PHILOSOPHY 413: FORMAL METHODS IN PHILOSOPHY

Professor Sarah Moss   University of Michigan, Fall 2019
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DESCRIPTION   This course is a fast-paced survey of formal methods used in contemporary philosophy. The course covers the basics of formal semantics, propositional modal logic, theories of indicative and subjunctive conditionals, probability theory, and Bayesian theories of updating and decision making.

In addition to learning basic concepts and results in each of these areas, students will gain mastery of course material through constant practice with it. This practice includes responding to cold calling in lecture, participating in collaborative problem set sessions, and reading contemporary philosophical papers that apply the formal tools covered in the course.

PREREQUISITES   A necessary condition for enrolling in this course is satisfaction of the QR/1 requirement with ECON 251 or 309, MATH 116 or 121, PHIL 303, or STATS 280 or 412.

MATERIALS   There is no single textbook that includes all of the material covered in this course. Many of the assigned readings are excerpts from textbooks, research books, and papers from a variety of disciplines and subfields, including syntax, semantics, modal logic, metaphysics, philosophy of language, epistemology, and economics.

All required readings will be posted on our course webpage on U-M Canvas. Students intending to pursue graduate work in philosophy may want to consider buying two books that feature prominently in the course—namely, Heim and Kratzer 1998, *Semantics in Generative Grammar* and Sider 2010, *Logic for Philosophy*.

GRADING   Problem sets: 50%
Final exam: 35%
Class participation: 15%

There are six problem sets assigned in this course, each consisting of ten problems. For each student, their lowest problem set grade will be dropped at the end of the semester. Students must collaborate on problem sets, submitting solutions on behalf of groups of three to five people. Each student in a group must participate in the generation of *each solution* submitted on behalf of that group; for instance, it is not permissible for groups to split up a problem set into portions that individual members complete independently.

Groups may collaborate with other groups, as long as each produces a distinct solution set. At the top of each problem set, please name the members of your group and mention any other groups with which you worked.

LAPTOPS

With two exceptions, students may not use laptops, tablets, or phones during lecture. Randomized studies have shown that students using laptops do significantly worse on exams that test their comprehension of the material. This is true even when students are not multitasking. Typing shifts students into transcription mode, whereas students writing by hand are actively processing course material.

The exceptions: first, I will permit the use of one laptop by a person who will circulate their notes to the entire class after lecture. You could set up a rotation system for which student will take notes on a given day, or you could let one volunteer assume that responsibility; this is all up to you, and I do not want to be involved. Second, if you have a disability that necessitates use of a computer, then obviously this can be accommodated.

PRINTING

If you would like to print out copies of the readings for this course, but this would be a financial hardship for you, please let me know; you are welcome to swing by my office at the start of the semester to pick up a stack of all the required readings.

DISABILITIES

The Americans with Disabilities Act is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Office of Services for Students with Disabilities. Their Student Intake Form can be found at `https://ssd.umich.edu/`.

At the University of Michigan, students are responsible for communicating any need for accommodations to instructors early in the semester, usually by presenting them with a Verified Individualized Services and Accommodations letter.

SNACKS

With the help of our department staff, I have hammered out a scheme for converting my research budget funds into food for hard-working students. Whenever your problem set group holds a significant working session—i.e. one that lasts at least an hour, let's say—I will happily buy you pizza, or sushi, or whatever sort of takeout food you prefer.

Here is how this works: you order the food, save your receipt, and email me with the amount spent. Then you email `expensereports@umich.edu` with a copy of the receipt and a list of the students who attended the session. Within a few weeks, you should get reimbursed. Please do not hesitate to contact me if you encounter any road bumps in this process.

Prerequisites and preliminaries

9/3   **review of basic components of formal systems of propositional logic, alternative formalizations, epistemology of logic**
Optional readings:
McGee 1985: "A Counterexample to Modus Ponens"
Boghossian and Williamson 2003: "Blind Reasoning"

9/5   **use and mention, corner quotes, argument schemas, substitutional quantification**
Required readings:
MacFarlane 2008: "Substitutional Quantifiers," p. 1–5
Williamson 1994: *Vagueness*, statement of bivalence on p.187–8
Optional reading:
Quine 1981: *Mathematical Logic*, §6: "Quasi-Quotation"

Formal semantics

9/10   **set theory, relations, lambda notation, category mistakes**
Required readings:
Steinhart 2018: *More Precisely: The Math You Need. . .* , §1.1–1.7, 2.2–2.3
Heim and Kratzer 1998: *Semantics in Generative Grammar*, ch. 1, §2.5
Optional reading:
Magidor 2013: *Category Mistakes*, §1.1–1.2

9/12   **semantic type, calculating semantic values, syntactic trees, basic tree vocabulary, syntactic constituency tests**
Required readings:
Heim and Kratzer 1998: *Semantics in Generative Grammar*, §2.1–2.3
McCawley 1993: "Some Syntactic Prerequisites," p.13–16
Carnie 2013: *Syntax: A Generative Introduction*, p.98–99
Optional readings:
Carnie 2013: *Syntax: A Generative Introduction*, §2.0–2.2, 3.0

9/17   **motivation for syntactic structure, functional application, practice computing semantic values, predicational and specificational copular sentences, semantically vacuous words**
Required readings:
Akmajian et al. 2010: *Linguistics: An Introduction. . .* , p.152–4
Heim and Kratzer 1998: *Semantics in Generative Grammar*, §3.1, 4.1–4.3.2
Optional reading:
Pryor 2010: "Reasons and That-Clauses"

9/19 **quantifiers, predicate modification, non-intersective adjectives, definite descriptions**

Required readings:

Heim and Kratzer 1998: *Semantics in Generative Grammar*, §4.3, 6.1–6.3

Optional readings:

von Fintel 2003: "Would you Believe it? The King of France is Back!. . . "

Yablo 2006: "Non-Catastrophic Presupposition Failure"

problem set 1 due

9/24 **truth relative to worlds, intensional semantic values, intensional functional application, context sensitivity, epistemic modals**

Required reading:

von Fintel and Heim 2005: *Intensional Semantics Lecture Notes*, ch. 1

Optional readings:

Lewis 1980: "Index, Context, and Content"

Egan and Weatherson 2005: "Epistemic Modals and Epistemic Modality"

Propositional modal logic

9/26 **modal logic symbols, flavors of modality, frames and models, semantics of modals, valuation functions**

Required reading:

Sider 2010: *Logic for Philosophy*, p.133 to definition of valuation on p.140

Optional reading:

Garson 2018: "Modal Logic," §1–2

10/1 **validity in a model, validity in a system, formal systems K, T, and S4**

Required reading:

Sider 2010: *Logic for Philosophy*, p.140 to Example 6.2 on p.143–4

Optional readings:

Hughes and Cresswell 1996: *A New Introduction to Modal Logic*, ch. 2

Sider 2010: *Logic for Philosophy*, §6.4.1, 6.4.3, 6.4.5

problem set 2 due

10/3 **formal system S5, constructing countermodels, practice with proofs, soundness and completeness, characteristic axioms**

Required reading:

Sider 2010: *Logic for Philosophy*, remainder of §6.3.2

Optional readings:

Garson 2018: "Modal Logic," §6

Sider 2010: *Logic for Philosophy*, §6.3.3, 6.4.6

10/8 **formal systems B and D, diagram of formal systems, applications of formal systems, paradoxes of deontic logic**

Required reading:

Sider 2010: *Logic for Philosophy*, §7.1–7.2

Optional readings:

Sider 2010: *Logic for Philosophy*, §6.4.2, 6.4.4, 7.3

Garson 2000: "Modal Logic," §7–8

Chisholm 1963: "Contrary-to-Duty Imperatives and Deontic Logic"

McNamara 2010: "Deontic Logic," §4.5

10/10 **more practice with validity proofs and constructing countermodels, debates about the logic of metaphysical necessity**

Required reading:

Salmon 1989: "The Logic of What Might Have Been," §1–2

Optional readings:

Lewis 1986: *On the Plurality of Worlds*, §4.4

Salmon 1989: "The Logic of What Might Have Been," §3–5

Conditionals

10/17 **subjunctives and indicatives, test battery for presuppositional content, presuppositions of conditionals**

Required readings:

von Fintel 2011: "Conditionals," §1–2

Beaver and Geurts 2011: "Presupposition," §1–3

Optional readings:

Gibbard 1981: "Two Recent Theories of Conditionals"

Edgington 1995: "On Conditionals"

Simons 2006: "Foundational Issues in Presupposition"

problem set 3 due

10/22 **strict conditional analysis of subjunctives, problems for the strict conditional analysis, Stalnaker 1968 analysis, modeling conversational context, vindicating the or-to-if inference**

Required readings:

von Fintel 2011: "Conditionals," §3.2

Stalnaker 1968: "A Theory of Conditionals," §1–2

Stalnaker 1975: "Indicative Conditionals," §1–4

Optional readings:

Bennett 2003: *A Philosophical Guide to Conditionals*, §65–67

Edgington 2004: "Indicative Conditionals," §4.1

Cariani 2019: "On Stalnaker's *Indicative Conditionals*"

10/24   **Lewis 1973 analysis, supervaluationism, conditional excluded middle, negative polarity items, downward entailing environments**
Required readings:
Weatherson 2014: "David Lewis," §3.1–3.2
Keefe 2008: "Vagueness: Supervaluationism," p.315–17
von Fintel 1999: "NPI Licensing, Strawson Entailment, and Context…," §1
Optional readings:
Lewis 1973: *Counterfactuals*, §1.3–1.4, 3.4
Swanson 2012: "Conditional Excluded Middle without the Limit Assumption"
Giannakidou 2017: "Polarity in the Semantics of Natural Language"

10/29   **Fauconnier-Ladusaw analysis of NPI licensing, consequences for semantic theories of subjunctives, dynamic strict conditional analysis, Sobel and reverse Sobel sequences**
Required reading:
von Fintel 2001: "Counterfactuals in a Dynamic Context," §3.1–3.4
Optional readings:
Heim 1984: "A Note on Negative Polarity and Downward Entailingness"
Gillies 2007: "Counterfactual Scorekeeping," §1–4
Episode 79 of *Elucidations*: Thony Gillies on conditionals[1]

10/31   **pragmatic variably strict analysis of subjunctives, material conditional analysis of indicatives, paradoxes of material implication, Ramsey test**
Required readings:
Moss 2009: "On the Pragmatics of Counterfactuals," §1–4
Abbott 2004: "Some Remarks on Indicative Conditionals," §1–2
Bennett 2003: *A Philosophical Guide to Conditionals*, §12
Optional readings:
Jackson 1979: "On Assertion and Indicative Conditionals"
Lewis 2018: "Counterfactual Discourse in Context"
problem set 4 due

Probability theory

11/5   **credences, probability axioms, conditional probability**
Required readings:
Strevens 2006: "Notes on Bayesian Confirmation Theory," §1–3.2
Titelbaum 2019: *Fundamentals of Bayesian Epistemology*, §3.1.1–3.1.2
Optional readings:
Hájek 2003: "What Conditional Probability Could Not Be," §4, 10
Easwaran 2016: "Conditional Probability," §9.4

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[1]Available here: `https://lucian.uchicago.edu/blogs/elucidations/past-episodes/`.

11/7 **Bayes' Theorem, Stalnaker's Hypothesis, triviality results, other challenges to the Hypothesis, non-truth-conditional theories of indicatives**
Required readings:
Titelbaum 2019: *Fundamentals of Bayesian Epistemology*, §3.1.3
Bradley 2015: "Appendix: Bayes' Theorem and the Base Rate Fallacy"
Edgington 1995: "On Conditionals," §6.1–6.3
Optional readings:
Lewis 1976: "Probabilities of Conditionals and Conditional Probabilities"
Edgington 1995: "On Conditionals," §7–8
McGee 2000: "To Tell the Truth About Conditionals"
Rothschild 2003: "Do Indicative Conditionals Express Propositions?"
Kaufmann 2004: "Conditioning Against the Grain," §1–2
Manrai et al. 2014: "Medicine's Uncomfortable Relationship With Math..."
Swanson 2016: "Probability in Philosophy of Language," §3–5

11/12 **Simpson's paradox, Conditionalization, Jeffrey Conditionalization, Judy Benjamin, generalized updating**
Required readings:
Titelbaum 2019: *Fundamentals of Bayesian Epistemology*, §3.2.3
Weisberg 2010: "Varieties of Bayesianism," §3.3–3.5
Optional readings:
Jeffrey 2004: *Subjective Probability: The Real Thing*, chapter 3
Schneps and Colmez 2013: *Math on Trial: How Numbers Get Used...*, p.109–20
Radelet and Pierce 1991: "Choosing Those Who Will Die...," §4

11/14 **credence and full belief, Reflection, Bertrand-style paradoxes, imprecise credences, dilation**
Required readings:
Strevens 2006: "Notes on Bayesian Confirmation Theory," p.99–103
White 2010: "Evidential Symmetry and Mushy Credence"
Optional readings:
Moss 2019: "Full Belief and Loose Speech," §1–4
Briggs 2009: "Distorted Reflection," p.64–73
Joyce 2010: "A Defense of Imprecise Credences...," p.296–307
Moss 2019: "Global Constraints on Imprecise Credences," §5

11/19 **Sleeping Beauty, observation selection effects, Doomsday argument, Bartha and Hitchcock response to Carter and Leslie**
Required readings:
Elga 2000: "Self-Locating Belief and the Sleeping Beauty Problem"
Bartha and Hitchcock 1999: "No One Knows the Date or the Hour..."

Optional readings:

Lewis 2001: "Sleeping Beauty: Reply to Elga"

Arntzenius 2003: "Some Problems for Conditionalization and Reflection"

Manley 2019: "On Being a Random Sample"

problem set 5 due

Decision theory, game theory, social choice theory

11/21   **expected utility, Dutch Book argument for probabilism, Sure Thing Principle, drunk driving example**

Required readings:

Weatherson 2011: *Logic of Decision,* §3.1, 3.3–3.5

Hájek 2008: "Dutch Book Arguments," §1–2.3

Optional readings:

Jeffrey 2004: *Subjective Probability: The Real Thing,* §1.1–1.6

Joyce 2004: "Bayesianism," §2

Buchak 2017: ''Precis of *Risk and Rationality*"

11/26   **causal decision theory, evidential decision theory, Newcomb problem, decision trees, strategic games**

Required reading:

Weatherson 2011: *Logic of Decision,* §6.1–6.4

Optional readings:

Gibbard and Harper 1978: "Counterfactuals and. . . Expected Utility," §1–3

Lewis 1981: "Causal Decision Theory," §1–9

Egan 2007: "Some Counterexamples to Causal Decision Theory," §1–3

Buchak 2016: "Decision Theory," §36.2–36.5

12/3   *Chicken, Driving, Matching Pennies***, existence of mixed-strategy Nash equilibria,** *Rock-Paper-Scissors, Stag Hunt, Prisoner's Dilemma*

Required reading:

Weatherson 2011: *Logic of Decision,* §9.1–9.3

12/5   *Split or Steal, Prisoner's Dilemma* **as a Newcomb problem, social choice functions, Arrow's Impossibility Theorem**

Required reading:

Weatherson 2011: *Logic of Decision,* §13.1–13.4

Optional reading:

Saari 2001: *Decisions and Elections,* §2.4–2.6

problem set 6 due

Final exam review session and course evaluations: December 10