniques of linear algebra with elementary applications.

Syllabus TL;DR

- This course will focus on both computational problems and abstract material. You should expect to grapple with both in this course.
- We have class two days a week in which we have traditional lecture mixed with class work and group work to explore abstract concepts.
- The weights for each part of the course grade are partially determined by you. I determine 75% of the grade, and you can determine the distribution of the other 25%. The last day to make this determination is Thursday March 12th (in time for midterm grades).
- Each week you have a weekly worksheet (at least 30% of your grade) due on Gradescope on Thursdays at 11:59 pm. Part of this worksheet will be graded on completion, part of this worksheet will be graded on correctness, and part will be graded on professionalism, neatness, and organization.
- Late work is accepted for Weekly Worksheets at a 10% penalty. Below are the last days to turn in late homework:
    - Unit 1: Thursday March 12th at 11:59 pm (Thursday after Evaluation)
    - Unit 2: Thursday May 7th at 11:59 pm (Last day of course)
- Each unit will be evaluated in two different ways all due on the same day (Tuesday March 10th and Thursday April 30th):
    - (at least 15% of total grade) A computational report over a take home problem covering an application of linear algebra
    - (at least 15% of total grade) A written presentation done in class
- Use the textbook, other classmates, office hours, tutoring in the Q-center, posted lecture videos, solutions to homework, extra practice problems, and myself to help guide you through the course.
- There is no Final Exam in this course, but you will turn in Digested notes covering the semester that are useful, tangible, and personalized (worth at least 10% of your grade).
- If you ever have a question or if anything arises throughout the semester, please email me at Benjamin.Lantz@uconn.edu. I am good at returning emails and can help with whatever you need.

Topics Covered

Unit 1: Systems of linear equations, linearly independent sets, row reduction and echelon forms, solution sets of linear systems, linear independence, rank, linear transformations, the matrix of a linear transformation, matrix operations, determinants, and inverses and invertible matrices.

Unit 2: Dimension of a vector space, change of basis, bases and coordinate systems, eigenvectors and eigenvalues (of linear transformations), characteristic polynomial, diagonalization, vector spaces, subspaces, null spaces, column spaces, inner product, length, orthogonality, and the Gram Schmidt process.

Expectations

We will be going over highly abstract ideas in this course that are sometimes difficult to grasp. You are expected to struggle and not immediately catch on to these abstract ideas. We will dedicate the entire semester to learning these ideas (so do not fret if it does not come immediately).

It is expected that you will work with others during class and outside of class. Please use each other as a resource when learning abstract materials. Also know that my job is to help you learn, and you should reach out to me early and often with any questions over material, the course, and with any concerns that may arise. Please know that office hours are for YOU, and you should use this resource as much as you would like. You do not need to make an appointment during normal office hours, please feel free to drop in unannounced (even if just to say hi or to ask a quick question).

You are expected to attend class each day. We will always be going over new material which will be built upon for the whole semester. You should expect to dedicate a large portion of time (4-8 hours per week) outside of class to homework and understanding material.

Prerequisites

MATH 1132Q, 1152Q or 2142Q. Recommended preparation: A grade of C- or better in MATH 1132Q. Not open for credit to students who have passed MATH 2144Q or 3210.

Textbook

“Linear Algebra and Its Applications” David Lay, Steven Lay, Judi McDonald 6th edition

We will be following the textbook throughout the semester. We will not be using MyMathLab throughout the semester however. There are other options for the e-text that are cheaper than what is offered through the Husky Book Bundle, mainly through the pearson website:

https://www.pearson.com/en-us/subject-catalog/p/linear-algebra-and-its-applications/P200000006235/9780136880929

This link should offer the e-text at $10.99/month which would amount to $44 instead of $95 at the bookstore.

Furthermore, you are welcome to find an old edition of this book and use this instead. I understand the buying/renting books can be a struggle, so please reach out if you have any questions about this process.

Academic Integrity

Cheating is prohibited in all aspects of the course. Cheating includes, but is not limited to, communication with other students during the written presentation, asking other students to complete your coursework, and copying or soliciting solutions from the internet (including the use of AI). UCONN and I both take academic dishonesty very seriously; any academic dishonesty will result in severe consequences.

Please see the university policy at the end of the syllabus for more information on Academic Integrity.

Lecture Notes

I created lecture videos for Linear Algebra during the pandemic for most of the sections that we will cover in the course. These videos and lecture notes are posted on HuskyCT in the corresponding sections. Although there will be overlaps, you should expect the lecture to be different than that of the lecture videos. It is important to attend class and participate in the discussions and class work provided. I will work to have supplemental materials for the sections in which I do not already have lecture videos.

Class work and Inquiry Oriented Learning

Each day in class, a portion of class will be dedicated to class work and thinking about open-ended questions. Attendance is important to engage with the material in this way and you will be assessed on this kind of thinking throughout the semester.

Tutoring

Tutoring is available for this class in the Q-center (Quantitative Learning Center) https://qcenter.uconn.edu/. For this course, tutors may not always be present, so please check the availability of tutors who know this topic with the Q-center.

Extra Practice Problems

If you need more practice problems than the ones given in class and on the worksheets there are two other resources for practice problems. For some of the sections in class I have solutions written out for a handful of practice problems. These are available on HuskyCT. Also, there is a selection of problems from each section of the textbook covered listed on the Weekly Worksheet. None of these problems are mandatory and are here purely for your convenience.

Class Cancellation Policy

If for some reason in-person class must be cancelled (snow day, I am sick, etc.), I will send an email as soon as I am able and if given enough time, we will try to hold class via Webex.

Communication

Please communicate with me often. I am available for questions about material at any time and I am very good at responding to emails quickly. Furthermore, please use the drop-in office hours at any time. You do NOT need to make an appointment for these times.

If you need to miss class, miss an assignment, or miss an extended period of time please communicate with me. I do not need to know any personal details of what is going on in your life, but I can work with you to come up with a plan on how to overcome any obstacles that may be present.

Communication is KEY! Please reach out early and often with any questions or concerns.

Late Policy

All homework (Weekly Worksheets) will be accepted for late credit at a 10% penalty up until a time after the unit of material. Completion of the homework is particularly important, and I want to incentivize doing the homework as much as possible. That said, falling behind with homework can be difficult to return from. Please do not rely on the late policy, but rather use it as a safety net in case anything were to happen throughout the semester. Below are the last days to turn in late homework:

Unit 1: Thursday March 12th at 11:59 pm (Thursday after Unit 1 Evaluation)

Unit 2: Thursday May 7th at 11:59 pm (Thursday of Finals Week)

Assessment and Grading

The course grade will be based on homework via Weekly Worksheets, Digested Notes, Written Presentations, Computational Reports, and a paper on an application of linear algebra. Grades will be consistently maintained in the HuskyCT gradebook (you should always have a general idea of what your grade is in the course). The weights of each of these categories is partially up to you. I will determine 75% of the grading distribution, and you will be able to set the other 25% (in 5% increments) after the first unit (Thursday March 12th). This 25% can be doled out in any way you would like, with the idea that you will weigh the grades based on what you find important. Below are two examples of what this could look like.

Assessment	Least Weight	Ex 1	Ex 1 Weights	Ex 2	Ex 2 Weights
Worksheets	30%	10%	40%	25%	55%
Written Presentations	15%	5%	20%	0%	15%
Computational Reports	15%	5%	20%	0%	15%
Digested Notes	15%	5%	20%	0%	15%

Weekly Worksheets (at least 30% of total grade)

Each week there will be a weekly worksheet due on Thursday at 11:59 pm on Gradescope going over the material from the previous week. A pdf should be uploaded to Gradescope before the deadline. These worksheets should be a central focus of time spent outside of class. Part 0 of these worksheets will include a silly question each week, a list of extra practice problems from the textbook, and other miscellaneous exercises. Part 1 of these worksheets will include questions that will be graded mostly on a completion basis and will focus more on computation. Part 2 of these worksheets will be graded on correctness and will focus more on concepts and more challenging problems. Additionally, 10% of the worksheets will be graded on professionalism, cleanliness, and organization of the work. I will try to offer as much feedback as I can

via Gradescope in a timely manner. Late worksheets will always be accepted at a 10% penalty until a few days after the Unit ends (See above for Late Homework policy). Furthermore, solutions will be made available on HuskyCT for the worksheets after you have turned in the worksheet and after the deadline.

Unit Evaluation (at least 30% of total grade)

At the conclusion of each unit in this course, you will be evaluated on the material in two different ways. A take home problem focused on computations that you will write a report for and a written presentation in class. For both of these a rubric will be given in advance for more details on what is expected. Details on the two are given below:

Computational Reports (at least 15% of total grade)

At the conclusion of each unit in this course, you will be given a take home problem. This problem will be computationally heavy and you are encouraged to use outside resources. The goal is to neatly write up a report solving the problem. The solution should be complete and it should be clear so that anyone reading it would understand how to complete the problem. This report will be graded on your ability to explain and do the computations, your ability to relay that information effectively and professionally, and accuracy. You will be given one week to complete the report, and it will be due on the same day as the written presentation (March 10th and April 30th). A rubric will be set before the first report is handed out so you will have a better idea of what is expected of you.

Written Presentations (at least 15% of total grade)

On Tuesday March 10th and Thursday April 30th, you will complete a written presentation in class more focused on abstract concepts. I will give you a prompt one week before the presentation to prepare for what you will write down in class. The goal is to prepare for this as you would an oral presentation, but instead of speaking orally, you will write your presentation (so everyone can do it at the same time). This presentation will be graded on your understanding of the material, your ability to connect ideas, and your ability to relay the information effectively. You will be allowed any paper resources on the written presentation. A rubric will be set before the first prompt is given so you will have a better idea of what is expected of you.

Digested Notes (at least 15% of total grade)

At the conclusion of the course, you will be asked to digest your notes in a compact way. This is not to rewrite the notes, but to have a tangible resource that you can use in the future. These notes should be less focused on specific information (which can be found very easily online), but rather personalized annotations and organization that helps YOU understand the material. You will be graded on the usefulness of the notes,

your creativity in the digestion of the topics, the professionalism in the notes, and your personalization of the assignment. A rubric will be set ahead of time so that you will have a better idea of what is expected of you.

Grading Scale

Letter grades will be assigned using the following scale:

A	:	93.00% and above
A-	:	90.00% - 92.99%
B+	:	87.00% - 89.99%
B	:	83.00% - 86.99%
B-	:	80.00% - 82.99%
C+	:	77.00% - 79.99%
C	:	73.00% - 76.99%
C-	:	70.00% - 72.99%
D+	:	67:00% - 69.99%
D	:	63.00% - 66.99%
D-	:	60.00% - 62.99%
F	:	59.99% and below

Letter grade cutoffs may be lowered if deemed necessary (although this is not likely and should not be expected).

Policy on Academic, Scholarly, and Professional Integrity and Misconduct (ASPIM)

https://policy.uconn.edu/2023/07/11/academic-scholarly-and-professional-integrity-and-misconduct-aspim-policy-on/