Applied Game Theory
APEC 8205   Fall 2011

Instructors:

Professor Terrance Hurley   Professor Steve Polasky
248H Classroom Office Building   337E Classroom Office Building
625-1238   625-9213 or 624-3663
tmh@umn.edu   polasky@umn.edu

Overview: This course will cover topics in game theory and their application to economic problems. For each topic, important theory and equilibrium concepts will be covered. We will review evidence from experimental economics on how people actually play games and address in what ways behavior accords or contradicts theory.   We will also introduce a number of important economic applications of game theory in each major topic area. There will be six main topics covered:

- static games of complete information
- dynamic games of complete information
- static games of incomplete information
- dynamic games of incomplete information
- alternative explanations of strategic behavior
- equilibrium dynamics

Throughout the course, we will perform a number of informal experiments and stage simple games as part of the class to demonstrate concepts, while providing an active learning environment.

Prerequisites: Ph.D. sequence in microeconomic theory (8001-8004 or 8101-8104) or permission of the instructors.

Grading:

Problem Sets	40%
Midterm	30%
Final	30%

Required Text:
Gibbons, R. 1992. *Game Theory for Applied Economists*. Princeton University Press.
Camerer, C. 2003. *Behavioral Game Theory*. Princeton University Press.

Supplementary Texts:
Davis, D.D. and C.A. Holt. 1993. *Experimental Economics*. Princeton University Press.
Fudenberg, D. and J. Tirole. 1991. *Game Theory*. MIT Press.
Kagel, J.H. and A.E. Roth. 1995. *The Handbook of Experimental Economics*. Princeton University Press.
Mas-Colell, A., M. Whinston and J. Green. 1995. *Microeconomic Theory*. Oxford University Press.
Samuelson, L. 1997. *Evolutionary Games and Equilibrium Selection*. MIT Press.
Tirole, J. 1988. *The Theory of Industrial Organization*. MIT Press.

Course Web Site
http://www.apec.umn.edu/faculty/thurley/apec8205.html

Interesting Web Sites on Game Theory & Experiments
http://www.people.virginia.edu/~cah2k/y2k.htm
http://www.marietta.edu/~delemeeg/expernom.html
http://www.economics.harvard.edu/~aroth/alroth.html

Course Outline

Introduction: The Rules of the Game (Lecture 1: 9/7) **(SP)**
1. Structure of Games: Description of a Game
    a. Players ("who")
    b. Actions ("who can do what when")
    c. Information ("who knows what when")
    d. Strategies ("who does what when")
    e. Payoffs ("who gets what when")
2. Representation of Games: Normal vs. Extensive Forms
3. A Taxonomy of Games
    a. Dynamic vs. Static
    b. Perfect vs. Imperfect Information
    c. Complete vs. Incomplete Information
4. Experimental Methods and Behavioral Game Theory

Readings:
    Required:
        Hart, S. 1992. Games in extensive and strategic forms. In *Handbook of Game Theory with Economic Applications*, Vol. 1 (Ed. R. J. Aumann and S. Hart). North Holland.
        Camerer, chapter 1 including the appendix.
        (skim) Goeree, J.K. and C.A. Holt. 2001. Ten Little Treasures of Game Theory and Ten Intuitive Contradictions. *American Economic Review* 91:1402-22.

Static Games of Complete Information (Lectures 2-3: 9/12 & 9/14)
1. Equilibrium Concepts: Pure and Mixed Strategy Nash Equilibrium, Dominant Strategies and Iterated Dominance **(TMH)**
    Applications: Second Price Auctions, Cournot-Bertrand Oligopoly, Common Property Resources, Compliance

Readings:
    Required:
        Gibbons, chapter 1

    Supplementary:
        Mas-Colell, Whinston, and Green, chapter 7 (except 7C), chapter 8, pp. 235-253
        Fudenberg and Tirole, chapters 1-2
        Walker, J.M., R. Gardner and E. Ostrom. 1990. Rent dissipation in a limited-access common-pool resource: experimental evidence. *Journal of Environmental Economics and Management* 19(3): 203-211.
        Gardner, R., E. Ostrom and J.M. Walker. 1990. The nature of common pool resource problems. *Rationality and Society*: 2335-2358.
        Cooper, R., D.V. De Jong, R. Forsythe and T.W. Ross. 1989. Communication and the Battle of the Sexes Game: Some Experimental Results. *Rand Journal of Economics* 20: 568-587.
        Harrison, G.W., and J. Hirshleifer. 1989. An experimental evaluation of weakest link/best shot models of public goods. *Journal of Political Economy* 97(1): 201-225.
        Millner, E.L., and M.D. Pratt. 1989. An experimental investigation of efficient rent seeking. *Public Choice* 62(2): 139-151.

Dynamic Games of Complete Information (Lectures 4 –9)
1. Subgame Perfect Equilibrium (Lecture 4: 9/19) **(TMH)**
    Applications: Entry Deterrence, Stackelberg Duopoly

2. Two-Stage Games (Lecture 5: 9/21) **(TMH)**
    Applications: Tariffs and Imperfect Competition, Duopoly Investment, Regulatory Game, Tournaments

3. Dictator and Ultimatum Games (Lecture 6: 9/26) **(THM)**

4. Bargaining Games (Lecture 7: 9/28) **(SP)**

5. Dynamic Games: Markov Perfect Equilibrium (Lecture 8: 10/3) **(SP)**
    Applications: Resource Oligopoly, Common Property Resource Game

6. Repeated Games, History Dependent Strategies, and Folk Theorem (Lecture 9: 10/5) **(SP)**
    Applications: Collusion, Cooperation in the Commons

Readings:
    Required:
        Gibbons, chapter 2
        Camerer, chapter 2, 2.1-2.6, pp. 73-83, chapter 4, 4.1, 4.2, pp. 151-182

    Supplementary:
        Mas-Colell, Whinston, and Green, section 7C; chapter 9, pp. 267-282, 296-299; chapter 12, pp. 400-411, 414-427
        Tirole, chapters 6 & 8
        Fudenberg and Tirole, chapters 3-5
        Binmore, K., A. Shaked and J. Sutton. 1985. Testing non-cooperative bargaining theory: a preliminary study. *American Economic Review* 75: 1178-1180.
        Coate, S. and M. Ravallion (1993). Reciprocity without commitment: Characterization and performance of informal insurance arrangements. *Journal of Development Economics* 40:1-24.
        Plott, C.R. and M. Levine. 1978. A model of agenda influence on committee decisions. *American Economic Review* 68: 146-160.

Static Games of Incomplete Information (Lectures 10-12)
1. Bayesian Nash equilibrium (Lecture 10: 10/10) **(TMH)**

2. Application to double auction game (Lecture 11: 10/12) **(SP)**

3. Applications to private provision of public goods, rent seeking, first price auctions (Lecture 12: 10/17) **(TMH)**

Readings:
    Required:
        Gibbons, chapter 3
        Kagel, J.H. 1995. Auctions: a survey of experimental research. In *Handbook of Experimental Economics* (Eds. Kagel and Roth).

Dynamic Games of Incomplete Information (Lectures 13-18)
1. Perfect Bayesian Equilibrium (Lecture 13: 10/19) **(TMH)**
    Applications: Environmental Conflict

2. Equilibrium Refinements (Lecture 14: 10/24) (**TMH**)

3. Signaling and Screening Games (Lectures 15 & 16 10/26 & 11/1) **(SP)**
    Applications: Spence's Education Game, Lemon Markets

Midterm I (11/3)

4. Heterogeneous Agent Types and Reputation (Lectures 17 & 18: 11/7 & 11/9) **(SP)**
    Applications: Game of Entry, Bank Loans

Readings:
    Required:
        Gibbons, chapter 4
        Camerer, chapter 8

Supplementary:
    Mas-Colell, Whinston, and Green, chapter 9, pp. 282-296; chapter 13
    Tirole, chapter 9
    Fudenberg and Tirole, chapters 8-10
    Banks, J., C. Camerer, and D. Porter. 1994. An experimental analysis of Nash refinements in signaling games. *Games and Economic Behavior* 6: 1-31.
    Camerer, C.F. and K. Weigelt.1988. Experimental tests of a sequential equilibrium reputation model. *Econometrica* 56(1): 1-36.
    McKelvey, R.D., and T.R. Palfrey.1992. An experimental study of the centipede game. *Econometrica* 60: 803-836.
    Brandts, J. and C. A. Holt.1992. An experimental test of equilibrium dominance in signaling games. *American Economic Review* 82: 1350-1365.
    Jung, Y.J., J.H Kagel and D. Levin. 1994. On the existence of predatory pricing: an experimental study of reputation and entry deterrence in the chain-store game. *Rand Journal of Economics* 25(1): 72-93.

Alternative Explanations of Strategic Behavior (Lectures 19-23)
1. A Nash Equilibrium with Errors: Quantal Response Equilibrium (Lectures 19 & 20: 11/14 & 11/16) **(TMH)**

2. Fairness and Altruism (Lectures 21 & 22: 11/21 & 11/23) **(SP)**

3. Bounded Rationality (Lecture 23: 11/28) **(TMH)**

Readings:

Required:

    McKelvey, R.D. and T.R. Palfrey. 1995. Quantal Response Equilibria for Normal Form Games. *Games and Economic Behavior* 10:6-38.

    Fehr, E. and Schmitt. 1999. A Theory of Fairness, Competition, and Cooperation. *The Quarterly Journal of Economics* 114: 817–868.

    Rabin, M. 1993. Incorporating Fairness into Game Theory and Economics. *American Economic Review* 83:1281-1302.

    Andreoni, J. and B.D. Bernheim. 2009. Social image and the 50-50 norm: a theoretical and experimental analysis of audience effects. *Econometrica* 77(5): 1607–1636.

    Stahl, D.O. and P.W. Wilson. 1995. On Player's Models of Other Players: Theory and Experimental Evidence. *Games and Economic Behavior* 10:218-254.

Supplementary:

    Andreoni, J. 1990. Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving. *Economic Journal* 100:464-77.

    Andreoni, J. and J. Miller. 2002. Giving According to GARP: An Experimental Test of the Consistency of Preferences for Altruism. *Econometrica* 70: 737-753.

    Fehr, E. and S. Gachter. 2000. Fairness and Retaliation: The Economics of Reciprocity. *Journal of Economic Perspectives* 14:159-81.

    Charness, G. and M. Rabin. 2002. Understanding Social Preferences with Simple Tests. *Quarterly Journal of Economics* 117(3): 817-869.

Equilibrium Dynamics (Lectures 24-27)

1. Evolutionary Game Theory: Replicator Dynamics and Dynamic Stability (Lectures 24 & 25: 11/30 & 12/5) **(SP)**

    Applications: evolution of cooperation

2. Experience-Weighted Attraction Learning As A Synthesis of Reinforcement Learning and Belief Based Fictitious Play (Lecture 26 & 27: 12/7 & 12/12) **(TMH)**

Readings:

    Required:

        Saumelson, Chapters 1 – 3.

        Camerer, chapter 8

    Supplementary:

        Axelrod, R. 1984. *The Evolution of Cooperation*. Basic Books.

        Camerer, C. and T. Ho. 1999. Experience –Weighted Attraction Learning in Normal Form Games. *Econometrica* 67:827-874.

        Cheung Y. and D. Friedman. 1997. Individual Learning in Normal Form Games: Some Laboratory Results. *Games and Economic Behavior* 19:46-76.

        Freidman, D. 1991. Evolutionary games in economics. *Econometrica* 59: 637-666.

        Friedman, D. 1996. Equilibrium in evolutionary games: some experimental evidence. *Economic Journal* 106: 1-25.

        Ido, E. and A.E. Roth. 1998. Predicting How People Play Games: Reinforcement Learning in Experimental Games with Unique, Mixed Strategy Equilibria. *American Economic Review* 88:848-881.

        Mailath, G. 1998. Do people play Nash equilibrium? Lessons from evolutionary game theory. *Journal of Economic Literature* 36: 1347-1374.

        Maynard-Smith, J. 1982. *Evolution and the Theory of Games*. Cambridge University Press.

Nyarko, Y. and A. Schotter. 2002. An Experimental Study of Belief Learning Using Elicited Beliefs. *Econometrica* 70(3):971-1005.

Summary: Lessons Learned and Research Agenda (Lecture 28: 12/14) (**SP**)

Readings:
 Required:
  Camerer, chapter 9
  Goeree, J.K. and C.A. Holt. 2001. Ten Little Treasures of Game Theory and Ten Intuitive Contradictions. *American Economic Review* 91:1402-22.