

ECON 380: Game Theory
Fall 2022
Northwestern University

Professor Asher Wolinsky
KGH 3461
Office Hours: WED 2-3 & by Appt.

COURSE DESCRIPTION: The course will survey some of the basic models and ideas of Game Theory. It will discuss examples drawn from economics and other social sciences, but the emphasis will be on understanding the game theoretic concepts rather than thinking seriously about the substance of the applications.

PREREQUISITES: Interest and ability to follow closely reasoned arguments. The level of mathematical technique required will not be high. Yet the level of abstraction and the level of precision will be relatively high. These are the sort of skills acquired in math courses.

TEXT: an introduction to Game Theory by Martin Osborne (Oxford University Press). The regular and "international" editions are identical except for the cover. Textbook's website which includes solutions to some of the problems:

<https://www.economics.utoronto.ca/osborne/igt/>

ONLINE COURSE: <https://www.youtube.com/user/gametheoryonline>

FORMAT: (i) Reading (and/or listening) of specified material prior to the Lecture. (ii) Lectures will review and discuss prior read (listened to) material under the assumption it was read. (iii) Regular homework assignments.

GRADE: (i) MIDTERM 25%; (ii) CUMULATIVE FINAL 75%; (iii) BONUS for HOMEWORK 10%; (iv) BONUS for PARTICIPATION in class discussion up to 10%.

HOMEWORK: (i) Problem sets will be assigned on a weekly basis. (ii) Submission of homework will be through Canvas. (iii) Assignments will not be graded as exams. A perfect score on an assignment does not require correct solutions, but only a serious effort to solve the questions. (iv) Solution of homework problems will NOT be discussed BEFORE they are submitted. (v) The textbook has a web site with many of the solutions. (vi) Solutions for the other problems will be provided after they are submitted.

BONUS FOR PARTICIPATION IN CLASS DISCUSSIONS: People who IMPRESS me in their class participation may get up to 10% bonus. However, participation in class is not required and keeping quiet will not detract from your grade.

TOTAL GRADE: Exams sum up to 100%. Good performance on the exams can get the maximum grade regardless of homework/class participation performance. The homework and class participation bonuses are just a form of insurance that allows me to adjust upwards the grades of people who did well on these dimensions. No commitment to grading on a "curve."

NAME PLAQUE: A clear well-made one is recommended. If you would like to be considered for the participation bonus, you should have such a well-made plaque and choose your seat and position to make it visible.

MIDTERM: Monday 10/24/22 in class time.

FINAL: Regular exam on Friday, 12/9/22, 3:00 - 5:00

MAKE-UP EXAMS: Will be given only to people who missed the regular exams for reasons that are recognized by WCAS as legitimate reasons and can present the appropriate documentation. In case you are not sure, check the WCAS policies and speak to a WCAS advisor before you decide. Make-up exams will be oral and will be given only AFTER the class took the exam in its regular time and it was graded.

TIMES AND LOCATIONS:

Lecture: MW 12:30 - 1:45, TECH M349

Session: F 12:30 - 1:45, TECH M349

TA: Jose Higuera Corona josehiguera2025@u.northwestern.edu

OH: Mondays 3pm-4pm and Fridays 11am-12pm

OTHER RESOURCES:

Other undergraduate level textbooks: Bonanno (more advanced online textbook), Binmore, Watson, Bierman-Fernandez, Harrington.

Graduate level textbooks: Osborne-Rubinstein, Maschler-Solan-Zamir, Fudenberg-Tirole, Myerson.

Other online resources: Polak's course at Yale, Kandori's course at Coursera.

COURSE OUTLINE AND READINGS (Econ 380):

The material referred to below is either in the textbook (T) or in the online course (OL). Almost all segments below are covered by the textbook. You should eventually read the entire chapter mentioned in the beginning of (almost) each segment. The more detailed reading/listening information that appears next to the subsections indicates the material you should read prior to the relevant class meetings.

0. Introduction. (T Ch. 1; OL 1-1, 1-2)

GAMES WITH COMPLETE INFORMATION

I. Strategic games (T Ch. 2, Ch. 3)

I.1 Model. T 2.1; OL 1-3

I.2 Examples: PD, Coordination, Matching Pennies, Stag Hunt. T 2.4, 2.5; OL 1-4.

I.3 Nash Equilibrium

I.3.i Definition and examples. T 2.6,2.7; OL 1-5,1-6, 1-8.

I.3.ii Discussion: Meaning, Existence, Multiplicity, Efficiency, Strictness.

I.3.iii Best response functions. T 2.8; OL 1-7.

I.3.iv Domination. T 2.9; OL 1-9,1-10.

I.4 Classical applications: Oligopoly T 3.1,3.2, Auctions T 3.5, Elections T 3.3, War of Attrition T 3.5.

I.5 Strictly Competitive (“0-sum”) games (Less advanced than T 11)

I.5.i Maxmin. T 11.1, 11.2.

I.5.ii Equilibrium, Value. T 11.4

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II. Extensive games with perfect information (T Ch. 5, Ch. 6)

II.1 Model T 5.1.1; OL 4-2.

II.2 Backward induction. T 5.1.2

II.3 Strategies, outcomes. T 5.2

II.4 Nash Equilibrium. T 5.3; OL 4-3

II.5 Subgame Perfect Equilibrium. T 5.4, 5.5; OL 4-4.

II.6 Discussion: Meaning, Existence, Multiplicity.

II.7 Classical applications: Ultimatum T 6.1.1, OL 4.6(?), **Stackelberg** T 6.2, **Bargaining** T 16.1, 16.2, **Race** T 6.4.

III. Extensive games: Extensions (T Ch. 7)

III.1 Simultaneous moves. T 7.1.

III.1.i Two-stage games. T 7.2

III.2 Repeated Games T 14.1-14.4 (Less advanced).

IV. Existence of Nash equilibrium

IV.1 Why it matters.

IV.2 The mathematical problem – fixed point.

IV.3 Existence of NE in supermodular, two-player game.

IV.4 Debreu-Fan-Glicksberg Theorem.

IV.5 Generality comments.

V. Strategic games with preferences over lotteries (T Ch. 4)

V.1 Expected utility. T 4.1

V.2 Mixed strategies. T 4.2, 4.3.1.

V.3 Nash Equilibrium. T 4.3.2,4.3.3; OL 2-2, 2-3 (?)

V.4 Discussion: Meaning, Existence, Indifference.

V.5 Domination. T 4.4, 4.5.

V.6 Examples T 4.6

V.7 Strictly Competitive (“0-sum”) games T 11

V.3.i Maxmin. T 11.1, 11.2.

V.3.ii Equilibrium, Value. T 11.4

V.3.iii. Examples

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VI. Strategic games with mediation

VI.1 Correlated Equilibrium OL 3-5 (?)

VII. Other solution concepts

VII.1 Conjectural equilibrium

VII.2 Rationalizability T 12.1

VII.3 Iterated deletion of strictly dominated strategies. T 12.2; OL 3-2

VII.4 Iterated deletion of weakly dominated strategies. T 12.3.

VII.5 Dominance Solvability. T 12.4

VII.6 Maxmin T 11.1, 11.2

VIII. Coalitional Games (T Ch. 8)

VIII.1 The model. T 8.1.

VIII.2 Core T 8.2, 8.3.

VIII.3 Examples: Voting T 8.6, Housing Market T 8.5, Marriage Matching T 8.7.

VIII.4 Other solutions

VII.4.i Nash Bargaining. T 16.3.

VII.4.ii Shapley value OL 6-3.

IX. Implementation

IX.1 The concept of implementation.

IX.2 Example(s)

GAMES WITH INCOMPLETE INFORMATION

If we get to this point, the continuation outline will be distributed.