MHF3202 - Sets and Logic

Spring 2025

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Office: LIT316 **Phone:** (352) 294-2350

Office Hours: TBD

Office hours will be determined in the first week of classes to maximize student access. They will also be posted on Canvas (Once determined). After Office Hours have been determined, the syllabus will be updated.

General Course Information

Description

This course is an introduction to rigorous mathematics. Mathematics is based on precise statements, precise meaning, and precise proofs. The course is an introduction to this basic point of view.

A major emphasis will be on writing mathematics precisely and clearly. Proofs will be an important part of this course.

The catalogue's description of this course is: Examples of sets, operations on sets, set algebra, Venn diagrams, truth tables, tautologies, applications to mathematical arguments and mathematical induction. Taking one, but not both, of MAS 3300 or MHF 3202 is required of mathematics majors. MHF 3202 can also be very useful for prospective and in-service secondary and middle school teachers. (M)

Prerequisites

A UF math course at the 2000 level or above with a minimum grade of C

Course Materials

We will use The book of proof, by R. Hammack, third edition as our textbook. It is available free online here, or you can get it via the Canvas shell for the course.

Course Goals:

This course introduces the idea of formal proof in mathematics, with the ultimate goal of providing a foundation of proof techniques, and understanding of how to build formal mathematical argument, necessary in all future mathematical courses. This includes teaching methods of proof - e.g. direct proof, induction, contradiction, contrapositive, etc; as well as determining logical truth and/or equivalence of statements that include structures like conditional statements, quantifiers, existence, uniqueness, negation, etc. We also cover the fundamental building blocks of mathematics in significantly more detail than most previous courses; sets and set manipulations/operations.

Ultimately we aim to be able to read and produce, logically sound (mathematical) proofs of theorems, lemmas, corollaries, etc - as preparation for future proof-based mathematical courses.

Course Website

E-learning Canvas, a UF course management system, is located at https://elearning.ufl.edu. Use your Gatorlink username and password to login. All course information including your grade on assignments, course homepage, syllabus, office hours, exam information, mail tool, discussion forum, etc. can be accessed from this site. Any additional/optional content that comes up during the semester will also be posted to Canvas.
TLDR: Go to Canvas, it has the information, or links to the information, for everything.

Grading

Grade Breakdown

See the tables below to see what will contribute to your grade, and what is necessary to attain a specific grade. Note that the grade ranges uses proper interval notation. This means that, although the end semester grades are rounded up to the next integer, the "lower bound" in the grade table is a parenthesis and not a bracket - so getting that value does not put you in that interval. So, for example, if you get a 178.8 that is rounded up to 179, which is a A-, not an A. If you get 179.1 that is strictly greater than 179, so that is an A, not an A-.

Assignment	Point Value	Total Points
Homeworks	5	50
3 Exams	50	150
Total Points		200

Grade	Point Range*	Grade	Point Range*
A	$(179, 200]$	C**	$(113, 133]$
A−	$(173, 179]$	C−	$(107, 113]$
B+	$(167, 173]$	D+	$(101, 107]$
B	$(146, 167]$	D	$(95, 101]$
B−	$(139, 146]$	D−	$(89, 95]$
C+	$(133, 139]$	E	$[0, 89]$

∗ Student grade values are rounded up at the end of the semester to the next integer hence the parenthesis-bracket intervals.

∗∗ Note that a minimum grade of C is required for General Education credit.

Assignment Breakdown

Below is more information on the individual types of work that will be offered/assigned throughout the semester. Of special note is the "Optional Problems" which are a vitally important aspect to the course design, please read that section.

Optional Problems

I have provided an "optional problems" list below for practice. These problems are listed by chapter/section so you know when you should be able to do them as we progress through the course. Note that these are indeed optional, so they are "due" only in the sense that you should try them so you can ask questions about the problems prior to the relevant homework/exams. Moreover, most Fridays will have at least a large portion of the class devoted to answering questions and/or going through the optional problems - as time allows.
It is important to note that optional problems are often used as - or directly inspire - (most of, but not all of) the problems on exams. Thus, although these problems are not collected or graded, it is absolutely in the interest of the student to do as many of these problems as possible, and at a minimum, at least work through the problems listed in the "Chapter Annotations" document on Canvas. The "Chapter Annotations" document lists the exercises (as well as definitions, remarks, and other content in the book) that I think are especially insightful and worthwhile.

Homeworks

Formal proof can be a very difficult and alien process, with considerable nuance. As a result, getting feedback on your proofs is arguably the most useful way to elevate your proof writing skill. Unfortunately, for these reasons it is also much more time consuming to grade proofs. As such, there will be five required homeworks assigned throughout the course that will be provided on Canvas - students will have a week to complete the homework set.

These homeworks are, in some sense, the minimal amount of feedback that a student needs to succeed. The intent is that the weekly review periods in class will provide the bulk of the opportunity for students to improve their proof writing skill and see how to work through (and prove) problems. The homework feedback will (ideally) be helpful to catch individual nuanced aspects of the proof writing, rather than larger scale misunderstandings/mistakes.

Exams

Exam details will be determined in the first week of class - at which point this syllabus will be updated.

One Week (Grade) Policy

Please be aware of the **One Week Policy**: Once you have received a grade on an assignment, you have **one week** to contact me in order to initiate any grade disputes. Once this one week passes, **there are no further disputes**. In particular, once the end of the semester nears, you *cannot* start disputing, say, grades from the first week or two. Also note that, for assignments due at the end of the semester, there isn't time for a full week to dispute grades, i.e. the grade dispute period is one week, or the end of the semester - whichever comes first.

Attendance Policy

Attendance is highly suggested. If you don't attend class, your chances of passing the class will be minimal.

Incomplete Policy

A grade of I (incomplete) will be considered only if you meet the Math Department criteria which is found at https://www.math.ufl.edu. If you meet the criteria you must see the instructor before the beginning of finals week to be considered for an I. A grade of I only allows you to make up your incomplete work. You cannot redo any previously completed work.

Etiquette, Evaluations, and Other Resources

Online Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at `https://gatorevals.aa.ufl.edu/students/`. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via `https://ufl.bluera.com/ufl/`. Summaries of course evaluation results are available to students at `https://gatorevals.aa.ufl.edu/public-results/`.

Class Demeanor or Netiquette

All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats. A guide to online etiquette is available at:
http://teach.ufl.edu/wp-content/uploads/2012/08/NetiquetteGuideforOnlineCourses.pdf

Honor Code

UF students are bound by The Honor Pledge which states "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Conduct Code specifies a number of behaviors that are in violation of this code and the possible sanctions. See the UF Conduct Code website for more information. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Students with Disabilities

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting: https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester. If a student does not supply the appropriate documentation in a timely fashion, the instructor may not be able to accommodate the student in a timely manner.

TLDR: Quick Reference

This is a quick reference for those that have **already read the syllabus**. There are some nuances in the syllabus that are skipped here - hence the "quick" part of "quick reference". Nonetheless, the below should answer the common questions that come up, especially as the semester moves forward.

Pre-Reqs: A 2000+ level UF math course.

What to Buy for the Course: Nothing. The book is free (see materials above for link, or get it on Canvas) and everything else is written by me and provided/linked on Canvas.

Goals: To learn and understand how to read/write formal mathematical proofs for your future "proof-based" math courses.

Course Coordination/Announcements/Information: (Basically) Everything goes through Canvas. Just look there if you need something.

Grading: There are 3 exams, whose details will be discussed in the first week of class. These are each worth 25% of your grade.

There are 5 homeworks, which will have (at least) a week each. They are worth a total (all 5 together) of 25% of your grade.

There is no Final Exam.

There are no projects or quizzes.

If there is a mistake in grading, get back to me about it within a week of getting the grade, or it is permanent.

End of the semester grades are rounded up - but the grade table uses interval formatting.

So if you get a 178.8 that is rounded up to 179, which is a A-, not an A.

If you get 179.1 that is strictly greater than 179, so that is an A, not an A-.

Attendance: Attendance is not mandatory; but without attending you won't pass.

Contact Instructor: You can email the instructor: Jason Nowell, using the email JNowell@ufl.edu.

You can also message me on Canvas via the mail tool. It goes to the same place - so don't do both.

I get an utterly insane amount of email. If you don't hear back from me within 3-4 days, email me again - the original might have gotten lost in the hordes.

My office is LIT316 (opposite side of the building from the math office) and office hours will be posted in Canvas.

Suggested Problem List

Course: Part 1

Chapter 1

Section 1.1, 1-15 odd.
Section 1.1, 29-43 odd;
Section 1.2, 4-11 odd.
Section 1.3, 1-7 odd, 10, 13, 15;
Section 1.4, 3, 5, 13-17 odd.
Section 1.5, 1-9 odd;
Section 1.6, 1;
Section 1.7, 1-9 odd.
Section 1.8, 2, 3, 4, 5, 7, 9, 10, 13.
Read Section 1.9;

Chapter 2

Section 2.1, 1-11 odd.
Section 2.2, 1-9.
Section 2.3, 1-11 odd;
Section 2.4, 1-5 odd.
Section 2.5, 1-11 odd;
Section 2.6, 1-13 odd.
Section 2.7, 1-9 odd.
Section 2.9, 1-9 odd.
Section 2.10, 1-6 and 8-10.

Course: Part 2

Chapter 4

Chapter 4, 1-7.
Chapter 4, 8-13.
Chapter 4, 14-20.

Chapter 5

Chapter 5, 1-13 odd,

Chapter 6

Chapter 6, 1-11 odd.

Chapter 7

Chapter 7, 1-9 odd.

Chapter 8

Chapter 8, 1-7 odd, 13, 19, and 22.

Chapter 9

Chapter 9, 1-19 odd.

Chapter 10

Chapter 10, 1-8.
Chapter 10, 9-21 odd.

Course: Part 3

Chapter 12

Section 12.1, 1, 6, 7, 9.
Section 12.2, 2, 4, 5, 11, 13.
Section 12.3, 1, 3 and 12.4, 1-9 odd.
Section 12.5, 1-9 odd.
Section 12.6, 1, 5-11 odd.

Chapter 14

Section 14.1, 1-11 odd.
Section 14.2, 1-9 odd.
Section 14.4, 1, 5.
Section 14.3, 3-9 odd.

Calendar

The course is broken up into three distinct part, each with a corresponding exam on that part. Below is an approximate breakdown of what content will be covered each week - note that the section numbers covered should correspond to section numbers in the "suggested problems" section, to see which suggested problems should be done for which week.

Part 1: Introduction to Sets and Logical Structure/Inference

We start the semester by establishing the fundamental building blocks of the formal statements in mathematics. In particular, we start with the definitions of sets and set operations (ch 1), then move to how we formalize statements/ideas into a logical framework where we can (rigorously) verify if a statement is true or false. We conclude with how to translate between this highly abstract/rigorous language (symbolic logic) and English sentences, how to properly negate these statements (English and Symbolic Logic), and what this means about logical inference (ch 2).

Week 1: Book Sections: 1.1 - 1.7.

Week 2: Book Sections: 1.8 - 2.1.

Week 3: Book Sections: 2.2 - 2.6.

Week 4: Book Sections: 2.7 - 2.12.

Part 2: Methods of Proof

In the second part of the course, we tackle the meat of the course; establishing the core set of tools used as approaches to proving. This involves: Direct Proof (ch 4), Proof by Contrapositive (ch 5), Proof by Contradiction (ch 6), Proofs of equivalence, existence, and uniqueness (ch 7), Proof of Set Relationships (e.g. equality, membership, etc. Ch 8), Disproof - e.g. Counterexamples and other techniques to disprove a statement (ch 9) and finally, Proof by Induction (ch 10).

Week 5: Book Sections: 4.1 - 4.5.

Week 6: Book Sections: 5.1 - 7.3.

Week 7: Book Sections: 8.1 - 8.3.

Week 8: Book Sections: 8.4 - 9.3.

Week 9: Book Sections: 10.

Week 10: Spring Break (No Class)

Part 3: Proofs of Functions, Cardinality, and Other Topics

The final part of the course covers common applications of proofs and the typical approaches. This section is highly tentative and depends on how the previous part goes, so the sections listed below are the *potential* book section list. This will be updated in class/canvas once we determine what sections (or outside content - based on interest and time allowance) will actually be covered.

Week 11: Book Sections: 12.1 - 12.2.

Week 12: Book Sections: 12.2 - 12.5.

Week 13: Book Sections: 12.6.

Week 14: Book Sections: 14.1, 14.2, 14.4.

Week 15: Book Sections: 14.3.

Week 16: Potential bonus topics or slack in schedule if needed.

The above is a general week by week outline of intended content coverage, but for the most updated dates and timeline, please refer to the module assignment breakdown in Canvas.