MATH 2710 – Section 004
Intro. to Advanced Mathematics
Fall 2022

Instructor:
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Meeting: Tu/Th 11:00pm-12:15 pm in MCHU 111

Office Hours: Tuesday 9:00-10:00 am in MONT 411
Wednesday 10:30-11:30 am online via WebEx
Friday 9:30-10:30 am in MONT 411
or by appointment (i.e., email me if you cannot make it at the above times)

Text: No required text. A PDF of course notes and problems is provided in HuskyCT.

Prerequisites: MATH 2110 and 2410, or MATH 2420 or MATH 2144. Not open for credit to students who have passed MATH 5046.

Goals & Expectations: Topics include logic, set theory, functions, elementary number theory, and a variety of proof methods including induction. As this course also serves as a bridge to upper-level proof-based math courses, it will be heavily focused on mathematical argumentation and language.

More specifically, by the end of the course you should be able to:

- Have a working knowledge of the mathematical language and notation of basic set theory, functions, and basic number theory
- Understand a mathematical definition by analyzing it and constructing examples and non-examples
- Determine if a given statement is true or false, including by example analysis
- Critically read mathematical arguments and understand them, including identifying and correcting errors in reasoning and recognizing sound logic
- Correctly apply a variety of proof techniques to produce a sound mathematical argument, and recognize when certain techniques may be more appropriate than others
- Communicate sound reasoning in mathematical language with proper English grammar
- Defend an argument to others both orally and in writing

Logic, reasoning, and proof are the cornerstones of mathematics. The material you will encounter in this class might feel quite different from what you are used to from calculus. This may throw you off at first, because you will be looking for numbers and won't find many! But, one way to thus see this course is as a fresh start, if you struggled in more computational math courses.

Face Coverings and Illness: To ensure a safe learning environment, masks/face coverings are recommended in classrooms, regardless of vaccination status. That includes covering both the mouth and nose, not just the mouth. Please join me in encouraging your peers and instructors to wear face coverings properly at all times in the classroom.

During the COVID-19 pandemic, it is especially important for you to stay home if you are feeling ill. Please contact me ASAP via email if you need to miss class due to illness or other personal reasons.

Participation and Climate: Each student in this class is vital to the success of the classroom community, which is why it is important that we all respect each other, carefully consider one another's ideas, and value each other's contributions. I am very serious about helping to create a classroom environment in which anyone feels free to ask questions, raise concerns, make mistakes, celebrate successes, and so on. You are expected to behave courteously and respectfully to your classmates and to me, but please do not stop yourself from asking a question because you fear it will sound stupid or obvious. We are all here to learn together, which means we will struggle often.

Grading Policy: Your graded work will be returned to you in a timely manner, usually within a week. If you believe there is a grading error, please work with me ASAP to resolve it. Each problem will be marked with:

- **S: success –** you've got the concept and I have no notes or only minor notes
- **R: please revise –** something important is still missing but you're on your way
- **N: not assessable -** you're missing the overall concept and should go back and maybe start fresh in your understanding of the concep**ts**

Homework: You will submit solutions each week to a few of the Problems (NOT Exercises) from the course notes. You may rewrite solutions as many times as you want to achieve an "S"; however, a maximum of six submitted problems per week (including rewrites) are allowed. You should submit problems as soon you complete them; you do not need to (and should not) wait to have all your problems for the week completed. Problems submitted after they have been presented can receive at most a grade of "R" (will be designated as R* if they were completed at an "S" level).

Presentations: You will present solutions to several homework problems throughout the semester. Some of these will be in class, while others will be posted in VoiceThread, via HuskyCT. You will be provided a rubric for these presentations, a sign-up sheet to volunteer to present problems in advance, and your group will support you during class to polish your solution before you present. If your presentation is not successful the first time, then you may try again during the following class.

When presenting, keep in mind that your audience is not me, your instructor. Your audience is your classmates, and so your presentations must be aimed toward your peers, to ensure that they understand and are convinced of any claims you are making. You are expected to present your work with both a visual and audio aspect; i.e., describing and explaining aloud the written work that is seen on camera or written on the board. Note: you must be present in class the period immediately after posting your presentation for discussion to receive an "S".

Class Time: Each day in class, we will spend time listening/responding to a few students' online and in-person presentations of their proposed solutions to homework problems. After resolving all questions and suggestions on that day's presentations, you will work in groups on problems and exercises as you prepare for the next set of presentations and/or to submit your homework problems.

Responses to Presentations: You are expected to be present for (in-person) and watch (online – before class) **all** of your classmate's presentations, and to actively participate in discussion about **many** of your your classmates' presentations both in-class and online. Please respond regularly to others' proposed solutions by asking clarifying questions and making constructive suggestions to improve the mathematical correctness, completeness, and communicative quality of the solutions. You will be provided a rubric for these responses.

Grading: At the end of the term, you're going to submit a Final Portfolio and Letter Grade Reflection, where you will tell me how you did and thus what grade you earned in the course, based on the following rubric we're going to create together.

You can use any work throughout the course (revised homework solutions, notes from presentations, other completed work) as evidence in this discussion. I will probably agree with you, because you know yourself, your work, and your understanding pretty well. If I don't, we'll talk about it.

Letter grade	Description of work and participation
A	Submit at least 10 problems at S (or R+) level, with thorough reflections, from 4 different chapters in the course notes in your Final Portfolio Present at S level at least 6 times, from at least 5 chapters in the course notes, with at least two in-class Respond substantively to at least 10 presentations in at least 8 different weeks of the semester, with at least a few in each format (IC and VT) Submit at least three new homework problems in each of at least ten weeks of the semester; at least 30 of these must eventually earn an "S" or "R+," with at least two "S" from each chapter of the course notes
B	Submit at least 8 problems at S (or R+) level, with thorough reflections, from 4 different chapters in the course notes in your Final Portfolio Present at S level at least 4 times, from at least 3 chapters in the course notes, with at least one in-class Respond substantively to at least 8 presentations in at least 6 different weeks of the semester, with at least a few in each format (IC and VT) Submit at least three new homework problems in each of at least ten weeks of the semester; at least 25 of these must eventually earn an "S" or "R+," with at least two "S" from each chapter of the course notes
C	Submit at least 6 problems at S (or R+) level, with thorough reflections, from 4 different chapters in the course notes in your Final Portfolio Present at S level at least twice (IC or VT)

	Respond substantively to at least a few presentations in each format (IC and VT) Submit at least three new homework problems in each of at least ten weeks of the semester; at least 20 of these must eventually earn an "S" or "R+," with at least one "S" from each chapter of the course notes
D	Submit at least 4 problems at S (or R+) level, with satisfactory reflections, from 4 different chapters in the course notes in your Final Portfolio Present at S level at least once (IC or VT) Respond substantively to at least a few presentations in each format (IC and VT) Submit at least three new homework problems in each of at least ten weeks of the semester; at least 15 of these must eventually earn an "S" or "R+"
F	Does not demonstrate understanding or participation at the level of any other letter grade

The distinctions of "+". within each letter grade will be based on "extra" achievements such as more presentations and/or homework problems. If you have achieved all but one level in a given category (and that level is still at the requirement for the grade level immediately below it), you will receive the "-" grade for that letter.

Notes:

1. Writing and rewriting are a key part of your learning and success in this class. I expect that many of your first attempts won't be perfect and will need revision, but that by addressing the comments I give you, you will learn.
2. Do not expect to be able to read the notes, and math in general, like a novel. It could take you an hour to parse one sentence – that is normal in math.
3. This course will require proactivity. It will be important to set your own deadlines, and frequently check your progress against the criteria outlined here to ensure that you are keeping up pace.
4. I understand we are in crazy times, and that crazy things can come up. I just ask that you keep me in the loop as to if this is what's going on in your life. Email me to check in if I won't see you or hear from you on a day we have class or in a week where you were supposed to present. I can be flexible given the circumstances, but if I don't know your situation I'll just be following the guidelines set out in this syllabus.

How to Succeed in this Course: According to the University, 3-credit course requires a *bare minimum* of 6 hours of work per week outside of class to pass. For a higher grade, you should consider nearly doubling this. Below are the kinds of things you'll need to do outside of class:

- Read through the notes and work through the exercises on your own in preparation for in-class discussions with your group
- Solve problems on your own to the extent you are able
- Compose final drafts of the problems you have already solved
- Revise problems previously submitted which have not yet earned an "S" or "R*"
- Prepare and post your presentations on VoiceThread, or prepare for your in-class presentations
- Watch and comment on classmates' presentations on VoiceThread

Diversity, Equity, and Inclusion: In learning, we must embrace diversity of race, gender, sexual orientation, ability, background, age, beliefs, ethnicity, and other visible and non-visible categories. As your instructor, I will do my best to foster a culture of equity and justice in this class and in the university as a whole. Discrimination will not be tolerated. By joining this classroom community you are committing to taking a growth mindset, which means we will work together to learn from each other and be more compassionate.

Academic Integrity: Please respect your and others' work and academic experience. You are expected to turn in and present work that reflects your own understanding of the topics. Therefore, your writing should not bear resemblance to that of any other student in the course or to any other sources used, and any ideas used for which any other party had a share in developing should be cited as such.

You may use any citation format – for example, a parenthetical at the end of your solution: "(I worked with Jaime from my group on #4)," or, "(I got the idea for my solution to #2 from 3Blue1Brown on YouTube: https://www.youtube.com/watch?v=P2LTAUO1TdA&t=2s&ab_channel=3Blue1Brown)."

Tentative Course Schedule

Week 1	Propositions and Truth Tables
Week 2	Conditional Statements
Week 3	Quantifiers
Week 4	Direct Proof and Proof by Contrapositive
Week 5	Proof by Contradiction, by Cases; Proving Equivalence
Week 6	Sets and Set Operations
Week 7	Proofs with Sets
Week 8	Relations and Partitions
Week 9	Functions; Proving Existence and Uniqueness
Week 10	Proofs with Functions, Inverses, and Composition
Week 11	Proof by Induction; Binomial Theorem
Week 12	Division and Modular Arithmetic
November 21-25	**Thanksgiving Recess – No Class**
Week 13	Proofs in Calculus
Week 14	Complex Numbers
Final Exam week	
Dec 12	**Final Portfolio Due**

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