

PHIL 452: Modal Logic

Fall 2026

Time and Place

Lecture	Mon, Wed 2 - 3:20pm	WPH 205
Office Hours	Mon 1 - 2pm	STO 221
Wed 12 - 1:30pm	Online One-on-One Session	Zoom Room
	Make an appointment	https://usc.zoom.us/my/uzquiano

Instructor

Name	Office	Email	Phone
Gabriel Uzquiano	STO 221	uzquiano@usc.edu	213-740-1074

Course Description

Modal logic is concerned with the study of modalities expressed by propositional operators such as *necessarily* and *possibly*. Many of these modalities are governed by a common logic and play an important role in philosophy. We will cover basic elements of propositional and quantified modal logic with an eye to philosophical applications. The course is divided into four main parts:

1. The Metatheory of Propositional Logic

We will prove the completeness of an axiomatic system for propositional logic.

2. Propositional Modal Logic

We will identify the minimal modal logic K and study some of its extensions. We will prove completeness and decidability results for them.

3. Applications of Propositional Modal Logic

We will discuss selected applications of modal logic and the possible worlds model theory in philosophy. They may include the logic of necessity, the logics of belief and knowledge, deontic logic, and the logic of conditionals.

Goals

By the end of this course students will be able to . . .

- provide a justification for the formal correspondence between validity and provability in deductive systems for propositional logic
- represent modalities in formal systems designed to formalize and study logical aspects of how they behave and interact with each other
- make use of the possible worlds framework to capture distinctions between modalities

- deploy the toolkit of modal logic to reframe and discuss a variety of questions in different areas of philosophy

Prerequisites

PHIL 220g, PHIL 222g, PHIL 350 or permission by the instructor. You should be familiar with propositional logic. The prerequisites may be waived in the presence of relevant background, which may include relevant courses in mathematics, linguistics, or computer science.

Course Materials

LECTURE NOTES

Material will be drawn primarily from my [notes](#). This is work in progress, and I will be making revisions as we progress through the semester. Further resources you may consider include:

- Blackburn, de Rijke, and Venema. [Modal Logic](#), Cambridge University Press, 2022.
- Cresswell and Hughes. [A New Introduction to Modal Logic](#). Taylor & Francis, 1996.

NB: Hughes and Cresswell use the symbol L for $\Box$ and M for $\Diamond$.

They are all available through the [USC Libraries](#).

BRIGHTSPACE

You will be able to access your grades through [Brightspace](#).

COURSE WEBSITE

Course materials will be available at the [website](#) for the course.

Course Requirements

PARTICIPATION

The course will be based on active participation and discussion. You will be expected to be present and prepared to ask questions, contribute to discussion, and to be helpful to others. Your collective participation in discussion will help set the pace for the course.

Participation will account for 5% of your final grade.

PROBLEMS

There will be a problem set almost every other week. The problems are designed to give you an opportunity to apply the material and hone the skills you will acquire throughout the course. We will discuss most, if not all of the problems as a group, but you will be responsible for your own written answers to the exercises. There are two course requirements associated with the problem sets.

Presentations

We will have a *problem session* almost every other Wednesday, where we will collectively discuss some of the problems as a group. To facilitate discussion, you will be expected to present your approach to a problem of your choice. Your presentation may or may not include a solution to the problem. However, you should *explain what the question is* and *briefly explain how the problem fits with the material of the course*. You may then explain your own attempt to solve the problem through a careful description of the steps you plan to take to answer the question.

Your presentations will account for 25% of your final grade.

Written Solutions

You will turn in written solutions for the problems we have discussed in the problem sessions. The point of the write-up is to *communicate* how to solve the problem in a way someone else would be able to follow. So, you should use English prose and write your solutions independently from each other. You should, in particular, explain each question and walk through your solution to the problem by means of a careful step-by-step justification. That is one of the ways in which you may make sure you understand the strategy used for each problem.

Your written submissions will account for 40% of your final grade.

Grading Scheme

Both presentations and written solutions will be graded on the basis of a proficiency scheme:

<i>Extending</i>	Your answers are thorough, complete, and justified through appropriate reasons or examples as the case may be. Communication is clear and complete.
<i>Proficient</i>	Some of your answers may require revision or expansion, but there are no significant gaps in your explanation. Communication is clear.
<i>Developing</i>	There are significant gaps in explanation, and further work and review of basic concepts involved in the assignment is recommended.
<i>Emerging</i>	Fragmentary or incomplete answers, which contain significant gaps and omissions.

Your grade for this portion of the course will be based both on the number of activities you have successfully completed and the standard at which you have performed in them. The table below lists the minimum requirements for each letter grade. Each row lists a number of activities of each type and the standard you must have achieved to earn the grade.

Grade	Written Solutions	Presentations
A	5 Extending/1 Proficient	4 Extending
A-	4 Extending/2 Proficient	3 Extending
B+	3 Extending/2 Proficient	1 Extending/1 Proficient
B	2 Extending/3 Proficient	3 Proficient
B-	1 Extending/4 Proficient	2 Proficient/1 Developing
C+	3 Proficient/1 Developing	1 Proficient/2 Developing
C	2 Proficient/2 Developing	3 Developing
C-	1 Proficient/3 Developing	2 Developing
D+	3 Developing/1 Emerging	1 Developing/1 Emerging
D	2 Developing/2 Emerging	2 Emerging
D-	1 Developing /3 Emerging	1 Emerging

To earn an A for this portion of the course, you will have provided written solutions for all 6 problem sets and presented in at least 4 problem sessions. You must have performed at an *extending* level on at least 5 problem sets and 4 presentations.

Note that it is the combination of the number of activities and the standard at which you have performed at them that earns you a given grade for this portion of the course. Even if someone provides written solutions for all 6 problem sets and presents in all 6 problem sessions, the final grade will be determined by the standard at which they have performed. If they perform at an extending level at no more than 3 problem sets, then they will earn at most a B+ for the course, regardless of the number of activities or the standard they achieve elsewhere.

FINAL PROJECT

There are two main options for the final project. You may either deploy the toolkit of modal logic to reframe and discuss a philosophical question of your choice or you may instead use the final project to provide a detailed presentation of some technical result not covered in lecture. The latter need not involve more than 5 to 8 pages, whereas a more philosophical discussion could approach 10 to 15 pages. There are two different course requirements connected to the final project.

Proposal

You will write a detailed proposal for your final project, which will allow us to give you some feedback on your approach as well as the feasibility and promise of your project. The proposal will require a substantial amount of work, and it should explain both your plan and your goal for the project.

The first part of the final project will be due on **Monday, November 11** by midnight and will account for 5 % of your grade.

Submission

This is the final project, which will be due on **Wednesday, December 10** by 10am.

The submitted version of your final project will account for 25 % of your final grade for the course.

Evaluation

Component	Weight	When
Participation	5 %	Weekly
Problem Sets	65 %	
Final Project		
Final Project Proposal	5 %	Mon 11/25
Final Project	25 %	Wed 12/10

Course Policies

Late Policies

There are strict deadlines for the problem sets. This is partly because the course requires some structure and because otherwise the logistics of the problem sets would be difficult to manage. The other reason for the strict deadlines, however, is that it is very important not to fall behind and to be able to work on the material we have presented before subsequent material is introduced. Otherwise, it might be difficult to understand how the new material builds on what we have done earlier in the course.

Life can be complicated and in the event of an emergency, you might not be able to submit a write-up in time or the assignment may not reach the standard you might have hoped to achieve. In order to accommodate these and other unforeseen circumstances, you will be given *four tokens* to spend during the term. You can use a token to do one of the following:

- extend a deadline for a write-up by 48 hours
- *repeat* a write-up *within two weeks of the original deadline*.

Schedule

This schedule is tentative and subject to change. In particular, the choice of applications of modal logic we study will be influenced by the interests of the class.

Date	Topic	Turn in
	BACKGROUND	
Mon 8/24	Sets and Relations	
Wed 8/26	Induction. Definitions by Recursion	
	PROPOSITIONAL LOGIC	

Mon 8/31	Basic Language	
Wed 9/2	Problem Session 1	Presentation
Mon 9/7	University Holiday: Labor Day	
Wed 9/9	Axiomatic Derivations	
Mon 9/14	The Deduction Theorem	
Wed 9/16	Problem Session 2	Presentation
Mon 9/21	Completeness	
	MODAL PROPOSITIONAL LOGIC	
Wed 9/23	Basic Language	
Mon 9/28	Frames	
Wed 9/30	Problem Session 3	Presentation
Mon 10/5	Frame Definability	
Wed 10/7	Bisimulations	
Mon 10/12	Axiomatic Derivations	
Wed 10/14	Problem Session 4	Presentation
Mon 10/19	Normal Modal Logics	
Wed 10/21	Canonical Models	
Mon 10/26	Completeness	
Wed 10/28	Problem Session 5	Presentation
	SELECTED APPLICATIONS	
Mon 11/2	Tense Logic	
Wed 11/4	Time and Modality	
Mon 11/9	Epistemic Logic	
Wed 11/11	University Holiday: Veterans Day	
Mon 11/16	Conditional Logic	
Wed 11/18	Problem Session 6	Presentation
Mon 11/23	Sphere Models	
Wed 11/25	Thanksgiving Break	
Mon 11/30	Quantified Modal Logic	

Wed 12/3 Free Quantified Modal Logic

Wed 12/11 Final Project Submission

Statement on Academic Conduct and Support Services

ACADEMIC CONDUCT

Plagiarism — presenting someone else’s ideas as your own, either verbatim or recast in your own words — is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section II, “[Behavior Violating University Standards](#)” Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and consult [university policies on scientific misconduct](#).

SUPPORT SYSTEMS

- [Counseling and Mental Health Services \(CMH\)](#) — (213) 740-9355 - 24/7 on call.
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.
- [National Suicide Prevention Lifeline](#) — 1 (800) 273-8255 - 24/7 on call.
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.
- [Relationship and Sexual Violence Prevention Services \(RSVP\)](#) — (213) 740-9355 (WELL), press ‘o’ after hours - 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.
- [Office of Equity and Diversity \(OED\)](#) — (213) 740-5086/Title IX - (213) 821-8298
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.
- [Reporting Incidents of Bias or Harassment](#) — (213) 740-5086 or (213) 821-8298
Avenue to report incidents of bias, hate crimes, and micro-aggressions to the Office of Equity and Diversity/Title IX for appropriate investigation, supportive measures, and response.
- [The Office of Student Accessibility Services \(OSAS\)](#) — (213) 740-0776
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.
- [USC Campus Support and Intervention](#) — (213) 821-4710
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

- [Diversity at USC](#) — (213) 740-2101

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

- [USC Emergency](#) — UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call.

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

- [USC Department of Public Safety](#) — UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call

Non-emergency assistance or information.