Syllabus: Game Theory
Vlad Manole, Ph.D.
Term: Spring 2016

Instructor: Vlad Manole
Email: vlad.manole@rutgers.edu
Phone: (973) 353-5354
Office: Hill Hall 808
Office Hours: Thursday 2:30 pm by appointment. To set up an appointment, the best way to contact me is by e-mail.

Description: This course will provide an introduction to the tools and insights of Game Theory. Game theory is the study of interactive decision-making, or decision problems that involve more than one person, each of whom is affected by the decisions of others. Game theory is used to study problems of coordination, cooperation and conflict. Examples of applications include relations between countries, including decisions to engage in an arms race and negotiations to avoid such a race; relations between firms, including decisions to collude in setting prices or engage in price wars; relations between firms and unions, including negotiations over wage rates and decisions to strike or relations between political candidates, including the setting of policy positions. Game theory has a major impact on the development of several branches of economics like Industrial Organization, International Trade, Labor Economics, Macroeconomics, and, as a reflection of its importance, ten game theorists received the Nobel prize in economics in the last 20 years (in 1994, 2004, 2006 and 2012). On the other hand, the use of Game Theory is not restricted just to economics, with notable contributions for the development of other fields, such as Political Science, International Relations, Sociology and Biology.

The course provides a well-rounded coverage of issues in Game Theory very useful for both students willing to continue their education toward a Ph.D. and toward students on their way to public and private sector employment.

There are no graduate course pre-requisites for Master students. However, it will be assumed that all students have had undergraduate coursework in Microeconomics and basic knowledge of calculus.

Grading: Paper presentation 10%, Homework: 20%, Midterm: 30%, Final Exam: 40%
There will be seven problem sets during the semester, with the best five grades counting for the homework grade. Solving problems is the only way to really learn Game Theory.
**Overview:**

(detailed course outline below)

<table>
<thead>
<tr>
<th>Basic Principles of Game Theory</th>
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<tr>
<td>Assumptions, strategies, information types</td>
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<td>Prisoner’s Dilemma and Nash Equilibrium</td>
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<th>Static Games with Complete Information</th>
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<tr>
<td>Pure Strategy Equilibrium, Dominance, Iterated Dominance</td>
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<td>Mixed Strategy Equilibrium</td>
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<td>Cournot-Nash &amp; Bertrand-Nash Duopoly</td>
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<td>Commons Problem (Nash) and Natural Monopoly/Bankruptcy</td>
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<th>Extensive form games</th>
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<td>Backwards Induction and Subgame Perfection</td>
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<tr>
<td>Stackelberg Duopoly and Entry Deterrence</td>
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<th>Finitely/Infinitely Repeated Games</th>
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<td>Moral Hazard (The Principal-Agent model)</td>
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<th>Games of incomplete information</th>
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<td>Perfect Bayesian equilibrium</td>
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<td>Adverse Selection - Signaling</td>
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<th>Coalitional Games</th>
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<td>The Core</td>
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<td>The Shapley Value</td>
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<td>The Nash Solution</td>
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**Textbook:**


**Recommended Material:** The New York Times, The Economist, the Financial Times, and/or the Wall Street Journal.

**Exams:**

Exams will contain problems similar to those proposed in the homework assignments. The midterm and final exams must be taken at the dates and times announced in class.

To be fair to all students, there is NO extra credit for any work that is not required from all students. Please do NOT request differential treatment as a way to boost your grades.

There are no makeup exams!

**Class Participation:**

I expect you to attend all lectures, to prepare in advance, and to participate actively in class discussions. Some of the material I will present in class is not in the textbook, but it will be required at the exams. Attendance
and active participation are essential to understand the material, to do the homework and to pass the exams.

Course Outline

This schedule is subject to change during the semester, based on the overall pace of the class.

Course | Course description
---|---
1 | Basic Principles of Game Theory
   - Assumptions, strategies, information types
   Dutta, chapters 1, 2

2 | Equilibrium in Strategic Form games
   - Prisoner’s Dilemma and Nash Equilibrium
   - Pure Strategy Equilibrium, Dominance, Iterated Dominance
   Dutta, chapters 3, 4, 5, 6

Homework 1

3 | Strategic form games with
   - Continuous strategies
   - Mixed Strategies
   Dutta, chapters 7

4 | Strategic form games with
- Cournot-Nash & Bertrand-Nash Duopoly
- Commons Problem (Nash) and Natural Monopoly/Bankruptcy

Dutta, chapters 8


Homework 2

5

**Extensive form games**
- Backwards Induction and Subgame Perfection

Dutta, chapters 11


6

**Extensive form games**
- Stackelberg Duopoly and Entry Deterrence

Dutta, chapters 13


Homework 3

7

**Repeated Games**
- Two - Stage Repeated Games
- Infinitely Repeated Games

Dutta, chapters 14


Midterm
8 Repeated Games
- Collusion between Cournot Duopolists
- Efficiency Wages
- Time-Consistent Monetary Policy

Dutta, chapters 15


Homework 4

9 Moral Hazard (The Principal-Agent model)

(*) Dutta, chapter 19


10 Games of incomplete information
- Bayesian Nash equilibrium

Dutta, chapter 20


Homework 5

11 Adverse Selection
- Signaling (Perfect Bayesian equilibrium)

Dutta, chapter 24


### 12 Coalitional Games
- The Core
- The Shapley Value

(*) Osborne and Rubinstein chapter 13, 14


Homework 6

### 13 Coalitional Games
- The Nash Solution

(*) Osborne and Rubinstein chapter 15


### 14 Review

Homework 7