Università di Torino
Scuola di Dottorato in Scienze Umane e Sociali
Dottorato di Ricerca in Economia "Vilfredo Pareto"

Decision Theory

2014

Instructor
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Course Presentation and Overview:
This is an introductory (but by no means easy) course in decision theory. The main issue we are interested in is the following: What is a good decision? Can we develop simple algorithms which will guarantee that we only take good decisions? So we are principally interested in decision theory as a normative tool, as an aid to actual decision making. We shall how ever see that this does not allow us to avoid being concerned with descriptive problems, that is: How do people actually take decisions? The latter types of questions are of course much more interesting to social scientists like economists and psychologists.

Exam:
As far as organizational issues are concerned, the course grade will be determined for 60% by home works (which will be handed out more or less every week), and for 40% by a 24-hour take-home final.

Required Text:
The required textbook for the course is Notes on the Theory of Choice by David Kreps (Westview Press, 1988). The few additional required readings (listed below) will be made available. Below, I also suggest some further reading for the real maso chists. Ask me for further reading if you are interested in some specific topics in the course.

Outline:
Here is the best guess as to what we will cover in the course:

1. (Very briefly) What is decision theory? An example: Your decision problem and its solution. Problems: The St. Petersburg Paradox and the need for utility.

Readings:
- Kreps, Chapters 1 and 4.
- Luce and Raiffa, "Individual Decision Making under Uncertainty", which presents older, but still used, decision models (this is what decision theory was in the early 1950s). Additional reading: Keeney and Raiffa, Decisions with Multiple Objectives, Chapter 1, describes decision theory from an applied perspectives. It presents some examples, and it explains how the techniques to be developed can be used to solve a large number of problems.

2. (Very briefly) Foundations: A general decision framework. Choice under certainty and ordinal utility theory.

Readings:
- Kreps, Chapters 2 and 3.

Additional reading:
- Krantz, Luce, Suppes and Tversky, Foundations of Measurement, Chapter 1, presents formally the analytical problems of measurement. This is demanding reading, but very enlightening.

3. Modelling choice under risk: Some preliminaries. The von Neumann-Morgenstern expected utility (EU) model. Linear utility on a finite set of prizes. The extension to infinite sets of prizes. What is utility? Monetary prizes: Risk aversion. First- and second-order stochastic dominance.

Readings:
- Kreps, Chapters 5 and 6.

4. A discussion of EU. The experimental evidence: The Allais paradox and similar diversions. Non-expected utility models.

Readings:
- Kreps, Chapter 14.
- Martin Weber and Colin Camerer, "Recent Developments in Modelling Preferences under Risk", OR Spektrum, 1987, 9:129-151, a survey of non-EU theories.

Additional reading:
- Mark Machina, "Choice under Uncertainty: Problems Solved and Unsolved", Journal of Economic Perspectives, 1987, 1: 121-154, a more economics-oriented survey.
- Peter Fishburn and Peter Wakker, "The Invention of the Independence Condition", mimeo, 1992, for some history.
- Kahneman and Tversky, "Prospect Theory: An Analysis of Decision under Risk", Econometrica, 1979, 47: 263-291, a fundamental paper on the experimental evidence against EU.

5. SEU: The Anscombe-Aumann and Savage models. The standard Subjective Expected Utility (SEU) model is presented, and subjective probability is introduced. First we consider a static world, and look at the lottery wheels/horse races model of Anscombe and Aumann, and the pure uncertainty model of Savage. Then, we discuss the extension of Savage's model to a dynamic framework, with some discussion on the idea of dynamic consistency of preferences.

Readings:
- Kreps, Chapter 7 through 9.
- F. P. Ramsey, "Truth and Probability", in The Foundations of Mathematics (R.B. Braithwaite, Ed.), Routledge, 1931.
- P. Ghirardato, "Revisiting Savage in a Conditional World", Economic Theory, 2002.

Additional reading:
- Leonard J. Savage, The Foundations of Statistics, Dover, 1972, in the opinion of many one of the gr eatest scientific contributions of the 20th century.
- P. Fishburn, "The Axioms of Subjective Probability", Statistical Science, 1986, 1:335-358.

6. A discussion of SEU. Ellsberg's paradox: We "define" ambiguity attitudes (starting from Ellsberg's classical paper), and discuss its normative and descriptive relevance. (I try to convince you that it is normatively relevant).

Readings:
- Daniel Ellsberg, "Risk, Ambiguity and the Savage Axioms", Quarterly Journal of Economics, 1961, 75:643-669, another milestone.
- C. Fox and A. Tversky, "Ambiguity aversion and comparative ignorance", QJE, 1995. (JSTOR)

Additional reading:
- Colin Camerer and Martin Weber, "Recent Developments in Modelling Preferences: Uncertainty and Ambiguity", Journal of Risk and Uncertainty, 1992, 5:325-370, a survey of non-SEU models.

7. Two basic preference models with ambiguity: The Choquet expected utility (CEU) model and the maxmin expected utility with multiple priors (MEU) model are introduced. Their intersection: convex capacities and their cores. A special case of CEU: The rank-dependent EU model.

Readings:
- Gilboa, "Introduction", in Uncertainty in Economic Theory: Essays in Honour of David Schmeidler's 65th Birthday, Routledge, 2004.
- D. Schmeidler, "Subjective probability and expected utility without additivity", Econometrica, 1989. (JSTOR)
- D. Schmeidler and I. Gilboa, "Maxmin expected utility with non-unique prior", Journal of Mathematical Economics, 1989

Course Schedule:

May 16 (10-12): Item 1 on the syllabus.

May 21 (10-12): Item 2 on the syllabus.

May 22 (10-12): Item 3 on the syllabus, part I (up to linear utility on a finite set of prizes).

May 23 (10-12): Item 3 on the syllabus, part II (from extension to infinitely many prizes till the end).

May 26 (15-17): Item 4 on the syllabus.

June 6 (10-12): Item 5 on the syllabus, part I, Ramsey and Anscombe-Aumann.

June 9 (15-17): Item 5 on the syllabus, part II, Anscombe-Aumann.

June 12 (10-12): Item 5 on the syllabus, part III, subjective probability and Savage's model.

June 16 (15-17): Item 5 on the syllabus, part IV, Savage's model and Item 6 on the syllabus, part I.

June 23 (15-17): Item 6 on the syllabus, part II, and item 7 on the syllabus.

Final exam (24-hour take-home) handed out!

All lectures will be held at the

      Collegio Carlo Alberto
      Via Real Collegio 30 – 10024 Moncalieri TO

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