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Game Theory

Aim: The aim of this course is to give students a solid foundation of formal research in game theory. I want to discuss some current results and there applications so that students are familiar with up-to-date research. The course aims to be formal hence students are expected to be at least not afraid of basic mathematical tools including: calculus, probability theory, fixed point theorems. Knowledge of mathematical appendix of Mas-Colell, Whinston, and Green (1995) should suffice.

Grade: 40% problem sets, 60% final exam.

Readings: Maschler, Solan, and Zamir (2013), Fudenberg and Tirole (2002)

Additional literature: Myerson (1991), Osborne and Rubinstein (1994), Gibbons (1992) or Aumann and Maschler (1995).

Syllabus:

L1. A short introduction to non-cooperative games. Strategic form game (definition). Best response. Pure strategy Nash Equilibrium (PSNE). Mixed strategies and Mixed Strategy Nash Equilibrium (MSNE). Existence of equilibrium.
Readings: Maschler, Solan, and Zamir (2013): 4-5, Fudenberg and Tirole (2002): 1

T1. Applications. Cournot and Bertrand.

L2. Lattice games. Posets, Lattices, Supermodularity, Increasing differences, Monotone comparative Statics. Tarski fixed point theorem.
Readings: Fudenberg and Tirole (2002): 12.3, Topkis (1998).

T2. Evolutionary stable strategies (ESS). Correlated equilibrium and other extensions.
Readings: Maschler, Solan, and Zamir (2013): 5.8,7-8, Fudenberg and Tirole (2002): 2

L3. Bayesian games. Types and Strategies. Bayesian equilibrium.
Readings: Maschler, Solan, and Zamir (2013): 9, Fudenberg and Tirole (2002): 6

L4. Extensive form games with complete information. History. Strategies. Nash equilibrium and subgame perfect Nash equilibrium.
Readings: Maschler, Solan, and Zamir (2013): 3, Fudenberg and Tirole (2002): 3

T3. Bargaining games. Interim and ex-ante strategies.
Readings: Fudenberg and Tirole (2002): 4.4
Additional readings: Osborne and Rubinstein (1990)

L5. Repeated games of complete information. Folks' theorems.
Readings: Maschler, Solan, and Zamir (2013): 13-14, Fudenberg and Tirole (2002): 4.7, 5.1-5.3, 5.5-5.6,

L6. Extensive form games with simultaneous moves and incomplete information. Sequential rationality weak perfect Bayesian equilibrium. Sequential equilibrium (SE).
Readings: Fudenberg and Tirole (2002): 8.1-8.3

L7. Repeated games of incomplete information. Survey of recent results.
Readings: Aumann and Maschler (1995).

T4. Applications of asymmetric information games. Adverse selection. Screening and signaling games. Pooling and separating equilibrium. Existence. Moral hazard and optimal contracts (principal-agent).
Readings: Mas-Colell, Whinston, and Green (1995): 13-14

L8. Communication in games. Hard vs. soft information, disclosure, cheap talk. Bayesian persuasion.
Readings: Milgrom and Stokey (1982), (or Milgrom (1981)), Crawford and Sobel (1982) (or Morgan and Stocken (2003)), Kamenica and Gentzkow (2011).

L9. Networks. Simple topologies on networks: regular lattice, Erdos-Renyi graphs, small-world networks. Learning in networks.
Readings: Vega-Redondo (2007), López-Pintado (2008), González-Avella, Eguíluz, Marsili, Vega-Redondo, and San Miguel (2011), Watts (2002).

*L10. Open and closed-loop strategies. Time-consistency. Bequest games, quasi-hyperbolic discounting models and policy games. Markov stationary strategies.
Readings: Fudenberg and Tirole (2002): 8.1-8.3.

*L11. Intro to mechanism design. Implementation. Efficiency and optimal mechanisms.
Readings: Fudenberg and Tirole (2002): 7

T5. Auctions. Private and independend valutions. Dutch and English auctions. First and second price sealed-bid auctions. Revenue equivalence theorem. Private, interdependend valuations. Common value auctions and winners curse.
Readings: Maschler, Solan, and Zamir (2013): 12, Milgrom (1989), McAfee and McMillan (1987)

L12. Nash bargaining solution. Axiomatization and solution. Cooperative game. Supperadditive games. Characteristic form games (TU). Convex games. Core and Shapley value. Axiomatixations and non-cooperative foundations. (Dubey; Dubey-Shapley; Hart, Mas-Colell)
Readings: Maschler, Solan, and Zamir (2013): 15-20, Myerson (1991): 8, 9

*L13. Nash program and foundations of general equilibrium.
Readings: Serrano (2005)

We welcome questions at any time. Please don't hesitate to ask us during class if there is something that you don't understand or that you want to discuss. (The only exception is a question about the grading of your homework or exam paper. Please ask these questions before or after class, or in office hours.) You may also ask questions in office hours, or any other time that you catch us in our office. You may also ask questions by email.

While studying you may find useful to use various scientific paper browsers like e.g.: `econpapers.repec.org`, `ideas.repec.org` and `scholar.google.com`; article databases, e.g. `www.jstor.org`, `www.sciencedirect.com` and `www.nber.org`.

Those interested in applications of game theory to strategic decision making are welcomed to attend my course: *Industrial Organization*, and those looking for applications in general equilibrium *General Equilibrium Theory*. Also, we invite all interested in economic theory to participate in **Warsaw Economic Seminar** (`sites.google.com/site/warsaweconseminars/`).

References

AUMANN, R., AND M. MASCHLER (1995): *Repeated games with incomplete information.* The MIT Press.

CRAWFORD, V. P., AND J. SOBEL (1982): "Strategic information transmission," *Econometrica: Journal of the Econometric Society*, pp. 1431–1451.

FUDENBERG, D., AND J. TIROLE (2002): *Game theory.* MIT Press, Cambridge.

GIBBONS, R. (1992): *Game Theory for Applied Economists.* Princeton University Press.

GONZÁLEZ-AVELLA, J. C., V. M. EGUÍLUZ, M. MARSILI, F. VEGA-REDONDO, AND M. SAN MIGUEL (2011): "Threshold learning dynamics in social networks," *PLoS One*, 6(5), e20207.

KAMENICA, E., AND M. GENTZKOW (2011): "Bayesian persuasion," *American Economic Review*, 101(6), 2590–2615.

LÓPEZ-PINTADO, D. (2008): "Diffusion in complex social networks," *Games and Economic Behavior*, 62(2), 573–590.

MAS-COLELL, A., M. D. WHINSTON, AND J. R. GREEN (1995): *Microeconomic theory.* Oxford University Press.

MASCHLER, M., E. SOLAN, AND S. ZAMIR (2013): *Game Theory.* Cambridge University Press.

MCAFEE, R. P., AND J. MCMILLAN (1987): "Auctions and Bidding," *Journal of Economic Literature*, 25(2), 699–738.

MILGROM, P. (1989): "Auctions and Bidding: A Primer," *Journal of Economic Perspectives*, 3(3), 3–22.

MILGROM, P., AND N. STOKEY (1982): "Information, trade and common knowledge," *Journal of economic theory*, 26(1), 17–27.

MILGROM, P. R. (1981): "Good news and bad news: Representation theorems and applications," *The Bell Journal of Economics*, pp. 380–391.

MORGAN, J., AND P. C. STOCKEN (2003): "An analysis of stock recommendations," *RAND Journal of economics*, pp. 183–203.

MYERSON, R. B. (1991): *Game Theory: Analysis of Conflict.* Harvard University Press.

OSBORNE, M. J., AND A. RUBINSTEIN (1990): *Bargaining and Markets.* Academic Press, Inc.

——— (1994): *A course in game theory.* MIT Press.

SERRANO, R. (2005): "Fifty Years of The Nash Program, 1953-2003," *Investigaciones Económicas*, 29(2), 219–258.

TOPKIS, D. M. (1998): *Supermodularity and complementarity*, Frontiers of economic research. Princeton University Press.

VEGA-REDONDO, F. (2007): *Complex social networks*, no. 44. Cambridge University Press.

WATTS, D. J. (2002): "A simple model of global cascades on random networks," *Proceedings of the National Academy of Sciences*, 99(9), 5766–5771.