

## Basic information

This fifteen-week course covers standard topics in game theory at the Master level and takes place from April 18, 2017, to July 25, 2017. It is scheduled on Mondays and Tuesdays, from 10:30 to 12:00, in Oeconomicum Seminarraum 2 (Building 24.31, ground floor).

Attached you can find a tentative syllabus of the course with details about the teaching plan. It is important for the students to attend the first lecture where the structure of the course will be discussed. Teaching materials, problem sets and homeworks will be sent to the enrolled students in due time. **Note:** If you are taking the course, please send me an e-mail to be included in the mailing list.

I can be contacted by e-mail at [martinez@dice.hhu.de](mailto:martinez@dice.hhu.de). Appointments for office hours (Oeconomicum Building 24.31, Office 01.05 first floor) during the semester are flexible, but should be arranged in advance.

There will be an exam at the end of the course. However, three voluntary homeworks are included in the course outline. The final grade for the student can be the maximum of either the weighted average of 70% exam plus 30% homework, or just 100% the grade of the exam. Working on the assignments can only improve the final grade achieved in the exam, and students are encouraged to work on them during the semester and to hand them in for grading.

## Bibliography

Most of the lecture notes employed in the lectures will be based on sections of:

Maschler, Michael, Eilon Solan, and Shmuel Zamir. *Game Theory*. Cambridge University Press (2013). (Referred to as [MSZ] in the syllabus)

Note, however, that this is an advanced book and that during the course, some of the topics will be covered in less technical detail than in the book. Others will be extended with examples and discussions from different sources as well.

Most of the topics can also be found in the standard reference that you may use in other Microeconomics courses:

Mas-Colell, Andreu, Michael D. Whinston, and Jerry R. Green. *Microeconomic Theory*. Oxford University Press (1995). [MWG]

An alternative (and open-access) source for some topics is Shoham, Yoav, and Kevin Leyton-Brown. *Multiagent Systems: Algorithmic, Game-Theoretic and Logical Foundations*. Cambridge University Press (2009), made conveniently accessible as PDF by the authors (<http://www.masfoundations.org/download.html>).

Some other classical textbooks:

Fudenberg, D., and Jean Tirole. *Game Theory*. MIT Press (1991).

Osborne, Martin J., and Ariel Rubinstein. *A Course in Game theory*. MIT Press (1994).

Myerson, Roger B. *Game Theory: Analysis of Conflict*. Harvard University Press (1997).

## Syllabus

*Week 1*

18.04.

### **Introduction to the course**

- Structure and evaluation

*Week 2*

24.04.

### **1. Basics of utility theory**

- 1.1.- Preference relations [MSZ Sec.2.1–2.2, p.9–14]
- 1.2.- Axioms of utility theory [MSZ Sec.2.3, p.14–19]
- 1.3.- Representation of preferences with utility functions [MSZ Sec.2.4–2.5, p.19–23]
- 1.4.- Discussion

25.04.

### **2. Extensive and normal form games**

- 2.1.- Game trees [MSZ Sec.3.1–3.3, p.39–47]
- 2.2.- Games with chance moves [MSZ Sec.3.5, p.49–52]
- 2.3.- Games with imperfect information [MSZ Sec.3.6, p.52–57]
- 2.4.- Definition of strategic-form games [MSZ Sec.4.1, 4.3–4.4, p.75–81, 84–85]
- 2.5.- Relationship between the extensive and strategic form [MSZ Sec.4.2, p.82–84]

*Week 3*

02.05.

### **Tutorial 1**

*Week 4*

08. and 09.05.

### **3. Solution concepts (I)**

- 3.0.- Two-player zero-sum games a special case [MSZ Sec.4.12, p.110–118]
- 3.1.- Security: the maxmin concept [MSZ Sec.4.10, p.102–106]
- 3.2.- Domination and rationalizability [MSZ Sec.4.5, 4.7, 4.11, p.85–91, p.95, 106–110]
- 3.3.- Stability: the Nash equilibrium [MSZ Sec.4.8–4.9, p.95–102]
- 3.4.- The mixed extension [MSZ Sec.5.1–5.2.4, p.144–163]
- 3.5.- Basics of correlated equilibrium as a more general concept [MSZ Ch.8, p.300–313]

*Week 5*

15. and 16.05.

### **4. Solution concepts (II)**

- 4.1.- Subgame perfect equilibrium [MSZ Sec.7.1, p.251–260]
- 4.2.- Rationality and backward induction [MSZ Sec.7.2, p.260–262]
- 4.3.- Sequential equilibrium [MSZ Sec.7.4, p.271–284]
- 4.4.- (Trembling hand) Perfect equilibrium [MSZ Sec.7.3, p.262–271]

*Week 6*

22.05.

### **Tutorial 2 and due date of Homework 1**

23.05.

## 5. Repeated games

- 5.1.- Finitely repeated games [MSZ Sec.13.1–13.4.1, p.519–534]
- 5.2.- Infinitely repeated games and discounting [MSZ Sec.13.5–13.7, p.537–554]  
and [MWG Sec.12.D, p.400–405]
- 5.3.- The Rubinstein model of alternating offers [MWG Ch.9, App. A, p.296–299]

*Week 7*

29. and 30.05.

## 6. Bargaining games

- 6.1.- The bargaining problem [MSZ Sec.15.1–15.2, p.622–626]
- 6.2.- The Nash bargaining solution [MSZ Sec.15.3–15.6, p.626–641]
- 6.3.- Other concepts [MWG Sec.22.E, p.838–846]

*Week 8*

06.06.

## Tutorial 3

*Week 9*

12. and 13.06.

## 7. Games with incomplete information (I)

- 7.1.- The Harsanyi model [MSZ Sec.9.4, p.345–361]
- 7.2.- Incomplete info. as an interpretation of mixed strategies [MSZ Sec.9.5, p.361–365]
- 7.3.- Discussion [MSZ Sec.9.6, p.365–367]

*Week 10*

19.06.

## Tutorial 4 and due date of Homework 2

20.06.

## 8. Games with incomplete information (II)

- 8.1.- Bayesian Nash equilibrium [MWG Sec.8.E, p.253–257]
- 8.2.- Auctions as Bayesian mechanisms [MAS Sec.11.1.2, p.332–333]
- 8.3.- The seal-bid first-price auction [MSZ Ex.10.43, 12.15, 12.27, 12.34, 12.40, 12.46]

*Week 11*

26. and 27.06.

## 8. Games with incomplete information (II)–continuation

- 7.1.- (Weak) Perfect Bayesian equilibrium [MWG Sec.9.C–D, p.282–296]
- 7.2.- Signaling [MWG Sec.13.C, p.450–460] and [MWG Ch.13, App. A, p.467–472]

*Week 12*

03.07.

## Tutorial 5

04.07.

**9. Basics of coalitional games**

7.1.- Examples with transferable utility [MAS Sec.12.1–12.2.1, p.383–391]

and/or [MSZ Ch.16, App. A, p.659–678]

7.2.- The Shapley value [MSZ Sec.18.1–18.6, p.748–767] and/or [MWG Sec.22.F p.846–848]

*Week 13*

10.07.

**Tutorial 6**

11.07.

**10. Basics of social choice**

7.1.- Social welfare functions [MSZ Sec.21.1, p.853–864] and/or [MWG Sec.21.A–C, p.789–799]

7.2.- Social choice functions [MSZ Sec.21.2–21.4, p.864–874] and/or [MWG Sec.21.E, p.807–811]

7.3.- Discussion

*Week 14*

17.07.

**Tutorial 7** and due date of **Homework 3**

18.07.

**Topic seminar.**

*Week 15*

24. and 25.07 – Wild card days.

These two days are reserved to extend any topic that was not finished during the lectures, to provide an additional tutorial if requested by the students, or to answer questions before the end of the course.