

**Applied Microeconomic Analysis of Game Theory and Information
APEC 8003**

Spring 2017

Class: Tu/Th 3- 4:15 McGrath 6

Discussion Session Th 4:30 – 5:45 Ruttan B22

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Overview: This course covers microeconomic theory in situations where there are multiple individuals or firms whose actions affect outcomes for other individuals or firms (“strategic interactions”). Strategic interactions arise in a wide range of economic situations including auctions, bargaining, common property resources, duopoly, externalities, and many more (extra credit for anyone who can complete the alphabet...). Strategic interactions require that individuals or firms take account of the choices of others in making their own choices. This makes situations with strategic interactions more complex than those without such interactions. Game theory is the standard tool for analysis of strategic interactions and will form the core of the material covered in this portion of the microeconomic theory sequence. The other major theme of this portion of the core sequence involves information. The information that individuals and firms have when they must choose an action can affect what they choose to do. The strategic use of information is another important component of strategic interactions. The first half of the course covers games of complete information and the second half covers games of incomplete information.

Prerequisites: APEC 8001-8002 or equivalent course

Course Requirements:	Problem sets	25%
	Midterm exam	35%
	Final exam	40%

Problem sets will be assigned weekly (except exam weeks). Problem sets are assigned to help you work through the material. It is *extremely* important that you work through the problems. It is virtually impossible to learn this material without doing the problems. I am convinced that the way one becomes a good economist is by actively practicing and applying the material rather than just reading it.

Meeting Times:

Lectures are on Tuesdays and Thursdays from 3:00 – 4:15 pm in McGrath 6. Most lectures will start with a game that illustrates the material we will cover in the lecture that day. Please be on time to class. If you are late you will not get to play the game for that day. Lectures will cover theory, relevant economic applications of the theory, and briefly discuss significant anomalies between theory and empirical evidence of how people behave in strategic situations.

Recitation sessions are on Thursday from 4:30 – 5:45 pm in Ruttan B22. The recitation sessions will cover questions that have arisen from that week's material as well as review answers to problem sets and exams and cover additional problems.

Required Texts: Gibbons, R. *Game Theory for Applied Economists*. 1992.
Mas-Colell, A., M. Whinston, and J. Green [MWG] *Microeconomic Theory*. 1995.

Optional Texts: Tirole, J. *The Theory of Industrial Organization*. 1988.
Fudenberg, D. and J. Tirole. *Game Theory*. 1991.

Other Useful Texts: Aumann, R. and S. Hart (Eds.). *Handbook of Game Theory*, Volumes I, II & III. 1992-2002.
Camerer, C. *Behavioral Game Theory*. 2003.
Dixit, A., D. Reiley, and S. Skeath. *Games of Strategy* (3rd Edition). 2009.
Maschler, M., E. Solan, and S. Zamir. *Game Theory*. 2013.
Myerson, R. *Game Theory: Analysis of Conflict*. 1997.
Schechter, S. and H. Gintis. *Game Theory in Action: An Introduction to Classical and Evolutionary Games*. 2016.
Schelling, T. *Strategy of Conflict*. 1960.

Web Page: The web page for this course is maintained on Moodle. You can log in through your My U Portal webpage. Assignments and lecture notes will be posted on the Moodle site.

Absence and Late Policy: You are expected to attend all lectures and recitation sections. Please notify Professor Polasky if you know you will be absent from lecture and notify the T.A. Ibrahim Keita if you know you will be absent from the recitation. Please submit assignments beforehand if you know that you will be absent when an assignment is due. To submit a late assignment without penalty, you must make arrangements prior to the due date. Late problem sets will be subject to a penalty and will not be accepted after answer keys have been passed out (typically one week from the due date). You are expected to take the midterm and final during the times when they are scheduled. If you cannot take these exams at the scheduled times you must make arrangements prior to the exam date to schedule another time.

Scholastic Dishonesty: Scholastic dishonesty is any act by a student that misrepresents the student's own academic work or that compromises the academic work of another. Examples include plagiarizing (the presentation of another's writing or ideas as your own), and cheating on assignments. Within this course, a student responsible for scholastic dishonesty can be assigned a penalty up to and including an "F" or "N" for the entire course. You can learn more about UMN policies on dishonesty at the Office for Student Academic Integrity: <http://www.osai.umn.edu/>.

Student Mental Health and Stress Management: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These

mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via <http://www.mentalhealth.umn.edu/>.

Course Outline

1. Introduction (January 17)
 - a. Course overview: the “imperfect world” - imperfect competition (strategic interactions) and imperfect/incomplete information
 - b. Introduction to game theory
 - c. Elements of a game
 - i. Players
 - ii. Actions/strategies
 - iii. Information
 - iv. Payoffs
 - d. Normal form and extensive form representation
 - e. Taxonomy of games and information
 - i. Cooperative vs. non-cooperative game theory
 - ii. Static vs. dynamic
 - iii. Perfect vs. imperfect information
 - iv. Complete vs. incomplete information

Required Reading: MWG chapter 7

Optional Reading: 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.

2. Static Games of Complete Information (January 19 & 24)
 - a. Nash equilibrium
 - i. Pure strategy Nash equilibrium
 - ii. Mixed strategy Nash equilibrium
 - b. Existence of Nash equilibrium in mixed strategies
 - c. Application of Nash equilibrium to common property resources
 - d. Strategic behavior and Pareto efficiency
 - e. Other solution concepts
 - i. Dominant strategy equilibrium
 - ii. Iterated dominance
 - iii. Rationalizable strategies
 - iv. Correlated equilibrium
 - f. Application of dominant strategy equilibrium: second price auctions

Required Reading: Gibbons Chapter 1
MWG, chapter 8, pp. 235-253, 260-261

Optional Reading: Fudenberg and Tirole, chapters 1-2; Tirole, chapter 5

3. Imperfect Competition (January 26 & 31)
 - a. Monopoly
 - i. Price discrimination
 - ii. Non-linear pricing
 - b. Oligopoly competition
 - i. Cournot model
 - ii. Bertrand model
 - iii. Hotelling model of product differentiation
 - c. Imperfect competition, information and inefficiency

Required Reading: Mas-Colell, Whinston, and Green, chapter 12, pp. 383-400, 411-413

Gibbons Chapter 1, pp. 14-22

Optional Reading: Varian, chapter 14, except section 14.7; chapter 16, pp. 285-294
Tirole, chapter 1; chapter 3, pp. 133-142; chapter 5

4. Dynamic Games of Complete Information (February 2 & 7)
 - a. Extensive form games and the order of moves
 - b. Subgame perfect equilibrium
 - c. Applications of subgame perfect equilibrium: Stackelberg equilibrium, entry deterrence
 - d. Two-stage games and strategic investment
 - e. Strategic substitutes and complements
 - f. Repeated games, history dependent strategies, and the folk theorem

Required Reading: Gibbons, chapter 2
MWG chapter 9, pp. 267-282, 296-299; chapter 12, pp. 400-411, 414-427

Optional Reading: Tirole, chapters 6 & 8
Fudenberg and Tirole, chapters 3-5

5. Static Games of Incomplete Information (February 9 & 14)
 - a. Representing incomplete information in games
 - b. Bayesian Nash equilibrium
 - c. Applications of Bayesian equilibrium: duopoly with asymmetric cost information, first price auction
 - d. Application: double auction
 - e. Incomplete information and inefficiency: Myerson-Satterthwaite Theorem

Required Reading: Gibbons, chapter 3, pp. 143-163
MWG, chapter 8, pp. 253-257

Optional Reading: Fudenberg and Tirole, chapters 6-7

MIDTERM EXAM: February 16

6. Dynamic Games of Incomplete Information (February 21)
 - a. Simple examples of dynamic games of incomplete information
 - b. Equilibrium concepts
 - i. Perfect Bayesian equilibrium
 - ii. Sequential equilibrium
 - iii. Proper equilibrium

Required Reading: Gibbons, chapter 4, pp. 173-183
MWG, chapter 9, pp 282-296; chapter 13, pp 467-472

Optional Reading: Fudenberg and Tirole, chapter 8; chapter 11
Tirole, chapter 9
(Both of these readings cover material in section 6 & 7)

7. Signaling Games (February 23 & 28)
 - a. Perfect Bayesian equilibria in signaling games
 - b. Separating, pooling equilibrium, and hybrid equilibrium
 - c. Application of signaling game: Spence job market signaling game
 - d. Equilibrium refinements: the intuitive criterion

Required Reading: Gibbons, chapter 4, pp. 183-210, 233-244
MWG, chapter 13, pp. 450-459, pp. 467-472

8. Screening Games (March 2)
 - a. Adverse selection and market unraveling
 - b. Application of screening games: insurance

Required Reading: MWG, chapter 13, pp. 436-450, 460-467

9. Mechanism Design (March 7)
 - a. Principle-agent problems
 - b. Hidden action and moral hazard
 - c. Hidden information and screening
 - d. Application of hidden information: monopolistic screening
 - e. The revelation principle
 - f. Optimal and second-best mechanisms
 - g. Application of mechanism design: first price auction

Required Reading: MWG, chapter 14; chapter 23

FINAL EXAM: March 9