**Math 279: Discrete Mathematics** Sections 1 and 2

S1: 12:00-1:00, S2: 1:10-2:10 MWF ∘ OLRI 243 ∘ Fall 2017 ∘ 4 credits

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## Logistics

*Instructor:* Dr. Kristin Heysse

- Office: OLRI 121
- Office Hours: Mon. and Thur. 2-4, Wed. 9:30-11 or by appointment/discovery
- Email: kheysse@macalester.edu

*Preceptors:*

- Logan Stapleton (lstaplet@macalester.edu)
- Nam Phung (nphung@macalester.edu)

See the Moodle page for preceptor office hour times.

*Disclaimer:* This syllabus is subject to reasonable change, provided I give you timely notice of such changes and they make sense for the class.

*Schedule:* a tentative course schedule is posted on Moodle. It will be updated as the semester goes on to reflect what we have done along with work to complete outside of class.

*Texts: Discrete Mathematics* by Chartrand and Zhang (required), *Discrete Mathematics: An Open Introduction* by Levin (optional, available for free online)

## Overview and Goals

***What is discrete mathematics?*** Discrete mathematics is the name given to a whole branch of math, independent from calculus, which studies individual, separate objects. Contrast this with calculus, where we consider continuous functions and their properties. We particularly care about counting, finding patterns in, and describing relationships between objects. While this sounds a little vague, discrete math is wildly applicable in the real world. Whether you work with complicated social networks, create efficient algorithms, or design experiments, you'll need discrete math! You'll immediately notice that this class is a little different than other math classes you've taken before. While calculus classes have you solving problems by performing calculations, we'll be working on generalizing our ideas and seeing connections between concepts. I love to think of discrete math as *puzzle math*, and a little creative thinking will go a long way in this class!

***What is a mathematical proof?*** The above description is only half the battle, however. We cannot only make claims, find patterns, and count objects. We need to convey **why** our ideas are correct beyond a shadow of a doubt. A mathematical proof does just this. A proof is a collection of **sentences** and calculations which fully describe your thought process, leaving no small detail out. A peer should be able to pick up your proof and understand your thinking without (much) effort. This is a skill, and developing it will take lots of practice. It's one of the main objectives of the course.

***What are the objectives for this course?*** By the completion of the course, you should be able to

- Construct mathematical arguments that explain results using paragraphs, symbols, and equations.
- Perform combinatorial analysis to solve counting problems.
- Use discrete structures to model and explain applied problems.
- Independently consider mathematical ideas with a "try something" mentality.
- Work productively in a group setting.

## Means of Assessment

***Weights and grades:*** Your learning will be evaluated in the following ways

| | |
|---|---|
| Exams (3) | 30% |
| Final Exam | 20% |
| Daily Questions | 20% |
| Homework Sets | 20% |
| Participation | 10% |

and the grading scale for the course is below.

| Grade | NC | D- | D | D+ | C- | C | C+ | B- | B | B+ | A- | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentage | 0 | 60 | 63 | 67 | 70 | 73 | 77 | 80 | 83 | 87 | 90 | 95 |

Midterm grades will be calculated with the first exam (40%), homework (25%), daily questions (25%), and participation (10%).

***Exams:*** There will be three in class exams. Each exam will consist of two parts: an in class part and a take home part. Take home parts will be given/posted at the beginning of the in class exam and due at the beginning of class the subsequent Wednesday. There will be no homework during exam weeks. If you have a conflict with an exam, let me know as soon as possible. The exam dates are set below with their tentative content. I will inform you with plenty of time if this changes to reflect the pace of the course.

- Exam 1: September 29 (sets, formal logic, methods of proof, functions)
- Exam 2: November 3 (induction, counting, permutations/combinations, and basic probability)
- Exam 3: December 1 (graphs, trees, and their associated concepts)
- Final: December 18, 4–6 pm (beginning algorithms, selectively cumulative)

The final exam is common between the two sections of 279, and as such the location is yet to be determined. I will post it on Moodle as soon as it is set.

Unlike homework, you *cannot* work together on exams. Any collaboration is considered to be academic dishonesty and will be handled as such.

*Goal:* exams are a way of evaluating how well you know the material (obviously). I specifically make my exams two parts because I feel that some mathematics is important to know off the top of your head, but some takes time to think about and revise. A two part exam allows for this.

***Homework:*** Homework sets will consist of approximately 5 questions and will be due every Friday by 4 pm (except during exam weeks). You can either hand it in during class or put it in my mailbox sometime during the afternoon. I will not be taking late homework except for in special circumstances.

Think of homework submission as a practice for how you would hand a report to a future employer. It should be something you are proud to have your name on. At the minimum, it should be well organized, legible, and clear. I reserve the right to take points if these standards are not met. In addition to this, your proofs must be written in complete sentences and have no mathematical gaps. Having the "gist" or "right idea" will not earn you full points on a question. Just as you would revise a paper, you should write down your first ideas on scratch paper and then formalize them for submission.

I *absolutely* encourage working together! It's how most mathematics is done in real life. Ask each other questions, debate about proof wording, and push each other to be better! That being said, I do require each student to write up the homework independently. My biggest tip for you is START EARLY. If I give you a week, it will probably take you a week (on and off) to finish!

*Goal:* the goal of homework is to give you a set of problems which require you to apply the material we've been working on, tie many concepts together in a single problem, and practice your mathematical writing. It's also the main way you will get feedback on your proof writing.

***Daily questions:*** After each class, I will assign one or two daily questions. Solutions to these questions will be due at the beginning of the next class period. The same standards for homework submission apply. You can always check solutions to daily questions with me during office hours. I will drop the three lowest daily homework scores, but as such *I will not take late daily homework (as of 9/25/17).* It's too hard to keep track if everyone is handing in daily homework whenever.

In addition, at two points in the semester, you will need to present your written work to the class. Presentation is completely voluntary, and you will not be forced to present if you are not prepared to do so. Each day at the beginning of class, I will call for volunteers and pick randomly from those students. We may have a few students present on one question if their methods are different. When you present, explain your solution and tell us: 1) how you thought about the problem, 2) what sort of scratch work did you do, 3) how you formalized your ideas. Also feel free to mention if you found something particularly helpful or if you struggled with some part. Basically, just tell us how you came to this solution in your own words!

*Goal:* The daily questions are meant to make sure you are keeping pace with the class and serve as a check for your own learning that day. It is also intended to help you understand how other students think about problems and how to communicate your mathematical thinking effectively.

***Participation:*** Pretty self explanatory. This part of your grade will depend on attendance, in-class engagement, and group work (periodically during the semester). Your presentations for our daily question will also be grouped into this category.

*Goal:* As probably goes without saying, the best way to learn math is to do math. If you talk to any mathematician (and really, anyone in the real world), they'll tell you that rarely is work done in isolation. This is particularly true in math. It's very helpful to have people to check your work with, bounce ideas around with, and practice your explanations on. One of our learning objectives is working productively in a group setting, and this grading category reflects that.

## Policies

***LaTeX***: LaTeX is an open source typesetting software which is great for writing up mathematics (and all scientific work). It's the premiere choice for all mathematical journals and textbooks. If you plan to work in math, it's best to start learning LaTeX as soon as you can. As such, we'll do the following for our class: 1) every LaTeX-ed daily question you turn in will earn 1 extra credit point on that question and 2) every LaTeX-ed homework set you turn in will earn you 5 extra credit points on that assignment. **This offer is only good until October 25**, they day before Fall Break. After this, you will be **required** to LaTeX your homework sets. There will be no such requirement for the daily questions.

On the Moodle page, you'll find a LaTeX primer and homework template (that you can

also use for daily questions). There are lots of resources for getting help with LaTeX, but the one I use is the LaTeX wikibook (en.wikibooks.org/wiki/LaTeX). It's very comprehensive and has lots of examples of code. The learning curve is a little steep with LaTeX, but it's worth the investment!

***Documented disabilities:*** I am committed to providing assistance to help you be successful in this course. Accommodations are available for students with documented disabilities. Contact Allie Quinn, (aquinn2@mac) to make an appointment. Students are encouraged to address any learning needs or accommodations with me as soon as possible. Additional information regarding the accommodations process for students with disabilities can be found at: macalester.edu/studentaffairs/disabilityservices/

***Academic integrity:*** First and foremost, if you feel the need engage in academic dishonesty in this class, *please come see me!* We will work together to get you back on track and sort out what you do not understand.

For our class, academic dishonesty is defined as using any inappropriate resource in the completion of for credit work. This includes, but is not limited to, talking to other students in regards to take home exams and using online resources (googling the question, using solution repositories like Math Stack Exchange, etc). If you have questions regarding the legitimacy of a resource, certainly feel free to ask. If you find yourself taking sections of a proof from any resource or copying a solution, you've probably found an inappropriate resource. Any sort of academic dishonesty in this class will result in a zero on that particular work and will be reported to the Director of Academic Programs.

***Expectations:*** As we are in this course together, we can set down some reasonable expectations for each other. You can expect me:

- to encourage questions in class and in office hours as time permits
- to respect the time constraints of our lecture
- to have reasonable expectations for outside of class work
- to be organized in grading and class management
- to respond to emails in a timely fashion (within 24 hours on a weekday, 48 on a weekend)

I can expect you:

- to be engaged in class by staying off electronic devices unless we are using them in class
- to seek help in class and in office hours when necessary
- to be respectful of other students and their learning processes

- to complete all work to the best of your ability
- to be a contributing group member during in class group work