Introduction to Formal Reasoning and Decision-Making

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Philosophy 109, Waller 210
M/Th 12:35-1:55
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Course Description

Reasoning is one of the most important activities in which humans engage. We form arguments for the ideas, beliefs, and views which we have. We argue against alternative ideas, beliefs, and views. We make decisions by weighing the pros and cons of various outcomes, and by estimating how likely those outcomes are. But what makes some kinds of reasoning good, and other kinds of reasoning bad? What rules ought to govern reasoning? And how should we make decisions?

In this course, students will learn some theories of reasoning which address these questions. We will begin with propositional logic, which is a theory of a kind of reasoning that takes the form of deductive arguments. Then we will discuss probability and rational choice: these are theories of a kind of reasoning that takes the form of inductive inferences. While covering these topics, we will occasionally discuss the incorrect ways in which humans often reason.

Course Requirements

1. Four homeworks (100 points each).
   - Students will be required to complete four homeworks.
   - Each homework must be submitted by the date and time on the schedule below.
   - Late homework will not be accepted.
2. Midterm (200 points).
   - Date: Oct 21.
   - The midterm will cover the material on propositional logic.
3. Final (200 points).
   - Date: Dec 9.
   - The final will be cumulative: it will cover propositional logic, probability theory, and rational choice theory.

For information about various course policies—for instance, the late assignment policy, the grade appeals policy, and the make-up work policy—see the course websites.

1. Sakai course website: https://sakai.rutgers.edu/portal/site/cf77aa12-0f0d-430c-a1e5-ff6ef912a843.

2. My course website: https://isaacwilhelm.com/introduction-to-formal-reasoning-and-decision-making/.

Goals for the Course

By this course's conclusion, you should be able to

- translate natural-language arguments into arguments in propositional logic,
- distinguish valid arguments from invalid arguments,
- discuss the basics of probability theory,
- use expected values to model rational decision-making, and
- discuss complex philosophical ideas respectfully.

Plagiarism and Academic Integrity

Please adhere to the Rutgers University policies on plagiarism and academic integrity. Penalties for violations of these policies can be severe: they include an automatic failing grade for the course, and possibly worse. A comprehensive overview of these policies can be found at http://academicintegrity.rutgers.edu/academic-integrity-policy/.

Accessibility

This class should be a great, fun, and educational experience for everyone. And of course, everyone deserves equal access to all educational opportunities at Rutgers. Disabled students are encouraged to speak with me if that would be helpful, and to avail themselves of the services provided by the Office of Disability Services: https://ods.rutgers.edu/.

Schedule

The readings will be drawn from two textbooks: *forallx: Calgary Remix* (Magnus, Button) and *An Introduction to Probability and Inductive Logic* (Hacking). The former is posted on the course's Sakai website, and the latter is available for purchase at the campus bookstore.

1. **Introduction**
    - Sept 5: reasoning.
2. **Propositional Logic**
    - Sept 9: natural-language arguments. Read *forallx* (Magnus, Button), "Chapter 1: Arguments".
    - Sept 12: valid and invalid arguments in natural language. Read *forallx* (Magnus, Button), "Chapter 2: Valid arguments".

- Sept 16: translation with sentence letters and connectives ¬ and &. Read *forallx* (Magnus, Button), "Chapter 4: First steps to symbolization" and "Chapter 5: Connectives".
- Sept 19: translation with connectives ∨, →, ↔.
- Sept 23: sentences in the formal language. Read *forallx* (Magnus, Button), "Chapter 6: Sentences of TFL".
  - <u>Homework 1 due</u> (at start of class).
- Sept 26: truth tables for the five connectives. Read *forallx* (Magnus, Button), "Chapter 8: Characteristic truth tables".
- Sept 30: arguments in the formal language; validity and soundness.
- Oct 3: truth tables for sentences in the formal language. Read *forallx* (Magnus, Button), "Chapter 10: Complete truth tables".
- Oct 7: arguments, entailment, validity, tautologies, contradictions, logical equivalence, consistency. Read *forall x* (Magnus, Button), "Chapter 11: Semantic Concepts".
- Oct 10: arguments, entailment, validity, tautologies, contradictions, logical equivalence, consistency (continued).
  - <u>Homework 2 due</u> (at start of class).
- Oct 14: catch-up.
- Oct 17: review.
- Oct 21: <u>midterm</u>.

3. **Probability Theory and Decision-Making**
- Oct 24: probability, credence, and chance. Read *Introduction to Probability* (Hacking), "Chapter 2: What Is Inductive Logic?".
- Oct 28: probabilistic reasoning in natural language.
- Oct 31: formalism of probability theory. Read *Introduction to Probability* (Hacking), "Chapter 4: Elementary Probability Ideas".
- Nov 4: formalism of probability theory (continued). Read *Introduction to Probability* (Hacking), "Chapter 6: The Basic Rules of Probability".
- Nov 11: stochastic truth tables, and rational credence at a time.
- Nov 14: conditional probability, and rational credence over time. Read *Introduction to Probability* (Hacking), "Chapter 5: Conditional Probability".
  - <u>Homework 3 due</u> (at start of class).
- Nov 18: stochastic truth tables, and rational credence over time.
- Nov 21: Bayes' theorem. Read *Introduction to Probability* (Hacking), "Chapter 7: Bayes' Rule".
- Nov 25: the law of total probability.
- Nov 26: expected utility. Read *Introduction to Probability* (Hacking), "Chapter 8: Expected Value".
- Dec 2: catch-up.
  - <u>Homework 4 due</u> (at start of class).
- Dec 5: review.
- Dec 9: <u>final</u>.