

# Advanced Logic

## SECTION

PHIL 471,  
Spring 2023

## INSTRUCTOR

Jer Steeger  
(they/them)

## EMAIL

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## OFFICE LOCATION

M396 Savery Hall

## OFFICE HOURS

MW, 3-4 pm

## DESCRIPTION

Folks usually hear about Gödel's famous incompleteness theorems—slogan-ized as “logic can't prove its own consistency”—before they ever see them. Some bemoan the results as a fundamental limit on the certainty of our reasoning; others celebrate them as evidence that it's impossible to reduce human thought to a computer program. We'll take a close look and decide for ourselves. In addition to building the tools to state and prove Gödel's theorems, we will assess how second-order logic fares against analogs of Gödel's arguments.

## REQUIRED TEXT

**(Z)** Zach, Richard (2021). *Incompleteness and Computability*. The Open Logic Project.

## GOALS

- **Know** how recursive functions capture a notion of computability and Gödel's first and second incompleteness theorems.
- **Do** the proofs of these theorems and build theoretical computer programs.
- **Feel** Hilbert's anxiety about the consistency of mathematics and awe (or surprise) at Gödel's arguments that he can't have them.

## COURSE AT A GLANCE

DATE	SECTION	CORE READINGS
<b>1. Introduction</b>		
3/28	1.1. The idea of Gödel's theorems	Nagel & Newman (2001), <i>Gödel's Proof</i> , Chs. 1-2
3/30	1.2. An overview of the theorems	<b>Z</b> 1.1 to 1.4
<b>2. Recursion and computability</b>		
4/4	2.1. Recursion 1	<b>Z</b> 2.1 to 2.6
4/6	2.2. Recursion 2	<b>Z</b> 2.7 to 2.11
4/11	2.3. Recursion 3	<b>Z</b> 2.11 to 2.18
4/13	2.4. Computability 1	Boolos et al. (2007), <i>Computability and Logic</i> , 5.1 to 5.2
4/18	2.5. Computability 2	Boolos et al. (2007), <i>Computability and Logic</i> , 5.3
4/20	2.6. Computability 3	Boolos et al. (2007), <i>Computability and Logic</i> , 8.1
<b>3. Arithmetization and representability</b>		
4/25	3.1. Arithmetization 1	<b>Z</b> 3.1 to 3.3
4/27	3.2. Arithmetization 2	<b>Z</b> 3.4 to 3.6

5/2	3.3. Representability 1	Z 4.1 to 4.3
5/4	3.4. Representability 2	Z 4.4 to 4.5
5/9	3.5. Representability 3	Z 4.6 to 4.10
<b>4. The incompleteness theorems</b>		
5/11	4.1. Incompleteness 1	Z 5.1 to 5.3
5/16	4.2. Incompleteness 2	Z 5.4 to 5.6
5/18	4.3. Incompleteness 3	Z 5.7 to 5.10
<b>5. Second-order logic</b>		
5/23	5.1. Second-order logic 1	Z 7.1 to 7.4
5/25	5.2. Second-order logic 2	Z 7.5 to 7.8
5/30	5.3. Second-order logic 3	Z 7.9 to 7.13
6/1	5.4. Coda	Hofstadter (1999), <i>Gödel, Escher, Bach</i> , Ch. 20

## ASSIGNMENT SCHEDULE

ASSIGNMENT	DUE DATE	POINTS	% OF TOTAL
Problem sets	Midnight, Monday, start of the week	10 each, 90 total	80%
Take-home final	Midnight, 6/9	20	20%

## GROUP WORK

Each of the problem sets will be done as a group that is randomly assigned at the start of each week. Each group will turn in one copy of the problem set. I will grade that copy and assign that grade to each member of the group. I highly encourage communicating with your groupmates outside class to work on problem sets and finalize your submissions.

## EXPECTATIONS AND ACCOMMODATIONS

I encourage you to read through the **UW Department of Philosophy's syllabus supplement** at <https://tinyurl.com/3949zyby>. It has detailed information on the department's policies on academic misconduct.

If you experience or witness sexual harassment or discrimination, I highly recommend contacting **SafeCampus** by visiting <https://www.washington.edu/safecampus/> or by calling their hotline at **206-685-7233**.

If you need disability accommodation, please let me know as soon as possible; I also highly recommend contacting **Disability Resources for Students (DRS)** at <http://depts.washington.edu/uwdrs/>.