MATH 2710

Class time and location: TTh 8:00– 9:15 am in MONT 225.

Instructor: Luke Rogers

Office Hours: TTh 9:15–10:30 am in MONT 339 or by appointment

Purpose:
This course exists to prepare you for proof-based courses in mathematics. Some of the mathematical content may be new to many of you, but it is not the focus of the course. The the main thing you are intended to learn is how to read, write, and understand mathematical proofs.

The focus on proof makes this course very different to many of the previous math courses you have taken, in that memorizing methods and identifying which method goes with which problem is not a very helpful strategy. Instead, problems will often feel more like exercises in translation from english to math, or in mathematical grammar: you will spend a lot of time figuring out how to arrange symbols and words to make unambiguous and correct mathematical arguments.

Text: *Book of Proof* by Hammack. Readings and some homework are assigned from the text, so you need access to it, but it is freely downloadable online.

Website:
A copy of this document, as well as other potentially useful information, including links for installing and using LaTeX, are available on the HuskyCT site for this course.

Expectations:
It is expected that you will attend all classes, complete all homework and do the exams. Many questions on exams will be similar or identical to homework questions or problems solved in class, so doing these will also be beneficial to you on exams. You are expected to read the book outside class. Reading to be completed before each class is listed in the Syllabus and Schedule.

Anything covered in class may appear on an exam, whether or not it is in the book. Anything in the sections of the book that are listed on the schedule may appear on an exam, whether or not it was discussed in class. It cannot be emphasized too much that mathematics is learned by doing, so the work you do outside class will be critical to your success in this course.

Grading:
Since this course plays a critical role in preparing you for proof-based material in later courses, I am required (by department policy) to give you a grade below C if, in my assessment, you are not ready to take those later courses. You need a C or better in this course to move on to those courses. This rule was put in place to protect students: before this rule was implemented, most students who passed this course with a low grade went on to fail one or more proof-based courses, making it hard for them to complete a math major.

Your grade will be based on homework (10%), two midterms and the final exam (30% each). Bonus points up to 10% will be available for constructive participation in class.

Homework grading: Only a few questions from each weekly homework will be graded for correctness, but this will be done in detail. There will also be time in class to discuss problems that you feel you did not understand. You are also strongly urged to attend office hours to discuss questions

from the homework. Exams may include at least one question requiring you to replicate a proof from the book; in this case a list of the proofs that might occur will be provided. At least 50% of the questions on all exams will be minor modifications of homework exercises. It follows that if you completely understand the proofs in the book and all the homework exercises then you can certainly pass the class.

Homework and Latex:
Homework will be assigned weekly and submitted on HuskyCT in PDF format only. A complete list of the planned homework exercises will be available early in the semester, but this may be modified during the semester if we progress more rapidly or more slowly through the text than anticipated.

Homework must be typed in LaTeX, which is a markup language (like html), or using a system that produces output that is indistinguishable to LaTeXoutput. You will either need a LaTeX compiler and editor or to use a cloud-based LaTeX system like overleaf. Some introductory material about how to obtain, install and use LaTeX is in a separate file on the HuskyCT course site. We will also discuss this in class. Many of you probably took 2705 and learned it already.

Getting Help:
The main ways to get help with course material are to ask questions in class and to come to my office hours. If you have any doubt about your work you should get help early and often. Do not leave this until the first midterm!

Academic misconduct and plagiarism:
The UConn student code and its section on academic misconduct should be well-known to you. Plagiarized work will not be tolerated in this class. If you hand in work that I discover has been copied from somewhere (a friend, the internet, wherever) you will lose 10% of your course grade. If you do so a second time, you will lose an additional 30% of your course grade. A third offense will get an automatic F grade.

Other policies and resources

- Policy Against Discrimination, Harassment and Related Interpersonal Violence
- The UConn student code
- Division of Student Affairs: student resource list
- Office of Institutional Equity
- Title IX office: Sexual Assault, Intimate Partner Violence and Stalking Awareness
- Office of the Dean of Students (including final exam rescheduling)
- UConn Mental Health Services
- Center for Students with Disabilities

Topics to be covered:

- Mathematical Logic: statements, truth tables, conjunctions, conditionals and biconditionals, quantifiers, compound statements, negation of statements.
- Set Theory: the notion of a set, operations on sets, determining set equality, Cartesian products, power sets, indexed sets, connections between logic and set theory.
- Proof techniques: direct proof, contrapositive proof, proof by contradiction, proving a biconditional using two conditionals, existence proofs, disproof by counterexample.
- Mathematical Induction: inductive proof, proof by smallest counterexample.
- Relations: relations as sets, equivalence relations, construction of integers and rationals from natural numbers
- Functions: function as a relation (set); domaiin, codomain and range; composition of functions; identity map; inverse map; injectivity, surjectivity, and bijectivity; inverse function theorem.
- Cardinality and counting: cardinality as an equivalence relation on a power set, finite and infinite sets, countable and uncountable sets, the Cantor diagonal theorem, binomial theorem.
- Elements of calculus: limits of functions, limits of sequences, uniqueness of limits, limit laws.