

# ECON5160 Game Theory

Spring 2021

Department of Economics  
Chinese University of Hong Kong

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Lectures: Fri 8:30 to 11:15  
Office Hour: Tue 10:00 to 11:00

## Course Description

This course focuses on game theory and its applications in economics. We will cover topics in strategic games, extensive games of complete or incomplete information, epistemic foundations of game theory, repeated games, bargaining theory, coalitional games and matching theory.

## Learning Outcomes

After completing this course, the students are expected to:

1. Acquire advanced knowledge in game theory;
2. Develop skills in game theoretic modeling and analysis;
3. Obtain preparations for conducting independent research in game theory.

## Recommended Textbooks

There is no required textbook for this course. My lecture is mainly based on the following books and the papers on the reading list.

1. D. Fudenberg and J. Tirole, *Game theory*, MIT, 1991.
2. M. Osborne and A. Rubinstein, *A course in game theory*, MIT, 1994.
3. M. Osborne and A. Rubinstein, *Bargaining and markets*, Academic Press, 1990.
4. A. Roth and M. Sotomayor, *Two-sided matching*, Cambridge, 1990.

## Assessment Scheme

**Problem Sets (30%):** There will be six or seven problem sets. Students are encouraged to form study groups to work on them, but each student must submit his or her own solution on or before each due date. On your submitted solution, it is required that you **write down the names of other members in your study group**. Late submission will not be accepted.

**Final Exam (70%):** The final exam is tentatively scheduled on **April 30**.

| Grade       | Descriptor   |
|-------------|--|
| A / A-      | Outstanding/Generally outstanding performance on all learning outcomes.  |
| B+ / B / B- | Substantial performance on all learning outcomes, OR high performance on some learning outcomes which compensates for less satisfactory performance on others, resulting in overall substantial performance. |
| C+ / C / C- | Satisfactory performance on the majority of learning outcomes, possibly with a few weaknesses.   |
| D+ / D      | Barely satisfactory performance on a number of learning outcomes   |
| F           | Unsatisfactory performance on a number of learning outcomes, OR failure to meet specified assessment requirements.   |

## Teaching Mode

All lecture will be conducted online via Zoom meeting. Face-to-face teaching and assessment may be resumed when the pandemic stabilizes.

## Academic Honesty

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details may be found at <http://www.cuhk.edu.hk/policy/academichonesty/>

## Course Outline

### 1. Strategic Games

Nash Equilibria in Pure and Mixed Strategies, Rationalizability and Iterated Elimination of Strictly Dominated Strategies, Bayesian Games, Correlated Equilibrium, Common Knowledge

### 2. Extensive Games, Signaling, Forward Induction

Backward Induction, Subgame Perfect Equilibrium, Weak Perfect Bayesian Equilibrium, Sequential Equilibrium, Trembling-Hand Perfect Equilibrium, Proper Equilibrium, Stable Equilibrium, Signaling Games, Forward Induction Reasoning

### 3. Repeated Games

Folk Theorems for Finitely and Infinitely Repeated Games, Finite Automaton and Complexity Considerations in Repeated Games, Community Enforcement

### 4. Bargaining Theory

Axiomatic Approach vs. Strategic Approach, Nash Bargaining Solution, Rubinstein Bargaining Game, Commitment Tactics in Bargaining

### 5. Coalitional Games and Matching

Core, Shapley Value, Two-Sided Matching, One-Sided Matching

## Reading List

### 1. Strategic Games, Common Knowledge

Aumann, R. J. (1974), "Subjectivity and Correlation in Randomized Strategies", *Journal of Mathematical Economics* 1, 67-96.

Aumann, R. J. (1976), "Agreeing to Disagree", *Annals of Statistics* 4, 1236-1239.

Aumann, R. J. (1987), "Correlated Equilibrium as an Expression of Bayesian Rationality", *Econometrica* 55, 1-18.

Aumann, R. J. and A. Brandenburger (1995), "Epistemic Conditions for Nash Equilibrium", *Econometrica* 63, 1161-1180.

Bernheim, B. D. (1984), "Rationalizable Strategic Behavior", *Econometrica* 52, 1007-1028.

Geanakoplos, J. (1989), "Game Theory without Partitions, and Applications to Speculation and Consensus", Yale University Working Paper.

Geanakoplos, J. (1994), "Common Knowledge", pp. 1437-1496 in *Handbook of Game Theory*, Volume 2 (R. J. Aumann and S. Hart, eds.), Amsterdam: North-Holland.

Harsanyi, J. C. (1967/68), "Games with Incomplete Information Played by 'Bayesian' Players, Parts I, II and III", *Management Science* 14, 159-182, 320-334 and 486-502.

Harsanyi, J. C. (1973), "Games with Randomly Disturbed Payoffs: A New Rationale for Mixed Strategy Equilibrium Points", *International Journal of Game Theory* 2, 1-23.

Mertens, J.-F. and S. Zamir (1985), "Formulation of Bayesian Analysis for Games with Incomplete Information", *International Journal of Games Theory* 14, 1-29.

- Milgrom, P. and Stokey, N. (1982), "Information Trade and Common Knowledge", *Journal of Economic Theory* 26, 17-27.
- Myerson, R. B. (1978), "Refinements of the Nash Equilibrium Concept", *International Journal of Game Theory* 7, 73-80.
- Nash, J. F. (1950), "Equilibrium Points in N-Person Games", *Proceedings of the National Academy of Sciences of the United States of America* 36, 48-49.
- Nash, J. F. (1951), "Non-Cooperative Games", *Annals of Mathematics* 54, 286-295.
- Pearce, D. G. (1984), "Rationalizable Strategic Behavior and the Problem of Perfection", *Econometrica* 52, 1029-1050.
- Rubinstein, A. (1989), "The Electronic Mail Game: Strategic Behavior Under 'Almost Common Knowledge' ", *American Economic Review* 79, 385-391.
- Selten, R. (1975), "Reexamination of the Perfectness Concept for Equilibrium Points in Extensive Games", *International Journal of Game Theory* 4, 25-55.

## 2. Extensive Games, Signaling, Forward Induction

- Aumann, R. J. (1995), "Backward Induction and Common Knowledge of Rationality", *Games and Economic Behavior* 8, 6-19.
- Cho, I.-K. and D. Kreps (1987), "Signaling Games and Stable Equilibria", *Quarterly Journal of Economics* 102, 179-221.
- Fudenberg, D. and J. Tirole (1991), "Perfect Bayesian Equilibrium and Sequential Equilibrium", *Journal of Economic Theory* 53, 236-260.
- Kohlberg, E. and J.-F. Mertens (1986), "On the Strategic Stability of Equilibria", *Econometrica* 54, 1003-1037.
- Kreps, D. and G. Ramey (1987), "Structural Consistency, Consistency, and Sequential Rationality", *Econometrica* 55, 1331-1348.
- Kreps, D. and R. Wilson (1982a), "Sequential Equilibrium", *Econometrica* 50, 863-894.
- Kreps, D. and R. Wilson (1982b), "Reputation and Imperfect Information", *Journal of Economic Theory* 27, 253-279.
- Milgrom, P. and J. Roberts (1982), "Predation, Reputation, and Entry Deterrence", *Journal of Economic Theory* 27, 280-312.
- Rosenthal, R. W. (1981), "Games of Perfect Information, Predatory Pricing and the Chain-Store Paradox", *Journal of Economic Theory* 25, 92-100.
- Selten, R. (1978), "The Chain-Store Paradox", *Theory and Decision* 9, 127-159.
- Van Damme, E. (1989), "Stable Equilibria and Forward Induction", *Journal of Economic Theory* 48, 476-496.

## 3. Repeated Games

- Abreu, D. (1988), "On the Theory of Infinitely Repeated Games with Discounting", *Econometrica* 56, 383-396.
- Abreu, D., D. Pearce and E. Stachetti (1986), "Optimal Cartel Equilibrium with Imperfect Monitoring", *Journal of Economic Theory* 39, 251-269.
- Abreu, D., D. Pearce and E. Stachetti (1990), "Toward a Theory of Discounted Repeated Games with Imperfect Monitoring", *Econometrica* 58, 1041-1064.
- Abreu, D. and R. Rubinstein (1988), "The Structure of Nash Equilibrium in Repeated Games with Finite Automata", *Econometrica* 56, 1259-1281.
- Aumann, R. J. and L. Shapley (1976), "Long-Term Competition — A Game Theoretic Analysis", pp. 1-15, in *Essays in Game Theory in Honor of Michael Maschler*, edited by N. Megiddo, Springer, New York, 1994.
- Benoît, J.-P. and V. Krishna (1985), "Finitely Repeated Games", *Econometrica* 53, 905-922.
- Ellison, G. (1994), "Cooperation in the Prisoner's Dilemma with Anonymous Random Matching", *Review of Economic Studies* 61, 567-588.

- Friedman, J. W. (1971), "A Non-Cooperative Equilibrium for Supergames", *Review of Economic Studies* 38, 1–12.
- Fudenberg, D. and E. Maskin (1986), "The Folk Theorem in Repeated Games with Discounting or with Incomplete Information", *Econometrica* 54, 533-554.
- Green, E. and R. Porter (1984), "Noncooperative Collusion under Imperfect Price Information", *Econometrica* 52, 87-100.
- Kandori, M. (1992), "Social Norms and Community Enforcement", *Review of Economic Studies* 59, 63–80.
- Kreps, D., P. Milgrom, J. Roberts and R. Wilson (1982), "Rational Cooperation in the Finitely Repeated Prisoner's Dilemma", *Journal of Economic Theory* 27, 245-252.
- Rubinstein, A. (1979), "Equilibrium in Supergames with the Overtaking Criterion", *Journal of Economic Theory* 21, 1-9.
- Rubinstein, A. (1986), "Finite Automata Play the Repeated Prisoner's Dilemma", *Journal of Economic Theory* 39, 83-96.

#### **4. Bargaining Theory**

- Abreu, D. and F. Gul (2000), "Bargaining and Reputation", *Econometrica* 68, 85-117.
- Binmore, K. G., A. Rubinstein and A. Wolinsky (1986), "The Nash Bargaining Solution in Economic Modelling", *Rand Journal of Economics* 17, 176–188.
- Crawford, V. (1982), "A Theory of Disagreement in Bargaining", *Econometrica* 50, 607-638.
- Kalai, E. and M. Smorodinsky (1975), "Other Solutions to Nash's Bargaining Problem", *Econometrica* 43, 513–518.
- Nash, J. F. (1950), "The Bargaining Problem", *Econometrica* 18, 155-162.
- Nash, J. F. (1953), "Two-Person Cooperative Games", *Econometrica* 21, 128–140.
- Rubinstein, A. (1982), "Perfect Equilibrium in a Bargaining Model", *Econometrica* 50, 97–109.
- Shaked, A. and J. Sutton (1984), "Involuntary Unemployment as a Perfect Equilibrium in a Bargaining Model", *Econometrica* 52, 1351–1364.
- Sutton, J. (1986), "Non-Cooperative Bargaining Theory: An Introduction", *Review of Economic Studies* 53, 709–724.

#### **5. Matching Theory**

- Abdulkadiroglu, A. and T. Sönmez (1999), "House Allocation with Existing Tenants", *Journal of Economic Theory* 88, 233-260.
- Gale, D. and L. Shapley (1962), "College Admissions and the Stability of Marriage", *American Mathematical Monthly* 69, 9-15.
- Kelso, A. and V. Crawford (1982), "Job Matching, Coalition Formation and Gross Substitutes", *Econometrica* 50, 1483-1504.
- Roth, A. and A. Postlewaite (1977), "Weak versus Strong Domination in a Market with Indivisible Goods", *Journal of Mathematical Economics* 4, 131-137.
- Roth, A., T. Sönmez, and U. Ünver (2004), "Kidney Exchange", *Quarterly Journal of Economics* 119, 457-488.
- Roth, A., T. Sönmez, and U. Ünver (2005), "Pairwise Kidney Exchange", *Journal of Economic Theory* 125, 151-188.
- Shapley, L. and H. Scarf (1974), "On Cores and Indivisibility", *Journal of Mathematical Economics* 1, 23-28.
- Shapley, L. and M. Shubik (1972), "The Assignment Game I: The Core", *International Journal of Game Theory* 1, 111-130.