University of Southern California Instructor: **Yilmaz Kocer**
ECON 504 – GAME THEORY **(213) 740-3512**
with Economic And Financial Applications **kocer@usc.edu**
Office KAP 306B

Meeting time/place : 12pm-1.50pm, Monday/Wednesday , KAP 144
Office Hours: after class **2-3pm**, also email me for an appointment.
Grader: Jeonghwan Yun jeonghwy@usc.edu ; email him first to see your midterm exams and your grades, and take a picture/copy of it for your records.

Course Description:
This is a lower graduate level course in game theory, intended for students who are interested in major applications of game theory on a diverse set of economic or financial questions. The course will cover a combination of standard results in game theory and analyze a diverse set of examples and applications of game theory in economic and financial markets and interactions. These will include reputation, herding, auctions, strategic information revelation and information accumulation in markets.

Learning Objectives
This class will enrich your abstract mathematical modelling toolkit by adding a strategic dimension all economic and financial interactions, markets, one might think of. Similarly, when beliefs and expectations and coordination matter (as it does in so many markets), game theory offers a tangible and coherent set of ideas to understand the web of interactions and outcomes. You will have a concrete understanding of the mechanics of a plethora of economic and financial phenomena through the game theory lens; beauty contests and coordination in markets, bank runs and currency attacks, the value and public and private information in markets, bubbles and crashes, the role of reputation in markets, theories of bargaining, why at times many make the same mistakes and information is not accumulated in the market to make sensible decisions (herding and information cascades), when we can expect strategic information in the market to be hidden and when to be transmitted. On the other hand, we will look at the "reverse engineering" version of game theory; mechanism design. We will analyze when we can expect to have agents to report truthfully what they know and arrive at a socially good outcome, when people might have incentives to lie. Similarly, we will look at how to design optimal auctions, matching markets, etc.

Prerequisite(s): Intermediate Microeconomics, Basic Game Theory, Basic Optimization and Multivariate Calculus, Basic Matrix Theory.

Recommended Preparation
You should know the very basics of Game Theory (like Nash Equilibrium, Backward Induction..etc.) and should have successfully taken an upper level undergraduate micro related course. You must feel comfortable with mathematical notation and have some mild training in multivariate calculus, optimization theory, real analysis and probability theory. For the mathematical sophistication level required, you should have perfect command of *Simon & Blume - Math for Econ*. level math; the Lagrangian method and basic optimization, basic logic, intermediate level calculus (multivariate) and some real analysis and probability, and matrix theory.

Course Notes
The main course portal will be Blackroom. I will post exams, answer keys, homeworks and other lecture note material and announcements on blackboard. Please familiarize yourself with the course web site ASAP. I may put lecture notes, papers, exams (and their solution key) or other relevant material. Please put "ECON 504" in the subject of your emails about this class.

Required Textbook

S. Tadelis, Game Theory: An Introduction, Princeton U. Press, ISBN: 9780691129082

Recommended texts

J Bergin, *Microeconomic Theory*
Durlauf & Blume, *Game Theory (New Palgrave Economics Collection)*
M. Osborne and A. Rubinstein, *A Course in Game Theory*
Mas-Colell Microeconomic theory, chapters 6,7,8

Advanced Game Theory

G. Mailath and L. Samuelson, *Repeated Games and Reputations*
D. Fudenberg, J. Tirole, *Game Theory*
P. Bolton, M. Dewatripont, *Contract Theory*

Description and Assessment of Assignments

- 2 in-class midterm exams (20 pts each= 40 pts), that cover all material starting from the last midterm onwards.
- I will deliver 2 problem sets (2x10=20 pts) a week before the midterm in class (the previous monday), for practice for the upcoming exam. You will submit your homeworks by the Wednesday class (still before the midterm). They are to be graded only as complete (10pts) or incomplete (0pts). I will give a brief solution key for these that day (wednesday), so that you have a chance to learn the solutions before the next Monday's exam.
- ATTENDANCE is %10 of the course grade.
- FINAL EXAM is cumulative, covering all material in this class, closed book, closed notes, calculators allowed, %30 of the grade weight of this class.

Grading Breakdown

Assignment/exam	points	% of Grade
Homework 1	100	% 10
Midterm 1	100	% 20
Homework 2	100	% 10
Midterm 2	100	% 20
FINAL EXAM	100	% 30
ATTENDANCE	100	% 10

Assignment Submission Policy and Exam Policy

Midterms and the Final Exam: The midterm exams and the Final will be in class with **closed book or notes,** however **calculators are allowed**. The Final exam will be in class on **MAY 5th 11am-1pm** (note it is earlier than class time !!) If you miss the midterms for a justified reason and provide sufficient evidence, your other exams/paper/homework grades will be counted instead of the midterm exam. If you miss the midterm for any other reason you will get a score of 0. If for a justified reason you don't take the final exam, you will receive an incomplete, which has to be removed in the earliest possible semester.

A –provisionary- summary of the journey in this class;

A brief summary of Decision theory: We will describe a generic choice situation: actions, outcomes and preferences. We'll briefly go over how choices over alternatives can be represented as "preferences" and these in turn by "utility functions". We will then extend the choice framework to decisions over risky prospects: expected utility and VNM preferences and towards another direction, decisions over time.
Reading: Chapter 1,2

Introduction to Game Theory We will first describe a strategic situation, as opposed to a decision theoretic one. We will describe a game and its ingredients: Actions / strategies, outcomes, payoffs, solution concepts. Are the "rules" and payoffs of the game known? (Complete vs. Incomplete information games) Is it a one-shot game with simultaneous moves or played over time? (static vs dynamic games). We will start with Static Games with Complete Information; games in normal form.
We will describe the "rationality" and informational assumptions on the players, and describe what a solution concept is, ***Reading: Chapter 3***.

Next, we define dominant strategies/ dominated strategies. We will see how we can "purge" dominated strategies iteratively as we expect them not being played by rational players: Iterated Elimination of Dominated Actions. On another vein, we will describe beliefs about the opponent's strategy and best responses to it. We will make a connection between strategies that are best responses to some belief, and those who survive the iterated elimination. We will see these in action in a Cournot Duopoly example. ***Reading: Chapter 4***

Next, we will move on to define our first solution concept: *Nash Equilibrium*, and see some classical examples in economics: Cournot and Bertrand competition, tragedy of the commons, battle of the sexes, prisoner's dilemma, electoral competition game…Next we will describe mixed strategies and randomization, and extend our solution concept to Mixed Nash Equilibrium, and prove its existence in finite games. ***Reading: Chapter 5,6***

We will move on to Dynamic games with complete information, namely extensive form games, and discuss why Nash equilibrium may not be sufficient to address incredible threats. We will define sequential rationality and backward induction; and *subgame Perfect Nash Equilibrium*. ***Reading: Chapter 7,8,9***

We will next prove the one-shot deviation principle. Moving on to Repeated Games, we will talk about dynamic tacit collusion, cooperation and reputation using repeated games. We will prove and discuss folk theorems. ***Reading: Chapter 10***
We will describe perfect/imperfect public monitoring and private monitoring repeated games.

We will apply the repeated games model to the Rubinstein bargaining, and discuss a Legislative bargaining scenario. ***Reading: Chapter 11***

We are now ready to incorporate uncertainty and informational concerns: games of incomplete information. Extending the notion of strategy and beliefs, and incorporating Bayesian updating, we will define Bayesian Nash Equilibrium. We will see examples of incomplete information games with Inefficient Trade and with Adverse Selection. ***Reading: Chapter 12***

Mechanism Design; Auction theory We will talk about "reverse engineering" of game theory; how to design market games where self-interested agents compete to bring about an efficient or in some sense desirable outcome?
We will start with the (major) example of Auction theory. We will discuss different types of auction setups (first price, second price, dutch, english) and describe the optimal bids and the revenues by the auctioneer, in a simple

setting. We will prove the *Revenue Equivalence theorem*. In the *common values* auctions, we will discuss the *Winner's curse*. ***Reading: Chapter 13***

We will study Mechanism design from a more general and theoretical standpoint. We will show the *revelation principle*, and study a very useful and general class: *VCG* of mechanisms, *i.e., Vickrey-Clarke-Groves mechanisms* and elaborate on its good qualities and deficiencies. ***Reading: Chapter 14***

We will move on to dynamic games with Incomplete Information and discuss why subgame perfection is not adequate. Formulating the relevant sequential rationality condition, we will describe *Sequential Equilibrium* and *Perfect Bayesian Equilibrium* ***Reading: Chapter 15***

Signaling games; we will study the standard education signaling a la Spence (1973), and define Seperating and Pooling equilibria. We will then talk about some forward Induction refinements to these equilibria ***Reading: Chapter 16***

Building a Reputation; we will study the repeated prisoner's dilemma with reputational concerns (the famous "Gang of Four" paper). We will model reputation as the others' favorable belief about your "type". ***Reading: Chapter 17***

Information Transmission and Cheap Talk; When somebody has the information and yet another has decision rights, can information be transmitted if they have conflicting preferences about what should be done? We will describe a "*cheap talk*" scenario where information is not verifiable and is free (as opposed to the Signaling framework). We will apply the model to Legislative Organization ***Reading: Chapter 18***

Course Schedule: A Weekly Breakdown (provisionary and rather optimistic!)*

Date	**Chapter**	**Date**	**Chapter**
January 9	intro	March 6	(11)
January 11	1,2	March 8	12
January 18	3	March 20	12 (HW2 delivered)
January 23	4	March 22	(13) (HW2 deadline)
January 25	4	**March 27**	**2nd Midterm Exam**
January 30	5	March 29	(13)
February 1	6	April 3	(14)
February 6	6 (HW1 delivered)	April 5	15
February 8	7 (HW1 deadline)	April 10	(16)
February 13	**1nd Midterm Exam**	April 12	(16)
February 15	8	April 17	(17)
February 22	9	April 19	(17)
February 27	10	April 26	(18)
March 1	10		

FINAL EXAM on MAY 5th FRIDAY 11am -1pm, in class

No class *on* ***Jan 16th*** *Monday (MLK day),* ***Feb 20th*** *Monday (President's day),* ***March 13th &15th*** *(spring break)*

** The chapter numbers in parenthesis are optional in that we will pick and choose depending on the class interests and capabilities and time left in the semester. The other (core) chapters will be mostly covered except some omissions I will point out as we proceed.*