Department of Mathematical and Statistical Sciences
College of Science
Clemson University

MATH 8510-001, Abstract Algebra
Fall 2022
MWF 12:20–1:10pm
Martin Hall E-004

Instructor: Matthew Macauley, Martin Hall O-325, macaule@clemson.edu, 656-1838 (no voicemail)

Course website: We will rarely use Canvas. All of the course material will be made freely available on the course website:

http://www.math.clemson.edu/~macaule/classes/f22_math8510/

Course Description: This will be a standard first-semester graduate course in abstract algebra, but there will be an extra effort to encorporate visuals to go along with the concepts. We will cover groups, homomorphisms, actions, extensions, universal properties, rings, and divisibility and factorization.

In the end, you will leave with a new appreciation of the beauty (and difficulty) of algebra, in a way that will develop your learning skills, which will be applicable to your other graduate courses and research.

Prerequisite: Undergraduate abstract algebra is recommended, but not required.

Modality: This is an in-person class, but there is considerable uncertainty due to COVID, especially with new variants. We all must be prepared to shift to an online modality with little notice, and I will email a Zoom link that will be used if this happens. Though I plan to follow whatever the current university modality policy is, there is a strong chance that on at least one day, I will be sick (nearly impossible to avoid with a preschooler at home), traveling due to a conference, or we will have a weather event like a hurricane, tornado, or snowstorm. If this happens, we will have class online (could be either synchronous or asynchronous), rather than it being canceled or taught by a substitute, and I will provide details ahead of time.

Communication Strategy: I prefer to communicate via emails rather than Canvas messages.

All of my email addresses (e.g., **macaule@clemson.edu**) go to the same gmail inbox, which I check multiple times a day. Though I have the gmail iPhone app, I don't get email push notifications. Also, I usually don't check email on Saturdays.

I will typically be in my office at least MWF, from roughly 8:00am–5:00pm. If you need to reach me immediately during the week, feel free to call my office phone, at (864) 656-1838. If I'm not there, please send an email rather than leaving a voicemail.

If you send me an email and do not get a reply by the time you go to bed, please re-send it, as that is either my mistake, or I haven't yet gotten to it, in which case that will bump it up to the top of my inbox. Just click "Reply" and "Send"; no need to explain.

Happy Hour: It has been my experience that evening Zoom office hours are much more frequently attended than (pre-COVID) on-campus office hours ever were. As such, three days a week at 7pm (MWF, unless said otherwise), you are invited to join me and your classmates on Zoom for an "Adult Beverage"[1], company, and office hours. I'll stick around to answer questions as long as there are some. However, except on days when HW is due, *I will only show up if at least one person RSVPs, either in class or by sending me an email before 6:30pm, saying they will attend.* If no one is there by 7:05pm, I will log off.

I am also available to meet by appointment, if desired, either over Zoom or in person. To make an appointment, email me and include block(s) of time in which you are available. Please let me know in advance if you want any Zoom meeting to be private, like if you want to discuss your grade. In that case, I will use a different Zoom meeting or a breakout room.

Textbooks: There does not yet exist a textbook that covers the material in this course in the manner that I will teach it. I am currently writing such a book, which should be completed within the academic year. I will provide students a rough draft of the completed chapters in this book. Feedback is very much welcome, and finding typos can get your name in the acknowledgements in the published version.

A complete set of my lectures note slides will be posted on the course webpage. There are also many useful resources that are freely available online, such as *Abstract Algebra: The Basic Graduate Year*, by Robert B. Ash (Univ. Illinois).

Useful websites:

Course webpage: `http://www.math.clemson.edu/~macaule/classes/f22_math8510/` (all relevant links posted here)

Canvas: `https://www.clemson.edu/canvas/` (will be used very sparingly, if at all)

Gradescope: `https://www.gradescope.com/` (click "Log in", then "School Credentials")

Homework: There will be 14 weekly homework assignments, usually consisting of ≈5 problems. Though it can be a difficult habit to form, *I strongly encourage students try to complete one problem per day, rather than save them all for the last 24–48 hours.*

Submitted assignments must be typeset with LaTeX. The pdf and tex files will be posted on the course webpage. Images can be done directly in the .tex file using TikZ, or hand-drawn and included with a command like `\includegraphics[width=.8\textwidth]{image.png}`

Working together is encouraged, but everyone must do their own work, and *collaborators must be cited*, Outside sources, such as webpages, must also be cited as well, if they were instrumental to a solution. Citations should be done on a problem-by-problem basis.

Homework assignments are due at 11:59pm EST, and will be submitted through Gradescope. Assignments can be submitted multiple times; only the last submission will be graded. There is a 3-hour grace period for deadlines, meaning that there is no penalty for assignments submitted within 3 hours of the deadline.

Assignments submitted after this period will not be accepted, but I will drop everybody's lowest score. This policy is intended to be an alternative to giving extensions due to unexpected circumstances such as an illness.

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[1]For me, this means drinks like **LaCroix** or **Kombucha**, which are *very unpopular* among kids.

Attendance: Please make an effort to attend all classes, and to be on time. I will try to show up 10 minutes early to all classes. In the unlikely scenario that I am absent 5 minutes after class has started, check your email. If you have not heard from me 10 minutes after class has begun, you may assume that class has been canceled.

If you cannot make class, due to illness, quarantine, or some other reason, please let me know as a courtesy.

Technology in class: One particular study on multitasking showed that students on laptops score 11% lower than those not on laptops. Morever, students who were not on laptops but had a laptop in their "line of sight" scored *17% lower!* Therefore, the use of laptops and cell phone in class will not be allowed. Tablets may be used *only* for taking notes.

Exams: There will be two 50-minute midterm exams during the semester and a cumulative 2.5-hour final exam.

If any exams need to be taken online, then I will proctor them over Zoom. You must provide consent to having the meeting recorded.

Exam rules (if online):

- Before beginning the exam, you must do a "room scan" with your camera, and also verify that all of the paper you brought is indeed blank.
- You must share your video for the entire duration of the exam.
- The camera must be far enough away so I can see your hands and paper at all times. That is, I must be able to verify that you are not using a phone or computer.
- When you are finished, send me a private Zoom Chat to let me know, and then scan and email your exam to me while still on camera. It must be scanned in one multi-page pdf document, and *not* multiple individual one-page documents.

Before *and* after submitting, double-check to make sure that the scanned file is (i) fully legible, (ii) complete (iii) the correct file, and (iv) correctly oriented (not upside down or rotated).

It is strongly recommended that you practice with your smartphone scanning app *before* the exam.

Grading: Your final grade will be computed as follows:

Homework	25%
Midterm 1	25%
Midterm 2	25%
Cumulative Final Exam	50%

I will drop either your lowest midterm grade, OR half of the weight of the final exam; whichever is lowest. Also, if you get an unambiguous **A** on the final exam, then you will get an **A** in the course, *assuming you have a passing grade on the homework*.

I do *not* grade using arbitrary round number cut-offs. I generally err on the side of having difficult exams (e.g., sometimes the median score is in the 50–60% range). This spreads out the distribution, and the scores generally fall into visually clear distinct "clusters" with large gaps between them. Roughly speaking, an **A** is the "very good" cluster, a **B** is statistically significantly below that, and a **C** is for outliers on the low end. I will use **+** and **-** grades for borderline cases, or for a bi-modal or

very wide cluster. Though past performance is not an indicator of future results, I have never given fewer than 50% **A**s in a graduate class.

Because of the aforementioned policies, the automatically calculated numeric grade that you see in Canvas, which is the average of every weighted graded submission, is NOT an accurate indicator of your grade. At any point in time during the class, I would be happy to give you a ballpark estimate of how you are doing.

Make-Up Policy: No make-up exams will be given. I will drop your lowest midterm, which means that if you miss a midterm, then your final exam grade will replace it. The homework deadlines will not be extended for individual students, and assigned homework must be turned in by the deadline.

Student Learning Outcomes: Upon successful completion of MATH 8510, students will be able to

- Use visual diagrams and pictures to demonstrate the important definitions and concepts of group theory (of course, in addition to being able to define them rigorously).
- Abstract skills and knowledge learned in undergraduate abstract algebra to a more general setting.
- Demonstrate a solid understanding of the theory of groups and rings at the graduate level.
- Formalize a number of standard mathematical concepts as universal constructions, and extend these to general categories.
- Read, write, and critique rigorous mathematical proofs on topics in abstract algebra.
- Develop good mathematical writing skills. Important aspects of this are *accuracy*, *clarity*, and *conciseness*.

Key Dates

Aug 24 (Wed)	Classes begin
Aug 30 (Tue)	Last day to register or add a class
Sep 6 (Tue)	Last day to drop a class or withdraw from the University w/o a W grade
Oct 28 (Fri)	Last day to drop a class or withdraw from the University w/o final grades
Nov 7–8 (M–Tu)	Fall break
Nov 23–25 (W–F)	Thanksgiving break
Dec 9 (Fri)	Last day of class
Dec 16 (Mon)	Final Exam, 8–10:30pm

"No exceptions": In any class syllabus, no matter how they are worded, policies and phrases like "no exceptions", "no make-ups", etc. are *never* actually what they sound, and this is especially true this semester. Things happen, from natural distasters (hurricanes, tornados), to human disasters (9/11, school shootings), to personal and family tragedies, to health emergencies (COVID, auto accidents, hospitalizations). This does not mean that any exception or extension will be granted, but I will do my best to be reasonable, fair, and accommodating.

Make-Up Policy: I will drop your lowest midterm, which means that if you miss a midterm, then your final exam grade will replace it. The homework deadlines will not be extended for individual students, and assigned homework must be turned in by the deadline. PLAN AHEAD: If you submit assignments minutes before the deadline, you take the risk of bad luck, e.g., a power outage, computer freeze or crash, personal emergency, zombie attack, etc., that could make you miss the deadline.

By default, any exam that was scheduled at the time of a class cancellation due to power outage / inclement weather will be given at the next class meeting. Any extension or postponement of

assignments or exams must be granted by me via email or Canvas within 24 hours of the weather-related cancellation.

Mental health: Your mental health is important to me, and I am always available to talk. Please don't hesitate to reach out. We're in this together, and all of us are strugling in some regards, myself included.

Social media: If you want to connect with me on Social Media, then use LinkedIn or Twitter. I don't really use the first one, though I have an account. I use the second one to promote my mathematical materials and current book project, at @VisualAlgebra. I will not accept friend requests on Facebook, there is just too much potential for risk and liability.

Academic Integrity: "As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning'. Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form."

Special Accommodations: Students with disabilities who need accommodations should make an appointment with Dr. Arlene Stewart, Director of Disability Services, to discuss specific needs within the first week of classes. Students should present a Faculty Accommodation Letter from Student Disability Services when they meet with instructors. Student Disability Services is located in Suite 239 Academic Success Building (656-6848; sds-l@clemson.edu). Please be aware that accommodations are not retroactive and new Faculty Accommodation Letters must be presented each semester.

Title IX Policy: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972.

The University is committed to combatting sexual discrimination including sexual harassment and sexual violence. As a result, you should know that University faculty and staff members who work directly with students are required to report any instances of sexual harassment and sexual violence, to the University's Title IX Coordinator. What this means is that as your professor, I am required to report any incidents of sexual harassment, sexual violence or misconduct, stalking, domestic and/or relationship violence that are directly reported to me, or of which I am somehow made aware.

There are two important exceptions to this requirement about which you should be aware:

Confidential Resources and facilitators of sexual awareness programs such as "Take Back the Night and Aspire to be Well" when acting in those capacities, are not required to report incidents of sexual discrimination.

Another important exception to the reporting requirement exists for academic work. Disclosures about sexual harassment, sexual violence, stalking, domestic and/or relationship violence that are shared as part of an academic project, a research project, classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX Coordinator.

This policy is at `http://www.clemson.edu/campus-life/campus-services/access/title-ix/`. Alesia Smith is the Executive Director for Equity Compliance and the Title IX Coordinator. Her office is at 223 Holtzendorff Hall, phone number is 864.656.3181, and email address is alesias@clemson.edu.