Phil 303: Introduction to Symbolic Logic

University of Michigan, Summer 2023

Contact	Instructor: Calum McNamara Email: camcnam@umich.edu Office: 1156 Angell Hall Office Hours: Tuesdays and Thursdays, 3-4pm (right after class)
Meetings	12pm-3pm, Tuesdays and Thursdays, G115 Angell Hall
Description	This course is a fast-paced introduction to formal (or "symbolic") logic, pitched at the intermediate level. Roughly speaking, logic is the study of (deductive) *arguments*, as well as related concepts like *consistency* and *consequence*. In this course, we'll focus mostly on two of the simplest and most important formal logical systems, namely (classical) propositional logic and (classical) first-order predicate logic. Both of these systems will be examined from several points of view (syntax, semantics, natural deduction,...). And along the way, we'll spend a good deal of time talking about philosophical issues arising out of the study of these systems. It will be fun! We will also spend a tiny bit of time looking at *modal logic* in the last week of the course.
Objectives	By the end of this course, you should (i) be familiar with basic logical concepts, like validity, soundness, entailment, etc.; (ii) be able to translate simple natural language sentences into propositional and predicate logic; (iii) be comfortable with truth-tables, models, and natural deduction, as well as proofs using basic mathematical induction; (iv) be able to comprehend meta-logical notions like soundness and completeness.
Prerequisites	None, though some experience with quantitative reasoning would be helpful.
Materials	Our primary reading material in this course will be the textbook *Forall x: Calgary*, by Magnus and Button. This book is completely open source, and is available at the following link: https://forallx.openlogicproject.org/forallxyyc.pdf. If you'd like, there are also printed copies of the book available for purchase here. I will also provide very detailed lecture notes, to supplement our readings from the textbook. (Also, please don't be alarmed by the amount of reading I seem to be assigning for each session. While this course is going to be quite intense—given our short timeline—the PDF chapters of *Forall x* are very, very short, and the font is large.)
Grading	Problem Sets: 50% (due weekly, beginning 7/13) Cumulative Final Exam: 40% (at 8am on Friday 8/18, in the normal classroom) Class Participation: 10%

Grades will *at least* be awarded according to the following (fairly common) scheme:

A = 93-100%; A− = 90-92.99%;
B+ = 87-89.99%; B = 83-86.99%; B− = 80-82.99%,
C+ = 77-80%, C = $73 − 77$%, C− = 70-73,
and so on.

I may lower the grade boundaries for letter-grades, if needed. But I will not raise them.

I will also be setting five "challenge problems" throughout the semester. They will be tough, but they'll be un-graded. More importantly, they'll be intellectually rewarding to work on, and will give you a deeper understanding of the course material as a whole. The challenge problems are completely optional, but I encourage you to try them. Also please free to come chat with me about them during office hours. If you need help getting started, we can work on them together.

Problem Sets   There will five problem sets assigned in the course. They will consist of a mixture of different types of questions: some will require you to give definitions, etc., some will require you to solve problems, and some will require you to reflect philosophically on the logical issues we're discussing.

You are encouraged to collaborate with other students on the problem sets. However, you *must* write up your solutions independently. Also, if you do collaborate with other students, please include a list of their names at the top of your problem set.

Honor Code   Although it should go without saying: don't cheat on the problem sets. (This includes merely copying answers from other students.) Minor infractions will result in you failing the relevant assignment. Major infractions will be kicked up to the university. (And note that punishments in that case can be pretty severe.)

Carnap   I have set up a page for the course on the Carnap website. This website provides extra problem set-style questions, which you can use to practice the basic concepts. The webpage can be found here.

Technology   With two exceptions, laptops, phones, and other electronic devices are not permitted to be used during lecture. Multiple studies have shown that students using laptops, etc., do significantly worse on exams that test their comprehension than students who do not use these things. This is true even when students are not multitasking. Typing shifts you into "transcription mode", whereas writing by hand requires you to actively process material.

The first exception to the technology rule is if you're going to take notes *by hand* on a device like an iPad or a reMarkable. That's allowed. The other exception is if you have a disability that necessitates using a computer, or some other electronic

device. If that's the case, then I'm happy to accommodate you. But if this is so, please speak to me about it as early as you can in the semester.

Disabilities   The Americans with Disabilities Act is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Students who require academic accommodations can work with the office for Services for Students with Disabilities (SSD) to arrange for (among other things) assistive technology, academic coaching, and other accommodations. Many students don't receive adequate diagnoses, or discover only late in their academic careers that they have access to academic accommodations. So, if you suspect that you might need such accommodations, it's worth reaching out early on.

For reasons of privacy and consistency, I ask that you start with SSD: their Student Intake Form can be found at https://ssd.umich.edu/. However, please know that whether or not you are able to arrange formal accommodations, I am committed to working with you to ensure that you are able to participate fully in the course. Just speak to me about your needs.

Support   For your reference: the University of Michigan has extensive resources available to students. These include, among many other things: Counselling and Psychological Services (CAPS); Student Technical Support; Campus Food and Affordability Resources; and so on. A complete list of resources is available here. I encourage you to check this list out. Many students are unaware of it.

Schedule   **Propositional Logic**

6/29   **Puzzles and paradoxes; sentences and propositions; validity and soundness; the language of propositional logic**

Readings: *Forall x*, Chapters 1-8

07/4   **No class!! Independence day!!**

07/6   **Truth-tables**

Readings: *Forall x*, Chapters 9-14

7/11   **Syntax and semantics; basic natural deduction rules; constructing proofs**

Readings: *Forall x*, Chapters 15-17

7/13   **More on natural deduction; derived rules**

Readings: *Forall x*, Chapters 18-20

Problem Set No. 1 due at the beginning of class, 7/13!!

7/18   **A little bit about soundness and completeness**

Readings: *Forall x*, Chapter 21

First-Order Predicate Logic

7/20 **Motivation for predicate logic; the language of first-order predicate logic**

Readings: *Forall x*, Chapters 22-28

Problem Set No. 1 due at the beginning of class, 7/20!!

7/25 **Truth in first-order predicate logic; models**

Readings: *Forall x*, Chapters 29-31

7/27 **Models again; countermodels; logical truths, etc.**

Readings: *Forall x*, Chapters 32-33

Problem Set No. 3 due at the beginning of class, 7/27!!

8/1 **Natural deduction in first-order predicate logic**

Readings: *Forall x*, Chapters 33-35

8/3 **More on natural deduction in first-order predicate logic; identity; derived rules**

Readings: *Forall x*, Chapters 36-39

Problem Set No. due at the beginning of class, 8/3!!

A Quick Look at Propositional Modal Logic

8/8 **Motivation for modal logic**

Readings: *Forall x*, Chapters 40

8/10 **Natural deduction in modal logic**

Readings: *Forall x*, Chapters 41-42

Problem Set No. 5 due at the beginning of class, 8/10!!

Course Review

8/15 **Review of all course topics**

No readings

Final Exam

8/18 **Final exam at 8am, in the normal classroom**