

# PHIL 143 - Modal Reasoning

Professor Wesley Holliday

TuTh 2-3:30

UC Berkeley, Fall 2012

123 Wheeler

## Syllabus<sup>1</sup>

### Description

An introduction to the logical study of modality in its many forms: reasoning about necessity, knowledge, obligation, time, counterfactuals, provability, and other modal notions. Covers core concepts and basic metatheory of propositional modal logic, including relations to first-order logic; the basics of quantified modal logic; and selected philosophical applications ranging from epistemology to ethics, from metaphysics to mathematics.

### Prerequisites

12A (or equivalent) or consent of instructor. A solid grasp of the material on propositional and first-order logic from 12A is essential for understanding the content of this course.

### Textbook

- *Modal Logic for Open Minds* by Johan van Benthem, available at the bookstore.
- Additional readings will be posted on [bSpace](#) (see the Readings section below).

### Requirements

- Short weekly problem sets, due on Tuesdays in class (40% of grade)
- Term paper of around 7-8 pages, due on Dec. 4 (40% of grade)
- Final exam on Dec. 11, 8-11am with location TBA (20% of grade)

Class and section participation will be taken into account in cases of borderline grades.

For graduate students in philosophy, this course satisfies the formal philosophy course requirement. Graduate students should see Professor Holliday about assignments.

### Sections

All enrolled students must attend a weekly discussion section. Sections will be led by GSI Justin Bledin, a Ph.D. candidate in the Group in Logic and Methodology of Science.

### Contact

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<sup>1</sup>The electronic version at [philosophy.berkeley.edu/people/page/123](http://philosophy.berkeley.edu/people/page/123) contains hyperlinks to readings and resources.

## Schedule

### Part I: Basic Concepts and Theory of Propositional Modal Logic

Aug. 23 (Th) **Course Overview**

Reading: none.

Aug. 28 (Tu) **Basic Language and Semantics**

Reading: [van Benthem 2010](#), ch. 2; [Pacuit 2009](#), §1.

Aug. 30 (Th) **Expressive Power and Invariance**

Reading: [van Benthem 2010](#), ch. 3; [Pacuit 2009](#), §3 (not including §3.1).

- Special session on LaTeX for problem sets.
- Problem Set 1 due in class Sept. 4.

Sept. 4 (Tu) **Validity and Decidability I**

Reading: [van Benthem 2010](#), ch. 4; [Pacuit 2009](#), §2.

Sept. 6 (Th) **Validity and Decidability II**

Reading: [van Benthem 2010](#), ch. 4; [Pacuit 2009](#), §2.

- Problem Set 2 due in class Sept. 11.

Sept. 11 (Tu) **Axioms, Proofs, and Completeness I**

Reading: [van Benthem 2010](#), ch. 5; [Pacuit 2009](#), §4.

Sept. 13 (Th) **Axioms, Proofs, and Completeness II**

Reading: [Blackburn et al. 2001](#), §4.2.

- Problem Set 3 due in class Sept. 18.

Sept. 18 (Tu) **Correspondence Theory**

Reading: [van Benthem 2010](#), §9.1-9.2; [Pacuit 2009](#), §3.1.

Sept. 20 (Th) **The Landscape of Normal Modal Logics**

Reading: [van Benthem 2010](#), ch. 8.

- Problem Set 4 due in class Sept. 25.
- Review first-order logic in section with your GSI before Sept. 27.

Sept. 25 (Tu) **Non-normal Modal Logics**

Reading: [van Benthem 2010](#), §10.4; [Pacuit 2007](#), §1, §2.2-2.3.

Sept. 27 (Th) **Modal Fragment(s) of First-Order Logic**

Reading: [van Benthem 2010](#), §A.1, §7.1-7.3, §7.5, §25.1.

- Problem Set 5 due in class Oct. 2.

Start thinking about paper topics as we cover applications in Part II.

## Part II: Applications of Propositional Modal Logic

Oct. 2 (Tu) **Temporal Logic I**

Reading: [Fitting and Mendelsohn 1998](#), §1.10; [van Benthem 2010](#), §18.1-18.3; [Venema 2001](#), §1-3 (up to Theorem 3.1), §4-5.

Oct. 4 (Th) **Temporal Logic II**

*Aristotle's Sea Battle and the Master Argument of Diodorus Cronus*

Reading: [Fitting and Mendelsohn 1998](#), 35-40. Recommended: [MacFarlane 2003](#).

- Problem Set 6 due in class Oct. 9.

Oct. 9 (Tu) **Counterfactuals I**

Reading: [Lewis 1973](#), §1.1-1.4, §2.3.

Oct. 11 (Th) **Counterfactuals II**

*Counterfactual Fallacies*

Reading: [Lewis 1973](#), §1.5-1.8.

- Problem Set 7 due in class Oct. 16.

Oct. 16 (Tu) **Deontic Logic I**

Reading: [Hilpinen 2001](#), 159-170¶2.

Oct. 18 (Th) **Deontic Logic II**

*Chisholm's Paradox of Contrary-to-Duty Obligations*

Reading: [Lewis 1973](#), §5.1.

- Problem Set 8 due in class Oct. 23.

Oct. 23 (Tu) **Epistemic Logic I**

Reading: [van Benthem 2010](#), ch. 12, §13.1-13.3; [Holliday 2012](#).

Oct. 25 (Th) **Epistemic Logic II**

*The Surprise Examination Paradox*

Reading: [Sorensen 1988](#), 253-255, 289-292, 317-320.

Recommended: [Yalcin 2007](#) on *Epistemic Modals*.

- Problem Set 9 due in class Oct. 30.

Oct. 30 (Tu) **Dynamic Epistemic Logic I**

Reading: [van Benthem 2010](#), §15.1-15.4, §15.6-15.7.

Nov. 1 (Th) **Dynamic Epistemic Logic II**

*Fitch's Paradox of Knowability*

Reading: [van Benthem 2004](#).

- Problem Set 10 due in class Nov. 6.

Please email a short description of your paper topic to your GSI by Nov. 15 at the latest.

### Part III: Mathematical Connections

Nov. 6 (Tu) **Intuitionistic Logic**

Reading: [van Benthem 2010](#), ch. 20; [Burgess 2009](#), §6.1-6.5.

Nov. 8 (Th) **Provability Logic**

Reading: [van Benthem 2010](#), ch. 21; [Boolos 1994](#).

- Problem Set 11 due in class Nov. 13.

### Part IV: Quantified Modal Logic

Nov. 13 (Tu) **Quantified Modal Logic I**

Reading: [Fitting and Mendelsohn 1998](#), §4.1-4.6.

Recommended: [Lindström and Segerberg 2007](#), §1 on history of QML in philosophy.

Nov. 15 (Th) **Quantified Modal Logic II**

Reading: [Fitting and Mendelsohn 1998](#), §4.7-4.8; [van Benthem 2010](#), §11.1-11.2.

- Problem Set 12 due in class Nov. 20.

Nov. 20 (Tu) **Quantified Modal Logic III**

Reading: [Fitting and Mendelsohn 1998](#), §4.9, §6.1-6.3; [van Benthem 2010](#), §11.3 -11.4.

No class Nov. 22. To allow more time on papers, there is no problem set due on Nov. 27.
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### Part V: Conclusion

Nov. 27 (Tu) **Modal Foundations of Classical Logic**

Reading: [van Benthem 2010](#), ch. 27.

Nov. 29 (Th) **Course Review**

Reading: none.

- Term paper due Dec. 4.

Dec. 11 (Tu) **Final Exam** (8-11am, location TBA)

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## Readings

Patrick Blackburn, Maarten de Rijke, and Yde Venema. *Modal Logic*. Cambridge, 2001.

George Boolos. [Gödel's Second Incompleteness Theorem Explained in Words of One Syllable](#). *Mind*, 103(409):1–3, 1994.

John P. Burgess. *Philosophical Logic*. Princeton University Press, 2009.

Brian F. Chellas. *Modal logic: an introduction*. Cambridge University Press, 1980.

Melvin Fitting and Richard L. Mendelsohn. *First-Order Modal Logic*. Kluwer, Dordrecht, 1998.

Risto Hilpinen. [Deontic Logic](#). In Lou Goble, editor, *The Blackwell Guide to Philosophical Logic*, pages 159–182. Blackwell, 2001.

Wesley H. Holliday. [Epistemic Logic and Epistemology](#). In S.O. Hansson and V.F. Hendricks, editors, *Handbook of Formal Philosophy*. Springer, 2012. Forthcoming.

David Lewis. *Counterfactuals*. Blackwell, 1973.

Sten Lindström and Krister Segerberg. [Modal Logic and Philosophy](#). In P. Blackburn, J. van Benthem, and F. Wolter, editors, *Handbook of Modal Logic*, pages 1149–1214. Elsevier, 2007.

John MacFarlane. [Future Contingents and Relative Truth](#). *The Philosophical Quarterly*, 53(212): 321–336, 2003.

Eric Pacuit. [Neighborhood Semantics for Modal Logic: An Introduction](#). 2007.

Eric Pacuit. [Notes on Modal Logic](#). 2009.

Roy Sorensen. *Blindspots*. Oxford University Press, 1988.

Johan van Benthem. [What One May Come to Know](#). *Analysis*, 64(2):95–105, 2004.

Johan van Benthem. *Modal Logic for Open Minds*. CSLI Publications, 2010.

Yde Venema. [Temporal Logic](#). In L. Goble, editor, *The Blackwell Guide to Philosophical Logic*, pages 203–223. Blackwell, 2001.

Seth Yalcin. [Epistemic Modals](#). *Mind*, 116(464):983–1026, 2007.

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## Other Resources

### Supplements to Part I

[Blackburn et al. 2001](#) is an excellent source for mathematical treatment of normal propositional modal logics. For more on areas of contemporary research, see the [Handbook of Modal Logic](#) (Elsevier, 2006). For non-normal modal logics, in addition to [Chellas 1980](#), an excellent source is Eric Pacuit's [Course on Neighborhood Structures for Modal Logic](#).

### Supplements to Parts II and III

The [Stanford Encyclopedia of Philosophy](#) contains articles on many of the applications from Parts II and III, which serve as good gateways to the relevant literatures.

There are also a number of books that cover philosophical applications of modal logic, including: *Modal Logics and Philosophy* by Girle (2009); *Modal Logic for Philosophers* by Garson (2006); *Possibilities and Paradox* by Beall and van Fraassen (2003); *Logic for Philosophy* by Sider (2010); *An Introduction to Non-Classical Logic* by Priest (2008); *Philosophical Logic* by Burgess (2009); *A Companion to Philosophical Logic* edited by Jacquette (2005); *The Blackwell Guide to Philosophical Logic* edited by Goble (2001).

### Supplements to Part IV

In addition to [Fitting and Mendelsohn 1998](#), the books by Garson, Priest, and Sider, and the *Handbook of Modal Logic* cited above contain chapters on quantified modal logic.

### LaTeX

For your problem sets, neatly handwritten submissions are fine. However, we recommend that you try [LaTeX](#) for typing your problem sets. LaTeX will beautifully typeset all of the logical symbols that you need to use in this course. Not only is this nice for those grading your work, but also it should help you to create clear and well-organized content. Knowing how to use LaTeX is a useful skill for other courses too. For help getting started with LaTeX, see Professor MacFarlane's LaTeX page for Phil 142: [johnmacfarlane.net/142/latex.html](http://johnmacfarlane.net/142/latex.html).

## Related Courses

Professor MacFarlane's [Phil 142 Philosophical Logic](#) course includes a unit on modal logic, covering Quine's objections to quantified modal logic and responses. Phil 142 is not offered this year, but the webpage contains many helpful resources: [johnmacfarlane.net/142](http://johnmacfarlane.net/142).

Professor Holliday's [Phil 290-7 Epistemic Logic and Epistemology](#) graduate seminar covers a number of applications of epistemic logic in epistemology. If you are interested in writing your term paper in this area, please have a look at the 290-7 syllabus at [wesholliday.net](http://wesholliday.net).

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## Course Policies

### Academic Integrity

- You are welcome to work together on solving problems, but you must write up answers on your own and indicate on your submission the student(s) with whom you worked.
- Students who are found to have plagiarized or cheated in the course will receive an F.

"Any test, paper or report submitted by you and that bears your name is presumed to be your own original work that has not previously been submitted for credit in another course unless you obtain prior written approval to do so from your instructor.

In all of your assignments, including your homework or drafts of papers, you may use words or ideas written by other individuals in publications, web sites, or other sources, but only with proper attribution. "Proper attribution" means that you have fully identified the original source and extent of your use of the words or ideas of others that you reproduce in your work for this course, usually in the form of a footnote or parenthesis."

—Report of the UCB Academic Dishonesty and Plagiarism Subcommittee, June 18, 2004

### Extensions and Late Work

- Extensions will be granted only in case of medical and family emergencies.
- Late problem sets without prior notification of an emergency will not be accepted.
- Your lowest score on a problem set during the semester will be dropped.
- Term papers submitted after the deadline will immediately lose one grade step (e.g., from B+ to B) and an additional step every 24 hours thereafter.

### Regrades

- You have one week after a problem set is returned to request a regrade of a problem.
- Requests must come with a written explanation of why you would like a regrade.
- When a problem is regraded, the score may go up, down, or remain the same.
- Regrade requests are for problem sets only. Term papers will not be regraded.

### Accommodations for Students with Disabilities

If you have a letter of accommodation from the Disabled Students Program, please let us know as soon as possible so that we can do whatever we can to help you in the course.