

Reasoning for Humans: Clear Thinking in an Uncertain World

Instructor:	Eric Pacuit (pacuit.org)
Semester:	Spring 2018
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Course Website:	umd.instructure.com/courses/1240548
Office:	Skinner 1103A
Office Hours:	Wed 2:15pm - 3:15pm or by appointment
Class Times:	TuTh 2:00pm - 3:15pm
Class Location:	Jimenez Building (JMZ) 0208

Course Description

In this course, students will use methods from logic and probability to analyze experiments about how humans reason and philosophical questions and puzzles about the nature of reasoning. Students will learn to identify some common informal reasoning errors, learn to identify arguments and their parts, study the concepts used to evaluate arguments, and learn the basic elements of deductive logic and probability theory. There will be an emphasis on different philosophical aspects of the problem of induction and on the relation between probability, deductive logic and inductive logic. We will use a variety of different formats during class meetings, including lecture, discussion, working on exercises together, and small group work. The goal is to develop a broad understanding of the principles that guide human reasoning.

Reasoning is a transition in thought, where some beliefs (or thoughts) provide grounds or reasons for coming to another. What makes certain transitions of thought “rational” or reasonable while others are considered irrational or erratic? This question has been a major focus of investigation in many different research areas, such as philosophy, logic, psychology, cognitive science and artificial intelligence. One objective of this course is to discuss important philosophical puzzles that have driven much of the foundational research on human reasoning. For example, the lottery paradox:

The Lottery Paradox: Imagine a fair lottery with a million tickets in it. For each ticket, it is so unlikely to win that it you are justified in believing that it will lose. From this you can infer that each ticket will lose. Yet, since the lottery is fair, you also know that there must be some ticket that will win. This line of thought seems perfectly reasonable; however, it leads to beliefs that are logically inconsistent.

A second objective of this course is to examine key experiments that have demonstrated the supposed limitations of our ability to reason “correctly”. For example, the conjunction fallacy:

The Conjunction Fallacy: This experiment is from Daniel Kahneman and Amos Tversky. Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations. Which is more probable?

1. Linda is a bank teller.
2. Linda is a bank teller and is active in the feminist movement.

In numerous experiments, it has been demonstrated that people tend to choose option 2. Does this show that something is wrong with our best theory of reasoning under uncertainty (probability theory)?

The course will include readings from the different disciplines mentioned above; however, no prior knowledge of any of these fields is presupposed.

Mathematical Background

There are no prerequisites for this course. An important objective of the course is to introduce the mathematical background on logic and probability that is needed to engage with the literature on reasoning. To that end, online videos and interactive tutorials on logic and probability will be made available to the students.

Literature

The readings for the course will be taken from the following textbooks and journal articles. The chapters and articles will be available on the course website.

- J. Adler and L. Ripps (eds.), *Reasoning: Studies of Human Inference and its Foundations*, Cambridge University Press, 2008 (especially the introductory survey by J. Adler, pgs. 1 - 34).
- D. Easley and J. Kleinberg Chapter 16 (Information Cascades) from *Networks, Crowds and Markets*, Cambridge University Press
- B. Fitelson and J. Hawthorne (2010). The Wason Task(s) and the Paradox of Confirmation, *Philosophical Perspectives*, 24, pp. 207 - 241.
- S. Hartmann and W. Meijs (2012). Walter the Banker: The Conjunction Fallacy Reconsidered, *Synthese*, 184:1, pp. 73 - 87

- G. Harman, Chapter 1: Rationality by (pgs. 9 - 27) from *Reasoning, Meaning and Mind*
- I. Hacking, *Introduction to Probability and Inductive Logic*, Cambridge University Press, 2001 (Chapter 6)
- D. Kahneman, *Thinking, Fast and Slow* by Daniel Kahneman, Farrar, Straus and Giroux, 2011
- B. Skyrms, *Choice and Chance: An Introduction to Inductive Logic*, Cengage Learning, 1999
- K. Stenning and M. van Lambalgen, *Human Reasoning and Cognitive Science*, The MIT Press, 2008
- E. Yudkowsky, *An Intuitive Explanation of Bayes' Theorem*, available at <http://yudkowsky.net/rational/bayes>

Grading Policy

The course requirements are:

- **Participation** (25% of your final grade): Students will be given a maximum of 35 points for active participation in the course (keeping up with the reading, asking questions, contributing to the discussion, etc.). In order to encourage participation, short assignments and surveys may be given during lectures. (These will not be graded, although you will receive points for handing in the assignments/surveys.) In addition, students will receive a maximum of 35 points for online discussion. For each of the 7 units, students must contribute to an online discussion. To receive full credit for the online discussion, students must ask at least one question and answer at least one question from another student.
- **Quizzes** (25% of your final grade). There will be 10-12 quizzes given throughout the semester. The quizzes will be either in-class or online. I will generally announce the quizzes either on the course website or in class (however, there may be some unannounced in-class quizzes). **The lowest quiz score will be dropped.** Since the quizzes are designed, in part, to encourage attendance and to ensure that students keep up with the reading, **make-up quizzes will not be offered.**
- **In-class tutorials** (25% of your final grade). At the end of each unit, there will be an in-class tutorial. During the scheduled in-class tutorial, students will work on these problems in teams, present solutions and discuss the answers with the instructor. The students must write-up their final solutions and hand them in on ELMS.

- **Exams** (25% of your final grade). Your exam grade will be the average of your grades on two exams:
 - **Midterm exam** The midterm exam is a take-home exam consisting of multiple choice problems and short essay questions. The midterm exam will be made available roughly half-way through the semester.
 - **Final exam** The final will be cumulative and given as an in-class exam given during finals week. A study guide will be provided during the last week of the semester. The exam will be held during exam week (May 12 - 18, 2018). Consult Testudo for the date, time and location of the final exam.

See undergraduate catalogue for description of grades, e.g., A+, A, A-, etc.: <http://www.umd.edu/catalog/index.cfm/show/content.section/c/27/ss/1584/s/1534>. Your final grade may be curved (althou

Schedule

Below is a tentative schedule for the semester. A more detailed schedule, including links to the reading material, can be found on the course website.

Introduction and Course Overview

- Thu 1/25: Introductory remarks and course overview
- Chapter 1: Rationality by G. Harman (pgs. 9 - 27) from *Reasoning, Meaning and Mind*
- Introduction: Philosophical Foundations by J. Adler, from *Reasoning: Studies in Human Inference and Its Foundations*

Unit 1: Logical Preliminaries

- Topics: Boolean connectives, truth-tables, valid arguments, logical equivalence
- Reading: Skyrms Chapter 1, online videos prepared by the instructor
- Lecture Dates: Tue 1/30, Thu 2/1, Tue 2/6
- In-class tutorial on sentential logic: Thu 2/8

Unit 2: Logic and Reasoning

- Topics: The Wason Selection Task, failures of Modus Ponens, non-monotonicity, closed-world reasoning, conditionals, introduction to non-classical logics

- Reading: Stenning and van Lambalgen, Chapter 2 (Anatomy of Logic) and Chapter 3 (A Little Logic Goes a Long Way)
- Lecture Dates: Tue 2/13, Thu 2/15, Tue 2/20, Thu 2/22
- In-class tutorial on non-classical logics: Tue 2/27

Unit 3: Inductive Logic

- Topics: Introduction to inductive logic,
- Reading: Skyrms Chapter 2
- Lecture Dates: Thu 3/1, Tue 3/6
- In-class tutorial in inductive logic: Thu 3/8

Unit 4: Probability Preliminaries

- Topics: Axioms of probability, stochastic truth-tables, conditional probability, Bayes rule, reasoning with probabilities
- Reading: Skyrms Chapter 6, online videos prepared by the instructor
- Lecture Dates: Tue 3/13, Thu 3/15, Tue 3/27
- **No Class (Spring Break)** Tue 3/20 and Thu 3/22
- In-class tutorial on probability: Thu 3/29

Unit 5: Inductive Logic, Probability and Reasoning

- Topics: The conjunction fallacy, The base-rate fallacy, The ravens paradox, The Grue paradox, the Wason Selection Task reconsidered, and framing effects
- Reading:
 - Skyrms Chapter 4
 - Chapter 15 from *Thinking Fast and Slow* by D. Kahneman
 - Walter the Banker: The Conjunction Fallacy Reconsidered by Hartmann and Meijs
 - The Wason Task(s) and the Paradox of Confirmation by Fitelson and Hawthorne
 - Chapter 34 from *Thinking Fast and Slow* by D. Kahneman
- Lecture Dates: Tue 4/3, Thu 4/5, Tue 4/10, Thu 4/12, Tue 4/17
- In-class tutorial on paradoxes of inductive logic: Thu 4/19

Unit 6: Interpretations of Probability

- Topics: Frequency interpretation, subjective probability, Preface Paradox, Lottery Paradox
- Reading: Skyrms, Chapter 7,
- Lecture Dates: Tue 4/24, Thu 4/26

Unit 7: Reasoning about Others

- Topics: Belief Polarization, Information Cascades
- Reading: Chapter 16 (Information Cascades) from *Networks, Crowds and Markets* by D. Easley and J. Kleinberg
- Lecture Dates: Tue 5/1, Thu 5/3
- In-class tutorial on reasoning about others and interpretations of probability: Tue 5/8

Concluding Remarks

- Thu 5/10: Concluding remarks and review for the final exam

Course Policies

A full list of course-related policies and relevant links to resources may be found at:

<http://www.ugst.umd.edu/courserelatedpolicies.html>.

Communication about this Course

I will use email to convey important information, and students are responsible for keeping their email address up to date, and must ensure that forwarding to another address functions properly. Failure to check email, errors in forwarding, and returned email are the responsibility of the student, and do not constitute an excuse for missing announcements or deadlines.

Class Cancelations

The University may be closed in the event of an emergency, in which case class will be cancelled. To find out if the University is closed you can check its main site (<http://www.umd.edu>), its emergency preparedness site (<http://www.umd.edu/emergencypreparedness/>), or call the “snow phone line” at 301-405-7669 (which covers more than just snow caused closings). If class is cancelled while the University remains open, then there will be an announcement posted on the course ELMS page.

Emergency protocol: In the case of an extended closure to the University (e.g., because of inclement weather), consult the ELMS course page for announcements and changes to any due dates.

Attendance and Absences

Students are expected to attend classes regularly. Consistent attendance offers students the most effective opportunity to gain command of course concepts and materials. Events that justify an excused absence include: religious observances; mandatory military obligation; illness of the student or illness of an immediate family member; participation in university activities at the request of university authorities; and compelling circumstances beyond the student’s control (e.g., death in the family, required court appearance). Absences stemming from work duties other than military obligation (e.g., unexpected changes in shift assignments) and traffic/transit problems do not typically qualify for excused absence. Students claiming an excused absence must notify the course instructor in a timely manner and provide appropriate documentation. The notification should be provided either prior to the absence or as soon afterwards as possible. In the case of religious observances, athletic events, and planned absences known at the beginning of the semester, the student must inform the instructor during the schedule adjustment period. All other absences must be reported as soon as is practical. The student must provide appropriate documentation of the absence. The documentation must be provided in writing to the instructor by the means

specified in this syllabus. The full university attendance/absence policy can be found here: <http://www.ugst.umd.edu/courserelatedpolicies.html>.

Academic Integrity

The UMD Honor Code prohibits students from cheating on exams, plagiarizing papers, submitting the same paper for credit in two courses without authorization, buying papers, submitting fraudulent documents and forging signatures. On every examination, paper or other academic exercise not exempted by the instructor, students must write by hand and sign the following pledge:

I pledge on my honor that I have not given or received any unauthorized assistance on this examination (or assignment).

Allegations of academic dishonesty will be reported directly to the Student Honor Council: <http://www.shc.umd.edu>

Disability Support

Students with a documented disability should inform the instructors within the add-drop period if academic accommodations will be needed. NB: You are expected to meet with your instructor in person to provide them with a copy of the Accommodations Letter and to obtain your instructor's signature on the Acknowledgement of Student Request form. You and your instructor will plan together how accommodations will be implemented throughout the semester. To obtain the required Accommodation Letter, please contact Disability Support Service (DSS) at 301-314-7682 or dissup@umd.edu

Copyright Notice

Class lectures and other materials are copyrighted. They are the property of the instructor - do not sell them, do not post them on a website. They may not be reproduced for anything other than personal use without written permission from the instructor. Copyright infringements may be referred to the Office of Student Conduct.

Academic Accommodations for Students who Experience Sexual Misconduct

The University of Maryland is committed to providing support and resources, including academic accommodations, for students who experience sexual or relationship violence as defined by the University's Sexual Misconduct Policy. To report an incident and/or obtain an academic accommodation, contact the Office of Civil Rights and Sexual Misconduct at 301-405-1142. If you wish to speak confidentially, contact Campus Advocates Respond and Educate (CARE) to Stop Violence at 301-741-3555. As 'responsible university employees'

faculty are required to report any disclosure of sexual misconduct, i.e., they may not hold such disclosures in confidence. For more information: <http://www.umd.edu/ocrsm/>

Diversity

The University of Maryland values the diversity of its student body. Along with the University, I am committed to providing a classroom atmosphere that encourages the equitable participation of all students regardless of age, disability, ethnicity, gender, national origin, race, religion, or sexual orientation. Potential devaluation of students in the classroom that can occur by reference to demeaning stereotypes of any group and/or overlooking the contributions of a particular group to the topic under discussion is inappropriate.

For information on elms, counseling, health, learning workshops, tutoring, writing help, student rights in undergrad courses, questions about graduation or add/drop/withdraw, please see <http://www.ugst.umd.edu/courserelatedpolicies.html>.