# Course Syllabus

MATH 3012 | Applied Combinatorics

Fall 2026| Section QHS | 3 Credits | Instructor: Kalila Lehmann

Course Description

This course covers elementary combinatorial techniques and proof methods used in discrete problem solving.

**Note: Section QHS is restricted to Dual-Enrolled High School Students. Undergraduate students may not enroll in this section.**

Pre-Requisites

Integral Calculus (MATH 1552) and Linear Algebra (MATH 1553, 1554, or 1564).

Students who plan to take CS 2050 often find it helpful to do so before taking MATH 3012.

Course Goals and Learning Outcomes

This semester, we'll learn a lot of specific knowledge and tools. But we have some overall goals to work towards- by the end of the semester, we hope you'll be able to:

- Apply basic counting techniques, and combine them to solve more complex problems
- Prove statements at the appropriate level using the principles of induction, inclusion/exclusion, and other combinatorial methods
- Solve problems at an appropriate level using recurrence relations, generating functions, and tools and ideas from graph theory
- In the above areas, communicate and document your mathematical reasoning and process effectively

Course Texts

There is no required textbook for this course; the posted notes will be your primary reference.

Some helpful supplementary resources are listed below:

- Discrete and Combinatorial Mathematics: An Applied Introduction, by Ralph P. Grimaldi (5th Edition ISBN 0-201-72634-3).

    - Any edition will do, and should be quite affordable (especially in digital format).
    - This text is very detailed, so may be a little overwhelming to read on your own- but if you want to see something done very carefully, it's a great resource.
- Applied Combinatorics by Michael T. Keller and William T. Trotter
    - This text is a free Open Educational Resource, available at the link above. You can also find an affordable print copy if you wish at that link as well.
    - This resource is great if you want a quick summary of a topic that you mostly understand or are trying to summarize. It is occasionally a little lacking in detail and explanation, so if you need details you might try a different source.
- Discrete Mathematics: An Open Introduction (3rd Edition), by Oscar Levin
    - This is also a free Open Educational Resource, available at the link above.
    - We cover a few topics that this book doesn't and cover others at a slightly more advanced level, but it has really excellent intuitive introductions to many of our ideas so it's a great resource for getting started.

Course Websites and Technology

Our course will utilize several online platforms this semester:

- Our Canvas site will be your main resource, used for announcements, assignment management, and distribution of course materials.
- Ed Discussion will host our communication channels and some interactive assignments.
- Gradescope will be used to submit, grade, and return weekly homework assignments and exams.

In order to submit your homework, you will need access to a tablet, scanner (a smartphone app will suffice), or other method of generating a copy of your work in .pdf format.

Course Requirements and Grading

At any level, **we all learn math by doing math.** This course is carefully designed to help you engage with the material in increasingly challenging ways, with an increasing amount

of independence. In order to get the most out of the class, you will need to be a little bit brave- let yourself try hard things (failing is an important part of learning too!), and ask questions when you have them.

The first time you encounter new material will be in the **lessons and lesson quizzes**. Here you will learn new ideas, identify any initial questions you should ask, and have a chance to try some first exercises to help you cement your new understanding and identify any sticking points.

Your **homework** will be the second time you tackle new ideas- this time without immediate assistance. Homework may be challenging, but this is your first opportunity to push yourself. We don't expect you to do it perfectly every time—you are still learning! I encourage you to think of homework as practice for exams: write every solution well as if it was worth a lot of your grade, and take the opportunity to get feedback on your best work before it costs valuable points. And remember—what you practice is what you'll automatically do on the exams!

Your **midterm and final exams** are the culmination of the hard work and good practice you've put in on the lessons and homework. The exams are weighted so that strong midterms can take pressure off of the final, but an excellent final can make up for midterms that cover material you needed a little longer to master.

Your overall grade will be calculated as follows, with details below:

- Lesson Quizzes: 5%
- Homework Assignments: 14%
- Unit Projects (3 x 2%): 6%
- Midterm Exams (3 x 15%): 45%
- Final Exam (2 parts, 15% each): 30%

Description of Graded Components

- **Lesson Quizzes:** After each lesson you read/watch, there will be a short quiz to help you check that you have internalized the basics of the new ideas you just learned before moving on. **You will be allowed to move on after attempting each quiz, but to earn full points you will need to re-attempt the quiz until you get all questions correct.**
    - For this portion of your grade, earning 85% of the points available will count as full credit (tallied at the end of the semester). For example, if there are 200 points available across all lesson quizzes, then you only need 170 points to earn full 100% credit.

- You may earn up to 5% extra credit on this portion of your grade by earning at least 90% of the available points. For example, if there are 200 points available across all lesson quizzes, earning 180 points or more will result in a grade of 105% for this section.
- All lesson quizzes for the term must be completed by the end of the instructional period, i.e., no later than 11:59pm on Tuesday, 12/8.

- **Homework Assignments:** The best way to master new skills is lots of practice. Each week, you'll submit your solutions to a collection of a few focused problems, to receive graded feedback on your work. Throughout this process, you will be graded on both correct mathematics and your presentation and explanation of your solution.
  - Weekly homework will be submitted through Gradescope (available through Canvas), and will be due regularly each Tuesday.
  - All homework must be submitted as a single PDF, and should be clearly legible with the work for each problem correctly designated in Gradescope. You are encouraged to typeset your homework using LaTeX or similar software, but not required to.
  - Late work will be accepted up to 3 days late (i.e., until 10:00pm on Friday for an assignment due 10:00pm on Tuesday) with a 10% penalty per day, assessed every 24 hours. You do not need permission to utilize this flexibility. Due to institutional deadlines, no late work for Homework 11 will be accepted.
  - You are welcome (and encouraged) to collaborate with your classmates on solving homework problems, and to bring your questions to office hours or meet me before/after class for quick questions. However, remember that the point of doing homework is to develop your individual understanding of the material- thus all solutions submitted for grading should consist entirely of your own original work. You should refrain from obtaining answers from the internet, past semesters, generative AI, or any other source.
  - Between the 11 homework assignments worth 20 points each, plus Homework 0, you will have 223 points available throughout the semester. Because you are expected to make mistakes as you try things for the first time, your grade will be calculated out of 200 points (with a

maximum grade of 210/200). Due to the flexibility built into the system, no homework extensions beyond the late deadline will be granted under any circumstances.

- **Unit Projects:** During each of the three units of the course, you will complete a unit project which will be due shortly after the corresponding exam window. These projects will assist you in preparing for your midterm exams, and will be turned in via Gradescope like your homework. More details and grading rubrics for these assignments will be published with each assignment. Late policies for projects are identical to those of the homework assignments.
- **Exams:** We will have three midterm exams and a final this semester, on the dates listed in Canvas. Each 50-minute exam will be a combination of multiple choice and free response questions, worth 15% of your grade. You can find more details about exams on the Exam Information page in Canvas.

The instructional team will attempt to return all graded work to you within one week of the due date.

Grading Scale

Your final letter grade will be assigned according to the following standard intervals:

**A**: [90%, 100%], **B**: [80%, 90%), **C**: [70%, 80%), **D**: [60%, 70%), **F**: [0%, 60%).

Percentage grades are **not necessarily** rounded to the nearest integer before conversion to letter grades. For example, 89.999% is converted to a B, etc. Assignment of letter grades will be made to all students uniformly based on course grade totals. **Individual "grade increases" will not be considered; please do not submit such requests.**

Course Expectations and Guidelines

**Regrading of Work**

If any of your work has been graded in error, you may submit a regrade request in Gradescope within 3 days of the date the assignment was returned. You are also responsible to report any missing grades within this window.

You should check your answers with the posted solutions before submitting a regrade request. In any request, please include specific detail explaining which rubric items have

been misapplied in grading your work. Regraded work may be adjusted to add or subtract points in order to correct any error.

**Student Use of Artificial Intelligence**

We understand that generative AI is becoming a part of modern life, and has its uses- but like anything, it is just a tool. Responsible and ethical use of this tool in this course includes things like asking for a summary, alternative explanation, or additional source of material on a particular course topic you're struggling with, or for additional practice problems of a specific type.

**You should not, however, ever submit your actual problems to be graded to an AI or any other source to ask for a solution. Such an action constitutes academic dishonesty, and is a shortcut that will be detrimental to your learning in the long term.**

**Academic Integrity**

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. All students enrolled at Georgia Tech, and all its campuses, are to perform their academic work according to standards set by faculty members, departments, schools and colleges of the university; and cheating and plagiarism constitute fraudulent misrepresentation for which no credit can be given and for which appropriate sanctions are warranted and will be applied. For information on Georgia Tech's Academic Honor Code, please visit the GT Code of Conduct Webpage.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

All work for this class is to be done individually. You are strongly urged to familiarize yourself with the GT Student Honor Code (Links to an external site.) rules. Specifically, the following is not allowed:

- Copying, with or without modification, someone else's work when this work is not meant to be publicly accessible *(e.g., a classmate's program or solution)*.
- Submission of material that is wholly or substantially identical to that created or published by another person or persons, without adequate credit notations indicating authorship *(plagiarism)*.

You are encouraged to discuss problems and papers with others as long as this does not involve the copying of code or solutions. Any public material that you use *(open-source software, help from a text, or substantial help from a friend, etc…)* should be acknowledged explicitly in anything you submit to us. If you have any doubts about whether something is legal or not please do check with the class Instructor beforehand.

**Accommodations for Students with Disabilities**

If you are a student with learning needs that require special accommodation, I encourage you to contact the GT Office of Disability Services to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also reach out to the distance math facilitator at your high school, and e-mail me as soon as possible in order to set up a time to discuss your learning needs. I hope this course is already accessible to you, but please do let me know if there is anything I can do to make it more usable!

**Student-Faculty Expectations Agreement**

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See the GT Student Faculty Expectations for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.