Syllabus

Department of Economics and Business
CENTRAL EUROPEAN UNIVERSITY

Advanced Microeconomics: Game Theory

- **Instructor:** Dr. László Á. Kóczy (koczy@krtk.mta.hu; office hours: Wed, 1310-1340 @ TC212, Óbuda University, Tavaszmező 17.)
- **Credits:** 2 (… ECTS)
- **Term:** Fall 2017-2018
- **Course level:** 1st year PhD or 2nd year MA/MSc
- **Prerequisites:** Microeconomics

Course description

This course presents the foundations of, and selected topics in, game theory. We will review basic definitions and equilibrium concepts, and develop applications ranging from auctions to political economy and industrial organization. The goal is to develop a structured way of thinking about strategic interactions, which students can use in their own work.

Game theory is a formal subject with theorems and proofs. However, it is used in all fields of economics, and I particularly encourage students with applied interests to attend. The material covered is useful for diverse fields including psychology and economics, industrial organization, and macroeconomics.

Learning outcomes

By the end of this course, students will have: 1. Knowledge and understanding of game theory at a level required to read current research in economics in applied theory. 2. The ability to use, modify and extend existing game theory models in the students' own research. 3. The ability to develop game theory models for the student's own research in applied theory. 4. The ability to read current research in game theory with the help of reference texts.

Reading list

The textbook for the course is
Hans Peters: Game Theory – A multi-levelled approach, Springer, 2008. ISBN 978-3-540-69290-4

Recommended Literature

- Gibson: Game theory – A primer. Financial Times/Prentice Hall, 1992 (an easy introduction)
- Owen: Game theory. 3rd edition. Academic Press, San Diego, 1995. (a classic)
- Myerson: Game theory. MIT Press, Cambridge, Massachusetts (a deep book written by a Nobel laureate)
- Osborne-Rubinstein, A course in Game Theory, MIT Press, 1994. (freely downloadable: http://gametheory.tau.ac.il/arielDocs/)
- Dixit – Nalebuff: The art of stretegy, W W Norton, 2008. http://www.artofstrategy.net/ (examples and stories)

Assessment

Requirements consist of homework assignments and a final exam. Students are encouraged to work in groups on the homeworks, but each student must submit her or his own solution. Your course grade will be determined as follows:

- Assignments 50%
- Final exam 50%

Course schedule and materials for each session (subject to change as the course develops)

1. Motivation and introduction. The beginnings of game theory. Games in strategic form. Finite two-player zero-sum games. Matrix a games, pure and mixed strategies, best response, Minimax Theorem.
   Peters, Chapters 1, 2, 12.1
   Further reading: Leonard, R. (2010). Von Neumann, Morgenstern, and the creation of game theory. From chess to social science, 1900–1960. Cambridge: Cambridge University Press.

2. Finite two-person nonzero-sum games. Bimatrix games. Pure and mixed strategies in bimatrix games. Strict domination, iterative elimination of strictly dominated strategies. Nash equilibrium. Finding Nash equilibria.
   Peters, Chapters 3, 13.1-13.2.2, 13.3
   Further reading: Nash, J. F. (1951). Non-cooperative games. Annals of Mathematics, 54(2), 286–295.

3. Games in extensive form. Extensive and strategic forms. Subgame, subgame perfectness, subgame perfect equilibrium.
   Peters, Chapters 4, 14.1-14.3.1

4. Finite games with incomplete information. Signaling games.
   Peters, Chapters 5, 14.3.2

5. Extensions of noncooperative games. Auctions and other applications.
   Peters, Chapter 6

6. Cooperative games with transferable utility: the core. Coalitions, characteristic function, individual and group rationality. Preimputations and imputations. The core. Shapley-Bondareva theorem.
   Peters, Chapters 9.1-9.2, 16

7. Cooperative games with transferable utility: values. Marginal contributions. Shapley value. The axiomatic approach and the axiomatisation of the Shapley value. Applications. A priori measures of voting power. The Banzhaf measure, Banzhaf index, Shapley-Shubik index. The nucleolus.
   Peters, Chapters 9.3-9.4, 17, (18), 19

8. Implementation. The Nash Program. Implementations of the Nash bargaining solution, the core and the Shapley value.
   Peters, Chapter 10.1; Pérez-Castrillo, D., & Wettstein, D. (2001). Bidding for the surplus : A non-cooperative approach to the Shapley value. Journal of Economic Theory, 100(1–2), 274–294. ; Perry, M., & Reny, P. J. (1994). A noncooperative view of coalition formation and the core. Econometrica, 62(4), 795–817.
   Further reading:

Peters Chapter 21; Gul, F. (1989). Bargaining foundations of Shapely value. *Econometrica*, *57*(1), 81–95.

9. Matching and assignment games. Stability. The Gale-Shapley or deferred acceptance algorithm. The Boston algorithm. Top trading cycles. Applications.

Peters, Chapters 10.3-10.4, 20.1; Roth, A. E. (2008). Deferred acceptance algorithms: history, theory, practice, and open questions. International Journal of Game Theory, 36(3–4), 537–569. Further reading: Abdulkadiroğlu, A., & Sönmez, T. (2003). School Choice: A Mechanism Design Approach. American Economic Review, 93(3), 729–747. ; Biró, P., Fleiner, T., Irving, R. W., & Manlove, D. F. (2010). The College Admissions problem with lower and common quotas. Theoretical Computer Science, 411(34–36), 3136–3153.

10. Advanced topics. Partition function form games. The alpha, beta, gamma, s, m and recursive cores.

Chander, P., & Tulkens, H. (1997). The core of an economy with multilateral environmental externalities. International Journal of Game Theory, 26(3), 379–401. Hafalir, I. E. (2007). Efficiency in coalition games with externalities. Games and Economic Behavior, 61(2), 242–258. Kóczy, L. Á. (2007). A recursive core for partition function form games. Theory and Decision, 63(1), 41–51.

11. Advanced topics. Allocation problems: apportionment. Apportionment methods and their properties.

Endriss, U., ed. (2017, forthcoming): Trends in Computational Social Choice; Chapters 3 & 16. Further reading: Balinski, M. L., & Young, H. P. (1982). Fair Representation: Meeting the Ideal of One Man, One Vote. New Haven: Yale University Press.; Pukelsheim, F. (2014). Proportional Representation. Heidelberg: Springer.