

## MCS 150, Discrete Mathematics

Spring 2021, 12:30–1:20 MTuThF

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**Website:** <https://homepages.gac.edu/~ituba/mcs150-1s21>. I will also use Moodle to post grades, recorded online classes, any online quizzes/exams, and perhaps a few other things.

**Office hours:** See class website.

**Textbook:** Harris Kwong. A Spiral Workbook for Discrete Mathematics. This is a free textbook and is available on the class website. If you really want a hard copy, you can either print one yourself or order one online (e.g. on Amazon) for about \$30.

**Course objective:** This is an introductory discrete math course. Discrete math is a broad area of math which comprises elements of algebra, number theory, and combinatorics, among other things. It is preoccupied with structures that are not continuous. It may be easier to understand what this means by contrasting it with calculus—which is part of the broader area of analysis. Calculus studies functions of the real numbers by looking at small changes in the inputs and the outputs of those functions. One thing we will study in discrete math is integer numbers and when one such number is divisible by another. If you think about where the integers are on the real line, you will notice that there are gaps among them. It is not possible to talk about continuous change from one integer to another. Hence the name discrete.

We will learn about divisibility, the Euclidean algorithm for finding the greatest common divisor of two integers, some enumerative combinatorics, modular arithmetic, recurrence relations, mathematical induction, the binomial theorem, and perhaps a few other related topics.

The primary purpose of this course is to transition you to think about math the way mathematicians do: as a logically rigorous system of definitions, axioms, theorems and their proofs. Our focus will be constructing precise arguments. An important objective of the course is for you to be able to construct such arguments yourself. We will solve some computational problems too to illustrate how our theorems work, but the focus will always be to understand how and justify why the basic principles and techniques that allow us to carry out the computations work. You will build and sharpen your proof writing skills, which are essential in upper division math courses.

**Mode of instruction and class attendance:** This course may be delivered as a hybrid course or fully online depending on how the coronavirus situation develops. If taught as a hybrid a course, some of the class meetings will be in person, while others will be online. Your attendance is expected in both in-person and synchronous online classes unless you have an exception approved by the college. If you skip classes you will miss the chance to learn skills that will be tested on the exams.

**On work outside class:** Have you ever wondered why taking three classes (12 units) qualifies you as a full time student? That's only 10 hours per week in class. The reason is that you are expected to do a lot of work on your own outside class. In fact, the rule of thumb of college education is that for every hour you spend in class, you should expect to spend three hours studying outside class. That is how 12 units makes full time: 10 hours in class and 30 hours studying outside class each week. That means you'll need to spend about 10 hours a week studying outside the classroom for this course. That is if you are well-prepared for the course. If your math background is lacking, then you'll have to spend more time. I am not kidding.

**Homework and reading** will be posted on the class website regularly. You will be able to follow

the progress of the course using the website. HW is an essential part of your learning, and you should take it very seriously. It is extremely important that you keep up with the HW. If you do not, you will quickly find yourself lost in class and at a great disadvantage during exams. Treat the HW as a learning opportunity, rather than something you need to get out of the way. Reread, revise, and polish your solutions until they are correct, concise, efficient, and elegant. This will really deepen your understanding of the material. You won't do well in a math class without doing all of the HW. Attending class and reading your textbook are necessary but not sufficient conditions for passing the course.

Two kinds of homework will be assigned. Some of your homework will be computer graded, using Webwork, which you can access via a link from the class website. You will get instant feedback. You will typically have several attempts to solve a problem. Use them judiciously. Check your work and try to make sure your solution is correct before submitting it. If you are careless, you will quickly run out of attempts. The winning strategy is to start working on your homework early, so if Webwork keeps rejecting your solutions, you have time to find the mistakes, and possibly to seek help. Your score on Webwork will be part of your grade in the class.

The other kind of homework will be mostly from the textbook. Your work on these exercises will be tested on quizzes and exams. Every quiz and half of every exam will consist of exercises straight from this kind of homework. I strongly suggest that you write up and turn in your homework by the due date. I will correct your work but will not assign a score to it. This is so you treat the homework as a learning opportunity rather than a means of evaluation. Once you get your corrected HW back, the exercises can show up on quizzes/exams.

There is an obvious winning strategy. Do the HW, turn it in on time, learn from the feedback you get, revise it, and keep your HW notes neat and organized. If you'd like, you can correct your mistakes and turn in your corrected work again for me to check. You can do this as many times as you would like. The familiarity you gain with the exercises by doing your homework and learning from your mistakes is what you need to do well on the quizzes. It will also let you complete half of each exam quickly and move onto the other half of the exam. The experience you get from keeping up with your homework will be invaluable in doing that other half of the exam. On the other hand, if you do not keep up with your HW, you will face many unfamiliar problems under time pressure on quizzes and exams. This is very difficult and your grade will likely reflect it. Clearly, if you don't turn in homework, I can't give you feedback on your work, no matter how much I want.

**Collaboration on the HW:** Limited collaboration on the homework with your fellow students in the class is OK. But see the section on Academic Integrity! The idea is to let you discuss and critique each other's ideas and not to let you split the workload. Keep collaboration constructive and reasonable. You should fully understand the solution and write it up on your own. Your understanding of the material will be tested on the quizzes and exams.

If you are approached by another student from the class who wants to copy your HW, think twice before generously sharing. You will feel bad if your crafty buddy outscores you on an exam by exploiting your and everybody else's collective wisdom without doing work of his/her own. Be especially careful not to give a fellow student a chance to use your work to cheat on a quiz or exam.

**Discussion sections:** I strongly encourage you to organize a weekly session to work with (not copy from!) your fellow students on problems in class and on the homework. This will help you keep up with your work and get ideas and feedback from others who are grappling with the same exercises as you. You may find that the sense of companionship motivates you to work.

**Quizzes:** We will have a quiz on average every one and a half to two weeks. It will be straight from the homework. It is your responsibility to attend class, so if you miss a quiz because you are not in class, you will usually not be allowed to make it up. But your lowest quiz score will

be dropped. If you miss more than one quiz, the missed quiz will count as a score of 0. If you miss more than one quiz and you have a compelling and documented excuse, let me know, and be prepared to show documentation for your excuse. Skipping class is not a compelling excuse.

**Midterm exams:** There will be two in-class exams on Mar 12 and Apr 9. If you skip an exam, you will normally not be able to make it up, unless you have a compelling (e.g. medical) and documented excuse. Forgetting that there is an exam or being unprepared for it are not considered compelling excuses. Your in-class exam score will be computed as  $\frac{2}{3}(\text{higher score}) + \frac{1}{3}(\text{lower score})$ .

**Final exam:** 1-3 PM on Tue, May 11 in BH 111. The final exam is an important part of your obligations at Gustavus. Do not make travel/vacation plans that prevent you from taking the final exam at this time. If you have more than two final exams scheduled for the same day, let me know well in advance.

**Grading scheme:**

Online homework	15%
Quizzes	20%
In-class exams	35%
Final exam	30%

A score of 80% or more will guarantee an A- or better, 60% a B- or better, 40% a C- or better, and 20% a D- or better.

**On independent work:** Problem solving skills are developed by solving problems, not by watching other people solve problems. Expecting to learn math without doing exercises on your own is like expecting to learn to ride a bicycle without ever sitting on a bicycle. Attending class and reading the textbook won't be enough to do well on the exams. You should work through every example and argument in the book and in your class notes and expect to have to re-read everything several times. It's slow, but then your reading list for this class is short.

**On academic integrity:** You must uphold the college's Honor Code ([https://gustavus.edu/general\\_catalog/current/acainfo](https://gustavus.edu/general_catalog/current/acainfo)) on every quiz and exam. Simply put, the Honor Code obligates you not to cheat, even when nobody is watching, and to report to the college every instance of academic dishonesty that you know of. Using unauthorized aids—including help from another person—on quizzes and exams constitutes cheating. Representing someone else's work as your own—even if you make minor changes to it, or reword it—is plagiarism. Cheating and plagiarism are violations of academic integrity and university policy. They are unfair to fellow students, who are doing honest work. If you get caught, the report becomes part of your academic record at Gustavus. The consequences range from receiving no credit for the work you cheated on to expulsion from the College depending on the severity of the violation and how many past violations you have committed. It's not worth it. Don't do it. If you are in doubt whether what you are doing is legitimate, it is better to ask me.

**Quality of work:** It is important that you work neatly on the assignments. The quality of your work will affect your grades on the exams. Quality has to do with how easy it is for someone else to read your solution to a problem. It is not enough to do the math right, you must also communicate it well.

**Students with disabilities:** Gustavus Adolphus College is committed to ensuring the full participation of all students in its programs. If you have a documented disability, or you think you may have a disability of any nature (e.g., mental health, attentional, learning, chronic health, sensory, or physical) and, as a result, need reasonable academic accommodation to participate in class, take tests or benefit from the College's services, then you should speak with the Accessibility Resources staff, for a confidential discussion of your needs and appropriate plans. Course requirements can-

not be waived, but reasonable accommodations may be provided based on disability documentation and course outcomes. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact Corrie Odland ([codland@gustavus.edu](mailto:codland@gustavus.edu), x7138) or Cinde Wiebusch ([cwiebusc@gustavus.edu](mailto:cwiebusc@gustavus.edu), x7228) at the Academic Support Center as early as possible. More information about accessibility resources is available at <https://gustavus.edu/asc/accessibility>.

If you need special arrangements, let me know well in advance so we can plan to accommodate your needs.