Texts   We will be using *Abstract Algebra: Theory and Applications*, by Thomas W. Judson as our textbook. We will cover material from Chapters 1–15, as described on the attached calendar. This is an open source textbook, which in part means you are free to make unlimited copies. The book's website is abstract.pugetsound.edu. The "2018 Annual Edition" will be the version I will follow for this course. Do not purchase an older edition, as there have been substantial changes in how theorems and examples are numbered, and it will be difficult to follow along with an older copy.

The book's website has links to help you with the purchase of a physical copy of the book, should you desire one. You may also download a PDF that is nearly identical to the hard copy, or another PDF which contains the extra material about Sage. Additionally, the online version has all the same content and the Sage examples are executable and editable, via the Sage Cell server, so is a far superior way to use the book.

As you begin working with Sage, you could find Gregory Bard's Sage for Undergraduates very useful. It is freely and legally available for download as a full-color PDF. (See links in electronic versions of this syllabus, or on the course page).

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. Do not confuse this address with the one used for submitting homework (I only look at the homework address when something is due). 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 10:00–11:50 on Monday and Friday, 10:30–12:20 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.

Class Preparation   Reading questions will help you prepare for the lectures on each chapter. They are posted on the course webpage, as a single PDF for the entire semester, which will not change. Failure to follow these procedures may result in your responses being returned un-graded.

1. These are due to me by 6:00 AM the morning of the day when we begin discussing a new chapter, as indicated on the schedule and/or announced in class.

2. Under no circumstances will they be accepted late.

3. Submit by email to the address announced in class, **not** my `beezer@ups.edu` address. Conversely, do not send general email to the address for reading questions.

4. Make your subject line **exactly, exactly** as follows: Chapter X, where X is the number of the chapter.

5. Put your full name as the first line of the body of your message.

6. Answer the questions in order, beginning each with the problem number.

7. Endeavor to send your answers as **straight** ASCII text, no HTML if you can help it. Definitely **never** send any of your responses as an attachment. LaTeX or PreTeXt syntax is fine for simple expressions.

8. You can expect a reply that morning, or within 30 hours at the latest. After that time, an email inquiry is appropriate.

Computation Abstract algebra has become increasingly important for its application to digital technologies. For example, we will cover cryptography (a key component of the Internet) in Chapter 7 (Introduction to Cryptography). Your textbook contains an interestiung exposition on efficient digital communication in Chapter 8 (Algebraic Coding Theory). Conversely, digital technologies are an ideal assistant for studying the subject. So computation will be a feature of the course.

For this reason, we will make extensive use of Sage. Since Sage is open source software, it is available freely in many places. You will need to purchase an account at CoCalc where we will have access to a powerful servers via your web browser and we can efficiently manage homework assignments. (Details on accounts will be provided in class, cost is $14 for the semester.) The assumption is that you have a paid membership on CoCalc for doing these assignments, so availability, version incompatibility, or convenience of other sites is not an excuse for not being able to complete the Sage assignments on-time.

For each chapter there will be assigned exercises to work in Sage. These will be due roughly on the discussion day following the lectures for each chapter, as a CoCalc worksheet or Jupyter notebook. We will discuss the exact procedure in class. Exact due dates will be announced in class. Under no circumstances will these assignments be accepted late.

Practice Exercises from the text will be suggested for each chapter. Of course, you are not limited to working **just** these assigned problems and you can find many more in textbooks in the library (ask me for suggestions). We have twelve class days reserved for discussions when we can talk about these problems. It is your responsibility to be certain that you are learning from the homework exercises. The best ways to do this are to work the problems diligently, start studying them early, and participate in the classroom discussion. If at this point you are still unsure about a problem, then a visit to my office is in order, since you are obviously not prepared for the examination questions. 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

Examinations   There will be six 50-minute timed examinations. Planned dates are all listed on the **tentative** schedule. The comprehensive final examination will be given at 8 AM on Wednesday, December 14. The final exam cannot be given at any other time, so be certain that you do not make any travel plans that conflict, and also be aware that I will allow you to work longer on the final exam than just the two-hour scheduled block of time.

Grades   Grades will be based on the following breakdown:

- Examinations: 50%
- Sage: 25%
- Reading Questions: 5%
- Final Examination: 20%

The lowest of your six examination scores will be dropped. Attendance and improvement will be considered for borderline grades, while excessive attendance and late-arrival problems will result in grade penalties. 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 Handbook*. You can find a link to a PDF version at www.pugetsound.edu/academichandbook, 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 Sage 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 At this point in your college career, you should be well on your way to being an independent scholar, who appreciates the beauty of mathematics and understands the effort needed to master new and difficult ideas. Consistent with that, I will be giving you a fair degree of freedom to learn this material in a manner that suits you. Of course, with freedom comes responsibility.

Read the book before the lectures, work the exercises early and diligently, tidy up your class notes each evening, and ask questions. Arriving late to class, or having conversations with others during class, not only disrupts your peers, but tells me you are not serious about your education.

"Modern" algebra is the basis of one of the two main branches of mathematics (analysis being the other). So every mathematician should have a basic understanding of its principal concepts. The investment of your time and energy applied mastering its basic concepts will be amply repaid by a full understanding of its deeper ideas.

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 arriving on-time. Repeated tardiness and absences will result in grade penalties, in accordance with university policies. Do not leave class during the lecture unless your continued presence would be a greater interuption — fill your water bottles, use the toilet, and so on, **in advance**. 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. 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 together. 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 you and your colleagues.

University Notices These are two notices the university administration requests we relay to 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 the Office of Accessibility and Accommodation, 105 Howarth, 253.879.3395. 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 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.

Tentative Daily Schedule

Monday	Tuesday	Thursday	Friday
Aug 27 Syllabus CoCalc	Aug 28	Aug 30	Aug 31 Problem Session
Sep 3 Labor Day	Sep 4	Sep 6	Sep 7 Problem Session
Sep 10 Exam 1 Chapters 1, 2 Drop w/out Record	Sep 11 CoCalc accounts	Sep 13	Sep 14
Sep 17 Problem Session	Sep 18	Sep 20	Sep 21 Problem Session
Sep 24 Exam 2 Chapters 3, 4	Sep 25	Sep 27	Sep 28
Oct 1 Problem Session	Oct 2	Oct 4	Oct 5 OKC
Oct 8 RSA Crypto	Oct 9 RSA Crypto	Oct 11 Problem Session	Oct 12 Exam 3 Chapters 5, 6, 7

Mid-Term

Tentative Daily Schedule

Monday	Tuesday	Thursday	Friday
Oct 15 Fall Break	Oct 16 Fall Break	Oct 18	Oct 19
Oct 22	Oct 23 Problem Session	Oct 25	Oct 26
Oct 29 Problem Session	Oct 30 Exam 4 Chapters 9, 10	Nov 1	Nov 2 Drop w/Auto W
Nov 5	Nov 6	Nov 8 Problem Session	Nov 9
Nov 12	Nov 13 Problem Session	Nov 15 Exam 5 Chapters 11, 13	Nov 16
Nov 19	Nov 20	Nov 22 Thanksgiving	Nov 23 Thanksgiving
Nov 26	Nov 27 Problem Session	Nov 29	Nov 30
Dec 3 Problem Session	Dec 4 Exam 6 Chapters 14, 15	Dec 6 Reading Period	Dec 7 Reading Period

Final Examination: Wednesday, December 14 at 8 AM

Suggested Exercises

Chapter	Computational	Theoretical
1	18, 25	8, 9, 22c, 28, 29
2	15	5, 10, 15, 16, 18, 27, 28
3	1, 3, 5, 6, 10, 17, 32	29, 30, 31, 38, 43, 44, 45, 46, 53, 54∗
4	3, 4, 5, 6, 7, 8, 9, 11, 20, 21, 22b	24, 26, 27, 28, 30, 34, 37
5	2, 3, 5, 7, 9, 10, 15	4, 18, 20, 23, 25, 27, 30∗, 33, 35
6	1, 2, 5	3, 6, 11, 12, 15∗, 17, 19, 20, 21, 23
7	7, 8, 9	
9	3, 5, 10, 12, 14, 16, 17	21, 22, 25, 29, 34, 35, 38, 48, 55∗
10	1bcd, 2, 3, 4	5, 6, 7, 9, 11, 12, 13, 14
11	2, 3, 4, 5, 6; Additional: 7, 8	8, 14, 15, 16, 19; Additional: 2, 3, 9, 10
13	1, 2, 3, 4bc	6, 9, 11, 12, 13
14	2, 3, 4, 6, 9, 11, 13, 17 (S_3 only)	20, 22, 24
15	1, 2, 3, 5, 6, 9, 15, 16, 17, 24	4, 7, 8, 10, 12, 14, 21

Exercises marked with an asterisk (∗) contain results that are of theoretical importance, and which could rightly be listed in the text as theorems.