#### Econ 200b, Winter 2024

#### Overview

This course comprises the second half of Shishkin's lectures on choice under uncertainty (through Thursday of 3rd week), Watson's introduction to game theory (Thursday of 3rd week through 8th week, and 10th week), and Vespa's overview of behavioral theory and experiments (9th week).

# Part 2: Game Theory

## **Economics 200B Part 2: Game Theory**

## Representations and Basic Solution Concepts for Static and Dynamic Games

Winter 2024, Professor Joel Watson

This is the first part of the core-sequence section on game theory and information economics. Game theory is a technical framework for rigorously analyzing decision-making in strategic settings, which are characterized by interdependence in that the decision makers care about each other's behavior. Almost every type of interaction between living things is strategic. The material covered in this first part includes representations of games and the basic tools for the analysis of static and dynamic games. Some applications will also be presented, including bargaining if time allows. Review of essential game-theoretic concepts and applications continues in Econ 200c, which covers repeated games, strategic communication, signaling, screening, mechanism design, and other topics.

**Schedule:** Tuesdays and Thursdays from 9:30 a.m. to 10:50 a.m. There will also exist exercise/discussion sessions led by the teaching assistant and possibly additional optional sessions held by Watson.

**Problem Sets and Examination:** Some exercises will be assigned. Exercises will be due each week on Friday at 11:59 p.m. You must complete the exercises to learn the material. You are encouraged to work on exercises both alone and in study groups, but please submit your answers individually. The final examination will take place either at the regularly scheduled time or during an extended period of time.

**Watson's Office Hours:** Watson's office hours will usually take place on Tuesdays at 12:30 - 1:50 p.m. in person at SSB 107. If the need arises for remote office hours in a given week, it will take place on Zoom (see the code above) not necessarily at the normal time. There may also be time after the class lectures to chat and answer questions outside the classroom. Please do not disturb Watson outside of office hours unless you have an appointment.

**Textbooks:** You are encouraged to consult whatever books match your learning style. Here are some popular texts, in alphabetical order:

Binmore, Fun and Games Fudenberg and Tirole, Game Theory Gibbons, Game Theory for Applied Economists Kreps, A Course in Microeconomic Theory Mas-Colell, Whinston, and Green, Microeconomic Theory McMillan, Games, Strategies, and Managers Osborne and Rubinstein, Game Theory Varian, Microeconomic Analysis Watson, Strategy: An Introduction to Game Theory

This is not a comprehensive list. Talk to Watson for more suggestions. You are probably familiar with Kreps, Mas-Colell-Whinston-Green, and Varian. If you used only one of these texts as a primary reference for 200A and 200B1, then it will probably be adequate for your studies in 200B2, although Varian's coverage of game theory is thin and Mas-Colell-Whinston-Green's treatment of game theory leaves much to be desired. Fudenberg-Tirole, Gibbons, and Osborne-Rubinstein are graduate level game-theory texts. Fudenberg-Tirole is the most comprehensive and difficult. Binmore's book is quirky. Watson's book is primarily for advanced undergraduates and first-year graduate students. It discusses all of the essential

concepts, definitions, and results without too many technical details. Students who are struggling to grasp some of the basic ideas will find it useful to read Watson's text first.

**Video lectures:** Several videos from Watson's Game Theory Video Handbook (for advanced undergraduates and beginning graduate students) will be assigned, as will additional videos created for graduate students. **How to Study:** Try to read the textbook coverage of specific topics and the assigned videos prior to attending lectures. You must work diligently on exercises to learn the course material; attending lectures is not nearly enough and would give you, at best, a false sense of understanding.

#### Topics to be Covered (aspirational list)

(weeks 3-4 of quarter)

### A. Representing Games

Strategies (pure, mixed, behavioral) Extensive form Normal form (standard versions with and without nature, Bayesian normal form) Situational form (notation, strategic players, nature) Knowledge and beliefs (brief overview) (Weeks 4-5)

## **B.** Analysis of Static Settings (Normal Form-Based Concepts)

Core rationality concepts: beliefs, best response, dominance, relation between Efficiency Iterated dominance, rationalizability Applications Nash equilibrium, mixed strategy Nash equilibrium Applications, examples with nature Epistemic approach to modeling knowledge and beliefs Correlated equilibrium, notes about payoff-relevance and types Existence (rationalizability, equilibrium) Strictly competitive games and security strategies (Weeks 6-8, 10) C. Analysis of Dynamic Settings Strategy-based concepts Overview of sequential rationality, incredible/credible threats Backward induction, iterated conditional dominance, subgame-perfect Nash equilibrium, one-deviation property Applications Basic bargaining theory Basic repeated game theory **Belief-based** concepts Beliefs and rationality: appraisal systems and sequential best response Minimal consistency and one-deviation property Extensive-form rationalizability Applications, forward induction and backward induction Perfect Bayesian equilibrium, sequential equilibrium Examples and applications Additional examples or behavioral topics: psychological and sociological games

**Mathematical Prerequisites:** Basic analysis (sequences, etc.) from Econ 205; compactness, convex sets, hyperplanes, separating hyperplane theorem; upper hemi-continuity, closed graph, correspondences, Kakutani's theorem; theorem of the maximum; supermodularity.