Games & Behavior

ECON 511H

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Department of Economics
University of North Carolina

Spring, 2020

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Outline

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Course Objectives

The course main goal is to provide tools to enable you to:

1. construct models of strategic behavior,
2. identify their (built-in) limitations and
3. think about how to apply them to real-life problems;
4. read research on game theory;
5. formulate a research project on strategic behavior.

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On Exactitude in Science

Jorge Luis Borges, *Collected Fictions*, translated by Andrew Hurley.

"In that Empire, the Art of Cartography attained such Perfection that the map of a single Province occupied the entirety of a City, and the map of the Empire, the entirety of a Province. In time, those Unconscionable Maps no longer satisfied, and the Cartographers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it. The following Generations, who were not so fond of the Study of Cartography as their Forebears had been, saw that that vast Map was Useless, and not without some Pitilessness was it, that they delivered it up to the Inclemencies of Sun and Winters. In the Deserts of the West, still today, there are Tattered Ruins of that Map, inhabited by Animals and Beggars; in all the Land there is no other Relic of the Disciplines of Geography.
Suarez Miranda,Viajes de varones prudentes, Libro IV,Cap. XLV, Lerida, 1658."

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Mont Sainte Victoire
Photography vs Cézanne

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Reaching Our Goals

To achieve our goals, we rely on:

1. Class discussion.
2. Problem solving practices.
3. Reading and discussion of research articles.

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Recommended Texbook

Osborne, Martin J. (2004)

An Introduction to Game Theory, Oxford University Press.

This is an excellent textbook, although it is not required, it provides a very nice companion to our course and is a great reference source.

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Tentative Coverage

1. Games: Non-Cooperative and Cooperative Games (NCG and CG)
2. NCG: Solution Concepts: Nash Equilibrium
3. NCG: Games with Continuous Action Spaces
4. NCG Symmetric, Zero-Sum, and Super-Modular Games
5. Constrained Optimization
6. NCG: Solution Concepts: Iterative Deletion of Strictly Dominant Strategies
7. CG: Solution Concepts:Pareto Efficiency
8. CG: Solution Concepts: The Core
9. CG: Applications: Matching and Trading
10. NCG: Solution Concepts: Mixed Strategy Nash Equilibrium
11. NCG: Solution Concepts: Correlated Equilibrium
12. NCG: Extensive Games: Solution Concept: Subgame Perfection
13. NCG: Extensive Games: Repeated Games
14. NCG Extensive Games with Imperfect Information
15. NCG: Solution Concepts: Perfect Bayesian Equilibrium
16. Mechanism Design

Class Information

• We meet Tuesdays and Thursdays, from 9:30 am to 10:45 am, at Murphey Hall, room 314.

• Be ready to bring your laptop loaded with Mathematica to class, prior notice when Mathematica is required will be posted on Sakai.

• Sakai will be used to post grades, course announcements, problem sets, assignments, etc...

• Please, use Sakai > Messages instead of regular email

Contact Info and Office Hours

1. Email: sergiop@unc.edu.
2. Please send messages thru Sakai.
3. Office hours (OH) are by Sakai appointment only:
   - Wednesday: 3 pm – 4 pm, Friday: 10 am – 11 am.
   - To schedule an OH meeting use Sakai > sign-up.
   - Do not hesitate to message me to schedule meetings outside regular OH if your schedule conflicts with the regular OH.

Evaluation

- **February 18th** — 1st Midterm
- **March 17th** — 2nd Midterm
- **May 1st** , Friday at 8 am — Final Examination
- Midterm grades account for 35% of the final grade.
- Final examination grade is worth 35% of the final grade.
- Ten or more problem sets and/or writing assignments on research articles: 20%.
- Research project: 10%.
- There are no make-ups.
- The weight of any missing midterm (with justification) is transferred towards the final exam.

Computing Grades

- Exam grades are converted into scores accordingly to:

$$\texttt{Score} \;=\; \texttt{Exam Grade} + 100 - \max(\texttt{Top Exam Grade}, 50).$$

- Assignments scores are identical to assignment grades.
- Course grades are computed accordingly to the table:

letter grade	min. score
A	95
A-	90
B+	87
B	83
B-	80
C+	77
C	73
C-	70
D+	67
D	63
F	50

To do list for the first week

1. If you are eligible for taking exams with ARS, please schedule with them within the first or second week of classes and notify me.
2. If a) you have more than 3 final exams in more than 24 hours; b) ECON511 is one of these exams; and c) you wish to re-schedule one of your exams; then you **MUST** ask for an alternative date beforeSeptember 10th. If you do not follow these procedures your request will not be accommodated.
3. Place an order for the software *Mathematica* throughout software.sites.unc.edu/software/mathematica/. The *student license is free*. However, you must place an order.

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Class Discussion

During this course, we shall employ additional material from TV, movies, or literature to discuss strategic related issues.

Sometimes, you may find the political or religious views; or the profanity contained in the additional material offensive or objectionable and you may feel uncomfortable.

I do not endorse any particular views ex but ...

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Class Discussion

I believe that as part of your university education, it is important you engage in critical thinking,

and also respect different opinions expressed by your classmates.

Problem Sets (PS)

1. PS are posted on Sakai > Assignments.
2. Past due date PS are not accepted.
3. PS are assigned to groups (max. size = 3).
4. Groups are randomly formed for each PS.
5. PS grading criteria:

grade	solutions	work	presentation
4.0	correct	explained	reasonable
3.5	comput. err.	explained	reasonable
3.0	concept. err.	explained	reasonable
2.0	–	omitted	reasonable
1.0	–	–	poor
0	–	–	–

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Research

- Econ 511 is a research-intensive course.
- Research readings will be posted weekly on Sakai.
- Students will work on a final research project. The topic of the research project will be "trade wars".

Econ. pre-requisites

ECON 410:

- Nash equilibrium,
- externalities, and
- Pareto efficiency.

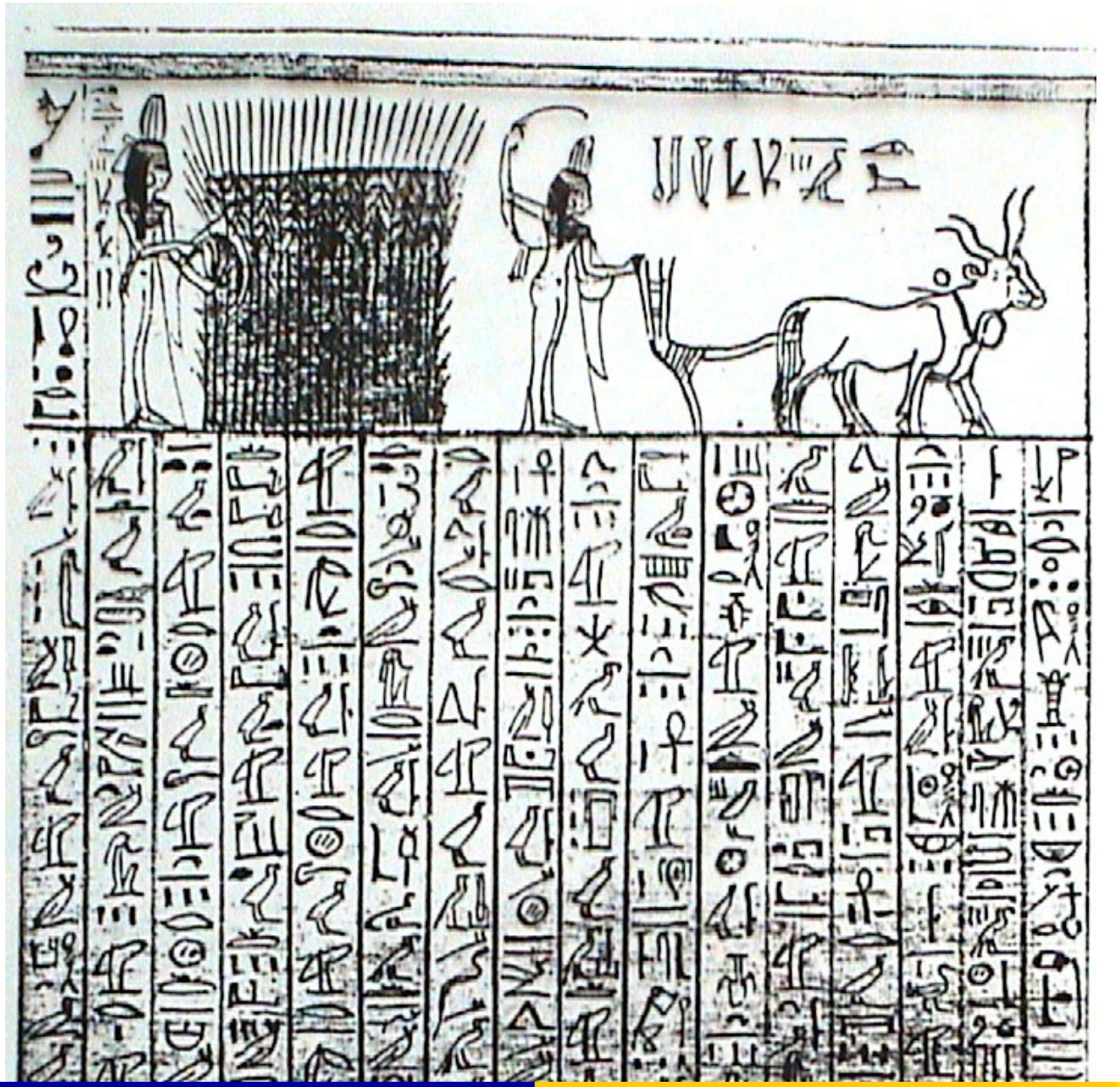
ECON 411 (for the time being...) is not (yet) required, however if you took ECON 411 and would like to avoid a bit of repetition, please email me so I can provide you with more advanced topics.

Some words about math. pre-requisites

We will cover bits of optimization, set theory and proof reasoning but I assume you have knowledge equivalent to Osborne's (suggested reading) mathematical appendix – please browse it – and please, do report any doubts or questions to me as soon as possible I can help you. Or check topics 1 to 2.3 in Martin Osborne's tutorial.

- Language of Set Theory
- Basic Calculus (derivation and integration).
- Probability (expectation of random variables)
- Reading Proofs.
- Finding Maxima and Minima.

Mathematics is a tool (language)



Mathematics is a tool (language)

If $f : [a, b] \to \mathbb{R}$ satisfies $[\forall x \in [a, b]$ and $\forall \varepsilon > 0, \exists \delta > 0$; such that $|x - y| < \delta \Rightarrow |f(x) - f(y)| < \varepsilon] \Rightarrow \exists z \in [a, b]; \forall x \in [a, b]\, f(z) \geq f(x)$.

If a real-function defined on a closed interval on the real line is continuous then it attains a maximum on the interval.

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Japanese, 日本語

1. Sometimes I might use Japanese characters (kanji and kana) in the same way we use Greek letters in mathematical writing.
2. Feel free to ignore any other use of Japanese in the lecture notes.

Questions & Answers

This course is called Game Theory. I like games!
The course sounds/looks fun !!
Should I take this class?

Sorry for curbing your enthusiasm...
But playing a game often is more fun than studying one... ☺

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I understand the lecture notes but during the exams I am not able to answer the questions. What am I doing wrong? How should I study for this class?

The only way to make sure you understood the material is to solve problems. Try to work in groups and try to solve as many problems as you can. Do not be frustrated if you get stuck with a problem. The problems where you get stuck are precisely the ones that are useful for your study. They should serve as a guide to where the focus of your reading should go and to which questions you should bring to class.

Questions & Answers

I am trying to solve problems but many of the posted or suggested problems lack an answer key. How can I check if my work is correct? What use is to solve a problem if I do not know whether my solution is correct?

The point of solving problems is not to come up with a right answer but rather to elicit questions that you may have about the material. If you are unsure about your work or answer this is good signal. Please do bring the problem to class and express your doubts. If you faced a challenge when trying to solve a problem, and you are not sure of your answer, or not sure on how to proceed at some step, chances are, your colleagues have similar questions and it is worth to discuss it in class.

The lack of an answer key is, for most of the cases, deliberate. It is designed to give incentives for you to work the problems rather than trying to memorizing solutions.

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Questions & Answers

I am about to graduate. I need an upper level requirement course.
This course is the only one that fits my schedule.
Should I take this class?

It depends on your degree of risk-aversion. The variance of grades sometimes is high. Many earn *A* grades (in particular in the Honors version of the course) but it is a challenging course, so lower grades are not unheard of.

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Is this course useful?
for an Econ PhD

I want to go to grad. school in Economics.
Game Theory is very important for Economics, should I take this course?

No. In grad school, you will have several opportunities to take Game Theory classes. If you want to increase your chances of being accepted by a top program, you should take more classes at the Mathematics Department.

Is this course useful?

Econ and other fields

Would you recommend this course to any Econ, CS or Poli Sci major or PPE minor?

Of course: if you want to learn more about incentives in strategic environments, this is a good course for you. If you plan to go to Law School, grad school in Public Policy, Political Science, etc ... or if you just want to learn for the sake of learning, this is a terrific course for you.

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Is this course useful?
outside academia

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Chances are, you will not write down a model for some concrete real-life situation, solve for its equilibrium and make accurate predictions based on it. But that does not mean that models are useless. Game theory may help you avoid real-life pitfalls. Also check this Noah Smith's article for several interesting examples of applications of GT to real-life.

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