Discrete Mathematics

Math 381 Section 004
Fall 2020

Instructor: Gracie Conte
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Email: gconte23@unc.edu
Office Hours: By appointment
Course Meeting Time: MWF 2:40pm - 3:30pm
Zoom Link: https://unc.zoom.us/j/95369763660?pwd=Y04xY3M1ZjJoSzQ3MUdqN0wvZlN4UT09
Meeting ID: 953 6976 3660

Course Information

Prerequisites: You must have earned a passing grade in MATH 232 (or an equivalent).

Text: The official text is: *Discrete Mathematics and its Applications*, eighth edition, by Kenneth H. Rosen. However, I find it cumbersome to read, especially early on. So we will mostly use *A Transition to Advanced Mathematics*, seventh edition, by Smith, Eggen and Andre. PDFs of both of these books will be posted on Sakai. If you want a hard copy, feel free to read a little of both before making that financial commitment.

Sakai: All handouts, solutions and other class material will be posted on Sakai which can be accessed by going to: https://sakai.unc.edu/portal

Gradescope: Exams, homework and worksheets will be submitted here. For each assignment, you will be able to submit a PDF of your (neatly) written work to each question. Your graded work and our comments will also be returned here.

Course Content: This course serves as a transition from computational to more theoretical mathematics. As such, the emphasis is on teaching you how to communicate logical truths in the form of proofs. After completing this course you should be comfortable with reading or writing a simple proof and become familiar with the various proof techniques, and begin to develop your own proof style. We approach proof writing by focusing on finite or discrete structures in mathematics. This will take us briefly through formal logic, then onward into set theory, relations, and functions, the principle of induction, permutations and combinations, graph theory, and some number theory. These objects of study are basic enough to create an accessible playground for us to learn proof writing, but they also provide the background necessary to understand more theoretical topics such as Combinatorics, Groups, Algebras, Graphs, Algorithms, and Statistics.

In many ways, this will be the first "abstract" math course in your academic career. Although we will explore specific, concrete examples whenever possible, this course requires you to hone your ability to analyze and articulate the logical essence of the problems being studied. In other words, you will be expected to learn how to communicate coherently and persuasively using the language and the grammar of mathematics. Group collaboration and teamwork must be developed as well, as the best way to learn communicating abstract mathematics is to communicate with each other clearly, efficiently, and candidly. Take this course as a time to develop your team-building, leadership, and communication skills as well.

Course Structure

This is an online course, but the material of 381 is not well-suited to this format, in my opinion. I do not assume that every student will be able to read the book and gain a full understanding of the material. The course format will be crafted to meet the needs of all students, and will require your dedication to the reading schedule, group work during lecture time, and promptly doing the homework.

Lectures: Every week I will post three short lecture videos that complement the reading for the week. I will post them on Sakai under the Warpwire tab most likely on Saturday. It is **your responsibility** to make sure you are on track, watching the videos and doing your readings by the prescribed days (see the schedule on the last page). I suggest reading your chapter, watching my video, then rereading the chapter. I don't expect you to fully grasp the material on your first reading, but I do think it will mentally prepare you to watch the lecture so you can glean as much as possible. At this point, rereading the section will hopefully allow you to understand most (maybe all) the material and pick up on things that were fuzzy before or you didn't notice.

Small Group: Videos cannot replace human interaction so we will meet in small groups **every** MWF on Zoom. Small group will occur at 2:40pm-3:30pm during what would be normal lecture time.
When we meet I expect you to:

1. have watched the day's lecture
2. have read the day's sections
3. written down any questions or confusions you would like me to go over
4. be ready to complete the day's worksheet which will be based on section material you've read and watched

During this time, you may ask questions about the day's material. After questions, there will be a worksheet corresponding to the material. These worksheets should help solidify your understanding. I will break you into small groups and expect you to talk amongst yourselves to do the worksheet. You won't be sitting next to each other but you aren't alone; take advantage of the platform I am providing to make some math friends. :)

Tips: You are strongly encouraged to ask questions throughout this course - in small group, in office hours and to each other. The more you are engaged in the material, the more beneficial this class will be. Group study is highly recommended. Throughout the term, you should be reading along in the textbook, reviewing your notes, and working problems beyond what are assigned in the homework to better grasp of the material and to be better prepared for both lectures and the exams. You should attempt homework problem or two before Small Group. It reveals weak spots you might not know you have.

Expectations

Attendance: Attending class is necessary (but not sufficient) to succeed in this class. We will begin class promptly to use our time as effectively as possible, thus you should be on time and prepared to start class. Leaving class early tells me that you did not want to be in class that day, and will be counted as an absence. If you finish the worksheet early, start in on the homework with your classmates. You are only allowed two unexcused absences.

Honor Code Statement: Each student is expected to abide by the Honor Code and the Student Code of Conduct. http://honor.unc.edu

In this class, all exams must be done **individually**. It is an instance of cheating to give or receive help on an exam, except from the instructor. On homework assignments, students are encouraged to work together in pairs or small groups, provided that all participants are contributing and the collaboration benefits the learning of all involved. Simply copying or trading answers is an instance of cheating.

Assignments and Grading

Homework: You will be given homework exercises to turn in roughly once a week. You may consult with other students, tutors, or myself on any homework problem, but the work you turn in must be your own. My advice is that you attempt every problem on your own first, then compare answers or seek help if needed. Homework will account for 15% of your course grade. No late work will be accepted. The two lowest HW scores will be dropped from the final average.

Perfect Proofs: You will submit three "perfect proofs" to me over the course of the semester. These are designed to be interesting and/or challenging problems related to the course material. Your first submission of a solution, if not perfect, can and must be resubmitted with edits; this process will repeat until the solution is correct and perfectly written. If you fail to submit a final, correct version, you will receive maximum half-credit on the problem. All perfect proof submissions must be typeset and submitted electronically (via Sakai). Perfect proofs will account for 6% of your course grade.

Worksheets: This class is all about communicating mathematically so you will have worksheets to complete every MWF. They are designed to ensure you have understood the basics, prompt you to think more thoroughly about the material and make you *communicate* with your classmates. These worksheets are also how I will take attendance. I will close the worksheet at on Gradescope at 4pm to make sure you have had enough time to finish, scan and upload. Submit ASAP so you don't forget! The two lowest worksheet scores will be dropped.

Exams: There will be two in class exams, lasting the entire class period.

- Exam 1: September 11th
- Exam 2: October 9th

Each exam will focus on material after the previous exam and up to the exam date; however, *knowledge is cumulative*, hence topics previously learned will undoubtedly arise in later exams. Exams are open book and open note. Your exam will be released at 2:40PM on test day via Gradescope. You will need to have Gradescope open and ready beforehand, along with writing implements and plenty of plain white paper to put your answers on. You will upload your work to Gradescope no later than 3:50PM the day of the exam. The extra 20 minutes allows you time to scan/photograph and upload your work to Gradescope, but also to maybe clean up your writing so that it is very legible. You will not need a blue book or scantron.

The **comprehensive Final Exam** will have a nontraditional format. I will meet with each of you individually and ask you to prove three questions of my choosing of varying difficulties. I like this format because this class is about communicating mathematically and it lets me ask questions about your proofs. I believe this will be a more fair assessment of your understanding of material. Obviously this won't fit on exam day so the last 5 days of class will be devoted to the final. Around late September I will post a long list of problems that I will draw from for the final exam. I highly recommend you to complete as many questions as possible so you have work to draw from on your exam day.

Late Work: *No late work will be accepted.* Exceptions will be made only in extreme circumstances with intervention from the Dean of Students' office.

Grade Calculation:

Homework	15%
Perfect Proof	6%
Worksheets	9%
Exam 1	20%
Exam 2	20%
Final Exam	30%

There are no extra credit opportunities

Course Grade:

92-100	A	77-79	C+
90-92	A-	73-76	C
87-89	B+	70-72	C-
83-87	B	67-69	D+
80-82	B-	60-66	D
		0-59	F

There are no grades of D- or A+.

Resources

Office Hours: You are strongly encouraged to come to office hours. This is the best way to get one-on-one help with any concepts or exercises, as well as to get more in-depth knowledge of the material.

Classmates: I strongly encourage you to collaborate with your classmates on your homework. Study groups are what got me through college, so I highly suggest you do the same.

Math Help Center: (http://math.unc.edu/undergraduate/math-help-center/).
The Math Department sponsors free tutoring in the Math Help Center in 273 Phillips Hall. Please see the website for hours of operation. Any changes will be posted at
http://math.unc.edu/for-undergrads/help-center and on the door of the room.

Paid Tutors: The Math Department keeps a list of paid tutors in the main office in Phillips 329 and on the Math Department website.

Additional Resources and Support:

- LGBTQ Center: https://lgbtq.unc.edu/
- Accessibility Resources Services: https://ars.unc.edu/
- Learning Center: https://learningcenter.unc.edu/
- Counseling Center: https://caps.unc.edu/
- Help Lines: http://activeminds.web.unc.edu/companions-to-caps/

Disclaimer: The instructor reserves the right to make changes to the syllabus, including due dates and test dates. Changes to MyLabMath due dates can be found on the MyLabMath site. Other changes will be announced in class or via Sakai.

Tentative Schedule

	Week	Date	Rosen	S.E.A	Topic
LOGIC AND PROOF METHODS	1	8/10		1.1	Propositional Logic and Equivalences
		8/12		1.2	Conditionals and Biconditionals
		8/14		1.3	Quantifiers & Predicates
	2	8/17		1.2	Rules of Inference
		8/19		1.4	Proofs: Direct Proofs
		8/21		1.4	Proofs: Proof by Cases
	3	8/24		1.5	Proofs: Proof by Contrapositive
		8/26		1.5	Proofs: Proof by Contradiction
		8/28			Review
	4	8/31		1.6	Proofs: Existence, Uniqueness
		9/02		2.4	Proofs: Induction
		9/04		2.4	Proofs: Strong Induction
	5	9/07			*No class: Labor Day*
		9/09			Review
		9/11			**Exam 1**
SET THEORY	6	9/14		2.1	Sets
		9/16		2.2	Set Operations
		9/18		3.1	Relations
	7	9/21		3.2, 3.3	Equivalence Relations, Partitions
		9/23		3.4	Ordering Relations
		9/25		4.1	Functions
	8	9/28		4.3, 4.4	One-to-one and Onto Functions, Inverses
		9/30		4.5	Images of Sets
		10/02		5.1, 5.2	Finite Sets, Infinite Sets
	9	10/05		5.3	Cardinality, Countable Sets
		10/07			Review
		10/09			**Exam 2**
COMBINATORICS & NUMBER THEORY	10	10/12	6.1		Principles of Counting
		10/14	6.2		Pigeonhole Principle
		10/16	6.3.2		Permutations
	11	10/19	6.3.3		Combinations
		10/21	6.5		Generalized Permutations and Combinations
		10/23	4.1		Modular Arithmetic
	12	10/26	4.3.2-5		Primes
		10/28	4.3.6-8		GCD and LCM
		10/30	4.4		Solving Congruences
GRAPH THEORY	13	11/02		3.5	Graphs
		11/04			Review
		11/06			**Final Exam Day 1**
	14	**11/09**			**Final Exam Day 2**
		11/11			**Final Exam Day 3**
		11/13			**Final Exam Day 4**
	15	**11/16**			**Final Exam Day 5**