

Clemson University  
School of Mathematical & Statistical Sciences

**MATH 4190-141 / 6190-141, Discrete Mathematical Structures**  
Summer Session I, 2022

**Instructor:** Dr. Matthew Macauley, macaule@clemson.edu

**Course Description:** This course is an introduction to discrete and algebraic mathematics and its applications, intended for students in computer science and engineering. Topics include basic set theory, inclusion-exclusion, counting, binomial and multinomial coefficients, multisets, propositional logic, proofs, paradoxes and the halting problem, the pigeonhole principle, existential and universal quantifiers, divisibility and primes, modular arithmetic, basic number theory, rational and irrational numbers, ceiling and floor, the Euclidean algorithm, relations, equivalence relations and equivalence classes, partial orders, functions, set cardinality, cryptography, symmetric ciphers, RSA, Diffe-Hellman, basic coding theory.

**Prerequisite:** Math 3110 (Linear Algebra).

**Communication Strategy:** Email is the best way to reach me. I will check it *at least* every few hours during the hours of 8am–9pm, seven days a week.

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. Just click “Reply” and “Send”; no need to explain.

Students are responsible for checking their Clemson email regularly, as that address will be the one subscribed to the class email list. I am not responsible if you miss important messages because you use a different email account.

**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, every M–F, you are invited to join me and your classmates on Zoom for an Adult Beverage<sup>1</sup>, company, and office hours. I’ll stick around to answer questions as long as there are some. However, *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 or needed (e.g., like if you work during the 7pm evening time). 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.

**Useful websites:**

*Course webpage:* [http://www.math.clemson.edu/~macaule/classes/m22\\_math4190/](http://www.math.clemson.edu/~macaule/classes/m22_math4190/) (all relevant links posted here)

*Canvas:* <https://www.clemson.edu/canvas/> (will be used minimally)

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<sup>1</sup>For me, this means drinks like **LaCroix** or **Kombucha**, which are *very unpopular* among kids.

**Texts:** We will use several *Open Textbooks*, which means they are published under a Creative Commons license and freely available online.

*Applied Discrete Structures*, by Ken Levasseur and Al Doerr. Version 3.5, 2018. Available at <http://faculty.uml.edu/klevasseur/ads2/>. A printed version can be purchased for \$44 from [www.lulu.com](http://www.lulu.com).

*Discrete Mathematics: An Open Introduction*, by Oscar Levin. 2nd edition, 2016. Available at <http://discrete.openmathbooks.org/home.php>. A printed version can be purchased for \$15 on Amazon.

*Discrete Mathematics for Computing*, by Wayne Goddard. Draft, 2018. <https://people.cs.clemson.edu/~goddard/texts/discreteMath/>

### **Required technology:**

A computer on which you can watch the YouTube lecture videos and view pdf files. A free adblocker like Adblock is recommended.

A reliable internet connection.

A free Zoom account, and a video camera that allows you to be recorded over Zoom (for exam proctoring).

A smartphone scanning app. There are many free apps, such as CamScanner or Adobe Scan. If you do not have a smartphone, a traditional scanner will suffice, but a smartphone app is preferred.

**Calculators/Other Technology:** A calculator is not required, but it may be useful when we cover cryptography. You will be allowed to use a traditional calculator on the exams (i.e., *not* a smartphone app, or computer, etc.).

**Schedule:** This course is being offered in an entirely ONLINE and ASYNCHRONOUS format through the course website, WeBWorK, and Canvas. The course calendar can be found on the course website.

**Lectures:** The lectures will be available on my YouTube channel. Students will be required to watch 1–2 lectures each day. The lecture schedule is listed on the course calendar.

**Homework:** Most homework assignments will be assigned using the open source program WeBWorK, freely available online. There will be selected written homework as well. Late assignments will NOT be accepted.

**Course Format:** This course is being offered in one summer semester so EVERYTHING GOES QUICKLY. I have taught this class during a regular semester and I plan to cover the same amount of material and assign the same amount of homework, but over 5 weeks instead of 15.

You should expect to spend 2–3 hours per day on this course:

Watching 1–2 online lectures.

Working homework problems.

You will prepare for two Midterms and a cumulative Final Exam.

Because this is an online course, our chief means of communication is through e-mail. It is important that you check your Clemson e-mail on a regular basis - at least once a day.

**Exams:** There will be two 90-minute midterm exams during the semester and a cumulative 3-hour final exam: Midterm 1 on Wed. June 1, Midterm 2 on Wed. June 15, and the Final Exam on Thu. June 23. I will proctor all exams over Zoom during a common time that we decide upon in advance. You must provide consent to having the meeting recorded.

Exam checklist (things to bring):

- Plenty of blank scratch paper and pens or pencils.
- One  $5 \times 7$  handwritten notecard; double-sided is okay.
- Calculator.
- Smartphone (for scanning your exam when you finish).

Exam rules:

- 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.

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 at least an A or B on the final exam, then you get at least that grade in the course, *assuming you have a passing grade (60%) on the homework*.

**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. **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.

**Student Learning Outcomes:** Upon successful completion of MATH 4190, students will be able to

Demonstrate knowledge and solve problems in several areas of discrete mathematics and number theory.

Use basic combinatorics to count various sets of objects.

Execute a few standard algorithms from discrete math and number theory.

Demonstrate knowledge about elementary discrete and algebraic structures.

Read, write, and critique simple mathematical proofs.

Use the RSA algorithm to encrypt and decrypt a message.

### Key Dates

May 17 (Tue)	Classes begin; late enrollment fee applies
May 18 (Wed)	Last day to register or add a class
May 23 (Mon)	Last day to drop a class or withdraw from the University without a W grade
May 30 (Mon)	Memorial Day holiday
June 1 (Wed)	Midterm 1
June 9 (Thu)	Last day to drop a class or withdraw from the University without final grades
June 15 (Tue)	Midterm 2
June 21 (Tue)	Last day of class
June 23 (Thu)	Final Exam

**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-1@clemson.edu ). Please be aware that accommodations are not retroactive and new Faculty Accommodation Letters must be presented each semester.

**Copyright Statement:** Some of the materials in this course are possibly copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Refer to the Use of Copyrighted Materials and “Fair Use Guidelines” policy on the Clemson University website for additional information: <http://clemson.libguides.com/copyright>

**Statement Included for Certification Purposes:** In this online course, you will interact with the content, instructor and classmates on at least a weekly basis through course assignments, asynchronous discussions and/or synchronous sessions as indicated in this syllabus.