Game Theory: Basic Concepts and Applications

Course Manual

1 Introduction

In this course we study the basic elements of game theory. The foundation of game theory was laid in an article by John von Neumann (1928), starting with the following sentence:

> "Die Frage, deren Beantwortung die vorliegende Arbeit anstrebt, ist die folgende: n *Spieler,* S_1, S_2, ..., S_n, *spielen ein gegebnes Gesellschaftsspiel* $\mathcal{G}$. *Wie muß einer dieser Spieler,* S_m, *spielen, um dabei ein möglichst günstiges Resultat zu erzielen?*"

The theory received widespread attention only after publication of the fundamental book of von Neumann and Morgenstern (1944, p.31), where the aim of Game Theory is described as follows:

> "[W]e wish to find the mathematically complete principles which define "rational behavior" for the participants in a social economy, and to derive from them the general characteristics of that behavior. And while the principles ought to be perfectly general—i.e., valid in all situations—we may be satisfied if we can find solutions, for the moment, only in some characteristic special cases."

Informally, game theory is a mathematical discipline that analyzes conflict situations. A conflict situation—the game—is a situation in which a certain number of individuals—the players—interact and thereby jointly determine the outcome. Each participating player has partial control over the situation, but never full control. Each player is endowed with certain individual preferences over the set of possible outcomes and strives to obtain the outcome that is most profitable to him. The aim of game theory is to prescribe which strategy each player in a game should play such that his partial influence on the situation is exploited in order to promote his interest optimally.

In this course students are faced with experiments that simulate situations of conflict that may arise in real-life. Afterwards, students study the (theoretical) literature and apply it to the situations they were faced with in the experiments. The aim is that students learn how to understand and analyze situations of conflict in order to be able to make optimal decisions.

2 Structure

The course stretches from June 15 to June 26, with daily meetings of two hours. Each block of two successive meetings (so five blocks in total) is related to a subject from game theory. On the odd meetings, the first day of each block, we start with a short introduction on the subject followed by an experiment. After the experiment, the students are offered some literature related to the subject which has to be studied for the next day. Moreover, students are expected to think deeply about the experiment and to find what theory would

predict. On the even meetings, the second day of the corresponding block, the meeting starts with a presentation of the literature by a pair of students. After this presentation, a general discussion on the subject may begin. After the general discussion, the experiments of the previous day are discussed. Students will be asked to present their thoughts on how to relate the situation in the experiment to the literature discussed. For the next day each pair of students is expected to have written a short essay in which the experiment is discussed and related to the literature.

The course structure is briefly displayed in Table 1.

Block	Meeting	Date	Subject
A			*Static Games: Rationalizability*
	1	June 15, 2009	introduction, experiment, study
	2	June 16, 2009	presentation, essay
B			*Static Games: Nash equilibrium*
	3	June 17, 2009	introduction, experiment, study
	4	June 18, 2009	presentation, essay
C			*Dynamic Games*
	5	June 19, 2009	introduction, experiment, study
	6	June 22, 2009	presentation, essay
D			*Games with Incomplete Information*
	7	June 23, 2009	introduction, experiment, study
	8	June 24, 2009	presentation, essay
E			*Cooperative Games*
	9	June 25, 2009	introduction, experiment, study
	10	June 26, 2009	presentation, exam, essay

Table 1: Time schedule

Since we are preforming experiments it is of outmost importance to respect the starting times for each meeting.

3 Literature

The literature can be found at the secretarial office of General Economics: Microeconomics (AE1) at A1.06 and Quantitative Economics (KE) at A3.10.

- OSBORNE, M.J. (2004), *An Introduction to Game Theory,* Oxford University Press.

- RAIFFA, H. (1990), *The Art and Science of Negotiation,* Harvard University Press.

3.1 Block A

Chapter 1 and Sections 2.1-2.5, Section 2.9, Section 4.4, and Sections 12.2-12.4 of Osborne (approximately 33 pages).

3.2   Block B

Sections 2.6-2.8, Section 3.1, Sections 4.1-4.3 and Section 4.8 of Osborne (approximately 55 pages).

3.3   Block C

Chapter 5, Section 6.2 Sections 7.1-7.2 and Section 7.7 of Osborne (approximately 48 pages).

3.4   Block D

Chapter 10, Sections 10.1-10.5 and 10.7 of Osborne (approximately 27 pages).

3.5   Block E

Chapter 17 and 19 of Raiffa (approximately 30 pages).

4   Evaluation

The evaluation depends on the quality of the presentation, the personal performance during the experiments and discussions, and the essays written by the group.

5   Teaching Staff

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