

Choices, Decisions, and Games (80-305/80-605)

Fall 2018

Tuesday/Thursday 3:00–4:20, PH A18C

<https://canvas.cmu.edu/courses/6646>

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Office hour: Friday 2:00–3:00, Maggie Murph Café (first floor of Hunt Library)

Course Description: This course is an introduction to formal models of choice and decision-making. We begin by examining choice under certainty, developing both qualitative and quantitative models of preference. We then expand our analysis to take into account uncertainty, focusing on the von Neumann-Morgenstern theory of expected utility and Savage's classic axioms. Empirical challenges to models are emphasized throughout, in response to which we will consider a variety of alternative representations of uncertainty (e.g., Dempster-Shafer belief functions, non-unique probability measures) and preference (e.g., framing effects, prospect theory).

Texts: *Notes on the Theory of Choice* by David M. Kreps; *Reasoning About Uncertainty* by Joseph Y. Halpern. Both are optional.

Course Objectives: The primary objective of this course is to develop *mathematical competence* in modeling decision making, along with the ability to apply this competence in useful ways. This means being able to:

- comprehend different models of choice in a variety of contexts;
- navigate alternative representations of belief and preference, and understand the connections between them;
- formalize intuitions and analyze real problems using decision-theoretic tools;
- probe and critically assess the underlying assumptions of standard models.

Grade Distribution:

Problem sets	60%
Tests	30%
Quizzes	10%

Course Outline: Weekly topics are subject to change; the below should only be considered a rough guideline. The evaluation schedule will not change.

Date	Topic	Evaluation
8/28 8/30	introduction · Allais paradox · mathematical preliminaries	– –
9/4 9/6	properties of relations · preference relations	quiz 1 PS1
9/11 9/13	indifference · ordinal utility	quiz 2 –
9/18 9/20	representation theorems · choice functions	PS1 due; test 1 PS2
9/25 9/27	uncertainty via state spaces · qualitative decision rules	quiz 3 –
10/2 10/4	act-state dependence · Newcomb’s paradox · Prisoners’ Dilemma	PS2 due; test 2 PS3
10/9 10/11	uncertainty as probability · expected utility	quiz 4 –
10/16 10/18	<i>Intermission</i>	PS3 due; test 3 –
10/23 10/25	von Neumann-Morgenstern expected utility theory	– PS4
10/30 11/1	Savage’s theory of choice	quiz 5 –
11/6 11/8	qualitative probability	PS4 due; test 4 PS5
11/13 11/15	utility functions for money · St. Petersburg paradox · risk aversion	quiz 6 –
11/20 11/22	Ellsberg paradox · ambiguity aversion <i>no class (Thanksgiving)</i>	PS5 due; test 5 PS6
11/27 11/29	alternative representations of uncertainty	quiz 7 –
12/4 12/6	topics (e.g., belief update, framing effects, prospect theory)	PS6 due; test 6 –

Evaluation: Most of the evaluation is based on problem sets, which are divided into take-home and in-class components. The in-class component is a 20-minute test that takes place on the day the take-home component is due (which is always a Tuesday). The in-class component covers the same material as the take-home component, but generally consists in shorter/easier problems. On the weeks in between problem set due dates, there will be a 10-minute quiz based on the material covered during the previous two weeks. There is no final exam.

Course Policies: Problem sets are due at the beginning of class. Late submissions will not be accepted unless arrangements have been made in advance. Collaboration is both allowed and encouraged; however, each student must write up their solutions independently, and clearly indicate for each question with whom they shared ideas. Failure to do so constitutes a violation of Carnegie Mellon’s Policy on Academic Integrity, available here: <http://www.cmu.edu/policies/student-and-student-life/academic-integrity.html>.

Campus Resources

Academic Development (AD): Academic Development is the place to go for help with your academic work. They offer everything from Academic Counseling in study skills to Peer Tutoring. They also offer Supplemental Instruction and EXCEL Groups for select courses. Their services are designed to help both students who are having academic difficulties and those who just want to improve their performance. For more information, visit <http://www.cmu.edu/acadev>.

Global Communications Center (GCC): The GCC, on the ground floor of Hunt Library, provides one-on-one tutoring in written, oral, and visual communication for any student, at any level, in any discipline, at any stage of the composing process (<http://www.cmu.edu/gcc>).

Intercultural Communications Center (ICC): The Intercultural Communication Center helps nonnative English speakers (both international students and students who attended high school in the U.S.) develop the English language skills and cultural understanding needed to succeed at Carnegie Mellon. The center offers classes and noncredit workshops and seminars (for example, Presentation Basics, Communicating Data Effectively, and Language and Culture for Teaching (for international TAs)). For more information, visit <http://www.cmu.edu/icc>.

Disability Services: The Office of Disability Resources at Carnegie Mellon University has a continued mission to provide physical and programmatic campus access to all events and information within the Carnegie Mellon community. They work to ensure that qualified individuals receive reasonable accommodations as guaranteed by the Americans With Disabilities Act (ADA) and Section 504 of the Rehabilitation Act of 1973. For more information, visit: <http://www.cmu.edu/disability-resources/>.

If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at access@andrew.cmu.edu.

Take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep, and taking some time to relax. You can't achieve your goals if you're sick from stress or burnt out.

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus; an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is usually better.

If you or anyone you know needs help, consider reaching out to a friend, faculty member, or family member you trust. Counseling and Psychological Services (CaPS) is also here to help: call 412-268-2922 and visit their website at <http://www.cmu.edu/counseling/>.