

School of Mathematical and Statistical Sciences
College of Science
Clemson University

MATH 4110-001, Combinatorics

Fall 2025
MWF 12:20–1:10pm
Martin Hall E-005

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/f25_math4110/

Course Description: This class will be an introduction to combinatorics. Unlike many subjects, such as calculus, linear algebra, abstract algebra, and real analysis, where there are standard well-traversed paths through the material, a combinatorics class is more like “visiting a museum.” The scope of this class will be more “breadth” rather than “depth,” and we have considerably flexibility as to what topics to cover.

Prerequisite: Math 3110 (linear algebra) and 3190 (intro to proofs), or equivalent.

Modality: This is an in-person class, but 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. There is a strong chance that on at least one day, I will be sick (nearly impossible to avoid with two young kids 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.

I have always had all of my email addresses forward to the same gmail inbox. Recently, Clemson has decided to drop the Google suite in favor of Microsoft. I refuse to migrate to Outlook after 25 years of using gmail. Thus, I have set up all email forwarding to **mattmacauley@gmail.com**. That said, I have noticed that a number of emails have simply not been forwarded properly. Also, since we adopted Microsoft, I have seen more legit emails get caught by spam filters than ever before. Thus, I recommend sending an email directly to my gmail account.

I will typically be in my office every day, from roughly 8:15am–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 my mistake. Or perhaps, I’m up later than you (likely!), and this will bump it to the top of my inbox. Just click “Reply” and “Send”; no need to explain.

Office Hours: 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, I will hold evening Zoom office

hours at 7pm (days TBD). I'll stick around to answer questions as long as there are some, and will log off at 7:10pm if no one shows up.

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.

Finally, I'm usually in my office all day, every day. *Feel free to drop by anytime*; just knock if my door is closed.

Textbooks: You do not have to buy a book for this class. I will draw from a number of resources, especially the following books:

- Miklós Bóna (Florida). A Walk Through Combinatorics: An Introduction To Enumeration, Graph Theory, And Selected Other Topics. Fifth edition, World Scientific, 2023.
- Richard P. Stanley (MIT). Enumerative Combinatorics, Volume 1, Second edition. Cambridge studies in advanced mathematics (2011).
- Herbert S. Wilf (UPenn). generatingfunctionology, 3rd edition, CRC press, 2005.

Useful websites:

Course webpage: http://www.math.clemson.edu/~macaule/classes/f25_math4110/ (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”)

Overleaf: <https://www.overleaf.com/>. You will need a free account.

ChatGPT: <https://chatgpt.com/>. You will need a free account.

Detexify: <https://detexify.kirelabs.org/classify.html>. See how to write symbols in L^AT_EX.

Unicodeit: <https://www.unicodeit.net/>. Useful for writing math symbols in emails.

Homework: There will be approximately weekly homework assignments that will be due at 11:59pm on the day posted. There is a 3-hour window grace period after this in which assignments can be submitted, without penalty. Beyond that, late homeworks will not be accepted, but I will drop everybody's lowest homework score. This policy is intended to be an alternative to giving extensions due to unexpected circumstances such as an illness.

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. You should keep all the graded homeworks in case of missing grades due to missing name or typo errors.

Homework should be typeset using L^AT_EX. For pictures, you can hand-draw them, take a photo, and use the `\includegraphics` command. Alternatively, you can use the TikZ graphics package. ChatGPT is great at helping generate such images.

Responsible use of AI on HW is encouraged, but it must be cited / documented, on an individual problem basis.

Lecture notes: In place of quizzes, students will typeset weekly lecture summaries in L^AT_EX. These will be due each Sunday night at 11:59pm.

Exams: There will be 2 in-class midterm exams and a final exam. All exams will be closed notes and closed book.

Attendance: Please make an effort to attend all classes if you are healthy, and to be on time. I will try to show up at least 5 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. Moreover, students who were not on laptops but had a laptop in their “line of sight” scored *17% lower!* Therefore, the use of laptops and cellphones in class will not be allowed. Tablets may be used *only* for taking notes.

Grading: Your final grade will be computed as follows:

Homework	20%
Lecture notes & attendance	20%
Midterm 1	20%
Midterm 2	20%
Final exam	40%

I will drop your lowest midterm grade, or half of the weight of the final exam, whichever is lower.

I do not impose arbitrary numeric cutoff lines for final grades, e.g., A=90+, B=80–89, etc. Rather, I grade by natural “clusters.” I tend to give difficult assignments and exams, and so the letter grades end up corresponding to lower numeric averages than they do in most classes.

Student Learning Outcomes: Upon successful completion of the course, students will be able to

- Solve basic enumeration problems using counting formulas, recurrences, and generating functions.
- Prove theorems and solve problems that involve asymptotic behavior of combinatorial structure.
- Prove theorems and solve problems related to integer partitions.
- Apply basic properties of partially ordered sets (posets).
- Apply ideas from graph theory, such as Cayley’s theorem for counting trees, and the chromatic polynomial.

Key Dates

Aug 20 (Wed)	Classes begin
Aug 26 (Tue)	Last day to register or add a class
Sep 1 (Mon)	Labor day (no class)
Sep 3 (Wed)	Last day to drop a class or withdraw from the University w/o a W grade
Oct 28 (Tue)	Last day to drop a class or withdraw from the University w/o final grades
Nov 26–28 (W–F)	Thanksgiving break
Dec 5 (Fri)	Last day of class
Dec 8 (Mon)	Final Exam Block, 8–10:30am

“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 disasters (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 struggling in some regards, myself included.

Social media: If you want to connect with me on Social Media, then use LinkedIn or Bluesky. 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. 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.

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