

PHIL 157.001: Logic and Decision Theory

Fall 2022

Instructor: Gerard Rothfus

Classroom: PH 328

Day/Time: Monday/Wednesday, 3:35-4:50pm

Office Hours: Tuesday/Thursday, 10:30-11:30am, 11 Caldwell Hall

Final Exam: Thursday, December 8, 4:00pm

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Brief Description

A broader discussion of practical reasoning, including inductive and deductive logic, which provides a good introduction to decision and game theory that is important for the social sciences, especially economics.

Long Description

This course introduces students to formal techniques for making and evaluating decisions. Along the way, we will explore various models for framing and analyzing both individual and social decision problems using resources drawn from a diverse array of fields including symbolic logic, probability theory, game theory, and voting theory. While our focus will be primarily normative and centered upon characterizing rational decision making, we will also consider the descriptive plausibility of the models we consider as applied to typical human agents. The course aims both to enhance students' understanding of decision theory as an academic field and to equip them with tools for use in their own practical decision making.

Learning Objectives

This course will equip students to:

- Represent and analyze arguments via propositional logic and probability theory.

- Identify cognitive biases that commonly afflict human inductive reasoning and decision making.
- Correct for these biases by applying Bayes' Rule and other principles of probability to assess the quality of arguments and the merits of possible choices.
- Measure subjective probabilities and utilities using standard elicitation techniques.
- Represent and analyze practical decision problems using the tools of rational choice theory.
- Employ decision algorithms like expected utility maximization
- Use game theory to analyze strategic interactions, esp. by finding Nash equilibria and related solutions to games.

Gen Ed Requirements

This course satisfies a Quantitative-Intensive (QI) *Making Connections Curriculum* Gen Ed requirement, which is described by the university as follows:

This second-level requirement is intended to develop and refine quantitative-reasoning skills in disciplinary contexts and to integrate the foundational skills across the curriculum. Students should become acquainted with how quantitative methods are applied in their major fields of interest and, when feasible, should be encouraged to take a quantitative methods course in their major or minor area of study or in an allied field. The course can either be (a) an additional core mathematical sciences course (as described in the Foundations component above), or (b) a course in any department with a substantial quantitative component (at least half). The course content should involve students in some of the following activities:

1. Using quantitative methods to model and solve problems, including problems requiring the development and implementation of computational algorithms.
2. Developing numerical reasoning above the level of basic algebra and trigonometry.
3. Collecting and interpreting quantitative data.
4. Constructing logically sound arguments and recognizing fallacies by using quantitative information, mathematical analysis, formal logic, and proofs.
5. Expressing ideas and concepts from the mathematical sciences orally and in writing.

6. Connecting the role of the mathematical sciences to cultural change, to other sciences, and to the arts and humanities.

Course Materials

The required textbook for this course is *Introduction to Decision Theory* (2nd edition) by Martin Peterson. It is imperative that you have access to a copy of this textbook as many of the homework exercises will be drawn from it. Please let me notify me if you have any difficulty obtaining a copy and we can find a solution!

Course Structure

The course will be organized around two weekly lecture/discussion periods, where various topics in decision theory will be explored and discussed in person. You are strongly urged to do the suggested readings before each lecture in order to be better prepared to engage, ask questions, make suggestions in discussion, etc. (Suggested readings are identified in the Course Outline below.) Periodically, I may also release short, pre-recorded videos to the class site (as well as YouTube), summarizing different ideas covered in the course. You may view these videos to help with understanding particular readings or just to get a better grip on key ideas in the course.

I will also hold office hours on Tuesdays and Thursdays from 10:30 to 11:30am. Feel free to come to these office hours and ask any questions you may have about the course! If you are unable to make these times any week and would like to discuss the course, you are very much encouraged to set up an appointment for another time. In these office hours, I am happy to go over past readings or discuss questions about upcoming assignments, new material, homework strategies, etc. Whether in or out of office hours, please feel free to reach out to me any time!

Course Assignments

Your grade in this course will be fully determined by (i) homeworks, (ii) exams, and (iii) participation.

Homework

There will be five problem sets assigned as homework over the course of the semester. These homeworks will be graded half for completion and half for correctness and will be due at the start of class, i.e. 3:35pm. (See the course outline below for homework due dates.) Late homework will be penalized ten points a day; though if you need to miss a class at which homework is due for

any reason you may email the homework in before the start of class without penalty. Your lowest homework grade will be dropped.

Exams

There will be three exams: two midterms and a final. The final will be cumulative. If your final exam grade is higher than your lowest midterm grade, your lowest midterm grade will be boosted to the average of your lowest midterm and final exam grades. All exams will be closed book/notes; the only material you need to bring is a pen or pencil and, if you desire, a rudimentary calculator. If you need to miss a test for a serious, university-approved reason, you will need to take a (different) make-up exam. (See the make-up policy below.)

Participation

Students are expected to attend lectures and participate in class discussions and activities. I will often make use of online polls to assess student comprehension of course material and to record attendance; participating in these polls will help a student's participation grade, which counts for 15% of the overall grade. Your poll answers will not be graded on correctness. If you will not have access to an electronic device suitable for accessing the internet during class (e.g. a smart phone or laptop), please let me know and we will find an alternative way for you to participate in such polls.

Every voice is welcome in our classroom and students should feel free to raise any questions or thoughts they may have regarding course material during our class discussions. However, every student is expected to respect the bounds of kindness and respect for their peers during these discussions. (Avoid interrupting, rude language, etc.) Conducting oneself with honesty and compassion is essential to good participation in the discussion and debate of controversial philosophical topics.

Grading

Your final grade will be a weighted average of your grades on individual assignments with the weights given by:

- Exam One: 15%
- Exam Two: 15%
- Final Exam: 25%
- Homework: 25%
- Participation: 15%

Grade Scale

A: 94-100	A-: 90-93	B+: 87-89	B: 83-86	B-: 80-82
C+: 77-79	C: 73-76	C-: 70-72	D+: 67-69	D: 60-66
F: <60				

If you have any questions about your grade at any point in the course, please don't hesitate to ask!

Attendance Policy

University Policy: As stated in the University's Class Attendance Policy, no right or privilege exists that permits a student to be absent from any class meetings, except for these University Approved Absences:

1. Authorized University activities
2. Disability/religious observance/pregnancy, as required by law and approved by Accessibility Resources and Service and/or the Equal Opportunity and Compliance Office (EOC)
3. Significant health condition and/or personal/family emergency as approved by the Office of the Dean of Students, Gender Violence Service Coordinators, and/or the Equal Opportunity and Compliance Office (EOC).

Class Policy: Aside from the exceptions referenced above, attendance is expected of all students and will contribute toward your grade via your participation score. That said, I understand if you need to miss class occasionally for a reason that does not fall under the University approved list. In these cases, feel free to reach out to me and let me know that you won't be able to make it to class. Then we can work together to make sure the absence won't negatively affect your participation grade.

Make-up Policy

If a student must miss a test for a university approved reason, an alternate test will be administered on another date. Please let me know as soon as possible if you will need to reschedule a test for such a reason.

Honor Code

All students are expected to follow the guidelines of the UNC Honor Code. In particular, students are expected to refrain from "lying, cheating, or stealing" in the academic context. If you are unsure about which actions violate the Honor Code, please see me or consult studentconduct.unc.edu.

Syllabus Changes

The professor reserves the right to make changes to the syllabus including project due dates and test dates. These changes will be announced as early as possible.

Accessibility Resources and Services

The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, including mental health disorders, chronic medical conditions, a temporary disability or pregnancy complications resulting in barriers to fully accessing University courses, programs and activities.

Accommodations are determined through the Office of Accessibility Resources and Service (ARS) for individuals with documented qualifying disabilities in accordance with applicable state and federal laws. See the ARS Website for contact information: <https://ars.unc.edu> or email ars@unc.edu.

Counseling and Psychological Services

UNC-Chapel Hill is strongly committed to addressing the mental health needs of a diverse student body. The Heels Care Network website is a place to access the many mental resources at Carolina. CAPS is the primary mental health provider for students, offering timely access to consultation and connection to clinically appropriate services. Go to their website <https://caps.unc.edu/> or visit their facilities on the third floor of the Campus Health building for an initial evaluation to learn more. Students can also call CAPS 24/7 at 919-966-3658 for immediate assistance.

Title IX Resources

Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Reports can be made online to the EOC at <https://eoc.unc.edu/report-an-incident/>. Please contact the University's Title IX Coordinator (Elizabeth Hall, titleixcoordinator@unc.edu), Report and Response Coordinators in the Equal Opportunity and Compliance Office (reportandresponse@unc.edu), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (gvsc@unc.edu; confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu.

Course Outline

Day:	Topic:	Assignment:
Aug 15	Introduction I	Syllabus
Aug 17	Introduction II	
Aug 22	The Decision Matrix I	Peterson Ch. 2
Aug 24	The Decision Matrix II	
Aug 29	Decisions Under Ignorance I	Peterson Ch. 3
Aug 31	Decisions Under Ignorance II	
Sept 5	Labor Day: No Class	
Sept 7	Decisions Under Risk I	HW1 Due
Sept 12	Decisions Under Risk II	Peterson Ch. 4
Sept 14	Utility I	Peterson Ch. 5
Sept 19	Utility II	
Sept 21	Review Day	HW2 Due
Sept 26	Well Being Day: No Class	
Sept 28	Exam One	
Oct 3	Probability I	Peterson Ch. 6
Oct 5	Probability II	
Oct 10	Probability III	Peterson Ch. 7
Oct 12	University Day: No Class	
Oct 17	Bayesianism I	Peterson Ch. 8
Oct 19	Bayesianism II	HW3 Due
Oct 24	Causal vs Evidential Decision Theory I	Peterson Ch. 9
Oct 26	Causal vs Evidential Decision Theory II	
Oct 31	Risk	Peterson Ch. 10
Nov 2	Review Day	HW 4 Due
Nov 7	Exam Two	
Nov 9	Game Theory I	Peterson Ch. 11
Nov 14	Game Theory II	Peterson Ch. 12
Nov 16	Game Theory III	
Nov 21	Social Choice Theory I	Peterson Ch. 13
Nov 23	Thanksgiving Holiday: No Class	
Nov 28	Social Choice Theory II	HW5 Due
Nov 30	Descriptive Decision Theory	Peterson Ch. 14
Dec 8	Final Exam, 4pm	