Course Guidelines
University of Puget Sound
Dr. Beezer

Linear Algebra
Math 290 A&B
Fall 2019

Texts

We will be using *A First Course in Linear Algebra*, by Robert A. Beezer as our textbook. We will follow Version 3.50 throughout the semester as the official version for the course. This version may be found as a PDF on the book's site at linear.pugetsound.edu, where it is made freely available with an open license. If you prefer, you can use the hardcover version, which is Version 3.00, and has only minor differences. See the book's site for information on ordering a physical copy.

The latest online version of the textbook is at linear.pugetsound.edu/fcla. This has the subtitle "(Beta Version)" presently, and is not the older green-themed version. You may find this version the most useful, and it will also perform well on a mobile device.

However, we will be using a special "enhanced" version online, which will be discussed in class.

The course web page has some recommendations for open textbooks about proof techniques, which will augment the shorter discussions in the textbook.

Course Web Page

Off of buzzard.ups.edu/courses.html you can find the link to the course web page.

Office Hours

My office is in Thompson 303. 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. Office Hours are 9:00–9:50 on Monday and Friday, 8:00–8:20, 9:30–9:50 on Tuesday and Thursday. Office Hours are first-come, first-served, so I do not make appointments for these times, nor do you need to ask me if I will be present at these times. You may assume I will be there, unless I have announced otherwise in class or by email. You **may** make an appointment for other times, or just drop by my office to see if I am in. Office Hours are your opportunity to receive extra help or clarification on material from class, or to discuss any other aspect of the course.

Computation

Linear algebra is at the heart of many large computations in computer science, physics, chemistry, economics, statistics, and other disciplines. So it is useful to become familiar with relevant software. Futhermore, freed from doing error-prone numerical computations you can concentrate on new ideas and concepts.

For both reasons, we will make extensive 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 by the "last day to drop" you will need to pay $14 for the entire semester so you can move your course project to a members-only server.

There are thorough discussions about Sage integrated into the web version of your textbook. We will discuss in class the use of Sage during examinations. In particular, if you do not own a laptop, investigate procedures **now** for borrowing one from the library.

Homework

There is a nearly complete collection of exercises in the text. Any (or all) of the problems will be good practice as you learn this material. Many of these problems have complete solutions in the text to further aid your understanding. Of course, you are not limited to working **just** these problems.

None of these problems will be collected, but instead they will form the basis for our seven "Problem Sessions" and for discussions at Office Hours. 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 as we work through the sections (see attached schedule) and to participate in the classroom discussions. If you are unsure about a problem, then a visit to my office is in order. Making a consistent effort outside of the classroom is the easiest 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

Examinations

There will be seven 50-minute timed exams—they are all listed on the **tentative** schedule. The lowest of your seven exam scores will be dropped. The comprehensive final exam will be given on Friday, December 20 at 8 AM (Section A, 10:00) or Wednesday, December 18 at Noon (Section B, 11:00). The final exam cannot be given at any other time and also

be aware that I may allow you to work longer on the final exam than just the two-hour scheduled block of time. In other words, ***plan your travel arrangements accordingly.***

As a study aid, I have posted copies of old exams on the course web site. These are offered with no guarantees, since techniques, approaches, emphases, and even notation will change slightly or radically from semester to semester. Some of the solutions contain mistakes, and some of the problem statements have typos. In other words, they are not officially part of this semester's course and I do not maintain them. In particular, I do not advocate working old exams as a primary, or exclusive, technique for learning the material in this course. **Use at your own risk**: they have not been reviewed for minor mistakes or inconsistencies with this semester's course. I will not entertain questions about the correctness of these materials via email.

Come to examinations prepared to remain in the room for the entire length of the exam. Leave all networked devices at home (this includes phones), or place them into a purse or book bag, ***POWERED OFF*** (not simply on silent or hibernating). As an alternative, you may check your device(s) with me if you wish. Violations will be treated as cases of Academic Dishonesty. In this course, an exception to this policy will be the use of laptops for Sage computations during examinations, which will be discussed further in class.

Writing

This course has been designated as part of the University's Writing in the Major requirement. Thus, there will be two proofs assigned for each chapter. You will be expected to formulate a proof, and write it up clearly. These will be graded on a pass/fail basis. Each chapter's questions will be returned to you with careful comments, and if you do not earn a pass, then you can resubmit them at the close of the next chapter. You may resubmit a problem for several consecutive chapters in a row, **so long as you make a serious effort on each outstanding problem at each opportunity**. Once you miss an opportunity to resubmit, or a retry does not contain any new work, or significant comments and hints are ignored, then it will be scored as a fail. Failure to follow the directions for submitting these can result in a retry with no feedback from me. Please read the instructions and details provided with these problems very carefully.

These will be due the day of the problem session prior to the chapter exam, and submitted **prior to the start of class**. Under no circumstances, including an inability to print, will they be accepted late. During the first part of the course, we will learn the mathematical typesetting software, LaTeX, and you will be required to use this tool appropriately when writing your proofs, and you may be required to do a retry soley on the basis of incomplete use of LaTeX. I might request your LaTeX source as part of grading your exercises, so make sure you retain these.

These problems ***ARE YOUR OWN WORK***. In other words, no collaboration on formulating the proof, no collaboration on writing the proof, no copying content from the book's source, and no discussion **whatsoever** with classmates or others familiar with the subject. In particular, I do not provide consultation in advance of submission, but rather will provide careful comments on your written submitted work. Late submissions will not be accepted and forfeit your opportunity to submit retries.

Reading Questions

Each section of the textbook contains three reading questions at the end. Once you have read the section **prior** to our in-class discussion, it will be time to consider these questions. Responses will be due by 6 AM of the day we discuss the section in class, and will not be accepted late. If a question asks for a computation, then provide a complete answer, perhaps with some relevant intermediate computations. If the question requests a yes/no answer, or asks "Why?" then give a thorough explanation using correct English grammar, syntax, and punctuation along with appropriate use of LaTeX. Cutting and pasting from the textbook without a citation is always plagiarism. And even providing a verbatim quote along with a citation will always get you zero credit.

Grades

Grades will be based on the following breakdown:

- Reading Questions: 10%
- Writing: 15%
- Examinations: 55%
- Final Examination: 20%

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, this includes Reading Questions and Writing Exercises. 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.

Purpose

This course is much different from most any mathematics course you have had recently, in particular it is much different than calculus courses. We will begin with a simple idea—a linear function—and build up an impressive, beautiful, abstract theory. We will begin computationally, but soon shift to concentrating on theorems and their proofs. By the end of the course you will be at ease reading and understanding complicated proofs. You will also be very good at writing routine proofs and will have begun the process of learning how to create complicated proofs yourself.

You will see this material applied in subsequent courses in mathematics, computer science, chemistry, physics, economics and other disciplines (though we will not have much time for applications this semester). You will gain a "mathematical maturity" that will be helpful as you pursue upper-division coursework and in any logical, rational, or argumentative activity you might engage in throughout your lifetime. It is not easy material, but your attention and hard work will be amply repaid with an in-depth knowledge of some very interesting and fundamental ideas, in addition to beginning to learn to think like a mathematician.

Conduct

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. I do not care how much food or drink you bring to class, so long as it does not distract others or make me hungry right before lunch. 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.

Student Accessibility and Accommodation If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Peggy

Perno, Director of Student Accessibility and Accommodation, 105 Howarth, 253.879.3399. She will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

I request that you give me at least two full working days to respond to any requests from this office.

Classroom Emergency Response Guidance Please review university emergency preparedness and 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.

Copyright and Fair Use Course materials are subject to the copyright law of the United States (Title 17 U.S. Code). They are for educational purposes only and limited to students enrolled in the course. Further reproduction or distribution is prohibited. [RAB: Except where publication includes an open license.]

Student Bereavement Policy The University of Puget Sound recognizes that a time of bereavement can be difficult for a student. Therefore, the university provides a Student Bereavement Policy for students facing the loss of a family member.

Students are normally eligible for, and faculty members are expected to grant, three consecutive weekdays of excused absences, without penalty, for the death of a family member, including parent, grandparent, sibling, or persons living in the same household. Should the student feel that additional days are necessary, the student must request additional bereavement leave from the Dean of Students or the Dean's designee. In the event of the death of another family member or friend not explicitly included within this policy, a bereaved student may petition for grief absence through the Dean of Students office for approval.

Learning Outcomes

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

- Understand vector spaces.

- Understand linear transformations between vector spaces.
- Understand that every vector space is isomorphic to the coordinate vector space over its base field.
- Understand that every linear transformation can be represented by a matrix.
- Understand that every matrix multiplication is composition of linear transformations.
- Understand that matrix diagonalization is achieved through a similarity transformation and is a matrix representation relative to a basis of eigenvectors.
- Understand that eigenvalues are a property of a linear transformation and are independent of representation as a matrix.
- Better understand the general concept of an **algebraic structure**.

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

Tentative Daily Schedule

Monday	Tuesday	Thursday	Friday
Sep 2 Labor Day	Sep 3 Section WILA	Sep 5 Section SSLE	Sep 6 Section RREF
Sep 9 Section TSS	Sep 10 Section HSE	Sep 12 Section NM	Sep 13 Problem Session
Sep 16 Exam SLE Last Day to Drop Without Record	Sep 17 Section VO	Sep 19 Section LC	Sep 20 Travel Day
Sep 23 Section SS	Sep 24 Section LI	Sep 26 Section LDS	Sep 27 Section O
Sep 30 Problem Session	Oct 1 Exam V	Oct 3 Section MO	Oct 4 Section MM
Oct 7 Section MISLE	Oct 8 Section MINM	Oct 10 Section CRS	Oct 11 Section FS
Oct 14 Problem Session	Oct 15 Exam M	Oct 17 Section VS	Oct 18 Section S

Mid-Term

Tentative Daily Schedule

Monday	Tuesday	Thursday	Friday
Oct 21 Fall Break	Oct 22 Fall Break	Oct 24 Section LISS	Oct 25 Section B
Oct 28 Section P	Oct 29 Section PD	Oct 31 Problem Session	Nov 1 Exam VS
Nov 4 Section DM	Nov 5 Section PDM	Nov 7 Section EE	Nov 8 Section PEE Last Day to Drop
Nov 11 Section SD	Nov 12 Problem Session	Nov 14 Exam D&E	Nov 15 Section LT
Nov 18 Section ILT	Nov 19 Section SLT	Nov 21 Section IVLT	Nov 22 Problem Session
Nov 25 Exam LT	Nov 26 Section VR	Nov 28 Thanksgiving	Nov 29 Thanksgiving
Dec 2 Section MR	Dec 3 Section CB	Dec 5 Problem Session	Dec 6 Exam R
Dec 9 Travel Day	Dec 10 Travel Day	Dec 12 Reading Period	Dec 13 Reading Period

Final Examination: Friday, December 20 at 8 AM (Section A, 10:00)

Final Examination: Wednesday, December 18 at Noon (Section B, 11:00)