Course Guidelines
University of Puget Sound
Dr. Beezer

Advanced Linear Algebra
Math 390
Spring 2021

Texts

Topics presented in class will come from several sources.

1. *A First Course in Linear Algebra*, by Robert A. Beezer. Free online at http://linear.pugetsound.edu. We will be consulting a draft revision—web location will be given in class.

2. *Numerical Linear Algebra*, by Lloyd N. Trefethen, David Bau, III. Concise, readable treatment of computational linear algebra. One of my favorites.

3. *Matrix Computations*, by Gene H. Golub, Charles F. Van Loan, 4th Edition. Comprehensive reference, well worth owning.

4. *A Second Course in Linear Algebra*, by Robert A. Beezer. My own (incomplete) project to present this material at an undergraduate level with an open license. Links to provisional copies are on course page.

Course Web Page

Off of buzzard.ups.edu/courses.html you can find the link to the course web page. This page will evolve as the course progresses.

Office Hours

Office Hours will be online, via Zoom, by appointment. Monday, Thursday and Friday mornings I am in class, and the remainder of weekdays I should be available. Making appointments or simple, **non-mathematical** questions can be handled via email—my address is beezer@ups.edu. I rarely do not receive your email, and I read all of my email all of the time, usually very shortly after receiving it. Urgency of replying varies by the hour, day and nature of the message. Please do not use email for any question that requires a **mathematical** reply. Email is not a good medium for discussing mathematics.

Computation

Linear algebra is at the heart of many large computations in physics, chemistry, economics, statistics and other disciplines. This course will give you the theoretical tools to understand the subtleties of numerical linear algebra.

We will make use of Sage. Since Sage is open source software, it is available freely in many places. We will be relying this semester on hosted versions at CoCalc, cocalc.com. You already have a course project associated to your UPS email address and you can choose to pay $14 for the entire semester to move your course project to a members-only server.

Homework

I will suggest problems as we work through the material. Any (or all) of the problems will be good practice. Of course, you are not limited to working **just** these problems. It is your responsibility to be certain that you are learning from these exercises. The best ways to do this are to work the problems diligently. Making a consistent effort outside of the classroom is the easiest way (only way?) to do well in this course.

> Mathematics not only demands straight thinking, it grants the student the satisfaction of knowing when he [or she] is thinking straight.
>
> —D. Jackson

> Mathematics is not a spectator sport.
>
> —Anonymous

> I hear, I forget. I see, I remember. I do, I understand.
>
> —Chinese Proverb

> An education is not received. It is achieved.
>
> —Anonymous

Exams

There will be three 50-minute exams. Dates are all listed on the **tentative** schedule. The third one will be given during the final examination time period. A one-hour final examination will occur on Wednesday, May 12 at 8 AM. The final exam cannot be given at any other time so plan any travel arrangements accordingly.

Come to examinations prepared to remain in the room for the entire length of the exam. Power off any electronic devices (this includes phones).

Project

A very large portion of this course will be a project on a topic of your choice. I view this as a substantial undertaking, and the deadlines and grading procedures will reflect this. Note that this comprises 2/5 of your course grade and a failure to make an early and serious start could lead to a very low score.

Here are the components:

1. Topic: Please clear your topic with me prior to researching your proposal. This is mostly to be certain you do not duplicate material I will present in class. This can be done via Zoom or on a Tuesday evening when I am on campus.

2. Proposal: One-page, printed summary of topics you will cover. Must include a researched and credible list of sources you will be consulting. Deliver to me via email. Sign-ups for presentations will be in the order proposals are accepted.

3. Rough Draft: Must be substantially complete for credit.

4. Paper:

   (a) Ten pages, single-spaced, if using sensible fonts and margins (12 point, 1 inch).

   (b) Must include a copyright/license on the first page.

   (c) Must be composed in LaTeX or PreTeXt.

5. Presentation: 20 minutes with 5 minutes for questions. Must be composed in Beamer or PreTeXt. These are scheduled to be virtual, but that could change.

Please note:

1. All credit deadlines are at the beginning of class on the indicated date.

2. Topics, proposals and rough drafts will either be accepted for full credit or returned for a retry. Retries for credit may be submitted up until the credit deadline, so plan ahead.

3. You cannot submit work for the next stage of your project until the previous stage has been reviewed and approved. Missing a credit deadline and then failing to give me enough time for a review is not an excuse for being unable to meet the next deadline.

4. Please note the procedures and formats in the table below. Not following these instructions will not extend any credit deadlines.

Component	Percent of Course Grade	Credit Deadline	Notes
Topic	0%		Prior to researching proposal.
Proposal	4%	March 26, 11:59 PM	One-page, PDF, via email.
Rough Draft	6%	April 18, 11:59 PM	PDF, via email.
Paper	20%	April 25, 11:59 PM	PDF, via email.
Presentation	10%	Class prior to presentation	PDF or HTML, via email.

Grades

Grades will be based on the following breakdown:

- Exams: 45%
- Final Exam: 15%
- Project: 40%

Attendance and improvement will be considered for borderline grades. Scores will be posted anonymously on the web at a link off the course page.

Academic Policy Reminders

Here are three reminders about important academic policies which are described thoroughly in the "Academic Policies" section of the *University Bulletin*. The online version is off of

`www.pugetsound.edu/academics/academic-resources/university-bulletins/`

or a printed copy may be requested from the Registrar's Office (basement of Jones Hall).

- *Registration for Courses of Instruction, Non-Attendance.*

  "Regular class attendance is expected of all students. Absence from class for any reason does not excuse the student from completing all course assignments and requirements."

- *Grade Information and Policy, Withdrawal Grades.*

  Withdrawal grades are often misunderstood. A Withdrawal grade (W) can only be given prior to the university deadline listed on our course schedule, and after that time (barring unusual circumstances), the appropriate grade is a Withdrawal Failing (WF), **even if your work has been of passing quality**. See the attached schedule for the last day to drop with an automatic 'W'.

- *Academic Integrity.*

  All of your graded work is expected to be ***entirely*** your own work. Anything to the contrary is a violation of the university's comprehensive policy on Academic Integrity (cheating and plagiarism). Discovered incidents will be handled strictly, in accordance with this policy. Penalties can include failing the course and range up to being expelled from the university.

Conduct

Virtual: Please find a quiet place with a good connection to attend online sessions, so that we might better have questions and discussions. I appreciate it if you can leave your camera on—please contact me privately if this is a problem. Please do not use chat to ask questions, or to talk to one another. You can use chat to be recognized with a question, or simply hold up your physical hand close to your camera.

In-Person: Daily attendance is required, expected, and overall a pretty good idea. Class will begin on-time, so be here, settled-in, and ready to go. In other words, walking in the door at the exact time class is to begin is not considered being on-time. Repeated tardieness and absences will result in grade penalties, in accordance with university policies. Do not leave class during the lecture unless remaining would be a greater distraction—fill your water bottles, use the toilet, and so on, **IN ADVANCE**. Come to class prepared to be attentive for 50 minutes. Mask-wearing is required at all times. Do not bring food or drink since you would need to remove your mask to consume it. Please do not offer me sweets. Please keep phones in your pocket or bag, unless you are using them to read course material. In short, we are here to learn and discuss mathematics. It is your responsibility to not distract your peers who are serious about their education, or distract me as I endeavor to make the best use of the class time for everybody.

University Notices

These are multiple notices the university administration requests we duplicate for you.

- *Classroom Emergency Response Guidance.*

  Please review university emergency preparedness, response procedures and a training video posted at www.pugetsound.edu/emergency/. There is a link on the university home page. Familiarize yourself with hall exit doors and the designated gathering area for your class and laboratory buildings.

  If building evacuation becomes necessary (e.g. earthquake), meet your instructor at the designated gathering area so she/he can account for your presence. Then wait for further instructions. Do not return to the building or classroom until advised by a university emergency response representative.

  If confronted by an act of violence, be prepared to make quick decisions to protect your safety. Flee the area by running away from the source of danger if you can safely do so. If this is not possible, shelter in place by securing classroom or lab doors and windows, closing blinds, and turning off room lights. Lie on the floor out of sight and away from windows and doors. Place cell phones or pagers on vibrate so that you can receive messages quietly. Wait for further instructions.

- *Student Religious Accommodation.*

  The university provides reasonable religious accommodations for academic courses and programs, and the university policy is found at this location[1]. If you need a reasonable accommodation due to a religious holiday or organized religious activity, you must give me written notice within the first two weeks of class so that we can coordinate the accommodation. If you have questions about the policy, you may contact the University Chaplain. If you have a grievance about the application of the policy or the handling of your request for an accommodation, you may contact the Dean of the Faculty.

Learning Outcomes

The University Curriculum Committee and accrediting agencies expect to see a list of learning outcomes.

- Solidify understanding of introductory topics from a more general viewpoint.
- Understand least-squares and projections.
- Understand generalizing diagonalization to Jordan Canonical Form and rational canonical form.
- Understand the "Big 5" of matrix decompositions: LU, QR, SVD, Cholesky, Schur.
- Understand the determinant via the Laplace expansion (cofactors), the Leibenz formula (permutations), or with an axiomatic definition.

[1] www.pugetsound.edu/about/offices-services/human-resources/policies/campus-policies/student-religious-accommodations-in-academic-courses-or-programs

- Appreciate the distinction between numerical and exact linear algebra.

Please review these at the **end** of the semester when they will be easier to understand.

Tentative Daily Schedule

Monday	Tuesday	Thursday	Friday
Jan 18 MLK Day	Jan 19	Jan 21	Jan 22
Jan 25	Jan 26 Problem Session Elect CR/NC	Jan 28	Jan 29
Feb 1 Last Day to Drop w/o Record	Feb 2 Problem Session	Feb 4	Feb 5
Feb 8	Feb 9 Problem Session	Feb 11	Feb 12
Feb 15	Feb 16 Exam 1	Feb 18 Spring Break 1	Feb 19 Spring Break 2
Feb 22	Feb 23 Problem Session	Feb 25	Feb 26
Mar 1	Mar 2 Problem Session	Mar 4	Mar 5
Mar 8	Mar 9 Problem Session	Mar 11	Mar 12

Mid-Term

Tentative Daily Schedule

Monday	Tuesday	Thursday	Friday
Mar 15	Mar 16 Problem Session	Mar 18	Mar 19
Mar 22	Mar 23 Exam 2	Mar 25	Mar 26 Project Proposal 11:59 PM
Mar 29 Spring Break 3	Mar 30 Spring Break 4	Apr 1	Apr 2
Apr 5	Apr 6 Problem Session	Apr 8	Apr 9
Apr 12	Apr 13 Problem Session	Apr 15	Apr 16 Project Draft Sunday evening
Apr 19	Apr 20 Problem Session	Apr 22	Apr 23 Project Paper Sunday evening
Apr 26	Apr 27 Problem Session	Apr 29 Presentations	Apr 30 Presentations
May 3 Presentations	May 4 Snow Day	May 6 Reading Period	May 7 Reading Period

Exam 3, Final Examination: Wednesday, May 12 at 8 AM