University of Vienna
UK 040106 Decision and Game Theory

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1 Overview

Decision theory is the mathematical study of strategies for optimal decision-making between options involving different risks or expectations of gain or loss depending on the outcome. Game theory is a set of tools for studying situations in which decision-makers (like consumers, firms, politicians, and governments) interact. This course provides an introduction to decision and game theory, with a strong emphasis on applications in economics. The objective of the course is to give students an understanding of the core concepts of decision and game theory and how to use them to understand economic, social, and political phenomena.

Decision and game theory is an analytical subject, and an ability to follow logical arguments - including some that are complex – is required to follow the material. The only way to absorb analytical material is to work through problems. I will assign weekly problem sets; to keep up with the course it is essential that you complete them.

The following topics will be covered:

1. Decisions under uncertainty
2. Strategic games; Nash equilibrium
3. Cournot's and Bertrand's models of duopoly
4. Hotelling's model of electoral competition; the citizen-candidate model
5. Mixed strategy Nash equilibrium, with applications
6. Dominated strategies; iterated elimination of dominated strategies and common knowledge of rationality
7. Strategic games with imperfect information; auctions

8. Extensive games; subgame perfect equilibrium
9. Ultimatum game, holdup game
10. Repeated games; collusion in repeated duopoly
11. Extensive games with imperfect information; signaling games

2 Textbooks

I know of no book that fits the course perfectly. Although the level of some parts is a bit higher than the level of the course, I will refer you a lot to the following book: *Martin J. Osborne, An Introduction to Game Theory* (Oxford University Press, New York, 2003).

Another book that covers some, but not all of the topics in the course, at approximately the same level, is *Robert Gibbons, Game Theory for Applied Economists* (Princeton University Press, 1992).

Additional literature and suggested reading:

- Avinash K. Dixit, Susan Skeath,and David Reiley, Games of Strategy, 3^{rd} edition (W.W. Norton and Company, 2010).
- Charles A. Holt, Market, Games & Strategic Behavior (Addison Wesley, 2006).
- Avinash K. Dixit and Barry J. Nalebuff, Thinking Strategically: The Competitive Edge in Business, Politics, and Everyday Life (W. W. Norton & Company, 1993).
- Adam C. Brandenburger and Barry J. Nalebuff, Co-Opetition: A Revolution Mindset That Combines Competition and Cooperation: The Game Theory Strategy That's Changing the Game of Business (Doubleday Business, 1994).
- Tim Harford, The Undercover Economist: Exposing Why the Rich Are Rich, the Poor Are Poor–and Why You Can Never Buy a Decent Used Car! (Random House, 2007).

3 Prerequisites

This course has prerequisites; for details, see its u:space / u:find entry. Please note the strict departmental policy on prerequisites.

4 Course Components

The course has three main components:

4.1 Lectures

I will use fairly detailed slides, which I will post before each class. Please see the tentative schedule (Section 5) for details. During the lecture, all students will participate in in-class experiments. Through making decisions in these experiments you will experience many different strategic situations first hand. This trains your empathy, strategic thinking, and social interaction skills. After the lecture, descriptions of the situations (experimental instructions), anonymized data sets containing the decisions of experiment participants, and a number of questions on each experiment will be posted online. The questions guide you in the analysis of the situations and data. Analyzing the situations and your own decisions with formal and informal tools lets you practise logical thinking, sharpens your economic intuition, and improves your knowledge about social and economic behavior of *real* people. Analysis can be done individually or in learning groups.

4.2 Tutorials

The tutorials are an essential part of the class. The TA will guide you in solving some problems related to the material in the previous class. They will not give you a solution, but will rather induce you to create a solution. The problems for each Tutorial will be posted on Moodle shortly after the class. You do not need to look at them before the tutorial, but you should be prepared to participate actively in the tutorial. I will post full solutions to the problems shortly after the tutorial.

4.3 Problem Sets

The problem sets are another essential part of the class. As for any analytical subject, the only way to learn the material in the course is to solve a lot of problems. I will assign a problem set each week that will be posted on Moodle shortly after each class. Your answers to these problems will not contribute directly to your grade (i.e., they will not be marked), but they will definitely contribute indirectly: you will not be able to do well in the course unless you do the problems.

5 Tentative Schedule

Section 2023S:

- Lectures: Wednesdays 6.30pm – 8.00pm & Thursday 4.45pm – 6.15pm.
- Tutorial: Fridays 8.00am – 9.30am.

In the following schedule, IGT refers to Martin J. Osborne, An Introduction to Game Theory.

- **Week 1:**
  Strategic games and Nash equilibrium (IGT Chapter 1 and 2.1-2.7).

- **Week 2:**
  Examples of Nash equilibrium in games with many players. Competition between firms: the models of Bertrand and Cournot (IGT 3.2 and 3.1). Using best response functions to find Nash equilibria in general games (IGT 2.8).

- **Week 3:**
  Electoral competition (IGT 3.3).

- **Week 4:**
  Mixed strategy Nash equilibrium (IGT 4.1-4.3 and 4.5).

- **Week 5:**
  Applications of mixed strategy Nash equilibrium: expert diagnosis and the volunteer's dilemma (IGT 4.6 and 4.8).

- **Week 6:**
  Easter break.

- **Week 7:**
  Easter break (cont.).

- **Week 8:**
  Implications of rationality and beliefs about others' rationality; strict domination (IGT 2.9.1). Never-best responses. Iterated elimination of strictly dominated actions. Weak domination. (IGT 2.9; see also 12.2 and 12.3, although the treatment there is more advanced than the one in class.)

- **Week 9:**
  Midterm test.

- **Week 10:**
  Auctions: private value sealed-bid auctions under first and second-price rules; common value auctions (IGT 9.6).

- **Week 11:**
  Extensive games: subgame perfect equilibrium (IGT 5.1-5.5).

- **Week 12:**
  Extensive games: Stackelberg duopoly; ultimatum and holdup games (IGT 6.1, 6.2).

- **Week 13:**
  Extensive games: Stackelberg duopoly; ultimatum and holdup games (IGT 6.1, 6.2) (cont.). Repeated games and collusion (IGT 14.1-14.12).

- **Week 14:**
  Repeated games and collusion (IGT 14.1-14.12) (cont.).

- **Week 15:**
  Extensive games with imperfect information; signaling games (IGT 10.1-10.5, 10.7).

- **Week 16:**
  Extensive games with imperfect information; signaling games (IGT 10.1-10.5, 10.7) (cont.). POTENTIALLY: Final preparation class *or* bonus class.

6 Evaluation

Your grade in the course will be based on your participation in the in-class experiments, your marks in a midterm test and a final exam.

6.1 In-Class Experiments

Active and regular participation in each in-class experiment will receive a weight of 20% in the final grade. These experiments will usually be conducted during lecture time. At the end of the session, students will automatically receive a participation grade for *two* in-class experiments.

6.2 Midterm Test

The midterm test will be held on Thursday April 27, 4.45pm – 6.15pm in OMP, HS1. The test will receive a weight of 35% in the final grade.

6.3 Final Exam

The final exam will receive a weight of 45% in the final grade. The final exam will be held on Thursday June 29, 4.45pm – 6.15pm in OMP, HS1. It will cover the entire term's work. Much of the material in the second half of the course builds on the material in the first half, so it is difficult to say exactly how much of the exam relates to each part of the course. However, probably between a quarter and a third of the points on the final exam will be for problems that could be answered on the basis of the material in the first half of the course alone.

6.4 Assessments

These are challenging times for everyone. You are requested to behave responsibly throughout the session. The university is doing all it can to mitigate the risk of infection. If you become ill and it affects your ability to do your academic work, consult me right away. If you get a concussion, break your hand, or suffer some other acute injury, you should register with Accessibility Services as soon as possible. Students who are absent from class for any reason (e.g., COVID, other illness or injury, family situation) and who require consideration for missed academic work should report their absence to their instructor.

7 Religious Accommodation

As a student at the University of Vienna, you are part of a diverse community that welcomes and includes students and faculty from a wide range of backgrounds, cultural traditions,

and spiritual beliefs. For my part, I will make every reasonable effort to avoid scheduling tests, examinations, or other compulsory activities on religious holy days not captured by statutory holidays. Further to University Policy, if you anticipate being absent from class or missing a major course activity (like a test, or in-class assignment) due to a religious observance, please let me know as early in the course as possible, and with sufficient notice (at least two to three weeks), so that we can work together to make alternate arrangements.

8 Learning Disability Accommodation Requirement

Students with diverse learning styles and needs are welcome in this course. If you have an acute or ongoing disability issue or accommodation need, you should register with Accessibility Services (AS) at the beginning of the academic year. Without registration, you will not be able to verify your situation with your instructors, and instructors will not be advised about your accommodation needs. AS will assess your medical situation, develop an accommodation plan with you, and support you in requesting accommodation for your course work. Remember that the process of accommodation is private: AS will not share details of your condition with any instructor, and your instructors will not reveal that you are registered with AS.

9 Academic Integrity

All students, faculty and staff are expected to follow the University's guidelines and policies on academic integrity. For students, this means following the standards of academic honesty when writing assignments, collaborating with fellow students, and writing tests and exams. Any discussion of course material is forbidden during the testing window of both midterm and final exam. Ensure that the work you submit for grading represents your own honest efforts. Plagiarism – representing someone else's work as your own or submitting work that you have previously submitted for marks in another class or program – is a serious offence that can result in sanctions. Speak to me or your TA for advice on anything that you find unclear. To learn more about how to cite and use source material appropriately and for other writing support, see the UniVie's writing support website. Consult the Code of Behaviour on Academic Matters for a complete outline of the University's policy and expectations. For more information, please see https://ctl.univie.ac.at/angebote-fuer-studierende/waehrend-des-studiums/academic-writing-in-english/.

10 Accommodation for Personal Reasons

There may be times when you are unable to complete course work on time due to non-medical reasons. If you have concerns, speak to me. It is also a very good idea to speak with an advisor in your department; they can support you in requesting extensions or accommodations, and importantly, connect you with other resources on campus for help with your situation.

11 Moodle Information

This course uses the University's learning management system, Moodle, to post information about the course. This includes materials required to complete class activities and course assignments as well as share important announcements and updates. The site is dynamic and new information and resources will be posted regularly as we move through the term. The principal source of information about all course-related work will be the course site in Moodle, so please make it a habit to log in to the site on a regular if not daily basis. To access the course website, go to the UniVie Portal log-in page at https://moodle.univie.ac.at and log in using your student ID and password. Once you have logged in to the Portal, look for the "My Courses" module where you will find a link to the UK040106 course site. Note that if you are currently enrolled in other courses at the University, your other course links will also appear here. Click on the UK040106 link to open our course area and view the latest announcements and updates, and access your course resources.
SPECIAL NOTE ABOUT GRADES POSTED ONLINE: Please note that any grades posted within the Moodle-Gradebook are posted for your information only, so you can view and track your progress through the course. No grades are considered official, included any posted in Moodle at any point in the term, until they have been formally approved by me at the end of the course. Please contact me as soon as possible if you think there is an error in any grade posted on Moodle.

12 Cell Phone and Laptop Use

Technology can support student learning, but it can also become a distraction. Research indicates that multi-tasking (texting, surfing the Internet, using social networks) during class time can have a negative impact on learning (Clapp, Rubens, Sabharwal & Gazzaley, 2011; Ellis, Daniels, Jauregui, 2010; Hembrooke & Gay, 2003). Out of respect for your fellow learners in this class, please refrain from using laptops or mobile phones for entertainment during class and do not display any material on a laptop which may be distracting or offensive to your fellow students. Laptops may be used only for legitimate classroom purposes, such as taking notes, downloading course information from Moodle, or working on an assigned in-class exercise such as in-class experiments. Checking social media, e-mail, texting, games, and surfing the Web are not legitimate classroom purposes.

13 Participation

This course is built on your participation. Please make all efforts to attend all classes and actively participate in discussions and in-class experiments. In our structured and unstructured discussions and dialogues, we will have many opportunities to explore challenging issues and increase our understandings of different perspectives. A positive learning environment relies upon creating an atmosphere where diverse perspectives can be expressed. Each student is encouraged to take an active part in class discussions and activities. Honest and respectful dialogue is expected. Disagreement and challenging of ideas in a supportive and sensitive manner is encouraged. Hostility and disrespectful behaviour is not acceptable. In the time we share together over this term, please honour the uniqueness of your

fellow classmates and appreciate the opportunity we have to learn from each other. Please respect each others' opinions and refrain from personal attacks or demeaning comments of any kind. Just as we expect others to listen attentively to our own views, we must reciprocate and listen to others when they speak, most especially when we disagree with them. In this class, our emphasis will be on engaging in the mutual exploration of issues as presented in the course readings as scholars, rather than in defending points of view we have formed outside the classroom.