Math 253 – Linear Algebra
Fall 2021
Syllabus

Professor: Josh Laison
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Student Hours:
Monday and Wednesday 1:50-2:50
Tuesday and Thursday 9:30-11:00
You are very welcome to talk with me at other times. If I'm in my office you can drop by without an appointment, or you can schedule an appointment via email. If you're off campus, you're welcome to meet with me via Zoom.
My schedule is on my webpage http://www.willamette.edu/~jlaison

Class Meetings: Collins 210, 11:30-12:30 Monday, Wednesday, Friday

Textbook: Contemporary Linear Algebra, Howard Anton and Robert Busby

Course Web Page containing the current schedule of topics and assignments by day:
http://www.willamette.edu/~jlaison/linear.html

Course WISE Site containing Python and final project resources:
https://wise.willamette.edu/portal/site/MATH-253-01-21_FA

Graded components of the course:

Theoretical homework	25%
Applied and Python homework	15%
WebWorK	15%
Exams (2)	25%
Group final project	15%
Class participation	5%
Total	100%

Student Learning Outcomes: In this course I hope you will gain knowledge of a variety of topics in linear algebra; gain experience thinking about linear algebraic ideas from theoretical, algorithmic, and applied viewpoints; improve your problem-solving, logical, and analytic skills; gain facility using technology to solve linear algebraic problems; and gain experience communicating about linear algebra in conversation and formal presentation.

Homework assignments:
You will have three types of homework assignments, each assigned once every week or two:

WebWorK: Shorter exercises focusing on computational skills. Graded by the WeBWorK system.

Theoretical homework: Problems from the textbook, focusing on the theory and abstract concepts.

Applied homework: A combination of problems from the textbook and other sources, including some more exploratory project-style problems and some coding in Python.

Please use the math hearth and my student hours often to work together and ask questions. Asking for help is a standard part of class, not a last resort.

Software: We'll use Python in this course. Several homework assignments will include a problem asking you to use Python to experiment and , and we'll spend time practicing with Python in class. I'll be using the Google Colaboratory Python environment, but feel free to use whatever you're most comfortable with.

Time Commitment: Willamette's Credit Hour Policy expects 2-3 hours of work outside of class for every hour of in-class time. Since this class meets three days a week you should anticipate spending 6-9 hours outside of class engaged in course-related activities.

Antiracisism Statement (Adapted from the Office of Equity, Diversity and Inclusion) I declare and affirm our commitment to anti-racist action in the coming academic year and beyond. I stand in solidarity with those who have been calling for justice and working for so long to end institutionalized racism and white supremacy across the country and at Willamette.

Systemic racism at Willamette University is not an issue that can be addressed superficially. It will take a deep commitment from all parts of our community to make the changes that are necessary, and that is what I offer here: a commitment to gather, build, and act on a clear anti-racist agenda together.

Land Acknowledgement: (Adapted from the Dean's Office) Willamette is built on the land of the Kalapuya, who today are represented by the Confederated Tribes of the Grand Ronde and the Confederated Tribes of the Siletz Indians. We offer gratitude for the land, for those who have stewarded it, and for the opportunity to work on it. We acknowledge that our University's history is fundamentally tied to the first colonial developments in the Willamette Valley.

Diversity and Accessible Education Statement: (Adapted from the Accessible Education Services Office) Willamette University and I value diversity and inclusion. We are committed to a climate of mutual respect and full participation. My goal is to create a learning environment that is usable, equitable, inclusive and welcoming for people of any gender identity or expression, race, color, national or ethnic origin, religion or religious belief, age, marital status, sexual orientation, or ability.

If there are aspects of the instruction or design of this course that result in barriers to your inclusion or accurate assessment or achievement, please notify me as soon as possible. Students with disabilities are also encouraged to contact the Accessible Education Services office in Matthews 103 at 503-370-6737 or `disb-info@willamette.edu` to discuss a range of options to removing barriers in the course, including accommodations.

Religious Accommodations: (Adapted from the Office of the Chaplain) Willamette University and I recognize the value of religious practice and strive to accommodate students' commitment to their religious traditions whenever possible. If you anticipate missing class for religious reasons, please contact me to discuss your needs.

Academic Integrity: (Adapted from the Dean's Office) As members of the Willamette University community, students are expected to display honesty, trust, fairness, respect, and responsibility

in their academic work. Plagiarism and cheating involve intellectual dishonesty, deception, and fraud, which inhibit the honest exchange of ideas.

This course will follow Willamette University Standards of Conduct and the Willamette Ethic, described in more detail here:

http://www.willamette.edu/cla/catalog/resources/policies/plagiarism_cheating.php

Plagiarism can take different forms, but its essence is presenting the words or work of another person as your own. When you are quoting from, paraphrasing, or using images created by another person in any of your work, you should acknowledge that source in a citation.

On the homework assignments: You may, and are encouraged to, discuss the homework with fellow students, and get help from your professor, textbook, notes, or calculator. However, your submitted written work should be your own. Copy/pasting sections of another assignment, reading and paraphrasing another source, including online sources, or providing your assignment to be copied by others, is a violation of university policy.

On the exams: You may consult your text and notes. You may not discuss the exams with anyone other than me. Copying others' work, or providing your work to be copied by others, is a violation of university policy.

Topics Covered:

Fundamental ideas	
Review of vectors, lines, and planes in 2D and 3D	Sections 1.1, 1.2, 1.3
Systems of linear equations	Sections 2.1, 2.2
Application: Splines and typography	
Matrices and matrix algebra	Sections 3.1, 3.2, 3.3
Application: Discrete dynamical systems and Markov chains	Section 5.1
Subspaces	Sections 3.4, 3.5
Application: Error correcting codes	
Linear transformations	Sections 6.1, 6.2, 6.3, 6.4
Application: Computer graphics	Section 6.5
Bases and dimension	Sections 7.1, 7.2, 7.3, 7.4
Application: Best approximation and least squares	Section 7.8
Eigenvalues and eigenvectors	Sections 4.4, 8.2
Application: Singular value decomposition and image processing	Section 8.6

Additional important topics, as time warrants	
Determinants	Sections 4.1, 4.2
General vector spaces	Sections 9.1, 9.3
Projection	Sections 7.7, 7.8
Coordinates and change of basis	Sections 7.11, 8.1

Final project topics	
Gauss-Seidel and Jacobi iteration (Applied math)	Section 5.3
The Power method and internet search (Computer science)	Section 5.4
Quadratic forms (Analysis)	Section 8.4
Systems of differential equations (Applied math and physics)	Section 8.10
Inner product spaces and Fourier series (Applied math and physics)	Section 9.2
Graph eigenvalues (Graph theory)	
Beineke and Wilson, Topics in Algebraic Graph Theory, Chapter 1	
Discrete Fourier transforms (Applied math and differential equations)	
Strang, Linear Algebra and its Applications, Section 3.5	
Hoffman, Leonard, Lindner, Phelps, Rodger, Wall, Coding Theory	
Finite affine planes and SET (Geometry)	
The Joy of SET, Gordon, Gordon, McMahon, and Gordon, Chapter 8	
Bézier curves and splines (Applied math, engineering, typography)	
Lyche and Mørken, Spline Methods	
Collaborative filtering and Netflix (Applied math, marketing)	
Bokde, Girase, Mukhopadhyay, Matrix Factorization Model in Collaborative Filtering Algorithms: A Survey	