

## GAME THEORY & BUSINESS

FALL 2023

**Instructor:** Andrea Prat (he/him/his)  
[ap3116@gsb.columbia.edu](mailto:ap3116@gsb.columbia.edu)  
Kravis 596

**Teaching Assistant:** TBD

**Review Sessions:** 11-12.30 on Fridays

### COURSE CONTENT

Companies (managers, individuals) often make decisions that affect the well-being of others. In turn, our payoff (compensation, well-being) is often affected by the choices made by others. In simpler terms, people often operate in situations of strategic interaction. Game Theory is the discipline that studies strategic interaction. The theory has two inter-related goals:

1. To advise parties involved in situations of strategic interaction on the best course of action.
2. To predict the outcome of strategic interaction.

This course is an introduction to Game Theory. Our goal is to learn the basic conceptual tools from Game Theory and identify some real-life business situations where these tools can be useful to a manager. The games presented and solved in class go to the essence (often in the simplest framework possible) of particular aspects of strategic interaction that arise in real-life situations. To understand the similarities between these simple games and the many situations that arise both in business and in our daily economic lives, the course provides applications of the theory to business and economics.

### COURSE STRUCTURE

Classes will combine theory and applications. We will present the concepts required to analyze different forms of strategic interaction. For instance: What do you know when you have to make a decision? Do you observe the choices of your opponents? Do you interact with them repeatedly? Different answers to these questions call for different frames of analysis. We will then apply the theory to business and economic situations. For example, we will study price and quantity competition, endogenous barriers, formation and stability of cartels, and auctions.

## READINGS

The course is self-contained but there is an optional recommended textbook: Avinash Dixit and Susan Skeath , *Games of Strategy*, Fifth Edition,. New York: WW Norton, 2021.

The fifth edition of the textbook is the latest, but the previous ones, especially the fourth (2015) and the third (2009) are quite similar.

Readings will be made available online, linked from the Canvas course website. These range from news articles to chapters of books. Readings are optional.

Also recommended for lighter reading on business and games is: Avinash Dixit and Barry Nalebuff , *The Art of Strategy*, New York: WW Norton, 2010

## ASSIGNMENTS AND FINAL EXAM

There are going to be graded assignments. Students are encouraged to work in groups for the assignments, but the answers must be turned in individually. Assignments are due at the beginning of the class indicated in the course outline. They will be handed out about one week before the due date.

The final exam contains problems that are similar – in format and difficulty – to the assignments. The final lasts two hours.

## GRADING POLICY AND CLASS PARTICIPATION

Grades in the course will be based on the three assignments, a final exam, and class participation:

Final Exam: 50%

Assignments: 30%

Class Participation: 20%

Each student's participation will be evaluated with respect to the contribution that the student makes towards the entire class' learning experience. The quality of contribution matters more than the frequency of speech.

## CONTENT

The course is structured around five topics:

	Complete Info	Incomplete Info
Simultaneous Moves	<b>Topic 1: Thinking About Games</b> Concepts: Dominant strategy, dominance solvability Games: prisoners' dilemma, guessing games, location games	<b>Topic 4: Bayesian Games</b> Concept: player types Games: auctions, trading
	<b>Topic 2: Nash Equilibrium</b> Concepts: reaction function, Nash equilibrium Games: markets, price oligopoly, quantity oligopoly, mergers, meet the competition	
	<b>Topic 3: It's More Complicated</b> Concepts: multiple equilibria, mixed strategies Games: coordination games, penalty kicks, inspections	
Sequential	<b>Topic 5: Sequential Games</b> Concepts: game tree, subgame-perfect equilibrium Games: promises and threats, entry deterrence, bargaining, dynamic pricing	
		Concept: signaling game Games: job market, bluffing

## Topic 1 Thinking about Games

What is Game Theory? Aspartame example, definition of game, plan of course

Dominance Solvability: game matrices, prisoners dilemma, dominant action, iterated deletion of dominated strategies, guessing game, location game, median voter theorem

## Topic 2 Nash Equilibrium

Nash Equilibrium: reaction function, definition

Application to markets: Price and quantity oligopoly, mergers, meet-the competition clauses, changing the game, quantal response equilibrium

## Topic 3 Nash Equilibrium When Things Are More Complicated

Multiple equilibria: coordination games, chicken game, risk dominance

Mixed strategy equilibria: penalty game, general problem, finding mixed strategy equilibrium

## Topic 4 Bayesian Games

Auctions: First price, second price, Private values, common values,

Bayesian games: General approach, trading games, and other examples

## **Topic 5**

### **Sequential Games**

Subgame perfect equilibrium: game trees and backward induction: various examples, promises and threats, Boeing vs Airbus, Alcoa, entry deterrence, Phillips

Bargaining games

Dynamic Pricing: infinitely repeated games

Sequential games with asymmetric information: Perfect Bayesian equilibrium, labor signaling game, poker