

Philosophy 155: Introduction to Mathematical Logic
Fall 2018, UNC Chapel Hill

MW 6.00pm-7.15pm
Caldwell 103

Instructor: Dominik Berger
Email: dominik@live.unc.edu
Office: Caldwell 12B

Office Hours: Wednesdays 5pm-6pm, Thursdays 2.30pm-3.30pm or by appointment.

Course Description

Logic is about patterns of correct reasoning, and the study of logic is about identifying the patterns that reasoning has to follow in order to be correct. In this course, we will learn how to use one important form of logic (which is called first-order logic) and how to apply it to certain instances of reasoning that we might encounter in any part of life. At the end of the class, you should (1) have a grasp of the language of first-order logic, (2) know how to approach a certain kind of mathematical problem, how to prove claims or find relevant counterexamples, and (3) have a better understanding of the notion of logical consequence and whether a certain claim logically follows from some other claim or not.

Readings

You will need to purchase a *new* copy of the following text:

Language, Proof and Logic, 2nd Edition, by Barker-Plummer, Barwise and Etchemendy

You need to purchase a new copy of this book so that you will have access to the online component of this course that allows you to get feedback on practice problems and submit homework exercises.

Course Requirements

Your grade will be calculated as follows:

Problem Sets: 40%
Midterm Exams: 40% (20% each)
Final Exam: 20%

There won't be extra credit opportunities in this class. You are expected to keep up with the material - since the content of the later chapters builds on the preceding ones, it is important that you do not fall behind. The problem sets are designed to help you realize if there are some parts of the material in a given week that you are having trouble understanding. If you should have difficulty with some of the problems, I would encourage you to come to office hours so that we can talk through the material again until it becomes clear. I am always happy to meet and talk through problems with you!

Problem Sets

You cannot learn logic merely by reading the book or coming to lectures. Instead, Logic is very similar to other quantitative subjects like Mathematics, Physics, Economics, etc. in that you will only learn it if you actively try to apply the concepts learned in class by solving many exercises. This is why this class will involve weekly problem sets that cover the material you have learned in a given week. Most of these problems will be taken from the list of exercises in the textbook, and many of these will allow you to get feedback through the program *Submit* before you officially submit them for grading. I will try to post the problem sets on Sakai the weekend before they are due.

I encourage you to work on these problem sets with a friend or in a group - this way you can help each other in case one of you gets stuck! In my experience, it is always easier to learn this material if you talk it through with others (or if you explain it to others yourself!) Even if you work on the problem sets in groups, I would still recommend you to first sit down and try to solve the problems yourself, and only after you have either found a way to solve the exercises or identified obstacles to meet with others. Note however that even if you work on the answers together, each person should still write down his or her own answers!

There will be around 10 problem sets in this class that will well exceed the 10 pages of written work required for courses meeting the General Education requirement. I will drop the lowest 2 problem sets when calculating your overall problem set grade.

Midterms

There will be two midterm exams in this class. The midterms will consist of a series of problems that are supposed to test your understanding of the material up to this point - though they are not cumulative and only cover the material since the last midterm. The exams are designed to take around one hour to solve, but since I know solving logic problems under time pressure can be difficult, I am prepared to give you more time should you need it.

Final Exam

The final exam will be cumulative, though it will focus more heavily on the topics covered since the second midterm. The final (just like the midterms) will be closed book.

Due Dates and Late Policy

The problem sets are due on **Fridays at 11.59pm** on the days indicated in the syllabus. Most homework exercises are to be submitted electronically to me via *Submit* (a program that is part of the online components of the textbook). Occasionally I will assign homework problems that can't be submitted through *Submit* - you can either email these exercises to me, leave a paper copy in my department mailbox (in the mailroom of Caldwell Hall), or bring the exercises to class.

I am prepared to give extensions on the problem sets until Sunday evening *if you have a valid reason for needing one* - if you should need an extension and have a valid reason, email me by **Thursday at 11.59pm** the day before the problem set is due with an explanation as to why you need an extension.

Late homework will be docked 1 letter grade for each day that it is late, unless you were experiencing a serious and genuinely unforeseen medical or personal emergency, and only when the emergency can be verified with the Dean of Students Office (<https://deanofstudents.unc.edu/>).

The midterms and final exam must be taken on the dates specified - any request to take the midterms or final on a different date must go through the Dean of Students Office.

Accommodations

If you require reasonable accommodations for a documented disability, you must register with ARS (<https://accessibility.unc.edu/>). Once I receive ARS's recommendations, I will be happy to work with you to implement them as appropriate.

Plagiarism

The UNC Instrument of Student Governance defines plagiarism as "deliberate or reckless representation of another's words, thoughts, or ideas as one's own without attribution in connection with submission of academic work, whether graded or otherwise." You are expected to abide by UNC's Honor Code, and refrain from any kind of academic dishonesty, including cheating and plagiarism. Just as you are bound by the Honor Code not to plagiarize, I am bound by it to report suspected cases of academic dishonesty of any kind to the Honor Court.

On the homework problem sets, you are encouraged to collaborate with others. However, you have to write down your own version of the solution - *Submit* automatically checks all submitted files for plagiarism (i.e. if certain files were copied and submitted several times). If you collaborate, please also write down the names of the people you collaborated with.

You might also sometimes get stuck on a problem and look online for solutions or approaches to the problem. I would encourage you not to do this, as this is not a good way to learn the material (come to office hours instead!), but if you do, you should likewise try to write down your own version of the solutions and not simply copy-paste

something you found online. Likewise, if you do this, you should cite the website that you consulted.

On the midterms and the final exam, collaboration is not allowed - and any attempt to collaborate during the midterms or final exams will be reported to the Honor Court.

Please bear in mind that plagiarism can be committed non-deliberately; if you are reckless in your use of other people's ideas, then you have committed plagiarism even if you didn't mean to do so. If you have any questions at all about proper citation of other people's work or ideas in the course, please don't hesitate to come talk to me about them. You are responsible for knowing what exactly counts as plagiarism and to not commit it in the work you submit for this class.

Note: The following schedule is provisional and subject to change.

Course Schedule

Week 1

Wednesday, August 22nd - Introduction and course mechanics

Friday, August 24th - Problem Set 0 due at noon (not graded)

Week 2

Monday, August 27th - Chapter 1: Atomic Sentences

Wednesday, August 29th - Chapter 2: The Logic of Atomic Sentences

Friday, August 31st - Problem Set 1 due at noon

Week 3

Monday, September 3rd - No class; Labor Day

Wednesday, September 5th - Chapter 3: The Boolean Connectives

Friday, September 7th - Problem Set 2 due at noon

Week 4

Monday, September 10th - Chapter 4: The Logic of Boolean Connectives
Wednesday, September 12th - No class; classes cancelled due to hurricane

Friday, September 15th - No Problem Set; classes cancelled due to hurricane

Week 5

Monday, September 17th - No class; classes cancelled due to hurricane
Wednesday, September 19th - Chapter 4: The Logic of Boolean Connectives

Friday, September 21st - Problem Set 3 due at noon

Week 6

Monday, September 24th - Chapter 5: Methods of Proof for Boolean Logic
Wednesday, September 26th - Chapter 6: Formal Proofs and Boolean Logic

Friday, September 28th - Problem Set 4 due at 11.59pm

Week 7

Monday, October 1st - Review
Wednesday, October 3rd - Midterm 1

Friday, October 5th - No homework

Week 8

Monday, October 8th - Chapter 7: Conditionals
Wednesday, October 10th - Chapter 8: The Logic of Conditionals

Friday, October 12th - Problem Set 5 due at 11.59pm

Week 9

Monday, October 15th - Chapter 8: The Logic of Conditionals
Wednesday, October 17th - No Class; Fall Break

Friday, October 19 - No homework; Fall Break

Week 10

Monday, October 22nd - Chapter 9: Introduction to Quantifiers
Wednesday, October 24th - Chapter 10: The Logic of Quantifiers

Friday, October 26th - Problem Set 6 due at 11.59pm

Week 11

Monday, October 29th - Chapter 11: Multiple Quantifiers
Wednesday, October 31st - Chapter 12: Methods of Proof for Quantifiers

Friday, November 2nd - Problem Set 7 due at 11.59pm

Week 12

Monday, November 5th - Chapter 13: Formal Proofs and Quantifiers
Wednesday, November 7th - Chapter 13: Formal Proofs and Quantifiers

Friday, November 9th - Homework Set 8 due at 11.59pm

Week 13

Monday, November 12th - Review
Wednesday, November 14th - Midterm 2

Friday, November 16th - No homework due

Week 14

Monday, November 19th - Chapter 15: First-Order Set Theory
Wednesday, November 21st - No Class, Thanksgiving Break

Friday, November 23rd - No homework; Thanksgiving Break

Week 15

Monday, November 26th - Chapter 16: Mathematical Induction
Wednesday, November 28th - Chapter 16: Mathematical Induction

Friday, November 30th - Problem Set 9 due at 11.59pm

Week 16

Monday, December 3rd - Chapter 19: Soundness and Completeness

Wednesday, December 5th - Review

Friday, December 7th - No homework due

Final Exam: Monday, December 10th at 6.00pm in Caldwell 103