

# The Limits of Logic (Phil 450, Fall 2014)

## Instructor

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Stonier 227

Office Hours: Mon, Wed 11–11:50am

I'm going to avoid lecturing so we have lots of time for your presentations. **Please come to office hours** if you feel like you could use more discussion of what's going on.

## Goals

- Develop tools for thinking carefully about languages, arguments, representation, truth, and their limitations.  
(This is “meta-logic”—rather than reasoning *within* a formal logical system, we'll mainly be studying the power of different formal systems from the outside.)
- Get really good at reading, writing, and presenting precise arguments.
- Learn some deep and beautiful truths, which have been entrusted to us as philosophers to carry to the world.

## Evaluation

- **Most important.** I will ask people to present solutions to exercises in every class meeting. I'll cold call for this, but it's ok to pass once in a while. You will probably be asked to present something once or twice a week. Make sure to plan ahead and **give yourself plenty of time** to do the exercises. (50%)
- Two take-home exams, at roughly the midpoint and endpoint of the semester. (20% + 30%)

## Collaboration

I encourage you to work together on exercises, but you are individually responsible for understanding, explaining, and defending anything you present in class. It's easy to trick yourself into thinking you understand something better than you do. This helps nobody. So here's the guideline if you work on a problem with others: throw away your notes from group sessions and write up your final solution on your own.

This does not apply to take-home exams. Do those by yourself.

## Suggested Texts

We're not going to stick close to any textbook, but these will be useful for reference, and are on reserve in the library. (If you come across other useful resources, let me know!)

- Sider, *Logic for Philosophy*
- Boolos, Burgess, and Jeffrey, *Computability and Logic*

- Enderton, *Mathematical Logic*

Tim Gowers has a series of blog posts on basic logical reasoning. They're targeted at beginning math students rather than philosophers, but you might find them helpful.

<https://gowers.wordpress.com/2011/10/09/basic-logic-summary/>  
<https://gowers.wordpress.com/category/cambridge-teaching/basic-logic/>

## Outline

1. Sets and Functions (some basics)
2. The Uncountable
  - There are just as many finite sequences as counting numbers.
  - There are more infinite sequences than counting numbers.
3. Propositional Logic
  - Every argument in propositional logic has a proof or a counterexample, but not both.
4. Quantifiers
  - Every argument in predicate logic has a proof or a counterexample, but not both.
  - No valid argument in predicate logic essentially uses infinitely many premises.
  - Any consistent statement in predicate logic is consistent with there only being countably many things.
5. The Inexpressible
  - No non-trivial language can define its own semantics.
6. The Undecidable
  - There is no effective method for deciding which methods will fail.
7. The Unprovable
  - No consistent, complete theory strong enough for some basic arithmetic has reasonable axioms.
  - There is no effective method for deciding which arguments in predicate logic are valid.
8. Further Topics
  - Modal logic and possible worlds.
  - The logic of provability. No consistent theory can prove its own consistency.
  - Second-order logic. Plural logic.

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### **Disability Services and Programs**

Located in STU 301

Open 8:30am–5pm, Monday–Friday

213-740-0776 (Phone)

213-740-6948 (TTD)

[ability@usc.edu](mailto:ability@usc.edu)

[http://sait.usc.edu/academicsupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html)

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## **Changes**

I may change anything at any time.