

MET910a: Tutorial Game Theory

Fall 2013

1 About

The objective of this course is to provide students with the basics of formal modeling in political science. The course has some breadth in coverage in the sense that it provides a graduate-level introduction and overview to different areas in game theory. It is also narrow in the sense that the emphasis is not on application and model testing but getting trained in reading and writing down formal models. At the conceptual level the course will cover the following topics: preferences and individual choices, decision theory, normal form games, Nash equilibria, extensive form games, subgame perfect equilibria, repeated games, bargaining, games with incomplete and imperfect information, Bayesian perfect equilibria, signalling games. At the substantial level, we will use these concepts to study, as examples, candidate competition, political lobbying, and war and deterrence.

2 Instructor

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3 Organizational stuff

3.1 Requirements

Successful participation is awarded with 2 ECTS credits. In order to earn these points you have to regularly and actively participate in class. You also have to hand solutions to the weekly assignments.

3.2 Date

Tuesday, 3.30pm-5pm

Begin: 10 September 2013

End: 03 December 2013

Location: A5, 6 Room B243

4 Structure/Concept

There is only one way to learn game theory: *You* have to read and practice a lot. This is where the tutorial comes in. We provide a learning experience where you actively practice game theory under close guidance and monitoring of your learning success. The main goal is to equip you with the necessary tools for understanding and solving standard game theoretic models.

4.1 Sessions

As the class is closely coordinated with the lecture there is no fixed plan for the sessions to provide enough flexibility to react to unanticipated developments. The structure however, is clear. We are going to discuss the problem sets in class and may solve additional problems. While a fair amount of the explanations will be my responsibility, I intend to provide enough room for you to do group work and present your solutions in class. I expect *every* student to present a solution to an exercise in class at least once during the semester.

4.2 Assignments

From the second week on we will distribute problem sets. The problem sets are graded. Your solution to the problem sets should be deposited in the mailbox by Monday, 9am. You can find the mailbox in the C part of building A5. Choose the entrance which faces the old

observatory. The mailboxes are to your right. The No. of our mailbox is 46206. The mailbox also has the name of our class.

I strongly encourage you to work in groups!

However, I expect *every* student to hand in their own solution. Please indicate on your solution sheet who you worked with. Your solution should contain the results and clearly show the steps you took to solve the problem. In case that you do not manage to get the full solution you may be awarded points for partially correct answers or for figuring out the general approach to tackle a problem. You can hand in handwritten or typeset solutions.

5 Literature

Textbook

McCarty, Nolan/Meirowitz, Adam. 2007. *Political Game Theory: An Introduction*. Cambridge: Cambridge University Press.

The class is based on the lecture and therefore we mainly work with the textbook by Meirowitz and McCarty, henceforth called MM07. I recommend to buy the book if you are serious about game theory. It will be helpful through your graduate program at the University of Mannheim and beyond. I may also suggest additional readings for specific sessions. These help to clarify things further but are not mandatory readings. In particular, the additional readings are not required to pass the final exam. Gaining a better understanding will not hurt you, though.

6 An annotated bibliography

There is a vast number of text books on game theory. In order to provide an overview, and to prevent you from being frustrated with a book that is too advanced, I have created a (non-exhaustive) list of books that may be useful at some point in your career (though not necessarily now!). In addition I dwell a bit on some math books as a good working knowledge of math is essential to the study of game theory.

Recommended Books

Binmore, Kenneth G. 1991. *Fun and Games: A Text on Game Theory*. Great Source Education Gr.

Clarke, Kevin A./Primo, David M. 2012. *A Model Discipline: Political Science and the Logic of Representations*. Oxford: Oxford University Press.

Kreps, David M. 1991. *Game Theory And Economic Modelling*. Oxford: Oxford University Press.

Osborne, Martin J. 2009. *An Introduction to Game Theory*. Oxford University Press.

Ross, Sheldon M. 2010. *Introduction to Probability Models*. Academic Press Inc. 10 edition.

Sundaram, Rangarajan K. 1996. *A First Course in Optimization Theory*. Cambridge: Cambridge University Press.

Sydsaeter, Knut/Hammond, Peter J./Strom, Arne. 2012. *Essential Mathematics for Economic Analysis*. Prentice Hall International. 4th revised edition.

Velleman, Daniel J. 2006. *How to Prove It: A Structured Approach*. Cambridge: Cambridge University Press. 2 edition.

Binmore (1991) is a classic text on game theory. One of the strengths of the book is the way the author introduces the material. Binmore covers a lot of philosophical aspects of game theory. I particularly recommend his chapters on bargaining. Depending on the use of the book the level can be quite advanced.

Clarke and Primo (2012) is a new textbook covering the topic of models in political science from the viewpoint of the theory of science. It is a very thought provoking book. You can expect to benefit a lot from reading it. I recommend to contrast it with Becky Morton's 'Methods & Models' and Ariel Rubinsteins 'Economic Fables' books.

Kreps (1991) is a book based on the lecture notes of David Kreps. He discusses a lot of strengths and weaknesses of game theory in an accessible manner. Topics include (amongst others) bounded rationality and problems of equilibrium selection. Recommended to all of you who want to deepen the understanding of concepts and boundaries of the approach.

Ross (2010) is a general introduction to probability theory which is needed for Bayesian games. The book covers a lot of ground (much more than we need for our class). The level of math is intermediate. The book is best used as a reference, not as a textbook.

Sundaram (1996) is an introduction to the mathematics involved in solving the optimization problems which are essential to game theory. The material is well structured and presented. Despite the title it is not an easy read and is mainly recommended for the more technical minded of you. That said, it does an amazing job to clarify the math behind the lecture and the problem sets.

Sydsaeter et al. (2012) is a good introduction to the mathematical concepts needed to understand game theory. It is well structured and accessible. It will be useful as a reference for the problem sets.

Velleman (2006) gives a nice introduction to the ways mathematical proofs are structured. He discusses several idealtypes which you may encounter if you continue your journey into the world of game theory.

Osborne (2009) is an introductory textbook. The ratio of greek and latin letters is reasonable. Osborne explains well and has a vast collection of examples for different types of games and their application. Most examples are taken from economics, though. That said it is a good book to read allong MM07.

General Game Theory Literature

Binmore, Kenneth G. 2007. *Playing for Real: A Text on Game Theory*. Oxford: Oxford University Press.

Dixit, Avinash I./Nalebuff, Barry J. 2010. *The Art of Strategy: A Game Theorist's Guide to Success in Business and Life*. New York: W. W. Norton.

Dutta, Prajit K. 1999. *Strategies and Games: Theory and Practice*. Cambridge: MIT Press. 2. edition.

Fudenberg, Drew/Tirole, Jean. 1991. *Game Theory*. Cambridge: MIT Press.

Gibbons, Robert. 1992a. *Game Theory for Applied Economists*. Princeton University Press.

Gibbons, Robert. 1992b. *A Primer in Game Theory*. Financial Times.

Harsanyi, John C./Selten, Reinhard. 1988. *A General Theory of Equilibrium Selection in Games*. Mit Pr. Illustrated edition.

Luce, Robert Duncan/Raiffa, Howard. 1989. *Games and Decisions: Introduction and Critical Survey*. New York: Dover Publishers.

Maschler, Michael/Solan, Eilon/Zamir, Shmuel. 2013. *Game Theory*. Cambridge: Cambridge University Press.

Morton, Rebecca B. 1999. *Methods and Models: A Guide to the Empirical Analysis of Formal Models in Political Science*. Cambridge University Press.

Myerson, Roger B. 1991. *Game Theory: Analysis of Conflict*. Harvard University Press.

Neumann, John Von/Morgenstern, Oskar. 2007. *Theory of Games and Economic Behavior*. Princeton University Press. Anniversary. edition.

Osborne, Martin/Rubinstein, Ariel. 1994. *A Course in Game Theory*. Cambridge: MIT Press.

Owen, Guillermo. 2013. *Game Theory*. Emerald Group Publishing Limited. 4. edition.

van Damme, Eric. 1991. *Stability and perfection of Nash equilibria*. Berlin; New York: Springer-Verlag.

Weibull, Jörgen W. 1997. *Evolutionary Game Theory*. MIT Press. Reprint edition.

Binmore (2007) is something like a second edition of Binmore (1991). While Binmore sticks to the concept of *Fun and Games* he has reworked and updated the book completely. It is still an entertaining read at an intermediate to advanced level. Particularly interesting are the philosophical treatments of game theoretical concepts.

van Damme (1991) is a standard reference when it comes to equilibrium refinements. It is quite technical but very interesting. Possibly a bit too advanced at your stage, though.

Dixit and Nalebuff (2010) is an extremely accessible book. Dixit and Nalebuff manage to explain fundamental concepts of game theory without delving into the math part of it. They manage very well to teach the intuition behind game theory. Recommended as an easy reading at bed time.

Dutta (1999) is an introductory text book on game theory. Sometimes it is a bit too basic for our needs. However, Dutta gives a lot of examples (mainly from economics) and explains the general ideas quite well.

Fudenberg and Tirole (1991) is probably *the* standard reference for game theory. You cannot do wrong by reading it. But be warned it is a fairly advanced textbook.

Gibbons (1992a) and Gibbons (1992b) are actually the same book (the latter is the international version). The book has a strong focus on economic applications but is the cleanest introduction to game theory at an intermediate level I am aware of. Despite this it is also quite concise. Recommended if you like more math but don't want too much math either.

Harsanyi and Selten (1988) is a famous treatment of the equilibrium selection problem. Harsanyi and Selten merge strands in the literature and develop a new approach which is still used as the basis for the class of *world games*.

Luce and Raiffa (1989) is a reissue of the classic from 1953. Luce and Raiffa do an excellent job in discussing decision-theoretic foundations of game theory. The outdated notation sometimes makes the book a hard read.

Maschler et al. (2013) is an advanced textbook on game theory. It is one of the most complete treatments of game theory so far. As it is a recent textbook it also covers topics and developments which came up after the publication of the other textbooks. Its focus is less driven by economic applications.

Morton (1999) is actually not a textbook on game theory but a book on what to do with the models. Becky discusses, how game theoretical models can and should be tested empirically. I recommend to contrast the reading with Clarke and Primo (2012) and some of the writings of Ariel Rubinstein (e.g. *Economic Fables*).

Myerson (1991) is another classic game theory textbook by a Nobel laureate. It is very advanced but it provides one of the cleanest introductions to game theory. A particular strength are the discussions of mechanism design and incentives. Due to its complexity and the somewhat different notation I would not advise you to use it now.

Neumann and Morgenstern (2007) has been a classic since its publication in 1946 and is the book that defined game theory as a subject. Its major focus is zero-sum games. It is interesting mainly for historical reasons. be aware that the notation is quite different from more modern texts.

Osborne and Rubinstein (1994) is a very advanced textbook. It has a somewhat different structure and covers some topics which are usually not found in other textbooks. A particular strength are the discussion of fundamental topics like the interpretation of mixed strategies. As is typical for a Rubinstein book, it is well written but definitely not an easy read.

Owen (2013) is a very technical text book on game theory. The major target group is students of mathematics and this is what you get. While it has a good treatment of concepts fundamental to social choice I definitely do not recommend the book for you at your current stage.

Weibull (1997) is a standard textbook on evolutionary game theory. The book is quite advanced. Although developed in Biology, evolutionary game theory gained importance in the social sciences as it helps to model population dynamics and (at least partially) solves the equilibrium selection problem.

Math Books

Chiang, Alpha C./Wainwright, Kevin. 2005. *Fundamental Methods of Mathematical Economics*. McGraw-Hill Higher Education. 4. a. international edition. edition.

Dixit, Avinash K. 1990. *Optimization in Economic Theory*. Oxford: Oxford University Press. 2nd edition.

Durrett, Rick. 2010. *Probability: Theory and Examples*. Cambridge: Cambridge University Press. 4th edition.

Fuente, Angel de la. 2000. *Mathematical Methods and Models for Economists*. Cambridge University Press.

Ok, Efe A. 2007. *Real Analysis with Economic Applications*. Princeton: Princeton University Press.

Simon, Carl P./Blume, Lawrence. 1994. *Mathematics for Economists*. Norton & Company.

Sydsaeter, Knut/Hammond, Peter/Seierstand, Atle/Strom, Arne. 2008. *Further Mathematics for Economic Analysis*. Prentice Hall. 2nd edition.

Sydsaeter, Knut/Strøm, Arne/Berck, Peter. 2005. *Economists' Mathematical Manual*. Springer. 4th edition.

Vohra, Rakesh V. 2004. *Advanced Mathematical Economics*. Taylor & Francis.

Chiang and Wainwright (2005) is a concise math book which covers most of the concepts we need for our class. It stands out in the way the material is presented, as Chiang and colleagues frame things with a mathematical model in mind.

Dixit (1990) is a classical treatment of optimization theory. The book has a strong focus on classical economic theory which reduces its usefulness for our class.

If you like integrals, then Durrett (2010) is a good book for you. Durrett discusses advanced topics in probability theory as needed in advanced game theoretic models. Not recommended at your stage though. If you really need to look something up, stick to Ross (2010).

Fuente (2000) is too hard for you and not the best written math book ever. It covers many important topics for advanced game theory, though.

Ok (2007) is maybe the most complete math book in the list. However, it is also probably the most advanced. Only recommended if you want to be a cutting-edge game theorist.

Simon and Blume (1994) covers most of the math we need in our class in an accessible way. The treatment of vector room theory and optimizatón is quite good. However, sometimes it is a bit lengthy.

Sydsaeter et al. (2005) is useful if you need to look up a specific formula. It is well structured and most of the math we need is covered. It is not a textbook but a mathematical manual (Formelsammlung). An electronic version (pdf) is available via [springerlink](#).

Sydsaeter et al. (2008) is a very clean and understandable textbook. It discusses many important concepts at an advanced level. In case that Sydsaeter et al. (2012) is too boring for you I recommend this book.

Vohra (2004) is a great read. It is a very thin and concise book. It covers some stuff that is useful but usually not found in other math textbooks (e.g. lattice theory and supermodularity). Its level is rather advanced but accessible.

Analytical Politics and Social Choice

Austen-Smith, David/Banks, Jeffrey S. 2000. *Positive Political Theory I: Collective Preference*. Ann Arbor: University of Michigan Press.

Austen-Smith, David/Banks, Jeffrey S. 2005. *Positive Political Theory: Strategy and Structure*. Ann Arbor: Univ. of Michigan Press.

Hinich, Melvin C./Munger, Michael. 1997. *Analytical Politics*. Cambridge: Cambridge University Press. 1. edition.

Mueller, Dennis C. 2003. *Public choice III*. Cambridge; New York: Cambridge University Press.

Sen, Amartya. 1984. *Collective choice and social welfare*. Amsterdam; New York: North-Holland.

Shepsel, Kenneth A./Bonchek, Mark S. 1997. *Analyzing Politics*. New York: W. W. Norton.

Austen-Smith and Banks (2000) is an advanced treatment of social choice topics. The second volume Austen-Smith and Banks (2005) then focuses more on strategic interaction.

Hinich and Munger (1997) is a classic introduction to analytical politics. They treat most of the math in an accessible way. They use as little math as possible but as much as necessary to follow the ideas. Particular interesting is the discussion of spatial preferences and separability issues.

Mueller (2003) is strictly speaking not a book on social choice (as the title suggests). However, he covers some stuff relevant to social choice and is a standard reference for public choice models.

Sen (1984) is a classic treatment of social choice theory. Particularly interesting is that Sen alternates technical and non-technical chapters.

Shepsel and Bonchek (1997) is a simple introduction into spatial preferences and the spatial model of politics. It is well suited as an introductory book for self study. A newer (extended) edition is available by now.

7 Useful stuff

7.1 gametheory101.com

William Spaniel, PhD candidate at the University of Rochester, has developed some awesome materials to introduce game theory. His website is full of examples and small videos that explain fundamental concepts of game theory in a non-technical and accessible way. You should have a look at the materials on <http://gametheory101.com/>.

7.2 \LaTeX

\LaTeX is a typesetting system. It is completely unlike MS Word which makes it highly desirable. Its major strength is the math typesetting capabilities which is very convenient for game theoretical applications. I also want to stress the fact that one has to put in a lot of effort to produce a document that looks ugly. However, \LaTeX has a steep learning curve, so the initial costs of learning it can be significant. Highly recommended if you intend to work on something formal in your master thesis/dissertation.